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(Ärztlicher Direktor: Prof. Dr. med. Attila Altiner)

Continuity of care at the interface of primary care and other healthcare providers

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Johanna Maria Forstner

aus Waiblingen

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Dekan: Herr Prof. Dr. med. Dr. h.c. Hans-Georg Kräusslich

Doktorvater: Herr Prof. Dr. Michel Wensing

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List of abbreviations

ACSC	Ambulatory Care Sensitive Conditions
ACO	Asthma-COPD-Overlap
ANOVA	Analysis of Variance
AOK	Allgemeine Ortskrankenkasse
BOBYQA	Bound Optimisation by Quadratic Approximation
CCI	Charlson Comorbidity Index
CI	Confidence Interval
CoC	Continuity of Care
COPD	Chronic Obstructive Pulmonary Disease
DMP	Disease Management Programme
ICD-10-GM	International Statistical Classification of Diseases and Related Health Problems, German Modification
ID	Identification Number
EI-index	External-Internal Index
FEV1	Forced Expiratory Pressure in one second
GP	General Practitioner
HZV	Strong primary care programme in Germany (German: *Hausarztzentrierte Versorgung*)
ICC	Intraclass Correlation Coefficient
MLM	Multi-Level Model
OR	Odds Ratio
RV EM	Political guideline obligating hospitals to provide discharge management (German: *Rahmenvertrag Entlassmanagement*)
SD	Standard Deviation
SECON	Sequential Continuity of Care Index
SNA	Social Network Analysis
VERAH	Care Assistant in General Practice (German: *Versorgungsassistentin in der Hausarztpraxis*)
VESPEERA	Improving Patient Care across Sectors: An Admission and Discharge Model in General Practice and Hospitals (German: *Versorgungskontinuitaet sichern: Patientenorientiertes Einweisungs- und Entlassmanagement in Hausarztpraxen und Krankenhaeusern*).
VIF	Variance Inflation Factor

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1 Introduction

1.1 Continuity of Care[1]

1.1.1 Concept and definition

Continuity of care (CoC) has been described as 'the degree to which a series of discrete healthcare events is experienced by people as coherent and interconnected over time and consistent with their health needs and preferences' (World Health Organization 2018, p. 8). As to a more straight-forward definition of this, the literature provides different approaches. These approaches have in common that they assign different dimensions to the concept of CoC. Yet, the number of dimensions and their contents as well as their distinction from other related concepts such as coordination of care, integrated care or case management differ and have changed over time (Parkerton et al. 2004; Uijen et al. 2012b). A common definition and also the one that will be considered in this dissertation is that by Haggerty et al. (2003). The authors distinguish three dimensions of CoC: relational continuity, informational continuity and management continuity, which will be described in the following.

1.1.1.1 Relational continuity

Relational continuity, which is often also referred to by the term provider continuity, is defined as 'an ongoing therapeutic relationship with one or more providers spanning different healthcare episodes' (Waibel et al. 2018, p. 258). It comprises two dimensions (Haggerty et al. 2003): The first dimension refers to the matter of seeing the same provider repeatedly and is also called longitudinal continuity (Freeman and Hjortdahl 1997). The second dimension covers the depth of the relationship between a patient and a care provider which is built on trust, responsibility, mutual personal knowledge and a feeling of being understood and is also referred to as interpersonal continuity (Ridd et al. 2009; Saultz 2003). The two dimensions are intertwined, as a longitudinal relationship is necessary to build a trusting relationship (Saultz 2003).

Continuity of care, especially relational continuity, is considered to be an essential element of primary care and is often used to measure the quality of primary care (Uijen et al. 2012b). As early as 1975, the Journal of Family Practice published a series on CoC in primary care which covered the dimensions of

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CoC (Hennen 1975), implications of CoC (McWhinney 1975), measurement and evaluation of CoC (Hansen 1975) and the implementation of CoC in a residency programme (Geyman 1975). Relational continuity is important when covering sensitive issues or when managing complex healthcare issues, such as chronic comorbidity. In the latter case, the responsible healthcare professional becomes a care coordinator, who provides the patient with information and who can convey a sense of security (Haggerty et al. 2013).

1.1.1.2 Informational continuity

Informational continuity is defined as 'the capacity of information to travel with the patient and within the health system' (Gardner et al. 2014, 590 f.) and therefore relies on patient records, telecommunication, referral systems and feedback from other care providers (Gardner et al. 2014). Informational continuity consists of two dimensions: The first one is the accumulation and collection of information about a patient and their medical history. Usually, information is collected in paper-based or electronic medical records and sometimes in the memory of the care provider. Medical records consist of both historical as well as current information (Agarwal and Crooks 2008). Second, informational continuity becomes especially relevant when patients receive care from different care providers and thus provider continuity is interrupted, such as when patients are admitted to or discharged from the hospital (van Walraven et al. 2010b). In this case, relevant parts of the accumulated information on the patient need to be transferred to other involved care providers, for example via doctor's letters, lab reports etc. At any time point when information needs to be transferred, it should be passed timely so it can be considered in the planning of further care and thereby patient safety can be ensured (Damschroder et al. 2009; Forster et al. 2004; Kripalani et al. 2007). Not only the availability of information but also the quality of the information impacts patient outcomes (van Walraven et al. 2010b).

Hospital discharges are an example of critical care transitions, which are defined as 'as the movement of a patient from one setting of care to another' (Agency for Healthcare Research and Quality 2018), where insufficient information flow is a danger to patient safety and the quality of healthcare. Current research shows that in many cases, information transfer after discharge is inadequate. For example, only 42% of general practitioners (GPs) received a discharge letter within two weeks of discharge in a study conducted by Bell et al. (Bell et al. 2009). Together with being sent out too late, discharge letters or summaries are often missing relevant information (such as results of laboratory tests). Furthermore, the majority of general practices were not noticed when patients were discharged and only very few were actively involved in their patients' discharge. These shortcomings occur even though there seems to be awareness of the relevance of this information flow and mutual consent on which kind of information should be passed. This indicates that there must be other factors that affect the quality of the

information provided and the time point of information transfer between hospitals and general practices (Kripalani et al. 2007).

1.1.1.3 Management continuity

Haggerty et al. (2003) define management continuity as 'a consistent and coherent approach to the management of a health condition that is responsive to a patient's changing needs' (Haggerty et al. 2003, p. 1220). Management continuity becomes relevant for patients with complex healthcare needs that require the involvement of many different care providers in fragmented healthcare systems (such as those with a strong separation between primary and secondary care) (Wright and Mainous 2018). Accordingly, when different care providers are involved, everyone should consider the information they are provided with and treat the patient complementary to the treatments and care of other care providers. Management continuity corresponds to care that patients experience as coordinated and can only be rated by patients, as they are the only ones who experience care provided by several care providers in different settings (Haggerty et al. 2003; O'Malley and Cunningham 2009; Waibel et al. 2012). Thus, management continuity is closely connected with care coordination. As with CoC, there is no uniform definition of care coordination and its understanding has changed in the last decades (Uijen et al. 2012b). Haggerty et al. (2008) define coordination as 'the delivery of services by different care providers in a timely and complementary manner so that care is connected and cohesive for the patient' (Haggerty et al. 2008, p. 118). Independent of a universally valid definition, evidence suggests that insufficient coordination of care can lead to shortcomings in the quality of care and rising healthcare costs (Hofmarcher et al. 2007, van Houdt et al. 2013). As healthcare systems become increasingly complex and patients are treated for several (chronic) conditions at the same time, many are being developed and implemented to achieve coordinated care (Schlette et al. 2009; Uijen et al. 2012b).

1.1.2 Impacts of continuity of care

Generally, high CoC has a positive impact on several outcomes, including patient satisfaction with healthcare (Salisbury et al. 2009), the utilisation of health services such as emergency departments (Huntley et al. 2014; van Walraven et al. 2010a), quality of life (Barker et al. 2017), medication adverse events (Kripalani et al. 2007) and mortality (Pereira Gray et al. 2018). Furthermore, many authors have conducted studies to measure the impact of CoC on hospital (re-) admission. In a study conducted in elderly patients in primary care in England, Barker et al. (2017) observed those with higher relational continuity to be less likely to be admitted to the hospital because of an ambulatory care sensitive condition (ACSC), i.e. a hospital admission that is considered avoidable with appropriate ambulatory care (Billings et al. 1993), such as back pain, heart failure or chronic obstructive pulmonary disease (COPD)

(World Health Organization. Regional Office for Europe 2015). As is the case with patients with other chronic conditions, the literature shows a high relevance of CoC in patients with COPD. High relational continuity has a positive impact on all-cause mortality. Cho et al. found that patients with low CoC had 22 % higher mortality than patients with high CoC (Cho et al. 2015). Furthermore, high CoC is protective against avoidable hospital admission (Kao et al. 2019; Lin et al. 2015) and hospital readmission. Swanson et al. (2018) found that in Germany, high CoC (as measured by three different indices) with ambulatory care physicians after hospital discharge reduced the risk of readmission within a year after discharge.

Consequently, there is a range of strategies to enhance CoC. Typically, they are programmes that have a care coordinating approach, thus promoting cooperation between providers and creating cohesive healthcare (Uijen et al. 2012b). This includes implementing a person to take over the role of care coordinator, strategies to improve patient self-management or general strategies to improve patient-centred care and strategies to improve care transitions (Uijen et al. 2012b). For example, disease management programmes (DMP) are an approach to improving care coordination for patients with selected chronic conditions. In Germany, they were first introduced in 2002 for type 2 diabetes and patients with breast cancer and have since been supplemented by other clinical pictures (Schlette et al. 2009). In patients with COPD, for example, participation in DMPs is recommended in care guidelines as it can lead to reduced rates of hospital admission, readmission or length of stay as well as improved quality of life (Bundesärztekammer (BÄK), Kassenärztliche Bundesvereinigung (KBV), Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften 2021; Lemmens et al. 2013; Poot et al. 2021). Furthermore, integrated care programmes, managed care approaches or accountable care organisations aim to coordinate healthcare across health professionals and thus overcome fragmentation of healthcare. Typically, they are addressed at defined populations, often in the context of chronic disease and complex care (World Health Organization. Regional Office for Europe 2016). Additionally, case managers can take over the role of care coordinators and are responsible for identifying eligible patients, assessing their needs and linking them with care providers. Often, case management is limited to a specific care setting. Different health professionals can take over the role of case manager (Uijen et al. 2012b). In hospital discharge management, it is often the nurses who take on this role, managing and coordinating follow-up care after discharge (Straßner et al. 2020).

1.1.3 Measuring continuity of care

To measure the impact of CoC on outcomes and the success of interventions that aim to improve CoC, it is necessary to use appropriate metrics. There is a large amount of research that focuses on qualitative data exploring patients' and care providers' experiences with CoC (Schang et al. 2013; Waibel et

al. 2012). Relying on a qualitative approach is important for understanding the concept of CoC, but is not suitable to measure the impact of CoC on health-related outcomes. Questionnaires, such as the Nijmegen Continuity Questionnaire, which measures the three subscales 'personal continuity: care provider knows me', 'personal continuity: care provider shows commitment' and 'teams/cross-boundary continuity', can help with the quantitative measurement of patient-reported CoC (Uijen et al. 2012b), but rely on patients' reports of healthcare events and are thus subject to recall bias.

Increasingly, measures of CoC are computed using routinely available data, such as computerised clinical data and administrative patient data. Indices such as the Bice-Boxerman Continuity of Care Index, the Herfindahl Index and the Usual Provider of Care Index measure relational continuity by calculating patterns of healthcare utilisation and concentration of care among health providers such as the so-called usual provider, who typically is a primary care provider (Saultz 2003). The Sequential Continuity of Care Index (SECON) also measures relational continuity but considers whether a consultation was with the same care provider as the previous one. It therefore also does justice to patients who are dependent on care from different providers due to multi-morbidity (Steinwachs 1979). The SECON was designed for measuring relational continuity but is often used as a measure of informational continuity as well (Reid et al. 2002). The indices are commonly used but are only an approximation of the complex and the not clearly defined concept of CoC, which should be considered in their interpretation (Pollack et al. 2016).

1.2 Primary care

Primary care is care that is provided in the family and the community setting. In general, it is provided by primary care physicians (such as family doctors, GPs and paediatricians) and other primary care providers (such as nurse practitioners). The American Academy of Family Physicians defines primary care physicians as care providers who 'are trained for and skilled in comprehensive, first contact and continuing care for persons with any undiagnosed sign, symptom, or health concern (the 'undifferentiated' patient) not limited by problem origin (biological, behavioural, or social), organ system, or diagnosis' (American Academy of Family Physicians 2022). Primary care is the first point of contact with the healthcare system for patients with health problems and is responsible for taking care of acute and chronic diseases, measures of health promotion and prevention (such as vaccinations or lifestyle consultations), patient education, the documentation of a patient's medical history and referral to secondary care such as ambulatory specialists or hospital care, if necessary. Its' relevance has first been stressed in the declaration of Alma-Ata in 1978 (World Health Organization 1978). According to Starfield (1992), primary care consists of four central elements that determine the strong primary care process (Kringos et al. 2010): accessibility, comprehensiveness, coordination of care and CoC.

Accessibility comprises concepts such as the availability of healthcare services to patients, their geographic reachability, financial affordability as well as equality in access. Better accessibility of primary care is associated with better quality of care, better overall population health and reduced total costs of healthcare (Kringos et al. 2010).

Comprehensiveness covers all aspects that refer to the scope of primary care such as the range of types of services provided or the range of health problems that are addressed and in this, amongst others, depends on resources such as technical equipment. High comprehensiveness of primary care is associated with better overall health, lower cost and reduced utilisation of secondary care (Kringos et al. 2010).

Coordination of care includes features such as gatekeeping, integration with secondary care, practices shared with others and a diverse skills mix. Gatekeeping is considered to be an essential building block of primary care systems in the European Union and leads to the targeted utilisation of secondary care and preventive care, thus also contributing to the appropriate use of resources (OECD 2016). A policy review of several European countries with traditionally weaker primary care systems, such as Western European social health insurance-based healthcare systems or those in countries that belonged to the former Soviet Union, showed that the introduction of gatekeeping programmes led to stronger primary care (Groenewegen et al. 2013). Coordination of care is of special importance in patients with chronic conditions and those who are affected by multi-morbidity, who have better health if living in a country with strong coordination of care (Hansen et al. 2015). Furthermore, it is intertwined with the other dimensions of primary care, especially CoC (Kringos et al. 2010) which can be seen as the result of successful coordination of care. As CoC has been described in detail in chapter 1.1, it will not be further elaborated on here.

Strengthening primary care also means strengthening the primary care workforce (Kringos et al. 2010). Due to demographic changes, in many industrialised countries, the primary care workforce is faced with high numbers of physicians aged 60 and older, increasing shares of women as well as changes in worktime models with more and more physicians deciding to work part-time (Strazdins et al. 2019). At the same time, there is an increase in patients presenting in healthcare, both in numbers and especially in complexity, as in ageing societies, the numbers of patients with chronic disease and multi-morbidity are increasing (Lehnert and König 2012). The skills mix helps to maintain the dimensions and influence the outcomes of primary care. Integrating nurses in primary care is associated with improved access, an increase in comprehensiveness and improved quality of care (Freund et al. 2015; Kringos et al. 2010). However, primary care is still mostly physician-based and non-medical professions are still underrepresented but, depending on the country, the share of nurse practitioners, registered nurses or

medical assistants has increased. Furthermore, there is a shift from delegation to teamwork but this is still limited by legal frameworks and remuneration schemes, which are physician-oriented (Freund et al. 2015).

Generally, countries with primary care-oriented healthcare systems have better population health, less social health inequalities, reduced utilisation of unnecessary secondary care and potentially lower healthcare costs or lower increase in healthcare spending, yet the evidence is inconclusive on the latter (Kringos et al. 2013b; Starfield et al. 2005). Regarding the utilisation of secondary care, strong primary care especially contributes to lower rates of hospital admission, readmission and admission for ACSC (Sawicki et al. 2021; van Loenen et al. 2014). Rates of admissions for ACSC are thus also indicators to measure access to and quality of primary care (OECD 2016). However, primary care is not given the same importance in all healthcare systems and countries can be distinguished into those with strong and those with weak primary care systems (Groenewegen et al. 2013; Kringos et al. 2013a).

1.3 Hospital discharge management[2]

Continuity of care gains relevance in healthcare systems that are characterised by high levels of specialisation and fragmentation between different health professionals and care organisations as well as between the elements on the continuum of care from prevention over acute care up to long-term care (Wright and Mainous 2018). High fragmentation of care leads to separate responsibilities and care providers 'focusing and acting on the parts without adequately appreciating their relation to the evolving whole' (Stange 2009, p. 100), is associated with shortcomings in information transfer between care providers and leads to suboptimal care, over, under and misuse of healthcare, sacrifices in the quality of care as well as increases in healthcare costs (Frandsen et al. 2015; Kripalani et al. 2007).

Thus, care transitions such as hospital discharges are very critical moments in a patient's history that can negatively impact healthcare (Forster et al. 2004; Kripalani et al. 2007; Moore et al. 2003), provider satisfaction (Kripalani et al. 2007) and healthcare system efficiency (van Walraven et al. 2002). Due to changes in reimbursement, such as the introduction of diagnosis related groups, hospital capacities

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[2] Parts of this chapter have already been published in the following publications:

Forstner, J., Straßner, C., Kunz, A., Uhlmann, L., Freund, T., Peters-Klimm, F., Wensing, M., Kümmel, S., El-Kurd, N., Rück, R., Handlos, B. and Szecsenyi, J. (2019a). Improving continuity of patient care across sectors: study protocol of a quasi-experimental multi-centre study regarding an admission and discharge model in Germany (VESPEERA). BMC Health Serv Res 19, 206, doi: 10.1186/s12913-019-4022-4.

Forstner J, Bossert J, Weis A et al. (2021) The role of personalised professional relations across care sectors in achieving high continuity of care. BMC Fam Pract 22:72. https://doi.org/10.1186/s12875-021-01418-8

Forstner, J., Pilz, M., Straßner, C., Weis, A., Litke, N., Uhlmann, L., Peters-Klimm, F., Aluttis, F., Baldauf, A., Kiel, M., Qreini, M., Kaufmann-Kolle, P., Schubert-Haack, J., El-Kurd, N., Tomaschko-Ubeländer, K., Treffert, S., Rück, R., Handlos, B., Karakas, G., Wensing, M. and Szecsenyi, J. (2023c). Hospital Admission and Discharge: Lessons Learned from a Large Programme in Southwest Germany. International Journal of Integrated Care 23, 4, doi: 10.5334/ijic.6534.

were reduced and the average length of stay decreased (Schelhase 2012, p. 379). At the same time, at first, the number of cases increased and patients had increasing complexity of comorbidities (Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen 2012). This combination of developments led to an increase in short-notice discharges, which further hinder the coordination of follow-up care and information flow (Gonçalves-Bradley et al. 2016). The resulting interruptions in CoC can affect the recovery process, harm patient safety and thus lead to adverse events, emergency department visits, unplanned readmission and increasing care cost (Gonçalves-Bradley et al. 2016; Hesselink et al. 2012b; Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen 2012). Thus, politics and research emphasise the relevance of overcoming fragmentation of healthcare, smoothing care transitions and improving coordination of care.

More specifically, hospital discharge management is an essential and inseparable component of achieving optimal transitional care. Discharge management refers to having a plan for the follow-up care of a patient before discharging them from the hospital (Gonçalves-Bradley et al. 2016). There is a multitude of studies that report the implementation of interventions to improve care transitions around hospital discharge. Mostly, they are hospital-based and provided around or after hospital discharge and implications for the design of an intervention targeting the reduction of hospital readmissions can be derived (Hansen et al. 2011; Hesselink et al. 2012a; Hesselink et al. 2014; Leppin et al. 2014; Mistiaen et al. 2007; Scott 2010; Straßner et al. 2020). In general, nurse-led discharge management showed to be effective (Straßner et al. 2020). A very common intervention, which in some studies had a positive effect on readmissions, is post-discharge telephone follow-up, often provided by the primary care team (Kripalani et al. 2007; Mistiaen et al. 2007; Scott 2010). Other interventions include discharge summaries in lay language that are addressed to the patient and adjusted to their needs or discharge templates for care providers (Garrido et al. 20; Hesselink et al. 2012a; Schlette et al. 2009; Zentner et al. 2010). Intervention bundles consisting of several pre- and post-discharge components showed to be more effective than single-component interventions (Kringos et al. 2013c; Kripalani et al. 2007; Moore et al. 2003; Straßner et al. 2020; van Walraven et al. 2002). However, research showed mixed findings, as study populations are heterogeneous, interventions vary and are described insufficiently, studies show methodological differences (such as follow-up times) and are often conducted using an observational study design which hinders the application of meta-analyses (Forster et al. 2004; Hesselink et al. 2014; Kripalani et al. 2007; Moore et al. 2003; Straßner et al. 2020; van Walraven et al. 2002).

An umbrella review conducted by Straßner et al. (2020) showed that the interventions focussed on components that were delivered before or after discharge. Components concerning hospital admission management were lacking in all of the studies included. The authors recommend studying those components in future studies. This confirms the results of a systematic review concluding that high quality-evidence on provider communication at hospital admission is scarce (Luu et al. 2016). Lee et al. (2015) demand to 'focus on providing transitional care within the entire cycle of care […] from time of admission to final transition to the primary care setting' (Lee et al. 2015, p. 8).

1.4 Cooperation between care providers[3]

As the preceding chapters have shown, primary care practitioners are not only the first point of contact with the healthcare system and the ones who accompany patients for a long time in their care history. They also play a major role in coordinating care amongst ambulatory care providers to avoid hospital admissions and in providing follow-up care after hospital discharge. Yet, interventions to improve care transitions and reduce hospital admissions are mostly addressed at hospitals (Hansen et al. 2011; Hesselink et al. 2012b; Leppin et al. 2014; Mistiaen et al. 2007). However, there are a few studies that involve primary care in interventions after hospital discharge. For example, in a cohort of high-risk surgical patients, follow-up with a primary care provider within 30 days after discharge was associated with a reduced risk of hospital readmission (Brooke et al. 2014). Balaban et al. (2008) evaluated a care transition intervention between hospitals and primary care providers which also included follow-up by a primary care provider. They found that patients receiving the intervention had fewer readmissions and emergency department visits than the control group (Balaban et al. 2008).

Thus, primary care providers need to cooperate with other health professionals to coordinate care or to provide continuing care even when provider continuity is not given. A review of theoretical frameworks on care coordination gives an overview of the key concepts of care coordination that the many definitions used have in common. This includes several concepts that refer to the persons involved, their roles and the quality of their relationships. The transfer of information between those involved was the concept that was most dominant among all frameworks included and refers to a deficit in communication and information transfer that should be addressed to achieve coordinated care (van

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[3] Parts of this chapter have already been published in the following publications:

Forstner, J., Koetsenruijjter, J., Arnold, C., Laux, G. and Wensing, M. (2023b). The Influence of Provider Connectedness on Continuity of Care and Hospital Readmissions in Patients With COPD: A Claims Data Based Social Network Study. Chronic Obstr Pulm Dis 10, 77-88, doi: 10.15326/jcopdf.2022.0359.

Forstner, J., Pilz, M., Straßner, C., Weis, A., Litke, N., Uhlmann, L., Peters-Klimm, F., Aluttis, F., Baldauf, A., Kiel, M., Qreini, M., Kaufmann-Kolle, P., Schubert-Haack, J., El-Kurd, N., Tomaschko-Ubeländer, K., Treffert, S., Rück, R., Handlos, B., Karakas, G., Wensing, M. and Szecsenyi, J. (2023c). Hospital Admission and Discharge: Lessons Learned from a Large Programme in Southwest Germany. International Journal of Integrated Care 23, 4, doi: 10.5334/ijic.6534.

Houdt et al. 2013). Additionally, studies that promote communication between primary care physicians and specialists showed improved patient outcomes (Foy et al. 2010).

The relationships between care providers and their cohesiveness have also been summarised under the term provider connectedness (Price and Lau 2013). Research shows that provider connectedness plays an important role in knowledge transfer as being densely connected with others can facilitate information flow (Tasselli 2014) and cooperation, as individuals easily know about others' behaviour and cooperative behaviour is contagious among those well-connected providers (Dijkstra and van Assen 2013). Provider connectedness and the influence of individual providers can also ease the uptake of innovations and the diffusion of opinions (Glegg et al. 2019). Thus, there are expectations that provider connectedness facilitates coordination of care (Bae et al. 2015; DuGoff et al. 2018).

Several studies have illustrated the relevance of provider connectedness for good cooperation, communication and coordination. For example, GPs' motives for collaboration are the development of personal relations with specialists as they make collaboration easier (Berendsen et al. 2007). In another qualitative study, Sampson et al. (2016) found that good relations enable collaboration and direct communication. Others attempted to measure communication and collaboration and their impact on healthcare. For example, Hustoft et al. (2018) measured team communication and collaboration and their association with patients' CoC in a questionnaire study and showed that patients experienced higher CoC when their treating healthcare team showed higher relationship scores. In a meta-analysis, however, an effect of interactive communication between GPs and specialists on patient outcomes in different patient populations was not found due to multifaceted interventions and limitations regarding the methodology of the studies included (Foy et al. 2010).

Social network analysis (SNA) is another approach to measuring and analysing the impact of relational attributes. Care providers know each other, exchange information and communicate with each other, even though it is not necessarily expected that they do so for each of their patients (Barnett et al. 2011; Pollack et al. 2013). The application of SNA in health services research has increased in recent years (Cunningham et al. 2012; Stillfried et al. 2017; Valente and Pitts 2017). For instance, Mascia et al. (2015) studied network characteristics in a network consisting of hospitals which were connected through patient referrals and found that their network position among other hospitals had an impact on patient readmissions. Geva et al. (2019) found that being connected with many other care providers is associated with reduced odds of 30-day readmission in patients with heart failure. In a cohort study of patients with heart failure and diabetes, network characteristics depicting care density reduced hospital admission rates for those with the highest care density and overall healthcare cost (Pollack et al. 2013).

Furthermore, Wyngaerden et al. (2019) found that several network characteristics impact CoC in patients with severe mental illness.

1.5 Characteristics of the German healthcare system

As the studies that are part of this dissertation were conducted in Germany, an overview of the characteristics of the German healthcare system regarding primary care and care transitions between hospitals and the ambulatory care sector as well as recent political developments is given.

1.5.1 Primary care in Germany

In Germany, like in other European countries with social health insurance, the role of primary care traditionally is not as strongly developed. This mostly shows in the fact that GPs practice in solo practices, patients have freedom of choice of provider and GP-based care programmes are voluntary, weakly incentivised and based on motivation (Groenewegen et al. 2013). Kringos et al. (2013a) assess German primary care to be strong regarding CoC, but weak regarding coordination of care. A shift in primary care can be observed, especially in increases in non-medical staff, but, from the outset, Germany never has been and still is not a country that has a very strong focus on putting primary care at the centre of the healthcare system (van Loenen et al. 2016).

Primary care is provided by GPs or internal specialists who mostly practice in single practices or shared practices with one other self-employed physician. There, they are predominantly supported by medical assistants, who are qualified through an apprenticeship for supporting practice processes and mainly have administrational tasks, such as patient management or billing and a few simple medical tasks such as giving injections and taking blood samples (Freund et al. 2015). Other health professionals are not typically involved in primary care (Groenewegen et al. 2013). To strengthen primary care, Germany introduced a strong primary care programme in 2008 (GP-based care programme, German: *Hausarztzentrierte Versorgung* (HZV)). All health insurers have to offer the programme, but participation is voluntary for both GPs and patients. The programme includes elements such as increased care coordination by GPs, requirements and training regarding qualifications and quality of care and a standardised remuneration system (Gerlach and Szecsenyi 2013). Furthermore, so-called VERAHs (care assistant in general practice, German: *Versorgungsassistentin in der Hausarztpraxis)* are deployed in general practices in the context of the HZV. They are medical assistants who are trained in wound management, prevention management, case management and routine home visits, to delegate physician tasks to non-physician staff and thus relieving the workload of GPs and ensuring the provision of care in a system that is characterised by increasing (chronic) morbidity and a shortage of physicians (Mergenthal et al. 2016; van den Bussche 2019).

Participation in the HZV by GPs and patients as well as deployment of VERAHs is high in the federal state Baden-Wuerttemberg, especially among patients insured with the Allgemeine Ortskrankenkasse (AOK) Baden-Wuerttemberg, a large health insurer covering approx. 4.5 million people in Southern Germany (AOK Baden-Württemberg 2017). In Baden-Wuerttemberg, across all health insurance companies, approx. 50% of all GPs and approx. 2.5 million insured persons participate in the HZV (Hausärzteverband BW 2020).

Since its' introduction, the primary care programme in Baden-Wuerttemberg was continuously evaluated considering several outcomes that indicate high-quality primary care. The analyses showed that patients who participated in the programme had reduced rates of hospital admissions and readmissions as well as admissions due to ACSC (Wensing et al. 2018). The programme also improved healthcare concerning eleven aspects of primary care, such as rates of drugs that should be avoided or medication costs, in patients with chronic disease (Wensing et al. 2017). In the evaluation of the HZV in another federal state, the authors showed that participation in the programme led to better care coordination in elderly patients with chronic multi-morbidity (Freytag et al. 2016).

1.5.2 Transitions around hospital care in Germany

The healthcare landscape in Germany is characterised by fragmentation, resulting from decentralised governance and a strong separation between hospital inpatient care and ambulatory medical care. In Germany, office-based ambulatory care is provided by primary care physicians and by (other) medical specialists, e.g. cardiologists and pneumologists. GPs can refer their patients to other office-based physicians and hospitals, but patients have freedom of choice of providers and can seek advice from office-based physicians without GP involvement (World Health Organization. Regional Office for Europe et al. 2004). Access to hospital requires admission by an office-based physician or classification as an emergency (Gemeinsamer Bundesausschuss 2017). GPs can take over follow-up care after specialist referral or hospital admission, but do not necessarily see the patient again.

In Germany, 19.4 million patients had an inpatient stay in acute care in the year 2019 (Statistisches Bundesamt 2022), a number which has increased continuously but is slowly decreasing since 2016 (Schelhase 2021, p. 408; Statistisches Bundesamt 2022). Readmission rates are typically calculated on different patient populations, overall readmission rates are rare. The evaluation of the HZV in Baden-Wuerttemberg revealed a readmission rate of 14.5 % within four weeks after discharge (Wensing et al. 2018). Overcoming fragmentation of healthcare by targeted discharge management has been on the political agenda for approx. 20 years. The Expert Standard on Discharge Management in Nursing Care (German: *Expertenstandard Entlassungsmanagement in der Pflege*), which was introduced in 2004, demands an assessment at admission, discharge planning, execution of the discharge and an

evaluation. Since 2007, when the entitlement to care management was first legally anchored with the Act to Strengthen Competition in Statutory Health Insurance (German: *Gesetz zur Stärkung des Wettbewerbs in der Gesetzlichen Krankenversicherung*), discharge management has continuously been pushed politically. In 2012, the Act on the Improvement of Care Structures in Statutory Health Insurance (German: *Gesetz zur Verbesserung der Versorgungsstrukturen in der gesetzlichen Krankenversicherung*) increased the binding nature of providing discharge management. Eventually, the legal obligation to provide hospital discharge management was introduced in 2015 with the Act to Promote Healthcare in Statutory Health Insurance (*Gesetz zur Stärkung der Versorgung in der gesetzlichen Krankenversicherung*), which aims to improve the continuity of patients' care when discharged from acute hospital care to other care providers. In October 2017, the respective political guideline came into effect, obligating hospitals to offer a structured discharge planning to all patients (RV EM, German: *Rahmenvertrag über ein Entlassmanagement beim Übergang in die Versorgung nach Krankenhausbehandlung nach § 39 Abs. 1a S.9 Sozialgesetzbuch V,* short: *Rahmenvertrag Entlassmanagement*). The guideline addresses no other care providers than hospitals and only demands in-hospital measures, such as an assessment at admission, the introduction of a discharge plan and the possibility to issue medication prescriptions or referrals to rehabilitation therapeutics.

Amongst legal regulations, the research project 'Improving patient care across sectors: An admission and discharge model in general practice and hospitals.' (German: *Versorgungskontinuitaet sichern: Patientenorientiertes Einweisungs- und Entlassmanagement in Hausarztpraxen und Krankenhaeusern* (VESPEERA)) was planned and conducted with funding provided by the Innovation Fund at the Federal Joint Committee. The VESPEERA programme was developed as an add-on to the HZV with the objective of the development and implementation of cross-sectoral care pathways between general practices and hospitals. It aimed to improve communication between care providers, close gaps in care transitions, avoid underuse and misuse of care, reduce readmissions and increase the health-related competence of patients through more participation and empowerment. Consequently, the VESPEERA programme, which is described in detail in chapter 2.3, is a complex intervention which intends to have an impact on a range of outcomes. Because of the complexity and new nature of the VESPEERA programme, the study did not only focus on the effectiveness of the planned intervention. Additionally, the implementation has been accompanied by a process evaluation which studies the organisational and societal context in which the interventions were applied. The process evaluation aimed to gain insight into the intervention fidelity, attractiveness and acceptance of the programme as well as determinants influencing implementation. Determinants to implementation as well as contextual factors were explored in interviews and questionnaires with health professionals from hospitals and general practices who did and did not participate in the VESPEERA programme.

The approach of the VESPEERA programme to strengthening primary care and cooperation between primary care and other care providers including the process evaluation provides the framework for this dissertation. An additional social network study was conducted to pick up insights from the interview study.

1.6 Aim and structure of this dissertation

This dissertation aimed to provide insight into CoC between care providers at the interface between primary care providers and other care providers. More specifically, it explored the impact of CoC as a characteristic of strong primary care and its impact on hospital readmissions.

The following topics and research questions guided this dissertation:

I. Current state regarding communication and information flow between primary care and hospitals:

    1. What is the current state of communication between hospitals and general practice and what should it ideally be like?

    2. What are the factors that influence information flow between hospitals and general practices?

II. Current state of provider connectedness between primary care physicians and other ambulatory physicians:

    1. What are the structural characteristics of shared patient-networks of ambulatory care physicians?

    2. Which network characteristics are associated with a) patients' CoC and b) patient readmission?

III. Development, implementation and evaluation of a care programme to improve communication and cooperation between general practices and hospitals:

    1. What effect does a care programme implemented in hospitals and general practices (VESPEERA) have on hospital readmissions and other outcomes?

    2. What are the factors that affect the implementation of the VESPEERA care programme?

2 Material and methods

This dissertation addresses multiple research questions concerning three overarching topics of interest that will be answered using different approaches based on a variety of data sources.

First, the observational qualitative interview study explores the current state of communication and information flow between hospitals and general practices and its determinants, addressing research questions I1 and I2. Then, in an observational design based on claims data, the current state of provider connectedness between ambulatory physicians and its impact on CoC and hospital readmissions will be explored (research questions II1 and II2). Then, the implementation of VESPEERA care programme VESPEERA in general practices and hospitals is addressed. The quasi-experimental effectiveness study addresses research question III1 and describes the evaluation of the impact of this care programme on hospital readmission rates. In an observational questionnaire study, the factors affecting the implementation of the care programme are explored (research question III2).

2.1 Qualitative interview study[4]

This study relies on qualitative interviews conducted within the VESPEERA process evaluation, which were identified as an appropriate data source to answer the research questions *I1) What is the current state of communication between hospitals and general practice and what should it ideally be like?* and *I2) What are factors that influence information flow between hospitals and general practices?*.

2.1.1 Study design

This part of the dissertation is a qualitative interview study exploring information flow between hospitals and general practices from the perspective of care providers. The interviews were conducted in the context of the process evaluation of the VESPEERA project. Ethical approval was obtained by the Ethics Committee of the Medical Faculty Heidelberg (S-352/2018) for the process evaluation of the VESPEERA study. All participants in the interview study gave their written informed consent before study participation. Data were pseudonymised before analysis.

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[4] This chapter has already been published in the following publication:
Forstner, J., Bossert, J., Weis, A., Litke, N., Strassner, C., Szecsenyi, J. and Wensing, M. (2021). The role of personalised professional relations across care sectors in achieving high continuity of care. BMC Fam Pract *22*, 72, doi: 10.1186/s12875-021-01418-8.

2.1.2 Participants and study setting

The study population for qualitative interviews includes all groups of care providers that were involved in the VESPEERA programme: GPs and VERAHs, hospital management, hospital physicians and hospital nursing staff from general practices and hospitals participating in the VESPEEERA project. Furthermore, hospital management, hospital physicians and hospital nursing staff from hospitals not participating in VESPEERA from outside of the VESPEERA intervention region (nine defined districts in Baden-Wuerttemberg: Heidelberg, Rhein-Neckar, Stuttgart, Esslingen, Ludwigsburg, Boeblingen, Reutlingen, Tuebingen, Calw) were recruited. Participants had to be either involved in VESPEERA on a management level (for example concerning the decision process of whether to participate in the VESPEERA study and the implementation of its intervention components) or an executing level (such as nursing staff working on wards in departments which participated in the VESPEERA study) or be involved in and be able to provide inside into admission and discharge management in general.

Participation in the interview study was possible when persons were professionally affiliated with one of the named sample-groups, were 18 years of age or older, had adequate skills in reading and speaking the German language and had the ability to give informed consent.

2.1.3 Sampling strategy

Sampling and recruitment for the interviews were pragmatic. Initial contact and invitation for participation in an interview were sent out via post directly to all GPs and VERAHs from GP practices participating in the VESPEERA study. Within the VESPEERA project, each hospital named a contact person for any project-related communication. These contact persons were invited to participate and asked to distribute the invitations to any eligible staff within their hospital or hospital department.

For the recruitment of staff from non-participating hospitals, a list of hospitals outside of the intervention region was created through an online search. A total of n = 59 hospitals/ hospital groups was identified and contacted via the hospital management. If several hospitals belonged to one clinic association, only one invitation was sent out.

When interest in participation was expressed via a fax coupon, potential participants were contacted via phone for study information. If interested, an appointment for an interview was made and study material was sent out via post. This included a study information letter describing the aims of the study, inclusion criteria and information on ethical and data protection considerations. Furthermore, they were sent the informed consent sheet, a questionnaire to collect socio-demographic information and a post-paid envelope. Participants returned the filled-in questionnaire and signed informed consent sheet using the post-paid envelope before the interview. The inclusion of interviews for the research

question of this study was ended when saturation of codes and contents in the analysis of the interview data was reached.

2.1.4 Data sources and data collection

Qualitative interviews were conducted using a self-developed semi-structured interview guide. As the interviews were conducted within the VESPEERA process evaluation, the interview guide was designed with regard to the research questions of the process evaluation and not those formulated for this dissertation. Topics addressed in the interview guide were possible consequences of the intervention, the working mechanism to achieve these effects, the attractiveness of the intervention programme, as well as contextual factors that determined the implementation of the intervention. The interview guide was not modified during data collection.

The interviews were conducted from September 2018 through September 2019. Interviews were conducted by three experienced female researchers and doctoral candidates (all around 30 years of age, with backgrounds in health services research and implementation science, interprofessional healthcare, speech and language therapy, social sciences and medical process management). Some of the participants and researchers were familiar with each other through the implementation process which could provide a source of bias and a barrier to neutrality regarding the participants' reports of their experiences. Thus, it was tried to have interviews conducted by researchers who have previously had little contact with the participants. Interviews were conducted either as telephone interviews or face-to-face interviews, according to the participants' preferences and the best possible fit to their schedule. All interviews were audio recorded, handwritten notes were taken during the interview by the respective researcher. Interviews were transcribed using simplified transcription rules, thus transcribed verbatim without paying attention to neither dialect/ informal language/ slang nor filler words such as 'um'. F4 software was used for transcription. Transcripts were not returned to participants for comments or correction and no repeat interviews were carried out.

For the reporting in this study, quotes to underline the statements in the results were translated from German to English with the aid of DeepL software and proofreading by a fluent English speaker, aiming to maintain the meaning and slang. The German originals can be found in appendix I (endnotes marked by subscript Roman small letters).

Before the interview, all participants filled-in a paper-based questionnaire on sociodemographic information. The questionnaire included questions on the participants' age, sex, profession, years worked in this profession and structural characteristics of the organisation they work at (the interview guides and questionnaires can be found in appendix II).

2.1.5 Analysis

Data analysis followed an inductive approach, thus no predefined theory was used. Instead, stepwise content analysis was used to structure collected material into themes and sub-themes that related to the study aim. First, a preliminary framework of themes was inductively developed based on a first glimpse of the data. Then, the first cycle of deductive line-by-line coding of the interviews was conducted. A further researcher not involved in data collection, who was around 30 years of age and has a background in health services research, implementation science, interprofessional healthcare and nursing, then selectively checked codings. Subsequently, the two researchers met and discussed codes and themes, which resulted in an inductive refinement of themes. In the second cycle of coding, data were deductively recoded in-depth and to the refined themes. The codes in each theme were then analysed by summarising the themes described within the different groups of the sample and between groups. The two authors then met to discuss the final coding of all interviews and major findings. MAXQDA software Version 18 was used for data coding and Microsoft Excel for data analysis.

2.2 Social Network Analysis[5]

The interview study described under section 2.1 was used to inform and design the SNA study.

The analyses described here aim to provide insight into shared patient-networks of ambulatory care physicians (GP and specialists) and their influence on CoC and hospital readmissions. The social network analysis addresses research questions *II1) What are the structural characteristics of shared patient-networks of ambulatory physicians?* and II2*) Which network characteristics are associated with a) patients' CoC and b) patient readmission?*

2.2.1 Study design

An observational study, in which patients are linked to physicians, was conducted using claims data from the AOK Baden-Wuerttemberg of the years 2016 to 2018. Ethical approval was obtained by the ethics committee of the Medical Faculty Heidelberg for the ExKoCare-Study (S-726/2018), in which this study was embedded. The ExKoCare-Study aimed to explore information transfer and collaboration in ambulatory cardiac care. The study focused on networks of care providers, care coordination and the uptake of recommended practices (Arnold et al. 2020).

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[5] Parts of this chapter have already been published in the following publication:
Forstner, J., Koetsenruijjter, J., Arnold, C., Laux, G. and Wensing, M. (2023b). The Influence of Provider Connectedness on Continuity of Care and Hospital Readmissions in Patients With COPD: A Claims Data Based Social Network Study. Chronic Obstr Pulm Dis *10*, 77-88, doi: 10.15326/jcopdf.2022.0359.

2.2.2 Data sources and data collection

Pseudonymised claims data were provided by the AOK Baden-Wuerttemberg for the years 2016 to 2018. This data set was originally provided for the evaluation of the HZV (Wensing et al. 2021) in Baden-Wuerttemberg and its use for the analyses in this section was granted by the data owner AOK Baden-Wuerttemberg. According to the Social Code Book X § 75, claims data can be used for research purposes. Data used include information on patients, information on physicians, information on healthcare provided by ambulatory physicians as well as information on hospital stays and hospital diagnoses. Patients were included if they were discharged after a hospital stay in the year 2017, the index initial hospital stay. The years 2016 and 2018 were used to check for inclusion criteria and to calculate other measures, such as readmissions following the index stay. In general, the observational period for the outcomes and several confounders is one year after discharge from the index stay.

All data preparation was done in dbForge Studio for MySQL and the SECON was computed using Java SDK (x64, V.18.02). Network construction, data manipulation, data analysis and export of tables were done using the statistics software R Version 4.1.2 (R Core Team 2010) in RStudio Version 2022.02.03. Data manipulation for analysis in RStudio was conducted using the R package tidyverse (Wickham et al. 2019).

2.2.3 Study sample

This study involved three populations: 1) the main study population: patients with COPD, 2) GPs treating those COPD patients and 3) other ambulatory physicians involved in healthcare for COPD patients and their shared-patients to build patient-sharing networks.

The study population comprised all **COPD patients** insured with AOK Baden-Wuerttemberg who were 40 years or older (as at around this age, the respiratory function starts to decline and the risk for getting COPD increases (Raherison and Girodet 2009) in 2017 and who had at least one overnight inpatient hospital stay in acute care due to COPD with discharge in the year 2017. COPD diagnoses were defined as the three-digit code J44 according to the International Statistical Classification of Diseases and Related Health Problems in the German Modification (ICD-10-GM) as the documented main discharge diagnosis, which was considered to be valid (Bundesversicherungsamt 2014). Patients with COPD were deemed appropriate for the conduct of this study as COPD is amongst the most relevant diseases that pose a burden on patients, healthcare systems and society (Soriano et al. 2017). In Germany, 2.6 million insurants of statutory health insurance were affected in 2017, the prevalence was 6.7 %. However, prevalence varies widely in Germany with Baden-Wuerttemberg having the lowest prevalence of COPD (Akmatov et al. 2019). Due to the burden of comorbidity and frequent exacerbations, readmission

rates are very high in patients with COPD. Njoku et al. (2020) conducted a systematic review that includes 57 studies from 30 countries. The authors found that between 2.6 % and up to 82 % of patients are readmitted within 30 days after discharge and even after 6 to 12 months after discharge, readmission rates are up to 47 % (Njoku et al. 2020). Furthermore, COPD is considered an ambulatory care sensitive diagnosis; in Germany approx. 76 % of all COPD-related hospital admissions and readmissions are considered avoidable (World Health Organization. Regional Office for Europe 2015). Thus, healthcare in patients with COPD requires optimal coordination. Generally, patients with COPD are taken care of by their GP who is responsible for the coordination of care, which includes documentation and initiation of participation in structured DMPs to increase patients' self-management. Furthermore, the GP refers patients to pneumologists in case of insufficient therapeutic success despite intensified treatment or after emergency care and to treat patients with severe courses of disease or patients who require special treatments. Care coordination also includes referrals to specialists to treat common comorbidities, such as cardiologists. Hospital admission is indicated in the case of severe exacerbations, severe lung infections or if symptoms persist or worsen (Bundesärztekammer (BÄK), Kassenärztliche Bundesvereinigung (KBV), Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften 2021).

Several criteria led to exclusion from the analysis. Patients for whom no readmissions could be determined due to transfer to other hospitals or hospices as well as due to death before discharge were excluded. However, as mortality rates after discharge in patients with COPD are high, the time of death was determined to exclude deceased patients for further analysis and overall mortality as well as the mortality after previous readmission was determined for informative purposes, but not further considered in the analyses). Furthermore, patients for whom the SECON could not be calculated (for example as they have not seen any GPs, cardiologists or pneumologists in the year after discharge from the index stay) were excluded. Lastly, patients were excluded if information on their GP was missing. This includes patients for whom the identification of a usual provider was not possible for example when they have not seen a GP in the observation period, as well as patients whose identified usual provider does not practice in Baden-Wuerttemberg such as patients living on the borders of Baden-Wuerttemberg or if they were treated elsewhere in Germany. Also, patients were excluded if the network characteristics of their GP could not be computed for example when their GP only shared less than five patients with any other physician or their GP treated less than 30 patients insured with AOK Baden-Wuerttemberg or if information on the general practices' location in an urban/ rural was not available.

The study considered ambulatory **GPs** (all specialist groups that qualify for working as a GP) practising in Baden-Wuerttemberg who treated at least 30 AOK-patients in 2017. The nesting of patients within a GP required the identification of a usual provider (Eriksson and Mattsson 1983). This was defined as the GP that was most seen in the observation period. If there was a tie, one of the physicians was chosen randomly.

GPs, pneumologists and cardiologists were included in the construction of patient-sharing networks as those physicians are generally involved in the care of patients with COPD (for COPD or any of the most common comorbidities (Bundesärztekammer (BÄK), Kassenärztliche Bundesvereinigung (KBV), Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften 2021; Smith and Wrobel 2014). They needed to practice in Baden-Wuerttemberg and treat at least 30 AOK patients in 2017. For the construction of connections between physicians, all insured persons with an outpatient visit in the year 2017 treated by the included ambulatory physicians were considered. As communication between care providers cannot directly be depicted using claims data, connections were constructed by identifying shared patients, which is a 'valid method for identifying relationships between physicians' (Barnett et al. 2011, 1603 f.) and approximates having a professional relationship. As a consequence, it was assumed that care providers who share patients also communicate in some way, even though no information on the quality and kind of communication is available. Naturally occurring networks between ambulatory physicians were identified based on at least five shared patients in 2017 and were computed based on ambulatory consultations. A cut-off of nine shared patients indicates having a professional relationship (Barnett et al. 2011) and was adjusted to the AOK Baden-Wuerttemberg covering approx. 45 % of the population in Baden-Wuerttemberg (AOK Baden-Württemberg 2017). Based on these connections, an edge list containing all connections (n = 121,756) between the physicians (n = 7,888) was created and used to build an undirected, unweighted whole network. This network was decomposed, disconnected graphs consisting of only one edge between two nodes (n = 6) were removed and only the biggest connected graph containing 7,876 nodes was used for further analyses. Then, ego networks were built to compute network characteristics. Ego networks consider the individual of interest, their directly associated individuals (ego-alter connection) as well as links between ego's alteri (alter-alter connections) (Burt 1992).

2.2.4 Measures

In the following chapters, an overview of the measures used in the analyses will be given. First, the outcomes and how they were operationalised for the analysis will be described. Then, the network characteristics will be explained. Finally, further factors on a patient and GP level that are known confounders will be described.

2.2.4.1 Outcomes

The outcomes of interest were CoC and readmission to the hospital. Both were determined for individual patients concerning the first COPD-related hospital stay in acute care in 2017, which was identified as the index stay.

CoC was operationalised by using the SECON (Steinwachs 1979) which is used to calculate provider continuity but is also often used to approximate informational continuity (Reid et al. 2002). Compared to other indices used to measure CoC, such as the Usual Provider of Care Index (Breslau and Haug 1976) or the Bice-Boxerman-Index (Bice and Boxerman 1977), the SECON does not indicate the share of consultations with one provider but expresses whether consecutive consultations are with the same (assigned value 1) or another physician (assigned value 0) as the previous consultation. This way, it considers the fact that patients with chronic comorbidity need to see physicians of different specialities (Steinwachs 1979). The index takes values between 0 and 1, with 1 indicating perfect CoC. In the calculation of the index, visits to GPs, pulmonologists and cardiologists in the year after discharge were considered. Pneumologists were considered as patients should be referred to them in cases such as worsening of the disease, changes in medication regimen or after emergency care (Bundesärztekammer (BÄK), Kassenärztliche Bundesvereinigung (KBV), Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften 2021). Cardiologists were considered as patients with COPD are at an increased risk of cardiovascular events after hospital discharge (Vogelmeier et al. 2018). Claims data do not allow for diagnosis-related differentiation of physician's consultations, thus all consultations with the above-mentioned physicians were considered. Only post-discharge CoC within an observation period of one year after discharge from the index stay or until death was considered as Swanson et al. (2018) found that in Germany, pre-discharge CoC does not impact hospital readmissions in patients with COPD.

Readmissions are based on the index stay. Different time frames are considered for readmissions to fall in. The time frames computed are 30 days, 90 days, 6 months and 12 months (Njoku et al. 2020). Each readmission is only considered within one of the time frames (i.e. a readmission after 23 days matches the 30-day-time frame, but is not considered in any of the other time frames), the measure is thus binary (readmission within the respective time frame yes/1 or no/0). Only acute care is considered and stays in psychiatric and rehabilitation institutions are not considered. Only readmissions due to the same indication are considered, i.e. only rehabilitations with the main discharge diagnosis J44.

For the identification of all relevant hospital stays, duration had to be at least two days, marked as acute care (versus rehabilitation) and reasons for admission were not to be a (re-) transfer from another hospital. Similarly, reasons for the discharge were also considered and stays were only included

if the discharge was an actual discharge and not, for example, a transfer to another acute inpatient facility. The chronologically first COPD-related hospital stay in 2017 was identified as the index stay, which was the starting point for further analyses. For the index stay, the criteria for the kind of discharge were more restrictive. Via this selection, only stays were considered where patients left the hospital alive, with no transfer to hospices (as death is foreseeable and healthcare is under other circumstances). Thus: for the index stay, the reason for the discharge was relevant, for the readmission the reason for the admission was relevant.

2.2.4.2 Network characteristics

Several characteristics of provider connectedness were determined.

Density is measured as the proportion of existing ties between providers compared to the maximum possible number of ties, here applied to physicians' individual networks. The measure takes on values between 0 and 1, with a density of 1 indicating that all possible ties do exist. In dense networks, as density approaches one, information can be transmitted easily, while in networks with low density, information might need to travel longer to reach its recipient. In shared-patient networks, density is also used as an indication of the 'cohesiveness of a network' (Glegg et al. 2019, p. 36).

Centrality measures in SNA show the importance of a node within the graph. **Degree centrality** measures this importance based on the number of links a physician holds with other providers and thus the number of their direct connections to others, which is an indicator of connectedness. The value takes positive integers, with a minimum of one (otherwise a physician would have no connections to others and would not be part of the network) and a maximum of 7,875 (size of the full network minus 1). Depending on the type of tie, this node might represent a popular individual, someone who holds much information or can connect to others easily (Freeman 1978). Translated to the context of shared-patient networks, this means that physicians with a high degree centrality know and communicate with many other physicians. Here, degree centrality within the physicians' individual network was computed. The value takes on positive integers.

Closeness centrality relies on the geodesic distance (the shortest path between two individuals, counts the number of edges on this path) and refers to a physician's sum of shortest paths to other providers in the total network. The measure is calculated from the full network and is based on the inverse of the average shortest path, thus higher closeness centrality indicates that a physician is in the 'middle' of the network. The measure takes on values between 0 and 1. Due to the large size of the overall network, closeness centrality measures took very low values and thus were multiplied by 10,000 for

the analyses. Generally, nodes with a high closeness centrality have a high influence on the whole network.

The external-internal (**EI**)-**index** is an indicator of the openness/ closedness of a network as it relates to internal and external connections in a network. Internal connections are those between two individuals who both belong to the physician's individual network, external connections are connections between a physician directly linked to the physician and a physician not directly linked to the individual physician. The value of the EI-index ranges between -1 and 1, with a positive score indicating more external relations and negative scores indicating enclosed subgroups that allow for no influence from outside of the group. Thus, networks with a high EI-index are more open to new information from outside of the group. Here, the EI-index was computed for each physician's individual network.

Cohesion is a measure of the togetherness of a network of care providers. It was measured as the minimum number of individuals needed to be removed to remove all directed paths within the individual physicians' network. The value takes positive integers, with a minimum of one and higher values indicating a more 'stable' network. There is no maximum value, as it depends on the size of the individual networks. Networks with high levels of cohesion usually show improved information flow and effective coordination (White and Harary 2001).

Network characteristics were determined using the R package igraph (Csardi and Nepusz 2006).

2.2.4.3 Other physician characteristics
Furthermore, the following GP characteristics were included: confounders were included: **practice size** (approached by computing the average number of patients treated per quarter year), as well as the **years worked in the current practice**, both measures allow for treating more patients, thus sharing more patients with other physicians, they therefore potentially impact on the network mechanisms; whether a GP practises in an **urban or a rural area** (as the allocation of physicians to practices, if practising in multiple practices, was random, the information of urban and rural is random as well); **participation in the DMP for COPD** and **the HZV** (both to control for factors that influence the number of contacts with GPs and other specialists and thus affect CoC); and the **share of contacts within the own ego network that constitutes specialists**.

2.2.4.4 Patient characteristics
The following patient characteristics were included in the analyses to control for factors that impact on CoC and/ or hospital readmissions in patients with COPD: **sex** (male/female) and **age** in 2017 as they impact on CoC (Wensing et al. 2021); the **Charlson Comorbidity Index (CCI)**, as patients with COPD

are affected by many comorbidities (such as lung cancer, cardiovascular diseases, osteoporosis, diabetes mellitus type II or mental disorders) and in general, comorbidities are amongst the most relevant predictors for readmission, however the evidence for certain comorbidities varied, therefore it was decided to not include diseases itself but the CCI in 2017 as a measure for the overall burden of disease (Njoku et al. 2020); additionally to the CCI, **asthma-COPD-overlap** (ACO) when patients had a valid asthma diagnosis (the so-called 'M2Q-criterion' was applied for all asthma-diagnoses (as indicated by ICD J45) in 2017, meaning that a diagnosis had to be documented in at least two quarter years in order to be assumed valid (Bundesversicherungsamt 2014), was included as a separate measure (yes/1 or no/0) as the evidence suggests that this is one of the factors that increases the risk of readmission and the one comorbidity with the most consistent association (Njoku et al. 2020); the **number of contacts with the usual provider** in the observational period as heavy primary care users have lower CoC (Barker et al. 2017); the **share of consultations with ambulatory physicians that were with specialists**; the **number of all-cause hospitalisations in the year preceding the index stay**, which can be taken as an equivalent for the number of exacerbations as the second-most important risk factor for readmission in patients with COPD (Alqahtani et al. 2020; Njoku et al. 2020) and hospital stays are more valid than exacerbations in claims data as the latter are based on documentation of diagnoses and quality of the documentation is limited (Petro et al. 2015; Schubert et al. 2010); the **length of the index stay** as a risk factor for readmission after exacerbation (Alqahtani et al. 2020); whether a patient lives in a **nursing home** or is discharged to a nursing home from the index stay which is a known factor to increase the risk for hospital readmission (Njoku et al. 2020) and in this case is based on the information on nursing home status in claims data for the month of discharge; the **severity of the COPD** (mild, moderate, severe or severity unspecified) using the ICD code of the index stay, based on pulmonary function (as measured by the forced expiratory pressure in one second (FEV1); **CoC** after discharge using the SECON, as the evidence shows that CoC decreases the risk for hospital readmission (Swanson et al. 2018). Measures referring to the observational period after discharge needed to be adapted to the different timeframes considered in the analyses of readmission, i.e. for the analysis of readmissions within 90 days after discharge, the measures that consider physician consultations (SECON, number of contacts with the UP, the share of consultations with ambulatory physicians that are with a specialist; for all see the paragraph on confounders), only consultations within 90 days after discharge are considered. For patients who were readmitted within the respective timeframe only those consultations preceding the readmission were considered.

2.2.5 Statistical Analysis

2.2.5.1 Descriptive analysis

For the descriptive analysis of continuous measures, means and standard deviations (SD) were computed, for the descriptive analysis of categorical measures, absolute and relative frequencies were computed. R packages psych (Revelle 2022) and epiDisplay (Chongsuvivatwong 2022) were used for descriptive analyses.

2.2.5.2 Analysis of the effect of network characteristics on continuity of care and readmissions

Data were analysed on a patient level with patients being nested in general practices. Data linkage was carried out using pseudonymised insurant and physician identification numbers (ID). The outcomes CoC and hospital readmission were measured on a patient level whereas predictors are on a GP level. Confounders expected to impact the outcomes were present both on a patient and a GP level.

Regression analyses were conducted to examine the impact of network characteristics (density, degree centrality, closeness centrality, EI-index, cohesion) on the SECON and the network characteristics and SECON on hospital readmissions, guided by the hypotheses in Figure 2. Other physician and patient characteristics were included as confounders to control for factors known to impact CoC and hospital readmissions. The expected working mechanism of the effect of network mechanisms CoC and network mechanisms and CoC on hospital readmissions, respectively, are depicted in figure 1.
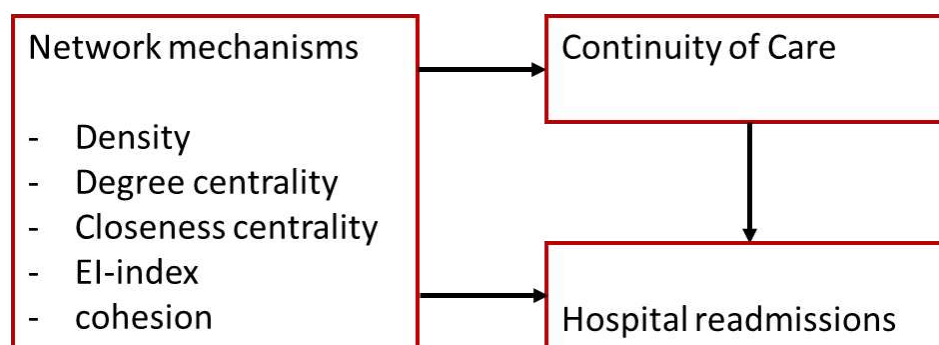
Figure 1: Expected working mechanisms underlying the social network analysis, Copyright 2023 *Chronic Obstructive Pulmonary Diseases: Journal of the COPD Foundation* (Forstner et al. 2023b)

The assumption underlying the hypotheses is that provider connectedness between GPs and ambulatory specialists has a positive impact on information flow, communication and collaboration concerning individual patients. It was hypothesised that this effect is stronger in enclosed groups of practitioners (low EI-index) that are densely and well connected (density and cohesion), as shared views can be built through recurrent social interaction and less influence from outside the network. Yet, the anticipation that not being very central holds advantages, as those who have fewer connections potentially have stronger connections and better knowledge about the tasks and responsibilities of others. Altogether, it was expected that knowledge about the responsibilities of others in the network and strong relationships leads to targeted physician consultations, resulting in higher CoC and improved information flow and targeted physician consultants, resulting in lower readmission rates.

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1. Regarding structural characteristics of networks:
   a. There is variation between networks regarding network characteristics (such as density), based on their geographical location (urban vs. rural.).
   b. The effect of network characteristics (especially density) is different between rural and urban areas. More specifically; in urban areas, the positive relationship between density and outcomes (see 2b and 3b) is stronger than in rural areas.
   c. Ego-networks of individual physicians in rural areas are denser than networks in urban areas.
   d. Ego-networks in rural areas have a lower E-I index than networks in urban areas.
   e. Cohesion is higher in ego-networks in rural areas than in ego-networks in urban areas.
2. Regarding the effect of network characteristics on informational continuity after hospital discharge:
   a. Dense networks are associated with higher CoC.
   b. Low centrality (degree and closeness) is associated with higher CoC (As care providers potentially refer patients to fewer other care providers, their relation, therefore, is stronger).
   c. A low E-I index is associated with higher CoC.
   d. High cohesion as a proxy for provider connectedness is associated with higher CoC.
3. Regarding the effect of network characteristics on readmission:
   a. High CoC is associated with lower readmission rates.
   b. Dense networks are associated with lower readmission rates.
   c. Low centrality (degree and closeness) is associated with lower readmission rates.
   d. A low E-I index is associated with lower readmission rates.
   e. High cohesion is associated with lower readmission rates.

Figure 2: Hypotheses underlying the regression analyses, Copyright 2023 *Chronic Obstructive Pulmonary Diseases: Journal of the COPD Foundation* (Forstner et al. 2023b)

Multilevel models (MLM) with random intercepts were used to consider the hierarchical structure of the data where COPD patients are clustered in GPs. For CoC, a linear MLM was computed and binary logistic MLMs were built for each of the readmission timeframes, containing the SECON as an additional predictor. The at-risk population includes those who have not been readmitted in the preceding time frame (as only the first readmission after the index stay is considered) or died in the preceding time frame.

For the analyses, continuous measures (outcome, predictors and confounders) were standardised around the mean to facilitate comparison of effects. First, a null model containing the intercept only was built to compute the intraclass correlation coefficient (ICC) to analyse how much of the variance in the outcome is attributable to being treated by a certain GP. However, even when the ICC was equal to or close to 0, MLMs were built to consider the natural clustering of the data. ICCs were computed using the R package performance (Lüdecke et al. 2021). Then, bivariate models of each of the predictors and models with all confounders and one of the predictors, respectively, were built to get raw effects for the impact of each of the predictors on the outcomes. Then, the following models were built before reaching the final model: models with measures on a patient level only, models with measures on a GP level only, models with confounders only and finally a model containing all confounders and predictors. Analyses of variance (ANOVA) were computed to compare the model containing confounders only and the final model to examine whether including network characteristics improved the model.

Measures were excluded from the analysis when they were strongly correlated (Pearson's r, eta, or Cramer's V > 0.6) or multicollinearity was high (variance inflation factor (VIF) > 10). Due to high correlation, the age of the GP and the share of specialists within an ego network were excluded from the analyses. Correlations were computed using the R packages Hmisc (Harrell Jr 2018), lsr (Navarro 2015) and ryouready (Heckmann 2015) and car (Fox and Weisberg 2019). Linear MLMs were fitted through the restricted maximum likelihood approach, binary logistic MLMs were estimated using the Bound Optimisation by Quadratic Approximation (BOBYQA) algorithm (Powell 2009).

Sensitivity analyses were conducted for models indicating singularity by building single-level models. Furthermore, models without each of the following measures were computed, compared to the preceding model using ANOVAs and excluded from the final model when removal significantly improved the model: practice size, as it had high but not strong correlation values; severity, as for many patients, severity is unspecified and thus difficult to interpret if significant and the SECON, as it was considered in the first analysis as an outcome and then included as a predictor in the analysis of readmissions. For the analysis of readmission within 30 days from discharge, the SECON as well as the number of contacts

with the usual provider was excluded from the model as the distribution of the data hindered convergence.

The level of significance was set to α = 0.05 for all models. Results are reported with standardised regression coefficients (β) for linear models and odds ratios (OR) for logistic models, respectively, together with their 95 % confidence interval (CI). Measures for the goodness of fit or variance explained are not reported as they were not of interest and some can only partly be applied to multilevel analysis (Lorah 2018).

2.2.5.3 Analysis of the variation and difference in network characteristics between urban and rural areas

For the analysis of differences in the network characteristics, the Welch two-sample t-test was computed to compare the means of the network characteristics between GPs in urban and rural areas, respectively. The level of significance was set to α = 0.05. The R package stats (included in Base R) was used for computing t-tests.

To analyse whether the effect of network characteristics on outcomes is stronger in urban areas, first, sub-groups were built based on whether a GP practises in an urban or a rural area and MLMs for each sub-group were computed for each of the outcomes, containing one predictor each and adjusting for all confounders. Then, MLMs for each of the outcomes were computed (irrespective of the subgroups), containing one predictor each, adjusting for all confounders and including an interaction term containing the respective predictor and the measure indicating urban/rural area to test whether network mechanisms have a different dynamic in urban compared to rural areas.

Multilevel models were fitted using the R packages lme4 (Bates et al. 2015) and lmerTest (Kuznetsova et al. 2017) was used to compute p-values and stats (included in Base R) for computing single models. All regression tables (except for the null model and the model containing interaction terms) were exported to Microsoft Excel files using the R package jtools (Long 2022), supported with the packages huxtable (Hugh-Jones 2022), officer (Gohel et al. 2023a) and flextable (Gohel et al. 2023b).

2.3 Evaluation of the VESPEERA programme[6]

This effectiveness evaluation addresses research question *III1) Which effect does a care programme implemented in hospitals and general practices (VESPEERA) have on hospital readmissions and other outcomes?*.

2.3.1 Study design

The VESPEERA programme was evaluated in a multi-centre quasi-experimental study, comparing all patients who received the intervention, regardless of the time point of enrolment in the programme, with a control group receiving usual care built from claims data. The study was conducted from 1 October 2017 until 30 September 2020, participant enrolment started in May 2018 and ended on 30 September 2019. The study was registered (DRKS00014294 on DRKS / Universal Trial Number (UTN): U1111-1210-9657) and approved by the ethics committee of the Medical Faculty Heidelberg before the start of the study (S-071/2018) as well as the ethics committee of the Medical Chamber of Baden-Wuerttemberg (B-F-2018-023).

2.3.2 Participants, study setting and recruitment

The VESPEERA programme was implemented in 7 hospitals and 72 general practices in 9 pre-defined districts in southern Germany (Heidelberg, Rhein-Neckar, Stuttgart, Esslingen, Ludwigsburg, Boeblingen, Calw, Reutlingen and Tuebingen). Those regions were selected as hospitals from within the districts that had expressed interest to participate in the project as part of the preparation of a project-specific integrated care contract during the time of writing the research proposal.

Patients were eligible for study participation when they were admitted to or discharged from the hospital, regardless of whether the hospital department participated in the programme, were 18 years or older and were insured with AOK Baden-Wuerttemberg. Patients who reside in long-term care institutions were excluded from study participation. Both the patient and their GP had to participate in the HZV, which implies that the GP coordinates access to hospital care (Wensing et al. 2017). Furthermore,

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[6] Parts of this chapter have already been published in the following publications:

Forstner, J., Straßner, C., Kunz, A., Uhlmann, L., Freund, T., Peters-Klimm, F., Wensing, M., Kümmel, S., El-Kurd, N., Rück, R., Handlos, B. and Szecsenyi, J. (2019a). Improving continuity of patient care across sectors: study protocol of a quasi-experimental multi-centre study regarding an admission and discharge model in Germany (VESPEERA). BMC Health Serv Res 19, 206, doi: 10.1186/s12913-019-4022-4.

Forstner J, Kunz A, Straßner C et al. (2019b) Improving Continuity of Patient Care Across Sectors: Study Protocol of the Process Evaluation of a Quasi-Experimental Multi-Centre Study Regarding an Admission and Discharge Model in Germany (VESPEERA). BMJ Open 9, e031245, doi: 10.1136/bmjopen-2019-031245.

Forstner, J., Pilz, M., Straßner, C., Weis, A., Litke, N., Uhlmann, L., Peters-Klimm, F., Aluttis, F., Baldauf, A., Kiel, M., Qreini, M., Kaufmann-Kolle, P., Schubert-Haack, J., El-Kurd, N., Tomaschko-Ubeländer, K., Treffert, S., Rück, R., Handlos, B., Karakas, G., Wensing, M. and Szecsenyi, J. (2023c). Hospital Admission and Discharge: Lessons Learned from a Large Programme in Southwest Germany. International Journal of Integrated Care 23, 4, doi: 10.5334/ijic.6534.

general practices had to employ a VERAH. For hospitals to participate in the project, they had to sign the integrated care contract with AOK Baden-Wuerttemberg.

Recruitment of hospitals started during the research proposal period (see above) in April 2016 through a public announcement by AOK Baden-Wuerttemberg. All hospitals that expressed interest in participation were then again contacted after the project has started and invited to officially participate in the project.

To recruit general practices, all eligible general practices located within the predefined districts were contacted by the HÄVG (*Hausärztliche Vertragsgemeinschaft*, the organisation that manages the HZV contracts for the German Association of General Practitioners) via fax or other communication channels such as newsletters and in continuing education workshops. If interested in participation, GPs and VERAHs signed up for training (see chapter 2.3.3.2). During the training, they received detailed information about the study and signed the participation form. General practices were recruited continuously and were able to join the project during the ongoing intervention phase. Participating practices then recruited patients by checking the inclusion criteria for a) patients with a planned hospital admission and b) patients after discharge after an unplanned hospital stay, provided the study information and received the signed informed consent forms, which remained at the study site.

A control group of patients from outside of the intervention region received usual care. It was built from claims data using propensity-score matching (Ho et al. 2011), considering age, gender, CCI at first hospitalisation (Sundararajan et al. 2004) and the number of hospitalisations during the observation period. If information about the GP was applicable, the variables age, gender, field of expertise and urbanity were considered to build the control group on the practice level.

2.3.3 The VESPEERA programme and implementation strategies

2.3.3.1 Description of the components of the VESPEERA programme

The VESPEERA programme was developed based on the following several pillars. It was informed by a review of the international research evidence (Straßner et al. 2020) as well as a review of quality deficits and potential for improvement in Germany (AQUA – Institut für angewandte Qualitätsförderung und Forschung im Gesundheitswesen GmbH 2015). Additionally, the programme was aligned with the RV EM and with the HZV. The experiences and requirements of the stakeholders were considered by involving them in the development process in the form of workshops in which they discussed the intervention components (see chapter 2.3.3.2). The VESPEERA programme consists of a set of compo-

nents that were applied depending on the type of hospital admission and time point of study enrol-ment (see figure 3). The three sets of components were: pre-admission interventions, in-hospital in-terventions and post-discharge interventions.

general practice before admission

Assessment before admission: patient master data, admission diagnosis, medical history, medication, living situation, legal situation, long-term care, contact person

admission letter: automatically generated from the assessment before admission

patient brochure: information to help prepare for hospitalisation

ADMISSION

hospital stay

determination of the HOSPITAL score: is calculated from 7 items and gives an indication of the risk of readmission

telephonic discharge conversation: with the general practice before discharge (if necessary)

patient discharge information: summary of the documents provided, information on the next steps, contact details for contact points in case of questions

DISCHARGE

follow-up care in general practice

assessment for planning of follow-up care after discharge: patient's condition after discharge, planning of further care, inclusion in telephone monitoring for patients with an increased risk of readmission

telephone monitoring: within 90 days after discharge; early detection of deterioration in the patient's condition

Figure 3: Components of the VESPEERA programme, figure by Forstner et al. (2022a) licensed under CC BY 4.0

Pre-admission interventions were delivered in a separate room in the general practice, mainly by VE-RAHs under the responsibility of the GP. They include a structured and standardised computer-aided **assessment before admission (A)** resulting in an **admission letter (B)**. The information on the reason for hospital admission, the patient's medical history, medication, living situation and long-term care situation including the availability of medical aids and appliances as well as the patients' legal situation were collected by the VERAH in a designated additional software ('CareCockpit') and automatically included in the admission letter. Furthermore, the letter included contact information of the general practice. The time of application of the assessment was not pre-defined and depended on the urgency of the admission but recommended to be as close to the admission as possible to ensure that the information was up to date. Furthermore, patients received a paper-based **patient brochure (B)** that aids in preparing for a hospital stay with information on relevant documents and items to bring, pa-tients' rights and obligations as well as information on contact points for further support. The brochure was written in simple language and complemented by pictograms.

Hospitals were responsible for integrating the VESPEERA admission letter into their processes in a way that it was accessible to all health professionals involved. Other in-hospital interventions were performed around discharge: In cases where needed, a **telephonic discharge conversation (C)** between the hospital staff with the general practice was performed. No sharp criteria were defined for cases where this conversation might have been necessary but a list was provided as orientation (one-page pdf file, provision to staff by hospital management according to internal processes). The decision on whether a physician, a nurse or another health professional was responsible for the discharge conversation of individual patients was made by the hospitals. The **HOSPITAL score (D)** (Donzé et al. 2016) was to be computed before discharge and shared with the general practice via the discharge letter. The HOSPITAL score consists of seven items (low haemoglobin, discharge from oncological services, low sodium, procedures, emergency admission, number of hospital admissions in the preceding year and length of stay) and can help to identify patients with an increased risk for readmission. Patients received paper-based **patient discharge information (D)** in simple language, providing an overview of documents, next appointments with the GP and the hospital, as well as the contact information of the hospital and self-help groups. If hospitals had already implemented a similar document, it was not necessary to provide the patient with the VESPEERA discharge information but adaption to its contents was recommended.

Post-discharge interventions in general practice were also conducted in the CareCockpit software by the VERAH and included a structured and standardised **assessment for planning of follow-up care after discharge (E)**. It includes medical, social and long-term care needs such as wounds, pain, medication, involvement of other health professionals and the option to compute the HOSPITAL score in case it was not provided by the hospital. It was recommended to perform this assessment timely after discharge, if possible, on the next working day. The patient received a brief paper-based summary of the arranged care plan which could be printed from the software. Patients with an increased risk for readmission (HOSPITAL score ≥ 5) were included in a structured and standardised three-month **telephone monitoring (F)** which included monitoring of symptoms as well as of the arranged care plan. If patients were in the practice regularly, the monitoring could be combined with in-practice visits and did not need to be additional telephonic appointments. In case of need, paper-based sheets could be printed from the software to bring to a home visit. The telephone monitoring included two mandatory appointments: one within a time frame of two weeks after discharge and one closing appointment three months after discharge. The number and frequency of in-between appointments were to be determined by the GP, based on their appraisal of the patient's needs and adherence, the medical urgency and other possibly relevant factors. Table 1 provides an overview of the intervention components and which should have been delivered to which patients.

Table 1: Overview of the intervention components and study arms of the VESPEERA programme

Interventions	Study arm 1: **planned** admission into a **participating** hospital	Study arm 2: **planned** admission into a **non-participating** hospital	Study arm 3: unplanned admission into a **participating** hospital	Study arm 4: unplanned admission into a **non-participating** hospital	Study arm 5: **control group**, not participating in VESPEERA
In the general practice before admission: (A) Assessment for admission (B) Admission letter and patient brochure	X	X			
In the hospital: (C) Telephonic discharge conversation (D) Determination of HOSPITAL Score and patient discharge information	X				
In the general practice after discharge: (E) Assessment for planning of follow-up care (F) Telephone monitoring, depending on the risk of readmission	X	X	X	X	

2.3.3.2 Description of the implementation strategies

Several strategies were applied to support the implementation of the VESPEERA programme in hospitals and general practices. The strategies are named according to the so-called ERIC compilation by Powell et al. (2015) and are reported using the recommendations by Proctor et al. (2013) as well as the so-called TIDieR checklist (Hoffmann et al. 2014) as follows:

First, consensus discussions with representatives of all stakeholders, thus hospital representatives, GPs, patients, sickness funds and researchers, have been conducted. All intervention components were thoroughly discussed in the developmental period concerning the relevance of items, the wording of items and the design of documents, such as the patient discharge information. By involving users in the development of the intervention, the acceptance and attractiveness of the programme were expected to increase. The contents of these discussions were, however, not part of the formal evaluation of the VESPEERA programme.

Second, formal commitments were obtained by participating hospitals. Adaptability was promoted to facilitate the integration of study components into clinical processes according to organisational resources such as the use of electronic patient records or staff availability and skill-mix. Therefore, each hospital provided information on how they ensured the identification of study patients, the use of the admission letter, the execution of the telephonic discharge conversation, the dissemination of the patient discharge information and the transfer of data to calculate the HOSPITAL score. These formal

commitments were obtained within four weeks of signing the participation agreement. Thereby, intervention fidelity as well as acceptance and attractiveness of the VESPEERA programme were expected to increase.

Third, the record system was changed by enhancing the PraCMan-Cockpit, software that is routinely used in Baden-Wuerttemberg within the PracMan case management programme (Freund et al. 2016). The resulting CareCockpit includes the additional VESPEERA module, which assists general practices with organising patient information, conducting the assessments and care planning, generating the admission letter and other documents and administrating telephone calls within the telephone monitoring. The CareCockpit is software that works independently from the practice information system and is used by the VERAH and the GP. Furthermore, the CareCockpit works as an electronic case report form for data analysis within the outcomes' evaluation.

Fourth, train-the-trainer strategies were used to instruct GPs and VERAHs in software utilisation and study processes. Trainers were teams of two (GP and VERAH) who are experienced in training the PraCMan-Cockpit and who were instructed in handling the CareCockpit by the study central office. GPs and VERAHs who were interested in participating in the VESPEERA programme signed up for a one-time 2.5-hour training. GPs and VERAHs learned the handling of the software in a role-play format.

Fifth, to support GPs and VERAHs with the implementation of all intervention components, educational materials were developed. Investigator site files were provided after participation in the training by the study central office. Investigator site files contained instructions and background information on the following: obtaining informed consent by patients, installation of the CareCockpit-software, an overview of frequently asked questions concerning the handling of the software, conduction of the intervention components and conduction of the patient survey. Furthermore, general practices were continuously provided with instructional video tutorials on handling the software by the study central office. Along with the training, educational materials were expected to increase intervention fidelity.

Sixth, both participating general practices and hospitals were provided ongoing consultation with the study central office and other consortium partners to support implementation. General practices and hospitals were repeatedly called by employees of the study central office and asked for the status of implementation and any problems that arise within the implementation process. General practices were offered refreshers on topics of the training, such as the procedure for obtaining informed consent by patients, handling of the software and instruction of the intervention components. Thereby, intervention fidelity was expected to increase.

Seventh, hospitals and general practices were provided feedback in the form of three benchmarking reports in September 2018, September 2019 and June 2020. The feedback reports were based on

structured, quantified data sources (claims data, patient data from the CareCockpit and patient survey data) and were aggregated on a hospital or general practice level. They were discussed in two moderated feedback meetings in October 2018 and November 2019 with care providers, where options for potential improvement will be developed. Feedback meetings were moderated by the study central office with support from the other project partners. Care providers had an active role in the meetings in a workshop format and reported their perspectives and experiences. Audit and feedback is a strategy to improve professional practice, which has mixed and overall moderate impacts on professional performance (Ivers et al. 2012; Ivers et al. 2014). In this context, feedback provided was expected to enhance intervention fidelity.

Additionally, hospitals and general practices received fee-for-service for conducting patient-related care services as well as lump sum reimbursement for study organisation and participation in workshops and feedback meetings. General practices invoiced the care services as part of their usual invoice process, which is carried out at the end of each quarter year. Hospitals invoiced the AOK Baden-Wuerttemberg at the end of each quarter year. Lump sums were paid after participating in the feedback meetings. Fee-for-service gives the incentive to provide the different intervention components and thereby was expected to increase intervention fidelity (Flodgren et al. 2011).

2.3.4 Measures, data sources and data collection

Overall, the VESPEERA programme was expected to reduce the number of avoidable readmissions and emergency care contacts, improve patient safety and patient involvement, reduce overuse, underuse and misuse of healthcare, improve CoC and interprofessional and cross-sectoral communication between patients, hospitals, general practices and the AOK Baden-Wuerttemberg.

2.3.4.1 Outcomes

The primary outcome was the number of readmissions due to the same indication (three-digit ICD-10-GM code) within a time frame of 90 days. This outcome was collected from claims data on a case level, meaning that each patient could have more than one readmission whereof all were considered in the analyses. Only hospital stays in acute care were considered and stays in psychiatric and rehabilitation institutions were not considered. Stays resulting in a transfer to another inpatient facility (rehabilitation, nursing facility) were not considered. An admission was considered an emergency admission if this was documented as the reason for admission in claims data, all other admissions were considered planned admissions. Regarding readmissions, only readmissions due to the same indication (same three-digit ICD code documented as the main diagnosis) in the respective time frame were considered.

Furthermore, a range of secondary outcomes, which were based on pseudonymised claims data, were considered in the analysis. Complementary to the primary outcome, the number of readmissions due to the same indication (three-digit ICD-10-GM code) within a time frame of 30 days was considered. Additionally, the number of admissions due to ACSC (see underlying list in appendix III), as well as the number of patients discharged from a participating hospital who use emergency or rescue services (emergency medical service, emergency ambulance, ambulance emergency response vehicle, ambulance, rescue helicopter) within a time frame of three months, were considered. Emergency or rescue services were defined as such when a hospital admission was marked as an emergency or when the use of the rescue service/emergency physicians/air rescue or outpatient emergency treatment was billed in the ambulatory care catalogue. Furthermore, outcomes that consider whether there was a delay in follow-up care after discharge and thus a gap in patients' care transitions were analysed. This includes the number of patients discharged to the outpatient sector from a participating hospital where the prescription of medication, a prescription for medical aids and appliances is delayed or the referral to rehabilitation therapeutics such as physiotherapy, occupation therapy or speech and language therapy was delayed. A delay was defined as a prescription or referral that has been issued later than seven days after hospital discharge, considering only prescriptions or referrals that were issued within the first 90 days after hospital discharge and before the next admission.

2.3.4.2 Data sources and data collection

For data analysis, a data set consisting of secondary claims data and primary data collected within the CareCockpit software in general practices was used. Claims data were provided by the AOK Baden-Wuerttemberg. Claims data were provided for patients from the intervention group from within the intervention region as well as for patients from Baden-Wuerttemberg but outside of the intervention region that fulfilled the inclusion criteria to build the control group. Data were provided for a time frame of six months before the intervention phase to three months after the intervention phase and included information on the GP and the general practice, insured master data, office-based services provided, diagnoses, prescriptions for medication, medical aids and appliances, referrals to rehabilitation therapeutics, the hospital stay with operations and procedures performed, long-term care services, home care and ambulances.

Primary data from the CareCockpit software were exported from the software each quarter year during the intervention phase and included information on which intervention components were conducted. Data from the admission letter included information on diagnoses, medication, the medical problem leading to the admission, antibiotics, antibiotic resistance, living situation, orientation,

chronic wounds, (instrumental) activities of daily living, mobility, falls, the legal situation and information on which documents were provided along with the admission letter. Data from the assessment for planning of follow-up care included information on the length of stay, the HOSPITAL score, (instrumental) activities of daily living, pain, wounds and other symptoms, changes in medication, referrals and prescriptions as well as further planned measures. Data from the telephone monitoring included information on any alarm symptoms, pain and medication reconciliation, as well as information on the status of any appointments, referrals and prescriptions from the planning of follow-up care.

Data linkage was carried out by an independent institute using pseudonymised patient IDs. After data linkage and before the transfer to the evaluating institution, IDs were pseudonymised once again.

2.3.5 Sample size

Since large-scale implementation of the VESPEERA programme in a geographical region was intended, the number of participating GPs and hospitals was not restricted. The sample size was estimated considering the expected number of participating general practices based on the number of general practices who participate in the HZV and the PraCMan programme (n = 115) and assumed rates for (re-) admission, unplanned admissions and rates of high-risk patients as well as expected drop-out rates, all based on AOK claims data. Admissions were expected to be planned and unplanned in 50 % of the cases, respectively. 56 % of planned admissions were expected to be made by a GP and therefore could be included in the VESPEERA programme. 40 % of planned admissions were expected to be cases treated in a participating hospital department. After discharge, 20 % of patients were expected to drop out as a result of death, transfer to a nursing home or loss to follow-up in the general practice. 60 % of discharged patients were expected to have an increased risk of readmission (HOSPITAL score indicating an intermediate or high risk for readmission). The alpha level was set to 5 %. The following power considerations were based on chi-square tests (to test for group differences) and adjusted for the hierarchical structure of the data with cases nested in patients nested in hospitals. Nesting in general practices was not possible as this information was not available for all patients from the control group. A relatively high intraclass correlation coefficient (0.3) can be expected when considering measurements within patients, however, the number of cases per patient was expected to be relatively small (approx. 1.6 cases per patient). The clustering by hospitals was considered with an expected number of approx. 540 patients per hospital and a presumed ICC of 0.03, which is a realistic value in health services research (Adams et al. 2004). Furthermore, a readmission rate of 23 % in the control group was assumed. With a power of 80 %, this resulted in a sample size of 1,270 cases after discharge in study arm 1 and 7,088 patients resulting in 11,340 hospital admissions in total. Since the control

group was built from claims data, the number of patients in the control group was chosen to equal the number of patients in the intervention group.

The sample size calculation deviates from the original calculation, which included calculations for all four study arms and was based on 250 participating general practices. During the course of the intervention, it became clear that the final number of participating practices and thus the sample size would be lower than expected and that no patient received the in-hospital intervention components. Thus, study arm 2 (patients with a planned admission in a non-participating hospital) became obsolete. Therefore and since the final sample size was lower than expected, it was decided to combine all study arms for the analysis of the VESPEERA intervention vs. the control group to increase the chance to detect the underlying effect of the VESPEERA intervention.

2.3.6 Statistical Analysis

To describe the data, absolute and relative frequencies were computed for categorical variables and mean values and SDs for continuous parameters. Confidence intervals for rates were derived by the formula of Wilson (1927).

In the primary analysis, difference-in-difference models (Dimick and Ryan 2014) were applied. The change in the primary outcome (before vs. after the intervention) of the intervention group was pairwise compared to the change in the control group. The model was estimated as follows:

$$\text{readmission}_{t,i} = \beta_0 + \beta_T \text{x time}_{t,i} + \beta_I \text{x intervention}_i + \beta_{IxT} \text{x (intervention : time)}_{t,i}$$

The index t describes the point in time, i is the index for the considered observation. The following parameters were estimated:

- β_0: intercept
- β_T: effect of time; the general change from before to after the intervention
- β_I: difference between groups at baseline
- β_{IxT}: difference between the change (before and after comparison) in the control and the intervention group; the main parameter for the outcome evaluation.

The parameter β_{IxT} is the main parameter to evaluate the effectiveness of the intervention, describing the difference in changes between the two groups over time. The above model was adjusted for the covariate 'hospital'.

Since the primary outcome is binary, logistic regression models were applied. Furthermore, there is a hierarchical structure underlying the data, with admissions nested in patients and patients nested in hospitals, respectively. This structure was considered in the model by including random intercepts at

each level. The combination of random and fixed effects results in a mixed logistic regression model. The resulting ORs are reported together with their 95 % CIs. All ORs are reported such that an OR smaller than 1 favours the intervention group while an OR larger than 1 favours the control group.

In addition to the primary analysis, a sensitivity analysis was conducted. First, again using the primary outcome but including 12 time points (six before the intervention and six after the intervention (measured month-wise), time trends before and after the intervention were compared using an interrupted time series-model (Kontopantelis et al. 2015). For all secondary endpoints that treat before/after comparisons of rates, logistic mixed models as in the primary analysis were applied.

To investigate if there are particular populations with a specific efficacy of the VESPEERA intervention, the primary analysis was conducted in subgroups. Subgroups were built based on the patient's age (younger than 65 years or 65 years and older) and the Charlson comorbidity index (low with CCI ≤ 2, medium with CCI = 3 - 4, or high with CCI ≥ 5 according to Huang et al. (Huang et al. 2014)). Furthermore, some VESPEERA patients received telephone monitoring in addition to the usual VESPEERA intervention, depending on their HOSPITAL Score. This was interpreted as add-on therapy and the primary analysis was run adding interaction effects to compare patients who received the VESPEERA intervention and telephone monitoring with the control group and patients who received the VESPEERA intervention but no telephone monitoring with the control group.

All statistical analyses were carried out using the statistical software R (R Core Team 2010), version 4.0.3. All data processing was done using the tidyverse package (Wickham et al. 2019). Propensity score matching was performed using the package MatchIt (Ho et al. 2011). Mixed models were fitted using the package lme4 (Bates et al. 2015).

2.4 Quantitative survey study[7]

This quantitative survey study addresses research question *III2) What are the factors that affect the implementation of the VESPEERA care programme?*.

2.4.1 Study design

This survey with care providers within the VESPEERA process evaluation was conducted as an observational explorative study. Ethical approval was obtained by the Ethics Committee of the Medical Faculty Heidelberg (S-352/2018) for the process evaluation of the VESPEERA study. All participants gave their informed consent before study participation. Data were pseudonymised based on the participants' healthcare organisation.

2.4.2 Study sample

All care providers from hospitals and general practices participating in VESPEERA who were involved in the delivery of the care programme or its implementation in the conceptual phase were eligible for participation in the survey study. All participants had to be at least 18 years old, have written and spoken German language skills and be able to give their informed consent to the study participation. The sample for the quantitative survey study comprises all participating practices and hospitals (full study population, see table 2).

Table 2: Planned sample size for the questionnaire survey

	Planned sample size
Hospitals	
Nursing	25
Hospital Management	25
Physicians	25
General practices	
GPs	100
VERAHs	100
Overall	275

GP: General practitioner, VERAH: Care assistant in general practice

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[7] Parts of this chapter have already been published in the following publication:

Forstner, J., Kunz, A., Straßner, C., Uhlmann, L., Kuemmel, S., Szecsenyi, J. and Wensing, M. (2019b). Improving Continuity of Patient Care Across Sectors: Study Protocol of the Process Evaluation of a Quasi-Experimental Multi-Centre Study Regarding an Admission and Discharge Model in Germany (VESPEERA). BMJ Open *9*, e031245, doi: 10.1136/bmjopen-2019-031245.

Forstner, J., Pilz, M., Straßner, C., Weis, A., Litke, N., Uhlmann, L., Peters-Klimm, F., Aluttis, F., Baldauf, A., Kiel, M., Qreini, M., Kaufmann-Kolle, P., Schubert-Haack, J., El-Kurd, N., Tomaschko-Ubeländer, K., Treffert, S., Rück, R., Handlos, B., Karakas, G., Wensing, M. and Szecsenyi, J. (2023c). Hospital Admission and Discharge: Lessons Learned from a Large Programme in Southwest Germany. International Journal of Integrated Care *23*, 4, doi: 10.5334/ijic.6534.

Participants were recruited using a short invitation letter, the information and consent documents and the questionnaire itself. If interested in participation, participants returned the signed consent form and the completed questionnaire to the study central office by post in a pre-stamped envelope.

All GPs and VERAHs as well as the contact persons in the hospitals received a personalised letter, all other care providers received a generally worded letter. Different ways were chosen to distribute the invitation letters. General practices that had more than three VESPEERA patients enrolled were visited by staff from the study central office in the practice and received their survey documents in person. With a few exceptions, hospitals were also visited personally by staff from the study centre. The survey documents were handed over personally to physicians and nurses in the wards in question or placed in their personal mailboxes. Hospitals that did not wish for a visit received a sufficient number of survey documents to distribute.

2.4.3 Data sources and data collection

The questionnaire was developed based on recurrent and prominent statements from the interview study and covers the following topics: working mechanisms and acceptance of each of the components of the VESPEEA programme, contextual factors (regarding networks, resources, external policy and external requirements, project management in the VESPEERA project and identification as well as study inclusion of patients), overall attractiveness and acceptance of the VESPEERA programme and perceived effects from the viewpoint of care providers; see appendix IV). Therefore, they can be considered valid in terms of content (Friedrichs 1990). Participants were asked to state whether they agree or disagree with the statements, each based on a five-point Likert scale. Furthermore, the questionnaires included one section regarding intervention fidelity, asking asked for each intervention component whether the care providers had used it at least once or were familiar with the contents. Additional information about the participant and the organisation they are working in was collected. Questionnaires were piloted for comprehensibility and completeness by two GPs, two persons from hospital management, one hospital physician and two hospital nurses. The data were collected through paper-based questionnaires and pseudonymised after receipt at the study central office.

2.4.4 Statistical Analysis

Survey data were analysed descriptively using means and SDs for continuous data and absolute and relative frequency for categorical data. Furthermore, means and SDs were computed for categorical data that was collected based on Likert scales.

Based on the responses regarding the utilisation of intervention components, a score depicting intervention fidelity was computed. For this purpose, the maximum number of potentially usable components was set to 1 (= 100 %) and individual use was measured against this. Participants from general practices could use a total of seven intervention components (assessment before admission, admission letter, patient brochure at admission, telephonic discharge conversation, HOSPITAL score, assessment for planning of follow-up care after discharge, telephone monitoring), participants from hospitals four intervention components (admission letter, HOSPITAL score, telephonic discharge conversation, patient discharge information).

For the presentation of the results, the two categories 'not at all true' and 'rather not true' were summarised into the new category 'not true'. Accordingly, the two categories 'very true' and 'rather true' were summarised into the new category 'true'.

Data were analysed using IBM SPSS Statistics Version 25.

3 Results

3.1 Results of the qualitative interview study[8]

Here, the results of the qualitative interview study are reported. First, a description of the study population is presented. This is followed by a detailed description of the themes identified in the content analysis, which are captioned in direct quotes from the interviews.

3.1.1 Description of the study population

A total of n = 49 interviews were conducted. The participants were assigned to the following groups: n = 6 GPs, n = 11 VERAHs, n = 15 hospital management (thereof n = 10 participating in VESPEERA), n = 6 hospital physicians (thereof n = 3 participating in VESPEERA) and n = 11 hospital nursing staff (thereof n = 6 participating in VESPEERA). The groups are not selective, the assignment to the groups, therefore, was based on the individual's role in VESPEERA. For instance, a hospital physician who is also responsible for discharge management in their clinic or department was assigned to the hospital management group. Nursing staff who were appointed implementation leaders for the VESPEERA implementation were also assigned to the hospital management group. Staff other than management, physicians or nursing (such as ward assistants or case management staff) were assigned to either hospital management or hospital nursing staff, depending on whether they had a managerial role in the VESPEERA implementation.

Across all groups, more than two-thirds of participants were female (n = 34, 69 %). The mean age was 47, ranging from 21 to 67. Based on the district of their organisation, about two-thirds of the participants worked in an urban area (n = 28, 60 %). Table 3 provides an overview of sociodemographic data within and across groups.

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[8] Parts of this chapter have already been published in the following publication:
Forstner, J., Bossert, J., Weis, A., Litke, N., Strassner, C., Szecsenyi, J. and Wensing, M. (2021). The role of personalised professional relations across care sectors in achieving high continuity of care. BMC Fam Pract *22*, 72, doi: 10.1186/s12875-021-01418-8.

Table 3: Sociodemographic characteristics of participants in the qualitative interview study

	General practices		Hospitals			Total
	GPs	VERAHs	Management	Physicians	Nursing staff	
Age [a]	58 (50-64) n = 6	40.5 (31-54) n = 11	50 (29-60) n = 15	53.5 (34-67) n = 6	41 (21-61) n = 11	47 (21-67) n = 49
Sex *(male)* [b]	2 (33 %) n = 6	0 (0 %) n = 11	7 (47 %) n = 15	5 (83 %) n = 6	1 (9 %) n = 11	15 (31 %) n = 49
Area *(urban)*	3 (50 %) n = 6	6 (60 %) n = 10	10 (66 %) n = 15	2 (33 %) n = 6	7 (64 %) n = 11	28 (60 %) n = 49
Years of experience	16.5 (2-25) n = 6	17.5 (3-38) n = 10	12 (2-22) n = 15	18 (7-32) n = 6	11 (0.25-28) n = 11	14 (0.25-38) n = 48
Single practice	4 (67 %) n = 6	5 (50 %) n = 10				9 (56 %) n = 16
Practice size *(patients per quarter year)*	1467 (850-2,400) n = 6	1775 (999-3,000) n = 8				1643 (850-3,000) n = 14
Hospital size *(basic and regular care)* [c]			6 (40 %) n = 15	4 (67 %) n = 6	7 (64 %) n = 11	17 (53 %) n = 32

[a] Numeric values are reported with their mean, their minimum and maximum and the number of valid values, [b] Categorical values are reported as absolute frequencies, relative frequencies in per cent and the number of valid values, [c] In Baden-Wuerttemberg (the study setting), hospital supply used to be based on the division of hospitals into categories, based on the number of beds. There is a distinction between basic, regular as well as specialised and maximum care (e.g. provided by university hospitals). Basic care hospitals only provide some highly used inpatient services, such as obstetrics, emergency care and internal medicine. Albeit no longer used, this categorisation still gives an impression of the size and geographical reach of a hospital (Ministerium für Arbeit und Sozialordnung, Familien und Senioren des Landes Baden-Württemberg 2010). The number provided refers to hospitals that belong to the categories of basic and regular care.

GP: General practitioner, VERAH: Care assistant in general practice

3.1.2 Results of the qualitative interview analysis

The result of the qualitative analysis can be characterised in terms of 16 subthemes across five main themes. The main themes identified are current cooperation, optimal cooperation, determinants of cooperation, personal emotional and social determinants as well as strategies to address emotional and social factors. Table 4 provides an overview of all themes identified.

Table 4: Themes identified in the qualitative analysis

	Definition	Examples of topics identified
Current cooperation		
Way of communication	Statements about who communicates with whom in which situation with which means of communication.	- Information at admission is mostly written and transferred via fax. - The extent of the content depends on the type of admission (urgent vs elective). - The most important means of communication at discharge is the discharge letter. - Discharge letters are still often missing information, are sent out too late or are never sent at all. - Synchronous communication via telephone does happen but is rather rare. - Mostly, phone calls are used to ask for missing information in written documents.
Evaluation of cooperation	Statements on how the quality of cooperation is perceived and how cooperation has developed in the past.	- Opinions regarding the quality of communication are heterogeneous. - Both sides do wish for more detailed information at admission/ discharge. - Skills mix can help to improve communication and cooperation.
Optimal cooperation		
Future cooperation	Statements on how the interviewees imagine future cooperation between hospital and general practice.	- Participants wish for better cooperation and communication. - In the future, participants see a need to standardise information transfer between hospitals and ambulatory care providers.
Optimal way of communication	Statements about which communication channels the participants perceive as optimal.	- Participants generally wish for media continuity and for a standard that defines the means of communication for different situations. - Mostly, information should be transferred by written means. - Both sides wish for short notifications about admissions and discharges. - The majority of participants wished for electronic communication and proposed different approaches. - Messenger systems were suggested for short messages that do not require an instant answer and are not meant to disrupt others' workflow.
Role and responsibilities of hospitals	Statements about what role and responsibility the inpatient sector should have in the cooperation between hospital and general practice.	- Hospitals are expected to coordinate care after discharge and inform all relevant care providers about the care plan. - There is a need for a change in paradigm towards more intense cooperation with GPs.
Role and responsibilities of general practices	Statements about what role and responsibility the outpatient sector should have in the cooperation between hospital and general practice.	- GPs are seen as responsible to provide comprehensive information about the patient's situation before admission, including information about the social and caregiving situation. - GPs are expected to become more involved after discharge and take over their role as care coordinator.

	Definition	Examples of topics identified
Determinants of cooperation		
Organisational	Statements on the extent to which organisational (outpatient, inpatient, cross-sector) factors influence communication.	- Information systems in hospitals and general practices are not compatible. - Phone calls mostly come from smaller hospitals. - Different timelines in hospitals and general practices impede telephonic reachability (a.m. surgery times in hospitals, p.m. out-of-office hours in general practices). - Telephone calls disrupt current activities. - In general practices that are well organised, medical assistants work independently and manage information flow. - Skills mix improves communication: case management, medical assistants and physician assistants.
Legal	Statements about the extent to which legal requirements influence communication.	- Data protection (fax requires phone calls for verification of identity, no verification of identity possible via telephone, impedes digital communication, hospitals need patients' consent for transferring medical information to other care providers). - Statutory regulations do not apply to patients with private health insurance (e.g. GP does not receive a discharge letter).
Financial	Statements on the extent to which financial factors influence communication.	- Healthcare organisations have to implement communication and information technology at their own financial risk. - Communication is not financially compensated.
Patient-related	Statements about the influence of patient factors on communication.	- Communication is more intense in complex cases (e.g. patients with multi-morbidity, polypharmacy, geriatric patients and oncological patients) or if misunderstandings are expected to occur. - Communication via telephone is preferred in those cases.
Individual	Statements about the extent to which individual characteristics influence communication.	- Some physicians are more likely to call than physicians in other hospitals. - Language barriers with foreign staff hinder information exchange.

	Definition	Examples of topics identified
Personal emotional and social determinants		
Appreciation and understanding of the respective other	Statements about how an understanding of the tasks of others and appreciation for their work influence communication.	- GPs do not feel appreciated by junior physicians in hospitals, GPs are under the impression that they put all the work on the GP. - VERAHs feel that detailed information at admission is not appreciated by the care providers in hospitals. - Hospital physicians tend to not trust external diagnostic results. - Communication improves when care providers have worked together for a longer time, as they gain an understanding of the others' working mechanisms. - Work shadowing can be an opportunity for developing an understanding of different areas of healthcare.
(Intrinsic) Motivation	Statements about what influence (intrinsic) motivation has on communication.	- Only few individuals seem to be intrinsically motivated to communicate with other care providers. - Motivation could be improved through positive reinforcement by patients. - A paradigm change is needed for hospital staff: healthcare does not end with hospital discharge.
Socialisation (regional, medical discipline, …)	Statements about the fact that the way of communicating is influenced by different types of socialisation.	- Medical students outside of Germany seem to be better trained for information exchange with other care providers. - Participants experience information flow to be better among geriatricians or oncologists. - Young GPs who have spent time in hospitals seem to be more aware of the information that needs to be passed. - Differences are observed between physicians in big hospitals, small hospitals or general practices.
Relationships	Statements on the extent to which personal relationships and contacts influence communication and contact establishment.	- Knowing someone and having met someone positively influences information flow and contact establishment. - Knowing someone especially influences the probability of oral communication. - Care providers know each other from formal and informal meetings, both are used for professional exchange. - Knowing someone seems to be one of the, or even the most important factor for successful information flow.

	Definition	Examples of topics identified
Strategies to address emotional and social factors		
Organised meetings and events	Statements on how organised formal meetings and events can help to improve cooperation and communication (e.g. by discussing and establishing structures).	- Regular events can help with exchanging ideas, getting to know each other and the respective others' role and responsibilities. - Events could be quality circles, events for continuing education or meetings with other care providers.

3.1.2.1 Current cooperation

Way of communication

In this subtheme, statements concerning the current means of communication, the persons communicating and the time points of communications were gathered.

When admitting a patient to the hospital electively, participants described the communication to be mostly written. This includes the referral, doctor's letters from previous hospital stays or visits with outpatient specialists, medication lists, lists of diagnoses, lab results and other diagnostic results such as from electrocardiograms or sonography. Some hospitals inform GPs or patients about the information and documents patients need to bring to their hospital stay appointment. Usually, the general practice gives all documents to the patient who is then responsible for handing them over at the hospital at the time of admission.

The statements by participants on which kinds of documents are transferred for urgent admissions differed. This ranges from some general practices that only provide a suspected diagnosis to others who provide the same documents as for elective admissions. Documents are handed to the patient, relatives or paramedics if the patient is picked up by an ambulance in the practice. If patients are admitted from their home during a domiciliary or if the patient is admitted without the GPs knowledge, participants report the most common way of transmission of documents to be via fax.

In some cases, oral communication does happen before an admission via telephone. For elective admissions, some GPs call the treating physician at the hospital to depict a patient's case in detail. When admitting a patient urgently, GPs often call many hospitals to find an available bed and a physician to treat their patient. Some VERAHs stated that in acute situations, communication is oral via telephone only. Pre-admission communication via phone usually happens between inpatient and outpatient physicians.

Post-discharge communication is mostly written as well, typically relying on discharge letters. It is usually paper-based and handed to the patient who is then responsible for handing it over to their GP. Staff from hospitals reported that all patients receive a discharge letter or a preliminary discharge letter with the final letter being sent out one to two weeks after discharge. However, general practice staff reported that the availability and quality of discharge letters differ. Some patients do not bring a discharge letter at all; however, it is not known whether the patient has not been provided with a discharge letter or whether the patient has forgotten to pass it to the general practice. Sometimes, discharge letters are too long and cannot be read totally. VERAHs stated that some hospitals give notice before discharging a patient via fax. The contents of the fax range from the note of discharge, lab

results and medication list up to preliminary discharge letters. According to VERAHs, this is seen as a positive trend in discharge communication.

In some cases, hospital physicians call GPs before discharging a patient. This was described by both parties to happen very rarely and only for non-routine cases. In complex cases, hospital physicians call GPs to ask for an appraisal of the patient's condition before hospital admission, to explain the treatments that have been carried out or to collaboratively plan the patients' further treatment relying on the GP's knowledge of the patient.

A participant from hospital management explained this as follows: *'These are the special things where the doctors call each other. But most of it is just routine and, in this case, there are no calls.' (Hospital Management)* [i] (see the German originals of all quotes in appendix I). One VERAH stated:

> *'Funnily enough that has never happened before, except for last week when someone called [...] yes, that he was being discharged and it was Friday [...] and yes, that was really great but otherwise it really never happened. So not with me, yes.' (VERAH)* [ii].

A hospital physician described calls to GPs before discharge as: *'But if we feel that the GP needs to be informed to better assess the situation, then it's just a tried and tested means, such a short phone call helps more than a two-page letter.' (Hospital Physician)* [iii].

Communication at other time points includes requests for doctor's letters or medication lists by both parties. These organisational requests are usually telephonic between medical assistants in the general practice and, depending on how hospitals or hospital wards are organised and staffed, nursing staff, case management staff, ward assistants or social services staff at the hospital. The requested documents are then faxed to the other party. Hospital staff did not see any problems in communication when further documents are asked for. General practice staff found it very common to call hospitals and ask for documents or information that they miss in the discharge documents: *'So, it's usually that we phone afterwards anyway to try and get any stuff out.' (GP)* [iv]. Medical questions concerning issues such as medication or allergic reactions or in cases when GPs are interested in the health status of their hospitalised patients are usually discussed between physicians.

Other channels of communication were mentioned by the participants. Written communication via e-mail seems to play a subordinate role and is used only if agreed upon beforehand. Some participants have reported projects where they have tried to implement so-called referral platforms. These platforms represent a kind of hospital-specific electronic health record that the hospital and all outpatient physicians treating common patients can access. Discharge letters and other medical documents can

be accessed via these platforms. One hospital physician reported cooperation with outpatient physicians that allows them to access the hospital information system and its internal mailing programme without restrictions.

Both parties described that they perceive the establishment of oral contact via telephone as one-sided and see the sector they belong to as the one that usually calls the other party. Apart from this, statements regarding ways of communication are congruent between all groups and complement the statements of others. Communication is summarised as unstructured, mostly written and oral via phone, as described by a hospital physician:

'But I'll say the communication, the communication is a little bit old-fashioned [...] yes, it's just telephone and fax. [...]. Email works, yes, only to a very limited extent with selected, so to speak, where it is specially agreed that you go this way of communication.' (Hospital Physician) [v].

Evaluation of cooperation

This subtheme summarises statements on how the quality of cooperation is perceived and how cooperation has developed in the past. Participants from all groups had opinions on the quality of cooperation.

Participants from all groups had different opinions on the trend of the quality of cooperation and communication between general practices and hospitals in recent years. Some hospital staff did not see any changes in cooperation, mostly because, all in all, cooperation always has been good and structures are well-established: *'So, my impression is that it can always be better, of course, but these are established structures that have proven themselves and, by and large, working together works quite well.' (Hospital Physician)* [vi].

Some find that cooperation has improved. For example, GPs emphasised preliminary discharge letters to be a positive trend. VERAHs mentioned that in their experience, the exchange between GPs and hospital physicians has increased. Furthermore, they said that general practices have to call hospitals less frequently for missing information and documents. However, if documents such as doctor's letters are requested, communication works well. This is confirmed by nursing staff:

'With the GPs, with the general practices in general, I can't remember that it didn't work out once [...] if the connection with a GP was established, as far as I know, this interest was usually great enough. But I know that this reflects my situation now, I know from other areas that it doesn't always go so well.' (Nursing staff) [vii].

Some hospital staff saw improvement in cooperation with general practices to have happened with the implementation of the measures of the RV EM or the certifications of medical centres. Furthermore, the creation of new positions, such as medical directors of interdisciplinary emergency departments, ward assistants or physician assistants led to improved cooperation and communication with outpatient physicians, as mentioned by hospital physicians and nursing staff: *'If it's about something specific medical or rather nursing-related, they [physician assistants] take over those calls and that way communication is better. Because of course they also relieve the doctors and - yes.' (Nursing staff)* [viii].

Hospital physicians observed an increase in the number of contacts that are established by outpatient physicians. Furthermore, they report that usually patients are admitted with specific inquiries.

Still, cooperation was not seen as a form of collaboration between hospitals and GPs where treatment of patients is planned together: *'And now we have really worked together over the phone. But those are really the absolute exceptions." (Hospital Physician)* [ix]. Other participants were disappointed as they did not see any improvement in the cooperation between general practices and hospitals, which generally was rated to be poor. Some participants from hospital management experienced a decreasing quality of cooperation with general practices resulting from barriers posed by the RV EM.

Hospital management staff wished for more information from GPs when electively admitting a patient to the hospital. Hospital physicians would like to see more detailed admissions. Some referrals include a suspected diagnosis only. Criticism was voiced in particular about discharge letters. According to both GPs and VERAHs, some discharge letters seem to be written not on the day of discharge, but some days beforehand. This leads to discharge letters containing outdated information, being incomplete (for example allergic reactions are not mentioned), or being erroneous. For GPs this means additional effort as they have to call the hospital and ask for clarification or missing information. One GP mentioned that he often cannot be bothered or does not have the time to call the hospital in these cases. One participant from hospital management was self-critical and also sees room for improvement in the way that his organisation discharges patients: *'First of all, you have to look at your own nose, right? I think that we can also inform better when we discharge patients.' (Hospital Management)* [x].

GPs also had opinions about telephone calls from hospitals. All participants said that they do receive calls, but not often enough. They expressed that they especially would like to be called when one of their patients passes away during a hospital stay. Most GPs only receive this kind of information via relatives of the deceased patient. This was confirmed by VERAHs. One GP who was not content with cooperation with hospitals said: *'I don't necessarily see that there are more phone calls now either...no, so rather less. I'm rather disappointed, to be honest. [...] So it hasn't gotten worse, but it hasn't gotten*

better either.' (GP) ^{xi}. Furthermore, GPs complained about the effort they have to put into telephone calls with hospitals when searching for a bed for urgent admissions.

What seems to be a special case as described by both participants from general practices and hospitals are emergency admissions or admissions by an outpatient specialist physician. Hospital management staff report that in some of these cases, no contact with a GP can be established and the hospital, therefore, does not have any information on hand about the patient's condition before admission. GPs on the other hand complain about the fact that in these cases they often are without knowledge of their patient being admitted to a hospital. Some learn about it by receiving a postal discharge letter, the majority however are informed by relatives or the patient himself after being discharged.

All in all, participants from all groups stated that oral communication between physicians via telephone takes place daily and is considered positive.

Still, cooperation is seen as difficult and communication needs to be improved: *'Contact is difficult.' (GP)* ^{xii}; *'Then you try to establish contact and then simply explain to them [...] it's often about this, yeah, good transition, right? And sometimes it's difficult, but, well.' (Hospital Management)* ^{xiii}; or *'What really could be improved is basically the contact between the referring doctors and the clinic, which is the case in every country.' (Hospital Physician)* ^{xiv}.

3.1.2.2 Optimal cooperation

Future cooperation

This subtheme comprises any statements about how the participants envision future cooperation and communication between hospitals and general practices.

All hospital staff groups mentioned that they would prefer closer contact between hospitals and general practices. Hospital physicians and nursing staff saw more intense and frequent cooperation as an opportunity to manage patient flow better, especially for elective admissions, to ensure that information that is passed on is complete and correct or to collaboratively plan patient care after discharge.

Furthermore, participants from hospital management and hospital physicians expressed a desire to establish processes and standards between all institutions. This could be a defined catalogue of information and documents that all admissions and discharges should include by standard. Hospital physicians saw the following as relevant information for hospital admission: diagnoses, medication, care after discharge, domestic setting, power of attorney, living will and contact persons.

One participant from hospital management thought that in the future, private companies will become more relevant and patients will become active and have health information on hand on their smartphones:

> *'Anyway, I believe that we will be overtaken at this point because we are so detailed with data protection and hospitals and billing that WhatsApp will overtake us and at some point, private providers will say 'I manage your patient data, you can take it with you everywhere' and then the patients will stand in front of us with the little smartphone and say 'It's all on there, please read it on this little screen'.' (Hospital Management)* [xv].

All statements in this subtheme were made by participants from hospitals and are tallying and complimentary. GPs and VERAHs did not describe any opinions on future cooperation between general practices and hospitals.

Optimal way of communication

As an addition to the subtheme 'Way of communication', this subtheme includes comments on which ways of communication the participants would rate as optimal.

Firstly, participants wished for a standard that defines the means of communication for different situations. Ideally, healthcare organisations can communicate with media continuity where admission letters and discharge letters are transferred in the same and standardised way. One participant from hospital management described what non-continuity of media looks like in everyday practice: *'Yes, and then I print out the doctor's letter, put it in the fax, fax it over and then throw the whole thing in the data bin afterwards.' (Hospital Management)* [xvi].

Hospital management wished for the introduction of a mandatory admission letter to summarise all information about a patient before hospitalisation. Additionally, hospital physicians would like to receive a notification about any upcoming admission, so that they can be discussed with the admitting outpatient physician. Hospital management would also prefer to send discharge letters to GPs before the day of discharge, for example via e-mail where it can be ensured that the recipient receives the information. GPs would like to receive notifications about upcoming discharges via telephone, fax or e-mail.

Hospital management saw the telephone as a means for queries, hospital physicians prefer communication via telephone for urgent cases. They wished for a clear definition of which information is allowed to be transferred via telephone. Furthermore, they mentioned that GPs should provide hospitals with a phone number where they can be reached during out-of-office hours, as usually the receptionists'

phone is connected to an automated answering machine during out-of-office hours. One hospital physician mentioned that he experiences GPs being very reluctant to provide such a telephone number for other care providers, even if it is filed in a confidential system.

Furthermore, hospital management would like to digitalise communication but is under the impression that GPs prefer communication via fax. However, GPs, too, made statements about electronic communication. GPs and hospital staff had several ideas about how communication should be digitalised. Participants from hospitals commented that information that is already on hand, such as medication lists, should be made digitally available and useable. Nursing staff would prefer communication that is non-paper based as paper is error-prone: paper can be lost, can be destroyed and the utilisation of outdated versions of documents such as medication lists can pose a danger to patients' well-being. Additionally, the transfer of paper-based documents via patients is unreliable, as care providers cannot influence whether the recipient receives the document. One participant from hospital management added that they would even go further than digitalised paper: *'So in the future, it is quite clear that we need to […] move away from paper, also away from digitalised paper.' (Hospital Management)* [xvii].

According to hospital management, the first step would be to encrypt communication and not use fax to communicate, as it is not secure, as mentioned by nursing staff. Participants from all hospital groups mentioned that they would like to use some kind of messenger system. This could be used as a means for rapid communication instead of communication via telephone which always disturbs the activities of the recipient. Furthermore, it could be used for notifications that do not require an answer or reaction. Hospital physicians added that admissions could be announced including symptoms and the suspected diagnosis. Hospitals could reply with a possible admission date, leading to better management of patient flow.

Additionally, participants had other ideas about digital communication between hospitals and general practices. GPs and nursing staff wished that software that is used in all organisations is compatible for information exchange. Therefore, hospital management participants prefer standardised communication according to the specifications of the electronic health record. Other ways of communication were seen in a kind of platform that all care providers could access. This could be an electronic health record, referral platforms, or allowing GPs access to hospitals' information systems. The latter was supported by GPs. Hospital management added that whichever means is implemented, it should be integrated into the hospital information system and not be an additional system to avoid double documentation.

Additionally, nursing staff saw electronic health records provided by sickness funds such as mobile apps for smartphones as a means of communication and storage of information such as medication lists. Moreover, hospital management was in favour of introducing an online market for care after

discharge. This could include institutional long-term care spots or medical aids and devices, including the approval processes with sickness funds. The identification of patients when communicating electronically could be realised by using a barcode, a central patient ID or an electronic health card.

All in all, statements made by the participants were mostly congruent and added to those of the other groups. Statements from participants from hospitals were more detailed than those from general practice staff who only had little idea about ideal ways of communication. There were only two statements that were contrary to the majority as described above: one nurse did not see any necessity for optimisation as the current ways of communication are proficient. Furthermore, one VERAH, and this was the only statement made by a VERAH in this subtheme, said that she would prefer paper-based communication. She described that persons like herself who prefer to work paper-based would print emails and other documents anyways.

Role and responsibilities of hospitals

This subtheme summarises statements about the role and responsibilities that participants associate with hospitals in the cooperation between hospitals and general practices.

Participants said that it is hospitals that should make the first move in contacting general practices and have to make sure that information during admission and discharge is shared in a standardised way. When patients are admitted, hospital physicians see it as their responsibility to assess, if necessary together with the GP, whether patients need to be treated in a hospital or whether outpatient care could be organised. When discharging a patient, the discharge letter should be given to care providers and patients. GPs also considered it hospitals' duty to provide other care providers with information. Hospital management adds that the hospital needs to coordinate care after discharge with those who will provide such care to plan it feasibly. Hospital management staff stated that hospitals should make their duties and obligations as well as jurisdictions transparent to other care providers. In general, participants from hospital management thought that a change of paradigm towards more intense cooperation with general practices is necessary.

Apart from one GP and one hospital physician, only participants from hospital management expressed ideas about the roles and responsibilities of hospitals regarding cooperation with general practices.

Role and responsibilities of general practices

This subtheme summarises statements about the role and responsibilities that participants associate with general practices in the cooperation between hospitals and general practices.

All participants from hospitals mentioned that GPs are responsible for providing the hospital with comprehensive and structured information when admitting patients to the hospital. This includes medication lists and information about the patient's social situation, nursing and caregiving situation and legal information such as a living will or power of attorney/ legal representative:

> *'From the referral side, I would like to see a mind for social situations, as it is actually written in the framework agreement, also delivered to the hospital by the GPs. In other words, what is the patient's level of care dependency, how is he cared for at home and when will the nursing service come? That this is simply information that also comes to the hospital from outside.' (Nursing staff)* [xviii].

Furthermore, hospital management referred to the fact that GPs usually know their patients well and therefore should be involved when planning care after discharge:

> *'There [in the regional home, communal neighbourhood structures] they always come back, that's where most of the information about them is and that's why it would only be conclusive for me if these care structures are also actively involved in the admission and discharge process, yeah.' (Hospital Management)* [xix].

Hospital physicians agreed that GPs should assess whether care after discharge that has been planned by hospitals is feasible, but hospitals should be responsible for contacting GPs and asking for their assessment. More generally, participants from hospital management saw the need for a change of paradigm towards more cooperation also true for general practices. They also should strengthen their role as coordinators of care and, in this regard, become more active.

GPs agreed that their role includes having responsibility for coordination, planning of care in general and follow-up care after discharge: *'So I think in that area we have such a big focus and a very big task in coordination, planning, care, follow-up.' (GP)* [xx].

All in all, participants from hospital management made the most comments on the role and responsibilities of general practices, all participants from hospitals agreed. Statements from general practices however were scarce, only one GP commented on this topic.

3.1.2.3 Determinants of cooperation

This theme includes comments on aspects that participants have the impression to be determinants of cooperation between hospitals and general practices. The theme is divided into five subthemes: organisational determinants, legal determinants, financial determinants, patient determinants and individual characteristics.

Organisational determinants

There are several organisational aspects that participants think to determine cooperation between hospitals and general practices and that mostly refer to oral communication via telephone.

One that has been commented on by participants from all groups except GPs is the reachability of the respective other, amongst others since GPs and hospitals have different timelines: *'The different time-lines where you are in the hospital and the practice [...] when rounds take place and the case managers become active, that...that just doesn't fit the processes in the general practice.' (Hospital management)* [xxi]. Participants from hospital management pointed out the fact that physicians often are in surgery and hospitals are without a concept of how these physicians can be reached by outpatient physicians via telephone. VERAHs supported the impression that hospital staff is difficult to reach via telephone. Hospital management added that GPs themselves are difficult to reach, medical assistants in general practices mostly pick up the telephone though. Nursing staff added that sometimes the hospital does not have any contact information for the general practice and therefore cannot call them. If they do call, they made the experience that often no one answers their call or that they have called during the general practices' out-of-office hours. Hospital management and VERAHs had the impression that telephone calls are impacted by time constraints, for example, due to lacking personnel: *'The GPs are basically overburdened in terms of organisation. They don't have the time.' (Hospital physician)* [xxii].

Hospital physicians saw a problem in telephone calls as they disturb any ongoing activity of the counterpart. However, they do think that if a high effort is put into organising telephone calls, they are feasible. Solutions as suggested by participants from hospital management are the implementation of contact persons, designated time slots for telephone calls between different care providers, or simply sending emails with a request for a call-back. Furthermore, VERAHs were under the impression that whether hospital staff calls the general practice depends on the organisation. According to their experience, staff from smaller hospitals rather calls than bigger hospitals such as university hospitals: *'Well, I don't think that in the big hospitals, the physicians are going to start calling [us]. I don't think so. I think it's more likely to happen in smaller hospitals.' (VERAH)* [xxiii].

Another factor determining communication between hospitals and general practices the skills-mix, as described by hospital management and nursing staff. In hospitals, well-implemented case management improves cooperation with other care providers. Additionally, medical assistants in hospital wards can help to improve cooperation with general practices, as they can take over any administrative tasks and thereby release the burden from physicians. Considering general practices, hospital management found well-organised practices to be characterised by competent medical assistants:

'There are a few practices where I think they are well organised, yes? Where it is very well pre-pared, yes, where the medical assistants do a lot, yeah? And they also work very precisely and the documents I receive make sense in terms of scope and form, yeah?' (Hospital management) [xxiv].

Lastly, GPs commented on the fact that most care providers use different information systems, which complicates communication.

All in all, participants from all groups made comments on how organisational aspects impact coopera-tion and communication with other care providers. Hospital management staff were the only ones who took a critical view of their own organisation and an appreciative view of other organisations. Participants from the other groups rather suggest difficulties within organisations from other healthcare sectors.

Legal determinants

The majority of comments in this subtheme address data protection as a determinant of communica-tion with other care providers.

As described in the subtheme 'Way of communication', care providers often communicate via tele-phone or fax. Both are impacted by data protection measures, as described by all participants except GPs and hospital physicians. Faxing was seen as critical from a data protection perspective, as the sender does not know whether the documents are received by the correct recipient. Therefore, com-munication via fax is usually accompanied by telephone calls for verification of identity. However, even on the telephone, the counterpart is unknown, as was mentioned by hospital management. On the other hand, opinions on data protection diverge as sporadically, hospital management and nursing staff said that due to data protection measures, communication via telephone is not allowed so they use fax only: *'And then you have to call and then a fax is sent here and you have to confirm again that it really is you and back and… Data protection, no, you know everything. Well, it's always an act.' (VE-RAH)* [xxv].

Nursing staff mentioned that they need the consent of patients to exchange information about the patient with other care providers. Thus, GPs do not receive a discharge letter if only the patient is listed as the recipient. Hospital management and physicians also found that data protection impedes digital communication, for example via a common platform.

Other legal determinants include a patient's health insurance: one GP said that for patients with com-pulsory health insurance, hospitals are obligated to write a discharge letter. These obligations do not apply to patients with private health insurance and he often does not receive any information at all.

One hospital physician furthermore commented that implementing access to hospital systems for GPs is difficult as there is a risk of allegations of corruption.

All in all, there were comments from participants from all groups that are congruent and complementary.

Financial determinants

Only two participants from hospital management mentioned financial determinants that impact cooperation and communication with other care providers.

One participant said that as long as there are no specifications for a telematics infrastructure by the government, healthcare organisations have to implement structures at their own financial risk: *'With the risk that we will have to spend money on this and switch over at some point as the IT infrastructure outside evolves.' (Hospital management)* [xxvi]. Another participant went one step further and said that every minute, care providers invest in compensation.

Patient factors

Interview participants mentioned patient characteristics that influence communication between hospitals and general practices. This subtheme comprises these statements.

One participant from hospital management said that for patients with a 'normal' course of treatment, the discharge letter is the preferred way of communication. Participants from all groups agreed that communication and exchange are more intense and therefore more often happen via telephone for complex cases. GPs, VERAHs, hospital management and hospital physicians gave examples of patients that fall in this category. This includes patients with multi-morbidity, patients with polypharmacy, patients with complex medication such as anticoagulants, palliative patients, patients with wound healing disorders and patients with parenteral feeding or an analgesic pump, geriatric patients, oncological patients, patients who reside in long-term care institutions, cases that require coordination of care after discharge, or patients who have had a long hospital stay:

> *'From time to time, it happens that patients whose discharge situation is difficult or complex and we know that some problems are still shaky, well, are uncertain how it will develop further, we try to make telephone contact with the doctors who will continue to care for them beforehand, so that we say 'This and that were our considerations. We assume that it will continue like this, but there could also be problems'. That the attending general practitioner simply is also informed by telephone and can perhaps also consider whether he will then carry out the follow-up care more closely and see the patient the next day if there are home visits.' (Hospital physician)* [xxvii].

Hospital physicians added that other cases where they would call a GP before discharge include those where misunderstandings are likely to occur. Another example would be patients who have comprehension problems regarding their condition.

Hospital management participants added that they would call the general practice before discharge especially if patients have a good relationship with their GP.

Only a few participants from the group of VERAHs said that they do not see any patient characteristics to be influencing communication with hospitals.

Individual characteristics

Participants from hospital management and hospital physicians mentioned that the degree of cooperation and communication depends on the physician himself. One hospital manager made this observation for GPs and mentioned that some even visit their patients in the hospital. One hospital physician spoke for his group and said that some physicians would always call the GP whereas other physicians would never call:

> *'So I could tell you that there are colleagues who always call because they think it makes sense because they want to pass on their needs or specific questions to the doctor who is responsible for the following care. Yes, and some colleagues never do that, so to speak.' (Hospital physician)* [xxviii].

One VERAH added that with foreign physicians, language barriers often hinder communication. The participants did not give any further detail on which other individual characteristics determine cooperation and communication.

3.1.2.4 Personal, emotional and social determinants

In addition to the determinants described above, the participants mentioned further determinants that can be described as emotional, social and personal and are thus mostly not bound to the organisation they belong to. Therefore, an own theme dedicated to personal emotional and social determinants, which is further split into five subthemes, has been identified.

Appreciation and understanding of the respective other

This subtheme includes statements concerning how understanding the responsibilities of others and appreciation for their contribution affect communication with others. Participants from all groups except hospital nursing staff commented on this issue and there were different examples reported on how this determinant influences communication.

GPs reported that they do not feel appreciated by hospital staff. They were under the impression that all of the work is put to them by hospital staff. One GP especially does not feel appreciated by junior physicians: *'How they (the junior physicians) judge us general practitioners. – 'Look at this and how and what he's sending us today' or something < both laugh > 'just gives us work' < laughs>.' (GP)* [xxix].

Furthermore, GPs wished to receive more information about their patients and would like to be up to date regarding their patients' health. VERAHs made the experience that providing paramedics and hospitals with admission letters is not appreciated. They were unsure whether admission letters even find consideration in the hospital. One participant from hospital management said that hospital physicians do not trust external diagnostic results. Another participant said that after having cooperated with other care providers for a while one knows the working methods and requirements of the other. This improves cooperation.

According to the participating hospital doctors, many of their colleagues believe that it is appropriate to involve GPs in many cases, as they know their patients well. One participant saw opportunities in including work shadowing for medical students to develop an understanding of different areas in healthcare: *'And then I find it very difficult to establish a communication where I don't know what makes the other person tick, what possibilities the other person has.' (Hospital physician)* [xxx].

All in all, each sector speaks critically about the respective other.

(Intrinsic) Motivation

Two participants from hospital management commented on motivation being a determinant of cooperation and communication. One said that it is only individuals who are motivated. Another participant sees the need for a change of paradigm. He said that among hospital staff awareness must be raised about the fact that healthcare does not end with a hospital discharge. He saw an opportunity to increase motivation through positive reinforcement: *'Well, I just think that the cultural change in people's minds, […] the fact that people are moving towards each other, is very important.' (Hospital management)* [xxxi].

Socialisation (regional, medical discipline …)

Participants from all groups made statements that can be summarised under the subtheme of socialisation. According to the participants, different kinds of socialisation affect communication.

One GP told about a case where he was content with the hospital physicians' communication. He said that he is quite sure that this particular physician must have gotten his diploma from outside of Germany, having the impression that universities outside of Germany prepare medical students better for communication with other care providers. The same participant said that he attaches the quality of

communication to the medical discipline. He observes good cooperation among geriatricians and on-cologists.

VERAHs described that young GPs who used to work in a hospital, for example during their specialist medical training are more aware of which information is relevant in the hospital: *'We have two young doctors who have been in the clinic for a long time, who come from a clinic and they are totally aware of the fact, they say you need the reports.' (VERAH)* [xxxii]. Hospital physicians also reported the relevance of knowing the other care providers' or organisations' workflow and see the need to spend time in different organisations during medical training. Furthermore, they said that medicine is practised differently in bigger hospitals than in smaller hospitals or general practices in a way that larger hospitals exhaust the possibilities of modern medicine.

Hospital management staff mentioned that they believe that achieving several certificates improved the cooperation with their admitting physicians. They also said that one has to consider that different care providers such as GPs or outpatient specialist physicians need to be approached differently.

There were not many statements, but there were complimentary comments from participants from all groups.

Relationships

There were many statements, mostly by GPs, hospital management and hospital physicians, on the positive influence of knowing someone personally on cooperation and especially oral communication via telephone. One hospital physician saw anonymity as a barrier to establishing contact. Others say how knowing someone, or better knowing someone's face, makes it easier to pick up the phone and call them: *'You could clearly tell that when you are sitting together at one table and have seen each other, you pick up the phone faster, get in touch personally and some things simply run more smoothly.' (Hospital management)* [xxxiii].

Participants talked about where they know other care providers from. GPs and VERAHs mentioned quality circles as an opportunity to get to know other health professionals. Other opportunities are events organised within physicians' networks (such as Christmas parties), groups of regulars or round tables. These events were seen as possibilities to get to know each other, meet new people, intensify relationships with established contacts or even make friends. Furthermore, private and informal meetings are used for professional exchange: *'Well, it was initiated by our former managing director here from the [health insurer] in [city] and he is retired but still, on the road as a consultant, I know him well from back in the day and we had dinner together <laughs >.' (Hospital physician)* [xxxiv].

GPs said that they are more connected with senior physicians than with assistant doctors, the latter probably do not see the relevance, according to GPs. Furthermore, they did see a need to get more connected among GPs. On the contrary, one participant from hospital management said that he has friends in other hospitals and he does make use of those contacts for information exchange. Hospital physicians and GPs agreed that they would rather call someone if they know them. Nursing staff added that this also applies to social services. The probability of oral communication somewhat depends on the individual or rather the relationship between individuals:

> *'You know what you look like, you know each other, you sometimes talk about something else [than work], you sit together over a beer and in this respect there's a good contact [...] Every now and then he calls and says, for example, 'I've got this and that, you sent me this and that and I did that', that was — like that and like that and that's all right or you have to look again or something, it's going quite well, yes.' (GP)* [xxxv].

This was confirmed by a participant from hospital management who saw relationships from the past as a facilitator to implement new practices that aim to improve cooperation:

> *'The advantage was that the case manager with whom we originally started was a long-established, senior nurse here at the hospital and this is probably the same in every city, the young doctors do their residency at the clinic and they all knew her at some point and then they go out and take over a practice. And then that was just over, so they already knew each other. She knew most of them, I think she knows most of the doctors in ambulatory practices and of course the hurdle of 'I'll pick up the phone, call them, talk to them personally or through their office staff' is not a problem.' (Hospital management)* [xxxvi].

One participant said that cooperation mostly depends on knowing others, therefore any other efforts on improving cooperation are not worthwhile. Others supported this by suggesting strategies for improving cooperation such as intensifying established relationships or implementing permanent contact persons who always take calls. A hospital physician again confirmed that health providers just know each other in small cities: *'Got a face to go with it, right. [City] is not exactly a big city, which means you know each other [...] and we know how to take each other, that's certainly an advantage.' (Hospital physician)* [xxxvii].

3.1.2.5 Strategies to address emotional and social factors

Participants from hospital management and hospital physicians mentioned organised meetings and events as strategies to exchange ideas with other care providers and thus address some of the emotional and social determinants of information exchange:

'I mean, here at the university hospital, it's the same as in [place]. You could attend any kind of continuing education events from early morning to late at night, which are of course also open to ambulatory physicians, but they are often very specific to complex diseases. In [place], as well as in [place] I, there is the general practitioners' day once in a half year, where also interested people can come. So such events, I think, could help to lower or break down obstacles and barriers.' (Hospital physician) [xxxviii].

These could serve as platforms to introduce themselves to others, exchange views on positive and negative aspects of the cooperation between the organisations involved and discuss the stakeholders' roles and responsibilities. One hospital physician said that networking among hospitals is also important.

They mentioned different events that could be adequate platforms for the described exchange: quality circles, the event 'Day of General Practice', which is established with departments of general practice in university hospitals and should be open for hospital physicians as well, or yearly meetings with other care providers. The latter is a kind of event that hospital management described to be established with nursing staff in hospitals together with other long-term care institutions.

3.2 Results of the social network analysis[9]

In this chapter, the results of the SNA are presented. First, the study population is introduced along with some descriptive characteristics and illustrative figures from a selection of physicians´ ego networks. Then, the results of the analysis of the effect of network characteristics on CoC and readmissions are presented, followed by the results that focus on variation and differences in the network characteristics and their effects between urban and rural areas.

3.2.1 Description of the study population and structural characteristics of networks

A total of 7,294 patients and 3,673 GPs were included in the analysis. The number of included patients per physician was on average two and varied between one and 15. Figure 3**Figure 4** shows two individual networks of GPs who take care of only one versus 15 patients and figure 4 illustrates how the GPs' networks may differ depending on urbanity, in both cases regarding the size of the network.

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[9] Parts of this chapter have already been published in the following publication:
Forstner, J., Koetsenruijjter, J., Arnold, C., Laux, G. and Wensing, M. (2023b). The Influence of Provider Connectedness on Continuity of Care and Hospital Readmissions in Patients With COPD: A Claims Data Based Social Network Study. Chronic Obstr Pulm Dis *10*, 77-88, doi: 10.15326/jcopdf.2022.0359.
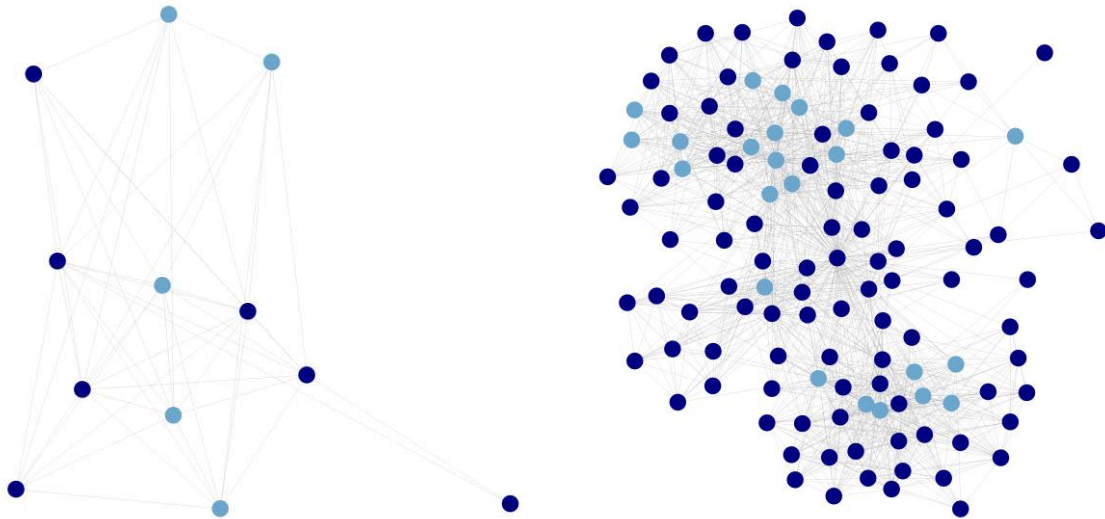
Figure 4: Two illustrations of networks depending on GP cluster size

Legend: Individual networks of a GP who has one patient with COPD in their cluster (left) versus a GP who has 15 patients with COPD in their cluster (right). Dark blue dots represent GPs and light blue dots represent specialists (pneumologists, cardiologists). Lines represent relationships between physicians, based on at least 5 shared patients.
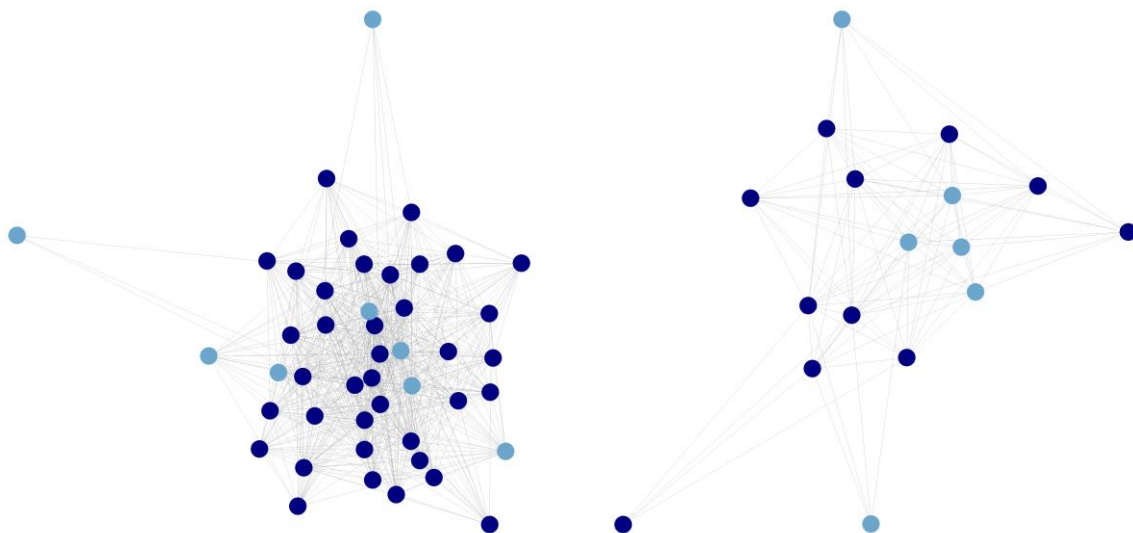

Figure 5: Two illustrations of networks depending on GP urbanity

Legend: Individual networks of a GP who practises in an urban area (left) versus a GP who practices in a rural area (right). Dark blue dots represent GPs and light blue dots represent specialists (pneumologists, cardiologists). Lines represent relationships between physicians, based on at least 5 shared patients.

General practitioners included in the analysis were on average 56.42 (SD 8.64) years old and had a mean of 15.24 (SD 9.4) years of experience in their current practice. Approx. two-thirds of GPs participated in the HZV (n = 2,346, 63.9 %) and the majority participated in the DMP for COPD (n = 3,266, 88.9 %). General practitioners were connected by sharing patients with approx. 30.5 (SD 19; equals degree centrality) physicians on average, whereof on average 23.01 (SD 10.94) were specialists. The average closeness centrality of GPs was 0.48 (SD 0.04). Ego-networks of GPs had an average density of 0.65 (SD 0.15), a cohesion of 5.56 (SD 3.28) and an EI-index of 0.7 (SD 0.14). All information on the characteristics of GPs can be found in table 5. Figure 6 illustrates an exemplary individual network.

Table 5: Description of the study population of GPs (n = 3,673) and networks

	N (%)	Mean (SD)	Range
Age *(years)*		56.42 (8.64)	32 – 80
Sex			
Male	2,487 (67.7)		
Female	1,186 (32.3)		
Region			
Urban	1,877 (51.1)		
Rural	1,796 (48.9)		
HZV *(yes)*	2,346 (63.9)		
DMP *(yes)*	3,266 (88.9)		
Average number of patients		525.87 (312)	19 – 3,442
Experience in practice in years		15.24 (9.4)	0.08 – 45.53
Share of specialists within ego network		23.01 (10.94)	0 – 100
Density		0.65 (0.15)	0.1 – 1
Degree centrality		30.50 (19)	2 – 183
Closeness centrality [a]		0.48 (0.04)	0.21 – 0.71
EI-Index		0.70 (0.14)	0.16 – 0.98
Cohesion		5.56 (3.28)	1 – 20

[a] multiplied by 10,000

SD: standard deviation, HZV: German: 'Hausarztzentrierte Versorgung', strong primary care programme, DMP: disease management programme, EI: External-internal
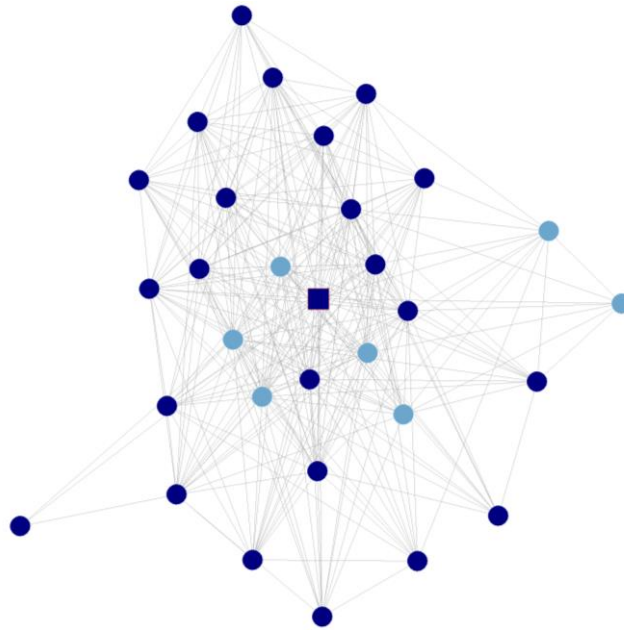
Figure 6: Illustration representing a network with average values in all network characteristics, Copyright 2023 *Chronic Obstructive Pulmonary Diseases: Journal of the COPD Foundation* (Forstner et al. 2023b)

Legend: Individual network of a general practitioner to illustrate what an average network looks like. Dark blue dots represent general practitioners and light blue dots represent specialists (pneumologists, cardiologists). The square in the middle of the network is the GP whose individual network is presented here. Lines represent relationships between physicians, based on at least 5 shared patients. This network has: density: 0.5, degree centrality: 30, closeness centrality: 0.49, EI-index: 0.73, cohesion: 3.

The patients included in the network study were on average 72.41 (SD 10.64) years old and had a mean CCI of 4.57 (SD 2.84), with 25 % of patients being affected by ACO. About 45 % of patients had severe to very severe COPD, but severity was not documented for over a third of the included patients. Overall, about a quarter of the study population died within the year after discharge (n = 1,762), on average approx. 5.7 months after discharge. Almost half of those died after previously having been readmitted (n = 762). Continuity of care, as measured by the SECON, was on average 0.73 (SD 0.23) within the year after discharge. With n = 2,783 patients, over a third of the study population was readmitted within a year after discharge. On average, patients were readmitted 128.74 (SD 104.28) days after discharge. Overall, 7.8 % (n = 571) were readmitted within 30 days after discharge, 10.1 % (n = 734) within 90 days, 8.8 % (n = 640) within 180 days and 11.5 % (n = 838) within 365 days after discharge, respectively. Table 6 provides an overview of the description of the COPD patients included in the study.

Table 6: Description of the study population of patients (n = 7,294)

	N (%)	Mean (SD)	Range
Age *(years)*		72.41 (10.64)	40 – 100
Sex			
Male	4,110 (56.3)		
Female	3,184 (43.7)		
CCI		4.57 (2.84)	1 – 18
Asthma-COPD-overlap *(yes)*	1,827 (25)		
COPD severity			
Not recorded	2,594 (35.6)		
Mild	363 (5)		
Moderate	1,119 (15.3)		
Severe	1,284 (17.6)		
Very severe	1,934 (26.5)		
Nursing home *(yes)*	344 (4.7)		
Number of hospital stays in the previous year		1.3 (1.75)	0 – 18
Length of index stay		9.1 (6.58)	2 – 102
Number of visits with usual provider			
In the year after discharge *(n = 7,294)*		21.98 (15.38)	1 – 140
Within 30 days after discharge [a] *(n = 7,294)*		2.52 (2.16)	0 – 23
Within 90 days after discharge [a] *(n = 6,569)*		6.25 (4.69)	0 – 46
Within 180 days after discharge [a] *(n = 5,681)*		11.54 (8.15)	0 – 86
Within 365 days after discharge [a] *(n = 4,874)*		21.61 (14.71)	0 – 140
Share of contacts with specialists on all physician contacts			
In the year after discharge		7.78 (11.35)	0 – 91
Within 30 days after discharge [b] *(n = 7,294)*		5.85 (16.26)	0 – 100
Within 90 days after discharge [b] *(n = 6,569)*		7.85 (16.26)	0 – 100
Within 180 days after discharge [b] *(n = 5,681)*		8 (23.38)	0 – 100
Within 365 days after discharge [b] *(n = 4,874)*		8.01 (11.37)	0 – 91
Time from discharge until readmission *(n = 2,783)*		128.74 (104.28)	0 – 365
SECON			
In the year after discharge		0.73 (0.23)	0 – 1
Within 30 days after discharge [b] *(n = 5,488)*		0.75 (0.36)	0 – 1
Within 90 days after discharge [b] *(n = 6,328)*		0.73 (0.3)	0 – 1
Within 180 days after discharge [b] *(n = 5,639)*		0.73 (0.25)	0 – 1
Within 365 days after discharge [b] *(n = 4,872)*		0.73 (0.22)	0 – 1
Readmission within 30 days *(yes; at risk: n = 7,294)*	571 (7.8)		
Readmission within 90 days *(yes; at risk: n = 6,569)*	734 (10.1)		
Readmission within 180 days *(yes; at risk: n = 5,681)*	640 (8.8)		
Readmission within 365 days *(yes; at risk: n = 4,874)*	838 (11.5)		
Overall mortality	1,762 (24.2)		
Mortality after readmission	762 (10.4)		
Time until death *(in months, n = 1,261)*		5.7 (3.65)	0 – 12

[a] or until readmission, [b] applies to the at risk-population only

SD: Standard deviation, CCI: Charlson Comorbidity Index, COPD: Chronic obstructive pulmonary disease, SECON: Sequential Continuity Index

3.2.2 Results of the analysis of the effect of network characteristics on continuity of care

The null model showed an ICC of 0.24, indicating that 24 % of the variance in the outcome is attributable to being cared for by a certain GP. In bivariate analyses of each of the network characteristics, degree centrality, the EI-index and cohesion showed to have a statistically significant impact on the SECON. When controlled for confounders on a patient and GP level, degree centrality and the EI-index remained to have an effect. Furthermore, closeness centrality significantly affected the SECON. Cohesion was no longer statistically significant when controlled for confounders. The results can be found in tables 7 and 8.

Table 7: Results of bivariate analyses regarding the SECON

	SECON	
	β	CI
Density	0.002	-0.025; 0.029
Degree centrality	**-0.058** ***	**-0.088; -0.029**
Closeness centrality	-0.012	-0.039; 0.015
EI-index	**0.040** **	**0.013; 0.067**
Cohesion	**-0.027** *	**-0.054; -0.000**
N *(patients)*	7,294	
N *(GPs)*	3,673	

Separate models were computed for each of the predictors.

*** p < 0.001, ** p < 0.01, * p < 0.05

SECON: Sequential Continuity Index, β: Standardised coefficients, CI: Confidence interval, EI: external-internal, GP: general practitioner

The final model was statistically better than the model containing confounders only (Chi^2 = 24.26, p < 0.001), indicating that network characteristics have a significant influence on the SECON. The analysis showed that an increase in closeness centrality by one SD (0.04) led to a decrease in the SECON by 0.029 SDs (SD = 0.23; 95 % CI = -0.054; -0.005, p < 0.05). An increase in the EI-index by one SD (0.14) led to an increase in the SECON by 0.037 SDs (β = 0.037, 95 % CI = 0.004; 0.071, p < 0.05). Density, degree centrality and cohesion did not have a significant impact on the SECON after hospital discharge.

Table 8: Results of the analysis of each of the predictors regarding the SECON, adjusted for confounders (overall and subgroup analyses for urban and rural areas)

	SECON	
	β	CI
Density		
Overall	0.024	-0.000 - 0.049
Urban	0.016	-0.017 - 0.049
Rural	**0.038 ***	**0.001 - 0.074**
Degree centrality		
Overall	**-0.063 *** **	**-0.094 - -0.032**
Urban	-0.03 **ᴵᴵᴵ**	-0.069 - 0.009
Rural	**-0.162 *** ᴵᴵᴵ**	**-0.217 - -0.108**
Closeness centrality		
Overall	**-0.028 ***	**-0.050 - -0.005**
Urban	-0.024	-0.057 - 0.009
Rural	**-0.031 ***	**-0.062 - -0.001**
EI-index		
Overall	**0.046 *** **	**0.022 - 0.070**
Urban	**0.033 * ᴵ**	**0.001 - 0.065**
Rural	**0.068 *** ᴵ**	**0.031 - 0.105**
Cohesion		
Overall	-0.009	-0.030 - 0.013
Urban	0.003	-0.025 - 0.031
rural	-0.026	-0.059 - 0.007
N *(patients) – overall/ urban/ rural*	7,294/ 3,835/ 3,459	
N *(GPs) – overall/ urban/ rural*	3,673/ 1,877/ 1,796	

Separate models were computed for each of the predictors, with the overall study population as well as for subgroups divided into GPs working in an urban or rural area.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, ᴵᴵᴵ effect is significantly different between urban and rural with $p < 0.001$, ᴵᴵ effect is significantly different between urban and rural with $p < 0.01$, ᴵ effect is significantly different between urban and rural with $p < 0.05$.

Models adjusted for: patient sex, patient age, asthma-COPD-overlap, nursing home, COPD severity, number of hospital stays in the previous year, number of contacts with the usual provider in the year after discharge, CCI, length of index stay, share of physician contacts that are with a specialist, GP sex, area of GP working place (overall only), GP participation in strong primary care program, GP participation in DMP, GP experience in practice years, GPs' average number of patients.

SECON: Sequential Continuity Index, β: standardised coefficients, CI = Confidence interval, EI: External-internal, GP: general practitioner, COPD: Chronic obstructive pulmonary disease, CCI: Charlson Comorbidity Index, DMP: Disease management programme

Concerning confounders on a GP level, patients whose GP participates in the HZV have a SECON which is 0.333 SD higher than patients whose GP does not participate in the HZV (β = 0.333, 95 % CI = 0.280; 0.386, $p < 0.001$). Patients whose GP participates in the DMP for COPD have a SECON which is 0.109 SDs lower than patients whose GP does not participate in the HZV (β = -0.109, 95 % CI = -0.188; -0.030, $p < 0.01$).

Patients whose GP practices in an urban area have a SECON which is 0.046 SDs higher than patients whose GP practices in a rural area (β = 0.046, 95 % CI = 0.002; 0.090, p < 0.05). Furthermore, an increase in the experience in practice of the GP by one SD (SD = 9.4) is associated with an increase in the SECON of their patients by 0.064 SD (β = 0.064, 95 % = CI 0.042; 0.086 p <0.001). Regarding the number of contacts with the usual provider in the year after discharge, an increase by one SD (SD = 15.38) led to an increase in the SECON by 0.196 SD (β = 0.196, 95 % CI = 0.177; 0.215, p < 0.001). All results are reported in table 9Table 9.

Table 9: Results of the final multivariate regression analyses regarding the SECON

	SECON	
	β	CI
Constant	-0.091	-0.197 - 0.015
Patient characteristics		
Sex *(ref: male)*	-0.026	-0.062 - 0.009
Asthma-COPD c -overlap *(ref: no)*	**-0.059** **	**-0.100 - -0.019**
Nursing home *(ref: no)*	**-0.154** ***	**-0.238 - -0.069**
Severity *(ref: mild COPD)*		
moderate COPD	-0.031	-0.120 - 0.058
severe COPD	-0.037	-0.125 - 0.050
very severe COPD	-0.004	-0.089 - 0.081
COPD, severity unspecified	-0.023	-0.106 - 0.060
Age	**0.058** ***	**0.039 - 0.077**
Number of hospital stays in the previous year	**-0.024** *	**-0.042 - -0.006**
Number of contacts with the UP in the year after discharge	**0.196** ***	**0.177 - 0.215**
CCI	**-0.047** ***	**-0.067 - -0.028**
Length of index stay	-0.001	-0.019 - 0.017
Share of physician contacts that are with a specialist	**-0.510** ***	**-0.529 - -0.491**
GP characteristics		
Area *(ref: rural)*	**0.046** *	**0.002 - 0.090**
Sex *(ref: male)*	-0.035	-0.082 - 0.012
DMP *(ref: no)*	**-0.109** **	**-0.188 - -0.030**
HZV *(ref: no)*	**0.333** ***	**0.280 - 0.386**
Experience in practice in years	**0.064** ***	**0.042 - 0.086**
Average number of patients	0.029	-0.004 - 0.062
Density	0.002	-0.033 - 0.037
Degree centrality	-0.023	-0.072 - 0.026
Closeness centrality	**-0.029** *	**-0.054 - -0.005**
EI-index	**0.037** *	**0.004 - 0.071**
Cohesion	-0.007	-0.033 - 0.019
N *(patients)*	7,294	
N *(GPs)*	3,673	
ICC of the null model	0.25	

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

β: Standardised coefficients, CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, UP: Usual provider, CCI: Charlson Comorbidity Index, DMP: Disease management programme, HZV: German: 'Hausarztzentrierte Versorgung', strong primary care programme, EI: External-internal, GP: general practitioner, ICC: Intraclass correlation coefficient

3.2.3 Results of the analysis of the effect of network characteristics on readmissions

The null model for **readmission within 30 days after discharge** showed an ICC of 0.35, indicating that 35 % of the variance in the outcome is attributable to being cared for by a certain GP. The final model was not statistically different from a model containing confounders only (Chi^2 = 0, p = 1). In bivariate analyses of each of the network characteristics, none showed to have a statistically significant impact on readmissions within 30 days after discharge. When controlled for confounders, this remained for all network characteristics except for the EI-index. The results can be found in tables 10 and 11.

An increase in the EI-index by one SD led to patients having a 1.25 higher chance of being readmitted within 30 days (OR = 1.25, 95 % CI = 1.055; 1.481, p < 0.01) and higher degree centrality increased the likelihood of 30-day readmission (OR = 1.257, 95 % CI = 1.001; 1.579, p < 0.05). Density, closeness centrality and cohesion did not have a significant impact on readmission within 30 days after hospital discharge. No other GP characteristics had a statistically significant impact on readmissions within 30 days. Regarding patient factors, amongst others, patients with an increase by one SD in the share of visits with ambulatory physicians that are with a specialist had a 0.886 lower chance of being readmitted within 30 days after hospital discharge (OR = 0.886, 95 % CI 0.794; 0.988, p < 0.05). The results are reported in table 12.

The null model for **readmission within 90 days after discharge** showed an ICC of 0/ could not be computed due to singularity, indicating that the variance in 90-day readmission did not depend on being treated by a certain GP. However, considering the clustering within the data, multilevel regression analyses were conducted, even though this was not indicated by the ICC. In bivariate analyses of each of the network characteristics, density and cohesion showed to have a statistically significant impact on readmissions within 90 days after discharge. These effects remained when controlled for confounders. The results can be found in tables 10 and 11. The sensitivity analysis using a single-level model confirmed the results, i.e. regression coefficients and CIs (see appendix V).

Table 10: Results of bivariate analyses regarding hospital readmission

	30-day readmission		90-day readmission		180-day readmission		365-day readmission	
	OR	CI	OR	CI	OR	CI	OR	CI
Density	0.936	0.841 - 1.042	**0.892** **	**0.822 - 0.968**	0.935	0.861 - 1.015	0.953	0.884 - 1.027
Degree centrality	1.053	0.943 - 1.177	1.023	0.948 - 1.103	1.046	0.966 - 1.133	1.03	0.956 - 1.110
Closeness centrality	1.048	0.943 - 1.165	1.055	0.977 - 1.140	1.038	0.956 - 1.127	1.067	0.990 - 1.149
EI-index	1.078	0.967 - 1.201	1.032	0.955 - 1.116	0.995	0.917 - 1.081	0.971	0.901 - 1.045
Cohesion	0.955	0.857 - 1.064	**0.919** *	**0.849 - 0.995**	0.94	0.864 - 1.022	0.932	0.863 - 1.005
N *(patients)*	7,294		6,569		5,681		4,874	
N *(GPs)*	3,673		3,486		3,237		2,978	

Separate models were computed for each of the predictors.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

OR: Odds ratio, CI: Confidence interval, EI: External-internal, GP: General practitioner

Table 11: Results of the analysis of each of the predictors regarding hospital readmission, adjusted for confounders (overall and subgroup analyses for urban and rural areas)

	30-day readmission		90-day readmission		180-day readmission		365-day readmission	
	OR	CI	OR	CI	OR	CI	OR	CI
Density								
Overall	0.942	0.831; 1.068	**0.860 ****	**0.772; 0.959**	0.921	0.831; 1.021	0.959	0.871; 1.056
Urban	0.934	0.807; 1.081	**0.832 ***	**0.716; 0.966**	0.923	0.806; 1.056	0.917	0.806; 1.045
Rural	**0.982 *****	**0.978; 0.986**	0.898	0.770; 1.047	0.914	0.776; 1.077	1.018	0.882; 1.175
Degree centrality								
Overall	1.003	0.862; 1.168	0.938	0.820; 1.073	0.992	0.879; 1.118	0.992	0.885; 1.112
Urban	0.975	0.827; 1.149	0.948	0.802; 1.121	1.031	0.893; 1.190	1.02	0.887; 1.174
Rural	0.908	0.236; 3.499	0.845	0.656; 1.087	0.984	0.769; 1.261	0.899	0.718; 1.125
Closeness centrality								
Overall	1.023	0.913; 1.145	1.057	0.959; 1.165	1.038	0.946; 1.139	1.061	0.974; 1.155
Urban	1.113	0.971; 1.277	1.097	0.948; 1.270	1.100	0.965; 1.253	1.102	0.972; 1.249
Rural	**0.960 *****	**0.959; 0.961**	1.043	0.921; 1.181	0.976	0.854; 1.115	1.014	0.904; 1.137
EI-index								
Overall	**1.143 ***	**1.010; 1.294**	1.094	0.985; 1.216	1.035	0.939; 1.142	0.975	0.891; 1.068
Urban	1.155	1.000; 1.334	1.035 ᵀ	0.900; 1.190	1.061	0.936; 1.203	0.927	0.823; 1.043
Rural	**1.232 *****	**1.231; 1.234**	**1.209 *ᵀ**	**1.028; 1.423**	0.987	0.842; 1.156	1.048	0.909; 1.207
Cohesion								
Overall	0.935	0.838; 1.044	**0.894 ***	**0.814; 0.981**	0.922	0.843; 1.008	0.928	0.854; 1.007
Urban	0.909	0.807; 1.023	0.944	0.835; 1.067	0.919	0.821; 1.028	0.900	0.807; 1.004
Rural	**1.012 *****	**1.008; 1.016**	**0.850 ***	**0.737; 0.981**	0.930	0.801; 1.079	0.966	0.852; 1.095
N *(patients) – overall/ urban/ rural*	7,294/ 3,835/ 3,459		6,328/ 3,301/ 3,027		5,639/ 2,946/ 2,693		4,872/ 2,532/ 2,340	
N *(GPs) – overall/ urban/ rural*	3,673/ 1,877/ 1,796		3,413/ 1,735/ 1,678		3,224/ 1,645/ 1,579		2,978/ 1,513/ 1,465	

Separate models were computed for each of the predictors, with the overall study population as well as for subgroups divided into GPs working in an urban or rural area.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ᵀᵀᵀ effect is significantly different between urban and rural with $p < 0.001$, ᵀᵀ effect is significantly different between urban and rural with $p < 0.01$, ᵀ effect is significantly different between urban and rural with $p < 0.05$

Models adjusted for: patient sex, patient age, asthma-COPD-overlap, nursing home, COPD severity, number of hospital stays in the previous year, number of contacts with the usual provider in the year after discharge, CCI, length of index stay, share of physician contacts that are with a specialist, SECON, GP sex, area of GP working place (overall only), GP participation in HZV, GP participation in DMP, GP experience in practice years, GPs' average number of patients. Some models regarding 30-day readmission were not adjusted for: COPD severity, share of physician contacts that are with a specialist and the SECON due to problems with model convergence.

OR: Odds ratio, CI: Confidence interval, EI: External-internal, GP: General practitioner, COPD: Chronic obstructive pulmonary disease, CCI: Charlson Comorbidity Index, SECON: Sequential Continuity Index, HZV: German: 'Hausarztzentrierte Versorgung', strong primary care programme, DMP: Disease management programme

The final model included 6,328 patients and 3,413 GPs and was statistically better than the model containing confounders only (Chi^2 = 14.57, p = 0.006). It showed that higher ego network density led to a lower likelihood of 90-day readmission (OR = 0.811, 95 % CI = 0.697; 0.942, p < 0.01) and a higher SECON (OR = 1.121, 95 % CI = 1.008; 1.246, p < 0.05) led to a higher likelihood of 90-day readmission. Closeness centrality, the EI-index and cohesion did not have a significant impact on the 90-day readmission likelihood. Concerning confounders on a GP level, patients whose GP participates in the HZV have a 1.293 higher chance of being readmitted within 90 days after hospital discharge than patients whose GP does not participate in the HZV (OR = 1.293, 95 % CI = 1.026; 1.629, p < 0.05). Regarding patient factors, amongst others, patients with very severe COPD had a 3.790 higher chance of being readmitted within 90 days after hospital discharge than patients with mild COPD (OR = 3.790, 95 % CI = 2.190; 6.559, p < 0.001). Patients who had more consultations with their GP within 90 days after discharge had reduced odds of readmission (OR = 0.615, 95 % CI = 0.544; 0.695, p < 0.001). The results are reported in table 12Table 12.

The null model for **readmission within 180 days after discharge** showed an ICC of 0/ could not be computed due to singularity indicating that the variance in 90-day readmission did not depend on be-ing treated by a certain GP. However, considering the clustering within the data, multilevel regression analyses were conducted, even though this was not indicated by the ICC. In bivariate analyses of each of the network characteristics, none showed to have a statistically significant impact on readmissions within 180 days after discharge, which remained when controlled for confounders. The results can be found in tables 10 and 11. The sensitivity analysis using a single-level model confirmed the results, i.e. regression coefficients and CIs (see appendix V).

The final model was not statistically different from the model containing confounders only (Chi^2 = 4.654, p = 0.325). Based on the final model, which included 5,639 patients and 3,224 GPs, the analysis showed that neither the network characteristics nor the SECON have a significant impact on the chance of being readmitted within 180 days after discharge. Concerning confounders on a GP level, patients whose GP participates in the HZV had a 1.371 higher chance of being readmitted within 180 days after hospital discharge than patients whose GP does not participate in the HZV (OR = 1.371, 95 % CI = 1.009; 1.715, p < 0.01). Regarding patient factors, amongst others, patients with very severe COPD had a 6.814 higher chance of being readmitted within 180 days after hospital discharge than patients with mild COPD (OR = 6.814, 95 % CI = 3.650; 2.722, p < 0.001). Patients who had more con-sultations with their GP within 180 days after discharge had reduced odds of readmission (OR = 0.558, 95 % CI = 0.491; 0.635, p < 0.001). The results are reported in table 12.

The null model for **readmission within 365 days after discharge** showed an ICC of 0.01, indicating that 1 % of the variance in the outcome is attributable to being cared for by a certain GP. Even though this indicates that the clustering within the data is rather low, multilevel regression analyses were conducted to account for the multilevel structure in the data. In bivariate analyses of each of the network characteristics, none showed to have a statistically significant impact on readmissions within 365 days after discharge, which remained when controlled for confounders. The results can be found in tables 10 and 11.

The final model was not statistically different from the model containing confounders only (Chi^2 = 7.435, p = 0.115). Based on the final model, which included 4,872 patients and 2,978 GPs, and controlling for factors on a patient and GP level, the analysis showed that none of the network characteristics had a significant impact on readmissions within one year after hospital discharge. Regarding CoC, patients who had a SECON increased by one SD had a 1.161 higher chance of being readmitted within one year after hospital discharge (OR = 1.161, 95 % CI = 1.051; 1.282, p < 0.01). Furthermore, no other confounders on a GP level had a significant impact on hospital readmission within 365 days after discharge. Regarding patient factors, amongst others, patients with very severe COPD had a 3.979 higher chance of being readmitted within 365 days after hospital discharge than patients with mild COPD (OR = 3.979, 95 % CI = 2.549; 2.999 p < 0.001). Patients who had more consultations with their GP in the year after discharge had reduced odds of readmission (OR = 0.578, 95 % CI = 0.513; 0.651, p < 0.001). The results are reported in table 12.

Overall, the analysis did not support hypotheses 2a, 2c and 2d, but provided support for hypothesis 2b regarding closeness centrality. Furthermore, the results do not support hypotheses 3a, 3c, 3d and 3e, but do partially support hypotheses 3b (regarding readmission within 90 days) and 3d (regarding readmission within 30 days).

Table 12: Results of the final multivariate regression analyses regarding hospital readmission

	30-day readmission		90-day readmission		180-day readmission		365-day readmission	
	OR	CI	OR	CI	OR	CI	OR	CI
Constant	**0.022 *****	**0.010; 0.046**	**0.027 *****	**0.014; 0.053**	**0.022 *****	**0.011; 0.044**	**0.070 *****	**0.042; 0.117**
Patient characteristics								
Sex *(female)*	0.823	0.675; 1.003	0.877	0.733; 1.048	0.932	0.781; 1.112	1.007	0.858; 1.182
Nursing home *(ref: no)*	0.631	0.378; 1.053	**1.849 ****	**1.249; 2.738**	1.372	0.878; 2.143	1.201	0.781; 1.845
Asthma-COPD-overlap	1.125	0.901; 1.405	1.071	0.874; 1.312	0.987	0.806; 1.207	1.005	0.838; 1.205
Severity *(ref: mild COPD)*								
moderate COPD	1.814	0.984; 3.344	1.278	0.705; 2.315	**2.784 ****	**1.453; 5.335**	**2.285 *****	**1.446; 3.609**
severe COPD	1.685	0.917; 3.098	**2.549 ****	**1.456; 4.463**	**2.926 ****	**1.537; 5.569**	**2.590 *****	**1.649; 4.069**
very severe COPD	**2.657 ****	**1.481; 4.765**	**3.790 *****	**2.190; 6.559**	**6.814 *****	**3.650; 12.722**	**3.979 *****	**2.549; 6.213**
COPD, severity unspecified	**1.929 ***	**1.078; 3.452**	**2.071 ****	**1.196; 3.584**	**2.691 ****	**1.434; 5.051**	**1.933 ****	**1.245; 2.999**
Age	**0.882**	**0.794; 0.981**	0.92	0.835; 1.015	0.925	0.841; 1.018	1.041	0.955; 1.135
Number of hospital stays in the previous year	**1.462 *****	**1.344; 1.590**	**1.570 *****	**1.440; 1.713**	**1.453 *****	**1.330; 1.588**	**1.505 *****	**1.373; 1.651**
Number of visits with the UP after discharge			**0.615 *****	**0.544; 0.695**	**0.558 *****	**0.491; 0.635**	**0.578 *****	**0.513; 0.651**
CCI	1.002	0.903; 1.112	0.977	0.885; 1.079	1.082	0.982; 1.192	**1.108 ***	**1.011; 1.213**
Length of the index stay	**1.147 ****	**1.056; 1.245**	**1.209 *****	**1.118; 1.309**	**1.124 ****	**1.035; 1.222**	0.971	0.886; 1.064
SECON			**1.121 ***	**1.008; 1.246**	1.080	0.974; 1.197	**1.161 ****	**1.051; 1.282**
Share of physician contacts that are with a specialist	**0.886 ***	**0.794; 0.988**	1.094	0.989; 1.209	1.035	0.939; 1.139	**1.142 ****	**1.043; 1.251**
GP characteristics								
Area *(ref: rural)*	1.052	0.843; 1.312	1.079	0.892; 1.305	1.032	0.859; 1.241	0.863	0.728; 1.021
Sex *(ref: male)*	1.008	0.796; 1.276	1.028	0.840; 1.258	1.108	0.913; 1.345	0.993	0.829; 1.188
DMP *(ref: no)*	1.011	0.676; 1.513	1.15	0.801; 1.652	1.173	0.827; 1.665	1.175	0.867; 1.591
HZV *(ref: no)*	1.068	0.819; 1.392	**1.293 ***	**1.026; 1.629**	**1.371 ****	**1.099; 1.712**	1.071	0.876; 1.309
Experience in practice	1.051	0.943; 1.171	1.015	0.925; 1.114	1.058	0.967; 1.156	1.023	0.942; 1.111
Average number of patients	0.904	0.770; 1.061	1.005	0.878; 1.151	1.006	0.887; 1.141	1.022	0.907; 1.151
Density	0.982	0.825; 1.168	**0.811 ****	**0.697; 0.942**	0.928	0.803; 1.072	1.002	0.876; 1.145
Degree Centrality	**1.257 ***	**1.001; 1.579**	0.839	0.684; 1.030	0.951	0.792; 1.141	0.899	0.756; 1.069
Closeness centrality	0.978	**0.865; 1.105**	1.016	0.914; 1.130	1.015	0.917; 1.123	1.077	0.982; 1.181
EI-index	**1.250 ****	**1.055; 1.481**	1.031	0.894; 1.188	1.008	0.883; 1.152	0.900	0.797; 1.016
Cohesion	1	**0.879; 1.138**	0.979	0.876; 1.093	0.952	0.856; 1.058	0.920	0.836; 1.014
N *(patients)*	7,294		6,328		5,639		4,872	
N *(GPs)*	3,673		3,413		3,224		2,978	
ICC of the null model	0.35		0/ NA		0/ NA		0.01	

*** p < 0.001, ** p < 0.01, * p < 0.05

OR: Odds ratio, CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, UP: Usual provider, CCI: Charlson Comorbidity Index, SECON: Sequential Continuity Index, DMP: Disease management programme, HZV: German: 'Hausarztzentrierte Versorgung', strong primary care programme, EI: External-internal, GP: General practitioner, ICC: Intraclass correlation coefficient, NA: not applicable

3.2.4 Variation and differences in the network characteristics between urban and rural areas

To test whether network characteristics are different between urban and rural areas, a Welch two-sample t-test was conducted. There was a statistically significant difference between urban and rural areas in the closeness centrality of GPs (mean = 0.485 vs. mean = 0.489, t = 4.628, p < 0.001), degree centrality of GPs (mean = 39 vs. mean = 30, t = -18, p < 0.001) and the EI-index of ego networks (mean = 0.66 vs. mean = 0.711, t = 17.904, p < 0.001). More specifically, closeness centrality and the EI-index both were higher in rural areas, degree centrality was higher in urban areas. No statistically significant difference between urban and rural areas was found for the density (mean = 0.63 vs. mean = 0.63, t = 0.545, p = 0.586) and cohesion of GPs' individual networks (mean = 5.49 vs. mean = 5.373, t = - 1.517, p = 0.129), see table 13.

Table 13: Results of differences in network characteristics between urban and rural areas

	Urban	Mean Rural	Difference	95 % CI	t	df	p-value
Density	0.63	0.63	0	-0.005; 0.009	0.545	7,286.2	0.586
Degree centrality	39	30	9	-10; -8.1	-18	6,349	**< 0.001*****
Closeness centrality	0.485	0.489	0.004	0.003; 0.006	4.628	7,087.4	**< 0.001*****
EI-index	0.66	0.711	0.051	0.0538; 0.067	17.904	7,225.1	**< 0.001*****
Cohesion	5.49	5.373	0.087	-0.268; 0.034	-1.517	7,244.8	0.129

*** p < 0.001; ** p < 0.01; * p < 0.05

CI: Confidence interval, df: Degrees of freedom, EI: External-internal

The analysis regarding differences in network characteristics between urban and rural areas supports hypothesis 1a but did not provide support regarding hypotheses 1c, 1d and 1e.

The subgroup analyses revealed that density did not affect the SECON in urban areas, but did so in rural areas (β = 0.038, 95 % CI = 0.001; 0.074, p < 0.05). The same applies to closeness centrality (β = -0.031, 95 % CI = -0.062; -0.001, p < 0.05) and degree centrality (β = - 0.162, 95 % CI = - 0.217; 0.108, p < 0.001). Regarding the impact of the EI-index on the SECON, the analysis showed a significant effect in both urban (β = 0.033,95 % CI = 0.001; 0.065, p < 0.05) and rural areas (β = 0.068, 95 % CI = 0.031; 0.105, p < 0.001), with a significant difference in the strength of effects (see table 8).

In the analyses of the impact of predictors on 30-day readmission, all predictors except for degree centrality showed a significant effect in rural, but not urban areas (density OR = 0.982, 95 % CI = 0.978; 0.986, p < 0.001; closeness centrality OR = 0.960, 95 % CI = 0.959; 0.961, p < 0.001;

EI-index OR = 1.232, 95 % CI = 1.231; 1.234, p < 0.001; cohesion OR = 1.012, 95 % CI = 1.008; 1.016, p < 0.001). However, the difference is not statistically significant. For the 90-day readmission timeframe, density had a significant impact in urban (OR = 0.832, 95 % CI = 0.716; 0.966, p < 0.05), but not in rural areas. Both the EI-index (OR = 1.209, 95 % CI = 1.028; 1.423, p < 0.05) and cohesion (OR = 0.850, 95 % CI = 0.737; 0.981, p < 0.05) had a significant effect in rural but not urban areas. The effect was only significantly different regarding the EI-index. None of the predictors affects 180-day and 365-day readmissions, neither in urban nor in rural areas (see table 11).

The results partly support hypothesis 1b, the relation between predictors and outcomes was stronger in urban areas for the impact of degree centrality and the EI-index on the SECON and the EI-index on 90-day readmissions.

3.3 Results of the evaluation of the VESPEERA programme[10]

In this chapter, the results of the effectiveness evaluation of the VESPEERA programme are presented. First, the characteristics of the intervention and the control group are described. Subsequently, the results of the analysis of the primary outcome and secondary outcomes as well as the results of the subgroup analyses are presented.

3.3.1 Description of the study population

During the intervention phase, n = 371 patients fulfilled the eligibility criteria in n = 986 hospital admission cases. The propensity score matching produced a control group of n = 371 patients (n = 985 cases). In total, n = 742 patients with n = 1,971 cases were considered in the intention-to-treat analysis.

In total, the patients were between 18 and 99 years and on average 70 years (SD 16) old. Male and female gender was equally represented. Patients in the intervention group were admitted on average 2.7 (SD 2.3) times during the intervention period. This number was identical in the control group (mean 2.7, SD 2.2). Using the classification of Huang et al. (2014), patients had moderate comorbidity. The length of stay on average was 7.4 (SD 9.1) days with a range of 0 to 69 days in the intervention group and 0 to 135 days in the control group. The top five main diagnoses of the overall study population as well as those of patients with readmissions were mostly related to diseases of the heart and the lung. Table 14 provides an overview of the characteristics of the study participants.

Table 14: Characteristics of the study population

	Intervention (n = 371)	Control (n = 371)	Total (n = 742)
Age			
Mean (SD)	69 (16)	70 (16)	70 (16)
Median	74	72	74
Q1 - Q3	59 - 81	60 - 82	59 - 82
Range	18 - 96	18 - 99	18 - 99
Gender			
Male	182 (49%)	183 (49%)	365 (49%)
Female	189 (51%)	188 (51%)	377 (51%)
Admissions			
Mean (SD)	2.7 (2.3)	2.7 (2.2)	2.7 (2.2)
Median	2	2	2
Q1 - Q3	1 - 4	1 - 3	1 - 3
Range	1 - 17	1 - 15	1 - 17
CCI at first admission			
Mean (SD)	3.6 (2.8)	3.4 (2.8)	3.5 (2.8)
Median	3	3	3
Q1 - Q3	1 - 6	1 - 6	1 - 6
Range	0 - 13	0 - 12	0 - 13

SD: Standard deviation, Q1 - Q3: interquartile range, CCI: Charlson Comorbidity Index, COPD: Chronic obstructive pulmonary disease

3.3.2 Results of the statistical analysis

Regarding the primary outcome, readmissions within 90 days due to the same indication, the rate after the intervention period was almost the same in both groups. In the control group, the readmission rate increased by 3.5 % from 9.5 % to 13 %. In the intervention group, a decrease of 2.5 % from 15.8 % to 13.3 % was observed (see table 15). Altogether, a difference of 6 % regarding readmission rates between the intervention and control groups was thus observed. Readmission rates within 30 days after admission increased in the intervention group and remained almost the same in the control group. Admissions due to ACSC decreased in the intervention group but increased in the control group. Regarding the delayed prescription of medication, the rate decreased in the intervention group but slightly increased in the control group. The delayed prescription of medical aids and appliances decreased in both groups. The rate of delayed referral to rehabilitation therapeutics slightly decreased in both groups. The rate of patients who utilised emergency and rescue services after discharge slightly decreased in the intervention group but increased in the control group.

Table 15: Descriptive results of the outcomes

	Rate pre-intervention [95% CI] [a]	Rate post-intervention [95% CI] [a]
Readmission within 90 days		
intervention	15.8 [10.6; 22.9]	13.3 [11.1; 15.9]
controls	9.5 [5.1; 17]	13.0 [10.8; 15.6]
Readmission within 30 days		
intervention	4.5 [2.1; 9.5]	6.9 [5.3; 8.9]
controls	5.3 [2.3; 11.7]	5.2 [3.8; 7]
Admission due to ACSC		
intervention	4.5 [2.1; 9.5]	3.9 [2.7; 5.5]
controls	3.2 [1.1; 8.9]	4.0 [2.9; 5.7]
Delayed prescription of medication		
intervention	28.1 [20.9; 36.7]	19.6 [16.8; 22.7]
controls	21.2 [13.8; 31]	24.0 [21; 27.3]
Delayed prescription of medical aids and appliances		
intervention	69.2 [55.7; 80.1]	56.7 [51; 62.3]
controls	73.5 [56.9; 85.4]	65.8 [60.2; 70.9]
Delayed referral to rehabilitation therapeutics		
intervention	74.3 [57.9; 85.8]	74.2 [67.5; 79.9]
controls	77.3 [56.6; 89.9]	68.8 [61.5; 75.2]
Emergency/ rescue services		
intervention	32.3 [25; 40.7]	30.3 [27.1; 33.6]
controls	29.5 [21.2; 39.3]	33.9 [30.7; 37.4]

[a] in per cent

CI: Confidence interval, ACSC: Ambulatory care sensitive conditions

The primary analysis did not show a significant effect (p = 0.385), although the intervention patients showed a slightly better outcome (OR = 0.662). No significance tests were performed for any secondary outcomes.

The primary analysis showed that intervention patients may be less likely to be readmitted within 90 days due to the same indication (see table 16). When looking at readmissions within 30 days due to the same indication, controls may be less likely to be readmitted than the intervention group. The intervention group may be less likely to be admitted due to ambulatory care sensitive conditions, to have a delayed prescription of medication and medical aids and appliances and utilise emergency and rescue services than patients from the control group. Patients from the control group however may be less likely to have delayed referral to rehabilitation therapeutics than the intervention group. The cost of care is possibly lower in the control group (mean difference: 76,423.2; SD 1,456,248).

The sensitivity analysis confirmed the results of the primary analysis.

Table 16: Results of the statistical analysis

	OR	CI	p-value
Readmission within 90 days	0.662	0.261; 1.680	0.38518
Readmission within 30 days	2.129	0.547; 8.285	
Admission due to ACSC	0.467	0.156; 1.399	
Delayed prescription of medication	0.530	0.263; 1.068	
Delayed prescription of medical aids and appliances	0.843	0.304; 2.337	
Delayed referral to rehabilitation therapeutics	1.535	0.404; 5.830	
Emergency or rescue services	0.696	0.328; 1.478	

OR: Odds ratio, CI: Confidence interval, ACSC: Ambulatory care sensitive conditions

For the analysis of the primary outcome, subgroup analyses were conducted considering whether patients received the intervention component 'telephone monitoring' (subgroups built for intervention arms only), age (threshold 65 years) and comorbidity (see table 17). Within both the subgroup with patients who did not receive telephone monitoring and those who did receive telephone monitoring, intervention patients may be less likely to be readmitted within 90 days than the control group. In both age groups, patients from the intervention group may be less likely to be readmitted than patients from the control group. In patients with mild comorbidity (low CCI), the OR was in favour of the control group. In patients with moderate comorbidity (medium CCI), patients from the intervention group may be less likely to be readmitted than patients from the control group. Regarding patients with severe comorbidity (high CCI), the likelihood of readmission was remarkably lower in the intervention group than in the control group (OR = 0.113).

Table 17: Results of the subgroup analysis

Subgroups	OR	CI
Telephone monitoring		
No	0.553	0.218; 1.406
Yes	0.695	0.204; 2.367
Age		
< 65 years	0.661	0.125; 3.488
≥ 65 years	0.464	0.129; 1.662
CCI		
Low	3.808	0.730; 19.859
Medium	0.712	0.093; 5.475
High	0.113	0.013; 0.997

OR: Odds Ratio, CI: Confidence interval, CCI: Charlson Comorbidity Index

3.4 Results of the quantitative survey study[11]

The following two chapters comprise the results of the questionnaire survey. First, the study population is described, including information on the reported intervention fidelity. Then, the results regarding all statements in the questionnaire are summarised and presented in detail in tables.

3.4.1 Description of the study population

There were n = 68 participants in the questionnaire survey. The majority of care providers who participated in the survey were from general practices and, on average, the participants had 23 (SD 11) years of professional experience. Experience with the VESPEERA programme differed, participants on average had taken care of 9.1 patients (SD 21, see table 18). Most of the intervention components were used at least once or known by about half of the participants, respectively. Individual fidelity according to self-reports is 0.4, i.e. 40 % on average, with a quite high variation (see table 19).

Table 18: Characteristics of the study population of the quantitative survey

	Mean (SD)	N (%)	Total n
Gender *(male)*		16 (24.2)	66
Age *(in years)*	48 (11.4)		63
Work experience *(in years)*	22.8 (11)		62
Area *(urban)*		29 (43.9)	66
Type of organisation *(general practice)*		50 (73.5)	68
Size of the general practice *(patients per quarter year)*	1,660.4 (640.1)		48
Size of the hospital *(beds per department)*	378.3 (536.4)		17
Number of VESPEERA patients cared for	9.1 (21)		62

SD: Standard deviation

Table 19: Self-reported intervention fidelity

VESPEERA component	N (%)	Total n
Assessment before admission was used at least once	33 (49.3)	67
Admission letter was used at least once	32 (47.8)	67
Patient brochure was handed out at least once *(general practice only)*	31 (68.9)	45
Familiar with the content of the patient brochure *(general practice only)*	34 (77.3)	44
HOSPITAL score was collected at least once	29 (44.6)	65
Telephonic discharge conversation was used at least once	11 (16.9)	65
At least one case is known in which the patient discharge information was used *(hospital only)*	2 (8.7)	23
Assessment for planning of follow-up care after discharge was used at least once *(general practice only)*	38 (77.6)	49
Telephone monitoring was used at least once *(general practice only)*	34 (70.8)	48
Fidelity (Score between 0 and 1); mean(SD)	0.4 (0.4)	68

SD: Standard deviation

3.4.2 Results of the survey

The participants are rather indecisive when asked to rate the benefit over the expenses to use the intervention components with a tendency to a positive balance (means between 3.2 and 3.7). Regarding the assessment before admission and the admission letter, no clear recommendation for its utilisation is given by the participants. As to the working mechanism of these intervention components, the participants think that they partially contribute to obtaining relevant information about the patient, especially social information relevant to social services. The participants do not think that admission processes in the clinic are accelerated by an admission letter. The assessment for planning of follow-up care after discharge is evaluated positively by the respondents from general practices. They agree that it is a suitable instrument to plan the patient's care after discharge in a structured and complete way. Despite the positive evaluation, the effort to conduct the assessment is seen as quite high compared to the benefit. Regarding telephone monitoring, participants from general practices see it as a suitable tool to check adherence to therapy and to identify further needs for patients with rather complex healthcare needs. Furthermore, they think that it can contribute to helping to avoid readmissions. More results on the working mechanism of the intervention components can be found in table 20.

Regarding contextual determinants to the implementation of the VESPEERA programme, the questionnaire included questions on the topics of networks, resources, external policy and requirements, project management in VESPEERA and the inclusion of patients in the study. The questionnaire included several questions regarding networks and personal contacts between hospitals and general practices.

Regarding the availability of hospitals in the region, most participants (80 %) stated that the hospital where most patients go is not the only hospital in the region. In contrast, almost 60 % of participants replied that the majority of patients in the region go to the same hospital. About two-thirds of participants have been working with the respective other care providers in the regions for many years and more than half participate in networking events. Half of the participants also replied that they have personal contacts with the respective other care providers, however, about 28 % of participants indicated that they do not have any personal contacts at all. In general, the resources available for implementing the VESPEERA programme, such as financial compensation and availability of staff and workplaces are described as insufficient by the majority of participants. Furthermore, many participants agree that external requirements affect cross-sectoral care. For example, the RV EM at least partly affected the implementation of the VESPEERA programme according to more than three-quarters of the study population. Furthermore, the General Data Protection Regulation of the European Union, which came into effect at the same time as the VESPEERA intervention started, hinders cooperation amongst care providers as well as the implementation of the VEPEERA programme, as stated by approx. half of the study population, respectively. Furthermore, more than a quarter of respondents said that participation in VESPEERA was a strategic measure due to AOK's high market share and another 42 % agreed at least partially (see table 21).

As a result of working with the VESPEERA programme, almost half of the participants agreed that their awareness of the importance of cross-sectoral cooperation increased. However, agreement with statements to improve cross-sectoral cooperation as a result of the VESPEERA programme (closer contact between hospitals and GPs, new contacts established, better provision of information and in general) is low (table 22). On the other hand, there is a tendency for participants to wish more comprehensive implementation of the VESPEERA programme, such as implementing it in all hospitals. Participants partially agree that the VESPEERA programme strengthens the role of the GP and the VERAH. Although implementation can be delegated to some extent, the majority of participants see the implementation as unwieldy (too bureaucratic, associated with double documentation and difficult to integrate into internal processes, see table 23).

Table 20: Working mechanism of the VESPEERA components

	Not true [a]	Partly true	True [b]	Mean (SD)	n
The assessment before admission/ admission letter					
… helps to get new relevant information about the patients.	6 (10.6 %)	13 (22.8 %)	38 (66.7 %)	3.7 (1)	57
… helps to complete the documentation of patient data in my practice/ clinic.	8 (14.1 %)	16 (28.15 %)	33 (57.9 %)	3.5 (1)	57
… leads to a clearer communication of the indication for admission.	7 (12.1 %)	13 (22.4 %)	38 (65.6 %)	3.7 (1)	58
… helps to get a better understanding of the patient's social situation before admission.	5 (8.6 %)	7 (12.1 %)	46 (79.3 %)	3.9 (1)	58
… leads to an acceleration of the admission process in the clinic.	28 (47.5 %)	20 (33.9 %)	11 (18.7 %)	2.7 (1)	59
… contains information relevant to the patient's discharge planning.	6 (10.5 %)	23 (40.4 %)	28 (49.1 %)	3.5 (0.8)	57
… contains important information for the nursing staff.	3 (5.1 5)	18 (31 %)	37 (63.8 %)	3.6 (0.8)	58
… contains important information for clinicians	2 (3.4 %)	16 (27.6 %)	40 (69 %)	3.8 (0.8)	58
… contains important information for social service/case management.	3 (5.1 %)	6 (10.3 %)	49 (84.5 %)	3.9 (0.8)	58
Overall, the benefit of the admission letter exceeds the effort.	12 (20.4 %)	18 (30.5 %)	29 (49.2 %)	3.3 (1.1)	59
The patient brochure					
… helps motivate patients to claim their rights during the hospital stay.	6 (18.2 %)	7 (21.2 %)	20 (60.6 %)	3.4 (1)	33
… helps motivate patients to actively contribute - within their means - to their recovery process.	6 (18.2 %)	4 (12.1 %)	23 (69.7 %)	3.6 (1)	33
Overall, the patient brochure helps to prepare patients for a hospital stay.	5 (14.7 %	6 (17.6 %)	23 (67.7 %)	3.7 (1.2)	34
The HOSPITAL Score					
… is easy to collect.	7 (13.4 %)	21 (40.4 %)	24 (45.8 %)	3.3 (0.9)	52
… helps identify patients at increased risk of readmission.	9 (17 %)	18 (34 %)	26 (49 %)	3.4 (1)	53
… helps to identify patients with increased support needs.	8 (18.9 %)	15 (28.3 %)	28 (52.8 %)	3.4 (0.9)	53
… helps to identify patients for inclusion in the telephone monitoring.	6 (11.5 %)	19 (36.5 %)	27 (51.9 %)	3.5 (0.9)	52
Overall, the benefit of the HOSPITAL Score exceeds the effort.	10 (18.6 %)	24 (44.4 %)	20 (37 %)	3.2 (1)	54
The telephonic discharge conversation					
… promotes general cooperation between hospital and general practice.	6 (10 %)	9 (15 %)	45 (75 %)	3.9 (0.9)	60
… is helpful for complex or vulnerable patients.	3 (5.1 %)	8 (13.6 %)	48 (81.3 %)	4 (0.8)	59
… should generally be carried out for all patients/ is helpful for all patients.	15 (25.1 %)	20 (33.9 %)	24 (40.7 %)	3.2 (1.1)	59
Overall, the benefit of the telephone discharge conversation exceeds the effort.	8 (14 %)	22 (39.3 %)	26 (46.4 %)	3.4 (1)	56

Due to rounding, some totals may not correspond with the sum of the separate values.

[a] Summary of the two categories 'Not at all true' and 'Rather not true', [b] Summary of the two categories 'Very true' and 'rather true'

SD: Standard deviation

Table 21: Contextual determinants to the implementation of the VESPEERA programme

	Not true [a]	Partly true	True [b]	Mean (SD)	n
Networks					
The majority of patients in the region go to the same hospital.	12 (18.5 %)	15 (23.1 %)	38 (58.4 %)	3.5 (1)	65
The hospital where most of the patients go is the only hospital in the region.	52 (80 %)	8 (12.3 %)	5 (7.7 %)	1.9 (0.9)	65
I have been working with the local hospitals/GPs in the region for many years.	4 (6.3 %)	17 (26.6 %)	43 (67.2 %)	3.9 (1.1)	64
I participate in networking events between general practices and hospitals.	16 (25 %)	15 (23.4 %)	33 (51.5 %)	3.3 (1.2)	64
I have personal contacts with some GPs in the region/ in the hospital (quality circles, continuing education).	18 (28.2 %)	13 (20.3 %)	33 (51.6 %)	3.3 (1.4)	64
Resources					
I consider the remuneration for admission and discharge management measures to be appropriate.	24 (40.7 %)	22 (37.3 %)	13 (22.1 %)	2.8 (1.1)	59
The invoice numbers and modalities in VESPEERA were easy to understand.	13 (22.4 %)	13 (22.4 %)	32 (55.2 %)	3.4 (1.1)	58
There is sufficient staff available in my hospital/ practice to carry out the VESPEERA programme.	41 (67.2 %)	12 (19.7 %)	8 (13.1 %)	2.3 (1)	61
There are sufficient workplaces available in my hospital/ practice to carry out the VESPEERA programme.	28 (47.5 %)	20 (33.9 %)	11 (18.7 %)	2.7 (1.1)	59
External policy and external requirements					
The implementation of the requirements of the legal regulation on discharge management complicates the implementation of the VESPEERA programme.	10 (20.4 %)	19 (38.8 %)	20 (40.9 %)	3.2 (1)	49
The EU GDPR makes cross-institutional and cross-sectoral cooperation more difficult.	7 (13 %)	19 (35.2 %)	28 (51.8 %)	3.6 (1.1)	54
The EU GDPR complicates the implementation of the VESPEERA programme.	9 (16.7 %)	16 (29.6 %)	29 (53.5 %)	3.5 (1.1)	54
The decision to participate was a strategic one due to AOK Baden-Wuerttemberg's high market share.	13 (26.5 %)	21 (42.9 %)	15 (30.6 %)	3 (1)	49
Project management in VESPEERA					
I feel that I have fully understood the VESPEERA project with its goals and contents.	5 (7.8 %)	10 (15.6 %)	49 (76.6 %)	4 (1)	64
The responsibilities of the individual project partners were clearly understood.	6 (9.7 %)	13 (21 %)	43 (69.3 %)	3.8 (1)	62
From the project partners' side, I had enough information and support that I need to implement VESPEERA.	4 (6.4 %)	11 (17.5 %)	48 (76.2 %)	3.9 (0.9)	63
I trust one or more institutions involved in the project organisation.	2 (3.2 %)	7 (11.1 %)	54 (85.7%)	4.2 (0.8)	63
From the beginning, I was aware of the fact that VESPEERA was a study.	2 (3.1 %)	1 (1.6 %)	61 (95.3 %)	4.7 (0.7)	64
From the beginning, I was aware of the fact that the VESPEERA project has a limited duration.	2 (3.1 %)	1 (1.6 %)	61 (95.3 %)	4.7 (0.7)	64

	Not true [a]	Partly true	True [b]	Mean (SD)	n
Inclusion of VESPEERA patients					
It is difficult to identify patients eligible for participation in VESPEERA.	18 (36.8 %)	17 (34.7 %)	14 (28.5 %)	3 (1.2)	49
It is difficult to successfully motivate eligible patients to participate in VESPEERA.	14 (29.8 %)	19 (40.4 %)	14 (29.8 %)	3 (0.9)	47
It is easy for me to communicate the goals and contents of VESPEERA to eligible patients in an understandable way.	9 (19.2 %)	17 (36.2 %)	21 (44.7 %)	3.3 (1)	47
The VESPEERA programme meets the needs of my patients.	4 (8.5 %)	26 (55.3 %)	17 (36.2 %)	3.3 (0.7)	47

Due to rounding, some totals may not correspond with the sum of the separate values.

[a] Summary of the two categories 'Not at all true' and 'Rather not true', [b] Summary of the two categories 'Very true' and 'rather true'

SD: Standard deviation, GP: General practitioner

Table 22: Results of the VESPEERA programme as perceived by the participants of the survey

	Not true [a]	Partly true	True [b]	Mean (SD)	n
Through VESPEERA, contact with patients could be intensified.	16 (29 %)	14 (25 %)	26 (46.5 %)	3.1 (1.4)	56
Through VESPEERA, closer contact could be established with the admitting physicians/ discharging hospitals.	31 (55.3 %)	15 (26.8 %)	10 (17.9 %)	2.3 (1.2)	56
Through VESPEERA, VERAHs are better integrated into care provision than before.	11 (19.6 %)	19 (33.9 %)	26 (62.6 %)	3.2 (1)	56
Through VESPEERA, patients could be better involved in decisions regarding further care than before.	19 (33.3 %)	24 (42.1 %)	14 (24.6 %)	2.9 (0.9)	57
Through VESPEERA, patients had a better understanding of their own care than before.	8 (14.6 %)	27 (49.1 %)	20 (36.3 %)	3.1 (0.9)	55
Through VESPEERA, patients were made aware of hospital departments participating in VESPEERA.	32 (58.2 %)	9 (16.4 %)	14 25.4 %)	2.3 (1.3)	55
The VESPEERA feedback meetings have supported networking between hospitals and general practices.	25 (47.2 %)	7 (13.2 %)	21 (39.7 %)	2.9 (1.2)	53
Through VESPEERA, to some extent, general practices/ hospitals work together that would not have worked together before.	43 (74.5 %)	8 (14.5 %)	6 (10.9 %)	2 (1.1)	55
Through VESPEERA, there was a better exchange of information between general practice and hospital.	34 (61.8 %)	6 (10.9 %)	15 (27.2 %)	2.4 (1.2)	55
VESPEERA has improved cooperation across care sectors.	29 (52.7 %)	11 (20 %)	15 (27.2 %)	2.6 (1.2)	55
Through VESPEERA, my awareness was raised that cooperation with other care providers is important.	13 (23.2 %)	17 (30.4 %)	26 (46.4 %)	3.1 (1.2)	56

Due to rounding, some totals may not correspond with the sum of the separate values.

[a] Summary of the two categories 'Not at all true' and 'Rather not true', [b] Summary of the two categories 'Very true' and 'rather true'

SD: Standard deviation

Table 23: Attractiveness and acceptance of the VESPEERA programme

	Not true [a]	Partly true	True [b]	Mean (SD)	n
I would recommend participation in VESPEERA to colleagues.	1626.2 %)	19 (31.3 %)	26 (42.6 %)	3.2 (1)	61
I would recommend participation in VESPEERA to all my patients.	15 (23.4 %)	17 (26.6 %)	32 (50 %)	3.3 (1.1)	64
I would like to see all general practices participating in VESPEERA.	11 (18.4 %)	11 (18.3 %)	38 (63.4 %)	3.5 (1.1)	60
I would like to see all hospitals participating in VESPEERA.	8 (12.6 %)	9 (14.3 %)	46 (73 %)	3.8 (1.1)	63
I would like to see all health insurance funds participate in VESPEERA.	11 (17.4 %)	11 (17.5 %)	41 (65.1 %)	3.7 (1.2)	63
Participation in VESPEERA strengthens the role of primary care.	5 (8 %)	14 (22.2 %)	44 (69.8 %)	3.8 (1)	63
Participation in VESPEERA strengthens the role of the VERAH.	5 (8.2 %)	12 (19.7 %)	44 (72.1 %)	3.9 (1)	61
The conduct of the VESPEERA programme can be delegated to a large extent to VERAHs/nurses.	6 (9.5 %)	17 (27 %)	40 (63.5 %)	3.7 (0.9)	63
The conduct of the VESPEERA programme is too bureaucratic.	4 (6.6 %)	18 (29.5 %)	39 (64 %)	3.9 (0.9)	61
The conduct of the VESPEERA programme leads to double documentation.	5 (7.9 %)	13 (20.6 %)	45 (71.5 %)	3.9 (1)	63
The conduct of the VESPEERA programme can be well integrated into internal processes.	31 (49.2 %)	24 (38.1 %)	8 (12.7 %)	2.5 (1)	63

Due to rounding, some totals may not correspond with the sum of the separate values.

[a] Summary of the two categories 'Not at all true' and 'Rather not true', [b] Summary of the two categories 'Very true' and 'rather true'

SD: Standard deviation, VERAH: Care assistant in general practice

4 Discussion

In the discussion part of this dissertation, first, the results regarding two topics will be discussed considering the broader scientific literature. First of all, this concerns the current state of communication and coordination as well as their influencing factors (research questions I and II). Subsequently, the results regarding strategies for improving coordination and thus increasing CoC will be discussed (research question III). Then, several overarching themes are taken up and discussed based on all results. After considering the strengths and limitations of this dissertation, the discussion closes with implications for healthcare, politics and research.

4.1 Current state and influencing factors of information flow, communication and cooperation between care providers

4.1.1 Communication and information flow between primary care and hospitals[12]

The qualitative interview study focussed on the current state of communication and information flow between hospitals and primary care as well as their influencing factors. The study originally focused on informational continuity, but also enabled a digression towards management continuity. Overall, contents, means and quality of information transfers were heterogeneous amongst the interview partners and, amongst others, also depended on the situation (e.g. elective vs. emergency hospital admission). There was a general feeling that cooperation and communication need to be improved, for example by guaranteeing media continuity and defining standards for means of communication for different situations. The GP was identified as the care provider who should be responsible for care coordination around care transitions. Several factors were identified to be influencing information flow, such as organisational and data protection issues. In addition, social factors were prominent among the factors that influence information flow. Even in times of increasing use of modern information technology, factors such as appreciation of the other's responsibilities and personally knowing each other were perceived to be crucially important for information flow and effective collaboration.

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[12] Parts of this chapter have already been published in the following publication:
Forstner, J., Bossert, J., Weis, A., Litke, N., Strassner, C., Szecsenyi, J. and Wensing, M. (2021). The role of personalised professional relations across care sectors in achieving high continuity of care. BMC Fam Pract *22*, 72, doi: 10.1186/s12875-021-01418-8.

4.1.1.1 Current state of communication and ideas for optimal communication

The participants described information as mostly being transferred via written means that are then sent to the other party via fax. In some cases, these are accompanied by telephone calls. Only few participants stated that they used e-mail or shared platforms as a means of communication. This reflects Germany's position as a relative laggard in digitalisation in healthcare. Information and communication technology is in the early stages of a national roll-out with a delay in protocol of approximately ten years compared to some other countries (Caumanns 2019). Lacking trust in data protection measures and digital innovations as well as questions regarding the sovereignty over patients' health data have hampered the introduction of an electronic patient record enormously (Albert 2020). Therefore, care providers resort to or stick with other means of communication and accept the risks (such as data protection) and increased efforts (such as accompanying a fax with a phone call) associated. Data protection hinders information flow between care providers as it leads to uncertainty about which means of communication to use. Even though fax machines lost their importance with the rise of email in the 21st century, fax still seems to be the preferred means of communication among care providers in Germany (Chen et al. 2010; Coopersmith 2014). By the participants in this study, it is seen as an aspect of convenience. The participants mentioned inter and intra-organisational messaging services for transferring information that does not need a synchronous response. Other studies also consider messaging services to be a suitable tool (Melby et al. 2015; Munchhof et al. 2020). This should be considered by healthcare organisations as well as health policymakers on the way to digitalisation.

Overall, care providers were not satisfied with the current state of communication digitalisation. There seems to be little consensus regarding the necessary contents of information at admission. Generally, written information is preferred, but timeliness and completeness of information still leave room for improvement. A systematic review by Kattel et al. (2020) investigating timelines and quality of hospital discharge summaries supports the statements of the participants in the study on hand. In observational studies, the authors found that the availability of discharge summaries with primary care physicians was given in only 55 % of the time. Quality of information was limited regarding test results, diagnostic tests performed and post-discharge medication. In a range of interventional studies, the authors found that electronic communication improved the timeliness of the availability of information, but not the quality. This implies that electronic tools can address only some of the shortcomings in information transfers around care transitions, but other factors must be involved that impact communication and information transfers.

As an outlook for improved communication and information transfers, improvements in media continuity at the interfaces between care providers and healthcare organisations are wished for. Furthermore, standards regarding the means of communication and informational content could improve the

quality of information. Beyond the purely technical aspects of information transfers, the participants see a need for a change in paradigm regarding cooperation: mostly, they would like to see more intensive cooperation and closer collaboration when it comes to the care of individual patients. In particular, participants from hospitals expect GPs to become more involved in care after discharge and to take on their role as care coordinator. GPs themselves see care coordination as one of the core activities of their work, which confirms the definition of care coordination as one of the pillars of primary care (Starfield 1992). In a qualitative study by Vassbotn et al. (2018), GPs expressed that lacking recognition by other care providers hampered their increased involvement in care coordination across healthcare sectors. This was not directly confirmed by the qualitative study reported here, but GPs suggested that lacking recognition hampered information flow. A more detailed consideration of this in the interviews might have allowed this aspect to be deepened, however, determinants to care coordination was not the main interest of the interview study.

4.1.1.2 Factors that influence information flow between hospitals and general practices

Organisational issues impact information flow, such as different work patterns in hospitals and general practices that affect reachability via telephone. One may need several attempts to reach the desired person, which leads to time constraints in an inherently tight work schedule. Similar results were found in the literature. In a qualitative study, Sampson et al. (2016) explored relationships between Scottish GPs and hospital specialists. Both GPs and specialists reported problems with accessing the respective other and described the result as a 'ping-pong' (Sampson et al. 2016, p. 47) of communication, having to go back and forth until one can reach the other. Time constraints as a barrier to communication and cooperation were also mentioned by Bramesfeld et al. (2012) in a qualitative study of mental health care providers in Germany. The participants in the study described in this dissertation proposed to introduce timeslots that are intended for telephonic conversations between general practices and hospitals to overcome this problem.

Technological infrastructures and organisational changes can facilitate information flow between care providers, but these were not the only important preconditions according to the interviewed individuals. Participants described emotional and social aspects as highly affecting information flow. First, this includes an understanding and appreciation of the role and responsibilities of the respective other, as well as an idea about what the other needs in terms of information at a certain time point. This is in accordance with previous research (Stratil et al. 2018). Second, participants from all groups stressed the importance of knowing their counterpart as one, if not the most important (as mentioned by one participant), factor to successful information flow. Different stages of knowing someone lead to different amounts of effort put into information flow: if I know someone's face, I am more likely to provide

them with relevant information. If, however, I have a personal relationship with someone, I am more likely to not only communicate about a patient's case but to collaborate with them and to involve their opinions and expertise when planning patient care. Bramesfeld et al. (2012) also found personal acquaintances to be essential facilitators of cooperation in mental healthcare. Furthermore, similar results are reported by Jones et al. (2015). Participants in their qualitative study conducted among hospitalists and primary care physicians stated that communication is better in cases where they know their counterparts as they have worked together previously. Similar results by Scaioli et al. (2020) and Vargas et al. (2018) confirm knowing someone personally is a factor that influences the provision of referral letters between general practitioners and outpatient specialists. In the study by Scaioli et al. (2020), GPs were more likely to send referral letters to specialists if they had an informal relationship. Vargas et al. (2018) found that only few physicians receive referral letters or replies from others, knowing and trusting the primary care physician was associated with increased use of reply letters. Both studies were conducted in large cross-sectional studies in Latin America and Europe, respectively. Participants in the study by Sampson et al. (2016) stated that knowing each other led to 'better conversation' (Sampson et al. 2016, p. 47). In the study reported here, this mostly applied to synchronous communication via telephone. However, even in countries where information and communication technology is more advanced, deficits in information transfer during care transitions persist (Sheehan et al. 2021). Furthermore, and complementary, Munchhof et al. (2020) found that direct communication, via phone, mail or a message, can help to pay more attention to discharge letters.

Price and Lau (2013) link the relationship between care providers which they call provider connectedness to the concept of CoC. They found that communication is more effective and CoC is more likely to be achieved when care providers built on an existing relationship. The authors describe communication as the 'glue' (Price and Lau 2013, p. 310) that facilitates CoC. Provider connectedness can emerge when care providers are geographically close or if they share patients over long periods. The authors also mention how some care providers act to build good relationships. The results of the study on hand suggest that 'knowing each other' seems to be inherent in rural areas. Participants from rural settings in the study by Sampson et al. (2016), in contrast to their colleagues from urban areas, stated that close geographical contact eased forming relationships. However, these relationships may also be achieved in more urban areas where health professionals do not naturally know each other and healthcare organisations are recommended to endeavour to create these relationships.

Nevertheless, considering high rates of fluctuation in hospitals, especially among physicians, relationships should not only be built between individuals. Instead, cooperation should happen on an organisational level and should include agreements on the form of communication in different situations,

such as asynchronous and standardised communication in routine cases or synchronous communication (face-to-face communication, via telephone) in complex cases that deviate from routine. Moreover, cooperation should include clarification about the roles and responsibilities of different care providers in the process of patient care. The participants suggested organising meetings and events between GPs and hospitals to connect care providers. They could also help with gaining understanding and growing appreciation for the respective other and their responsibilities. Medical education, where physicians in training see different areas of healthcare and work shadowing could be complementary strategies. The participants in the study by Sampson et al. (2016) also mentioned joint educational events as a suitable strategy for forming relationships.

The results of this study highlight the relevance of personalised professional relations for the interplay of the different dimensions of CoC. Relational continuity with a longitudinal and trusting relationship should precede informational continuity, as it helps with accumulating information about a patient. However, this involves patients and care providers, which was out of focus of this study. The accumulated information is then shared between providers and is necessary to provide complementary care. The interview partners implied this by mentioning that information about the patient's situation before hospital admission can help with planning care after discharge to fit the patient's context. Personal relations between care providers facilitate the information flow, especially those that can be considered direct and synchronous, such as telephone calls. This is not only desired by care providers, but also the foundation for collaboration and thus management continuity.

4.1.2 Current state of provider connectedness between primary care physicians and other ambulatory physicians [13]

This social network study aimed to explore the structural characteristics of shared patient-networks of ambulatory physicians and was an attempt to identify possible characteristics of social networks with regard to CoC and readmissions as indicators for the quality of ambulatory care and more specifically primary care. Networks tended to be different between urban and rural areas. Overall, the study found that provider connectedness between GPs and ambulatory specialists in shared-patient networks showed some effects on short- and midterm hospital readmissions and CoC after hospital discharge in patients with COPD but had overall little predictive power.

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[13] Parts of this chapter have already been published in the following publication:
Forstner, J., Koetsenruijjter, J., Arnold, C., Laux, G. and Wensing, M. (2023c). The Influence of Provider Connectedness on Continuity of Care and Hospital Readmissions in Patients With COPD: A Claims Data Based Social Network Study. Chronic Obstr Pulm Dis *10*, 77-88, doi: 10.15326/jcopdf.2022.0359.

4.1.2.1 The effect of network characteristics on continuity of care and readmissions

The assumption underlying the hypotheses was that provider connectedness between GPs and ambulatory specialists has a positive impact on information flow, communication and collaboration concerning individual patients. Altogether it was expected that knowledge about the responsibilities of others in the network and strong relationships leads to targeted physician consultations, resulting in higher CoC and improved information flow and targeted physician consultants, resulting in lower readmission rates.

In accordance with the assumptions, being part of an enclosed group of physicians (low **EI-index**) seemed indeed to be beneficial for patients' readmission within 30 days after discharge. However, different than hypothesised, it showed to be related to lower CoC. One can only speculate about the reasons for the latter effect. No other study that investigated the impact of enclosed groups on outcomes was found.

Furthermore, as expected, high network density lowered the likelihood of 90-day readmission, but the impact of being densely and well connected (**density and cohesion**) was neither shown in other readmission timeframes nor in CoC. Other studies also showed that network density can positively impact patient outcomes such as CoC and hospital length of stay (Mundt et al. 2015; Wyngaerden et al. 2019). This partly supports the claim of Burns et al. (2022), who suggested that high network density contributes to better integration of care. In other studies, however, higher density increased readmission rates (Mascia et al. 2015; Uddin et al. 2013). The authors argue that high density is an indicator of little specialisation and division of labour which results in ineffective and unstructured referral pathways (Mascia et al. 2015).

Regarding **centrality**, it was expected that a less central GP within their network was beneficial as stronger ties are built with (the fewer) other care providers. This was confirmed regarding CoC but showed another direction of effect regarding 30-day readmission. The results of other studies investigating the impact of centrally distributed networks or central care providers within a network are also inconclusive regarding an effect and the direction of the shown effect on outcomes such as readmission, CoC and others (Geva et al. 2019; Mascia et al. 2015; Mundt et al. 2015; She et al. 2020; Uddin et al. 2013; Wyngaerden et al. 2019). For example, in a study that investigated the impact of networks consisting of GPs and specialists on emergency department visits in patients with ambulatory care sensitive conditions, She et al. (2020) found that higher degree centrality reduced rates of emergency department visits. This is contrary to the results reported here, where higher degree centrality affects patient care negatively (higher odds of readmission within 90 days after discharge, as indicated by the odds of density). In networks between hospital physicians investigated by Uddin et al. (2013), higher

degree centralisation increased readmission rates. Furthermore, in a study of the impact of primary care team networks on hospital length of stay in cardiovascular patients, low centralisation positively impacted outcomes (Mundt et al. 2015). Regarding a hospital referral network, low centrality led to higher readmission rates and thus shows a different direction of effect than the results reported here (Mascia et al. 2015). The authors' attempts for explanation are different in the studies presented and range from the interpretation that high interaction among network members leads to a shared team vision about goals (Mundt et al. 2015), that network density is seen as a measure of capacity to communicate with others (Uddin et al. 2013), and that high centrality allows effective coordination as there is a large selection of providers to choose from whereas high density is an indicator of little specialisation and division of labour which results in ineffective and unstructured referral pathways (Mascia et al. 2015). Here, low centrality was expected to aid in building strong ties. However, providers with high centrality may support coordination of care by steering information flow (Burns et al. 2022; Mascia et al. 2015).

Lastly, **CoC** was expected to reduce the risk of hospital readmission, which was not the case in the population here. However, this can potentially refer to a time bias: If a patient's health condition has worsened and therefore various visits to several physicians (together with an increase in the number of visits with the GP) were necessary, patients' health status influences both the number of physician visits as well as the likelihood of a hospital stay. This is supported by the very strong association between disease severity and the likelihood of being readmitted.

Concerning hospital readmission, different periods were analysed, as they can potentially reveal conclusions about the responsibilities of different areas of the healthcare system. The results show that the impact of provider connectedness on the likelihood of readmission decreases over time after a discharge. Generally, the opinion is that very short-term readmission (< seven days) is attributable to hospital care and the discharge process, whereas mid- and long-term readmissions are rather attributable to outpatient care, patient self-management, community resources, (Kripalani et al. 2014) or care coordination (Verhaegh et al. 2014). Very short-term readmissions were not considered, however, the results support that outpatient care and care coordination impact mid-term readmissions, whereas long-term readmissions might potentially not be reduced by more GP involvement. The analysis shows that COPD severity has a large impact on long-term readmissions, therefore they might be more attributable to a patient's self-management, or not avoidable after all (Majothi et al. 2015).

4.1.2.2 Variation and differences in network characteristics between urban and rural areas

Regarding the differences in the network characteristics between urban and rural areas, degree centrality, closeness centrality and the EI-Index showed statistically significant differences. Presumably, however, this does not so much suggest that physicians in urban regions are networked differently than physicians in rural regions. Rather, it indicates the supply of physicians with whom someone might network in the first place, which is lower in rural than in urban areas. Regarding differences in the effect of network characteristics on readmissions and CoC between urban and rural areas, some effects were found. The effect of degree centrality on CoC and the effect of the EI-index on readmissions within 90 days were stronger in urban than in rural areas. Similar to the main analysis, these effects are not consistent across endpoints and time periods considered. The administrative unit underlying the categorisation in urban and rural areas are districts. It has to be considered that even within an urban district, there might be rural areas. Thus, for future research, a more detailed approach to urbanity might be useful (Danek et al. 2022).

4.1.3 Conclusion

The qualitative study adds to a large body of research on care transitions (Straßner et al. 2020). Only few of those papers have highlighted the relevance of personal relations to information transfers between healthcare organisations. The strength of this study is that it links it to CoC, especially informational and management continuity, a dimension of CoC which is often neglected in CoC studies (Breton et al. 2012). The results of this study stress how all dimensions of CoC need to be addressed in future studies and in interventions aiming to increase CoC to contribute to successful change.

The relevance of personal relations with regard to CoC, which was revealed in the qualitative interview study, was addressed in the social network study. Overall, its results indicate that provider connectedness potentially affects patient healthcare. However, these effects were small, did not improve the overall predictive power of explanatory models and were not congruent across outcomes. Thus, the working mechanism and whether the chosen constellation of characteristics is the most appropriate operationalisation of provider connectedness cannot conclusively be explained and recommendations for the targeted creation and investment in shared-patient networks of ambulatory physicians cannot be derived.

4.2 Strategies for improving coordination and coordination of care[14]

The VESPEERA programme aimed to improve information flow and communication between hospitals and general practices. No statistically significant effect of the intervention on patients' hospital readmission rates was found. However, the results of the primary analysis as well as the analyses of secondary outcomes and the subgroups showed trends that patients might have benefitted from the intervention. For most outcomes, the ORs were in favour of the intervention group.

The process evaluation relying on a quantitative survey with care providers participating in the VESPEERA programme provided insights into the working mechanisms of the intervention components, acceptance of the intervention and intervention fidelity. Intervention fidelity was low and contextual factors that affected the implementation of the intervention are available resources, external requirements such as legal regulations, networking between care providers and belief in its working mechanism.

4.2.1 The impact of the VESPEERA programme on outcomes

The decrease in readmission rates in the intervention group and the increase in the control group (which corresponds to the overall trend in this population (Wensing et al. 2018)) adds up to an effect of 6 %. It can be assumed that the effects would be statistically significant if the targeted sample had been achieved. Facchinetti et al. (2020) published a meta-analysis on the effect of CoC interventions on readmissions in elderly patients with chronic conditions. They were able to include 3,003 patients from eleven studies in the analysis of readmissions between 30 and 90 days after discharge. Readmission rates were significantly lower in the intervention than in the control group (21.9 % vs. 29.8 %, thus an effect size of 7.9 %). The reported risk ratio of 0.74 (95% CI, 0.65; 0.84, p < 0.001) translates into an odds ratio of 0.82, which is similar to the results presented here (result of an effect size of 6 % with an OR of 0.66). It might therefore be assumed that there is an effect of the VESPEERA programme on readmissions within 90 days after discharge and that this could have been able to show within a larger study population.

There are various explanations for the absence of significant effects. First of all, lower rates of readmission than assumed and low rates compared to studies looking at similar populations can be observed (Wensing et al. 2018). Together with an overall small sample size, this is the most probable explanation for the absence of effects. Primary care teams reported barriers to implementation among

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[14] Parts of this chapter have already been published in the following publication:
Forstner, J., Pilz, M., Straßner, C., Weis, A., Litke, N., Uhlmann, L., Peters-Klimm, F., Aluttis, F., Baldauf, A., Kiel, M., Qreini, M., Kaufmann-Kolle, P., Schubert-Haack, J., El-Kurd, N., Tomaschko-Ubeländer, K., Treffert, S., Rück, R., Handlos, B., Karakas, G., Wensing, M. and Szecsenyi, J. (2023c). Hospital Admission and Discharge: Lessons Learned from a Large Programme in Southwest Germany. International Journal of Integrated Care *23*, 4, doi: 10.5334/ijic.6534.

others to be resource-related (time, staff and working place), the study-related measures to be too elaborate and that the timing of application (i.e. when a patient showed up after being discharged) could not be planned. This led to the fact that they, contrary to the study protocol, pre-selected patients who were perceived to be most likely to benefit from the programme. Furthermore, fewer patients than expected were admitted to hospitals electively by the primary care teams. Mostly, they were included in the programme after hospital discharge. Hospitals only participated with selected departments as at the same time the project started, a new legal regulation came into place obligating hospitals to implement comprehensive measures to improve discharge management. Consequently, the number of participating hospitals was lower than originally planned (25 hospitals were expected to participate) and those participating had little to no capacity to implement the intervention. The combination of barriers to implementation in general practices and hospitals resulted in the fact that no patient received in-hospital intervention components.

One part of the intervention was telephone monitoring, a common and highly researched component in discharge management interventions. Many systematic reviews on this topic give hints about the effectiveness of telephone follow-up after discharge but studies are characterised by heterogeneity and inconclusive evidence (Bahr et al. 2014; Cusack and Taylor 2010; Mistiaen et al. 2007; Woods et al. 2019). In the case of the study presented here, telephone follow-up was delivered to patients at high risk for readmission according to the HOSPITAL score (Donzé et al. 2016). The subgroup analysis showed that both the subgroup with telephone follow-up (those at high risk for readmission) and the subgroup without telephone follow-up (lower risk for readmission) profited from the intervention. No risk stratification and thus no telephone monitoring was performed in the control group. Van Walraven et al. (2010b) found that post-discharge contact with a regular physician decreased the risk of readmission. A recently published study by Leppert et al. (2020) found that a timely primary care follow-up significantly reduced 30-day readmissions in patients after acute ischemic stroke admission. Consequently, it can be assumed that close follow-up after discharge by the primary care team can potentially avoid readmissions.

The potential benefits of receiving the intervention regarding readmissions seemed higher in patients with severe comorbidity. Patients with severe comorbidity have an increased risk of readmission, which has been observed for different patient groups (Buhr et al. 2019; Härstedt et al. 2015; Kwok et al. 2018; Librero et al. 1999; Voskuijl et al. 2014). The intervention, therefore, appears to be particularly beneficial in those patients who are most likely to benefit from it in terms of their condition.

4.2.2 Including primary care in admission and discharge management

The outcomes used in this study to some extent are outcomes that are typically used in the evaluation of programmes to reduce readmissions, but outcomes such as readmissions within 90 days, admissions due to ACSC, utilisation of emergency services and prescriptions after discharge are also associated with strong primary care. For example, van Loenen et al. (2014) found that strong primary care can reduce avoidable admissions due to ACSC. Huntley et al. (2014) studied how strong primary care, characterised especially by provider continuity, reduced the utilisation of emergency departments. Wensing et al. (2021) found that high CoC in the HZV reduced the risk of admission, readmission and avoidable admission. Its' effect on admission rates for high-risk patients was confirmed (Sawicki et al. 2021). Van Walraven et al. (2010b) found that post-discharge contact with a regular physician decreased the risk of readmission. A study by Leppert et al. (2020) found that timely primary care follow-up significantly reduced 30-day readmissions in patients after acute ischemic stroke admission. Furthermore, most interventions aiming at the reduction of readmissions take place before or after discharge (Straßner et al. 2020). The VESPEERA programme, however, covered the whole cross-sectoral care process beginning with pre-admission intervention components in general practice, followed by intervention components during the hospital stay and at hospital discharge and concluding in general practice. Additionally, as in this study, only the intervention components in general practice were carried out with reasonably high fidelity, the observed benefits can be attributed to those components and thus result from increased efforts within primary care. Including primary care in multi-component care transition interventions thus represents an opportunity to contribute to the reduction of readmissions and further strengthen primary care (Bricard and Or 2019; Saluja et al. 2019; Spencer and Singh Punia 2021; Spivack et al. 2022). This especially but not only applies to countries with traditionally weak primary care systems, such as Germany and other countries with social health insurance systems (Groenewegen et al. 2013; Kringos et al. 2013b).

4.2.3 Intervention fidelity of the VESPEERA programme

The analysis of the intervention fidelity captured adherence based on the at least one-time use of each of the respective intervention components. The results show that only few intervention components have been used by many of the participants whereas others were hardly used at all. This indicates that the VESPEERA programme was not delivered as planned such as that patients did not receive all intervention components they were supposed to or did receive no intervention at all. At the same time, some of the participants of this survey possibly delivered none of the intervention components. This makes sense, as hospitals were not able to identify any VESPEERA patients, fidelity for participants from hospitals was therefore expected to be zero. Statements from participants that they have used some of the components should therefore be interpreted with caution.

Assessing fidelity of the VESPEERA intervention can provide a possible explanation for the absence of effects as high intervention fidelity is expected to show high success regarding outcomes (Mihalic 2002). However, the literature shows that complex interventions provide more room for variation in delivery and more often are not delivered as planned compared to more simple interventions (Carroll et al. 2007).

4.2.4 Factors influencing the implementation of the VESPEEA programme

Several aspects were included to assess factors affecting the implementation of the VESPEERA programme. This includes the working mechanisms of each of the intervention components, contextual factors and perceived results by applying the intervention as well as acceptance of the intervention.

There were aspects regarding the working mechanisms as well as determinants of implementation that can be attributed to the programme itself. Overall, half of the participants see the benefits worth the effort, with the HOSPITAL score being the least accepted intervention component. This is due to dominant factors like very limited resources in the organisation (e.g. staff, working places) to conduct the VESPEERA programme or possibly even any additional workload in general and the programme being perceived as too elaborate, bureaucratic and difficult to integrate into existing processes.

Availability of resources is a known factor to impact implementation (Jabbour et al. 2018; Kaplan et al. 2010; Li et al. 2018) as well as the complexity of the intervention, which is associated with compliance regarding the utilisation of an intervention (Carroll et al. 2007; Gilhooly et al. 2019). Furthermore, external legal regulations that came into effect and consumed resources approx. at the same time and also inappropriate remuneration for discharge management in general impacted implementation. The latter could indicate previous experiences that from the outset put participants in a negative frame of mind towards the implementation of the programme. However, in a systematic review by Chauhan et al. (2017) exploring interventions aiming to change practice in primary healthcare, the authors did not find evidence that financial incentives led to a change in the professional behaviour of GPs.

Furthermore, not all participants were convinced of the evidence and impact on the outcomes of the intervention components. For example, the HOSPITAL score was shown to identify patients at increased risk for readmission, but only approx. half of the participants believe that the score would fulfil this. Possibly, participants should have been provided with different sources of evidence regarding all individual intervention components, as strong evidence presented from different sources can support implementation (Damschroder et al. 2009). Due to the small sample size and the approach towards assessing intervention fidelity (one-time use vs. patient-based use), it was not assessed whether those with higher fidelity rated the intervention components better.

Lastly, as a result of the interviews, statements regarding the project management and study conduct in VESPEERA were added to the section exploring contextual factors. The participants showed high rates of trust towards at least one of the organisations involved in the study and about three-quarters of participants seemed to have understood the responsibilities of each of the project partners. This could indicate some kind of a relationship between project partners and the participating hospitals and general practices. In fact, relationships were established through ongoing, mostly telephonic, contact that was built by providing education and support for the implementation of the VESPEERA programme. In a review of the literature, Gilhooly et al. (Gilhooly et al. 2019) found that establishing a relationship with stakeholders is an implementation strategy that is associated with improved compliance in the implementation of care bundles in acute hospital care. For future studies, it is thus recommended to consider this as an implementation strategy from the outset.

The agreement that there are many hospitals available in the region could be an explanatory factor for the fact that hospitals were not able to identify any VESPEERA patients. Regarding networking, up to two-thirds of participants were already well connected, participate in network events and have been collaborating for many years already, which could explain why participants did not see closer contact or new contacts between care providers as a result of the VESPEERA programme and the included feedback meetings. However, this is contrasted by the agreement that awareness towards cooperation with other care providers was raised and primary care as well as the role of the VERAH was strengthened and a wish for a roll-out.

Interestingly, most of the statements regarding results (that were derived from the interviews) noticed through applying the VESPEERA programme concern rather soft factors such as cooperation with other care providers than harder patient and healthcare system-related outcomes. Overall, the survey showed approval of the overall programme as well as the individual components and possible benefits for patients and cooperation with others. However, several contextual factors have had a considerable influence on fidelity despite motivation and conviction of the benefits.

4.3 Discussion of recurring topics

4.3.1 The future of continuity of care

The previous chapters of this dissertation have shown the relevance of the different dimensions of CoC and their interdependencies. Three of the four studies presented focused on the concept of CoC. The interview study investigated the relevance of informational and management continuity based on qualitative reports about information flow between care providers. It did not focus on assessing the quality of informational continuity in relation to specific events but rather examined determinants that affect information flow. The social network study measured relational continuity using the SECON, which can also be used as a substitute for informational continuity (Reid et al. 2002) by considering the number of bridges between care providers that need to be overcome. The implementation of the VESPEERA care programme aimed to increase CoC by introducing a care programme to improve communication between care providers. However, no measure of CoC was considered in this analysis. Much rather, it was assumed that an improvement in the measured outcomes implies increased CoC. Thus, the three studies considered CoC and somewhat showed their importance, but no measurable effects of CoC could be shown. This is in contrast with the literature that has investigated the impacts of CoC on healthcare and the health of individual patients as well as healthcare systems sufficiently and there seems to be little scope to question its relevance (Pereira Gray et al. 2018; Huntley et al. 2014). Hence, this raises the question of whether CoC is still important, whether it can and should be sustained or why none of the studies presented here confirmed the relevance and impact of CoC on healthcare.

Putting aside the limitations of each of the studies, the measures only indirectly measured the concepts of interest, such as CoC and active coordination of care between care providers. In the social network study, by using the SECON, informational continuity was only measured as a proxy, as the number of transitions between providers does not give any measurement of whether information has in fact been passed, if it was transferred timely and no information regarding the quantity or quality of information. Approaches to measuring informational continuity typically consider the availability and completeness of information (Reid et al. 2002), such as counting discharge letters and the duration until they are transferred to others (Bell et al. 2009; Chen et al. 2010). For measuring relational continuity, studies typically rely on questionnaires (Uijen et al. 2012a) or administrative data. Using the latter, relational continuity is measured by calculating indices that refer to the duration of a relationship, care density with one provider (share of visits that are with a single provider, usually the GP or another identified usual provider) or sequences of visits with care providers (Hetlevik et al. 2021;

Nyweide 2014; Pollack et al. 2016; Reid et al. 2002; Saultz 2003). Another approach is the measurement of the regularity of visits with a care provider (Lytsy et al. 2022). The interpersonal aspect of relational continuity is rarely assessed in studies (Saultz 2003). Measuring management continuity is approximated by examining follow-ups or compliance with management plans or care pathways (Reid et al. 2002).

However, it is questionable whether this is appropriate when taking care of patients with complex health problems that indicate the involvement of several highly specialised health professionals and whether it is the goal to achieve high provider continuity with a usual provider (Jackson and Ball 2018; Wright and Mainous 2018). This is highlighted by the fact that CoC in England has declined, even though the National Health Service has assigned all patients to a GP. The problem associated with such patient enrolment programmes is that the assigned GP is not always the one that patients prefer to see. For the future, the authors suggest that changes in healthcare systems that impact changing access to primary care, such as online appointment booking systems, should not be at the expense of CoC (Tammes et al. 2021). The General Practitioner Committee at the British Medical Association supports the relevance of CoC over access (Waters 2022). However, in situations where patients are faced with acute healthcare problems, they might value access over CoC and seek urgent care such as in emergency departments, with another GP in the same practice as their usual GP or with an out-of-hours GP (Hetlevik et al. 2021), or if sensitive issues are to be addressed (Wilfling et al. 2021). Considering this, lower scores with CoC indices do not necessarily indicate lower quality of care but might indicate that patients received appropriate care for their health problems (Blozik et al. 2020). This goes in hand with a need for more diverse ways to measure CoC or measures that consider more than one dimension of CoC (Reid et al. 2002) and pay respect to morbidity, urgency, appropriateness and integration of care, such as suggested by Hetlevik et al. (2021) or Yao et al. (2022).

At the same time as asking whether high provider continuity with one provider is desirable, it also makes sense to put into question whether this can even be achieved in healthcare systems that are faced with a changing workforce. Even though solo practices are still the dominant form of organisation for physicians in many healthcare systems, a shift towards delegation to non-physician professions or in more progressive healthcare systems, team-based healthcare can be observed (Freund et al. 2015; Maier and Aiken 2016). Additionally, with the shift toward shared practice models, increasing shares of ambulatory physicians are in an employment relationship and shares of physicians who decide to work part-time are increasing (Stengel et al. 2021). As a result, numerous physician positions will remain unfilled in the future. For Germany, for example, it is estimated that up to 20,000 GP positions will not be filled in 2030 (Sachverständigenrat zur Begutachtung der Entwicklung im

Gesundheitswesen 2014). These shortages and part-time models do impact relational continuity, however, research suggests that patients are more satisfied with their healthcare when their GP works part-time (Panattoni et al. 2015).

The above has shown that even though it is not a new topic and the healthcare landscape is changing, CoC is still high on the research agenda (numbers of studies indexed on PubMed when searching for 'continuity of care' yield more than 800 results for the year 2022). Wright and Mainous (2018) conclude that 'Patients like continuity. GPs like continuity.' (Wright and Mainous 2018, p. 668). So, what is needed is certainly not a departure from CoC, but rather a paradigm shift that includes loosening strict views on the importance of high CoC combined with little utilisation of secondary care, but rather high management continuity and the focus on strong coordination of care and targeted utilisation of healthcare, which is where programmes to improve care transitions and enhance CoC are directed. For example, Wright and Mainous (2018) recommend that, if using patient lists, patients should be linked with their preferred GP and focus on increasing informational and management continuity to do the changes in patients' needs and healthcare systems justice. Furthermore, Przysucha et al. (2018) point out that when aiming to achieve high management continuity, payers should be considered as well, as they have the budget and thus also decisions on the delivery of health services and thus ultimately influence whether a care plan can be realised. Ljungholm et al. (2022) advocate that for improved coordination of care, cooperation should not only be enforced on a personal but also on an organisational level as well, which supports the results of the qualitative study presented as part of this dissertation.

4.3.2 Continuity of care and personal relations

The previous chapter has shown that to maintain CoC, it is increasingly necessary to take into account that care concepts require cooperation between health professionals. There is research that confirms what the participants in the qualitative interview study mentioned, which is that 'knowing each other', thus having seen someone's face, having talked to them or even knowing them on a personal level, influences and facilitates cooperation (Berendsen et al. 2007; Price and Lau 2013; Sampson et al. 2016; Tomaschek et al. 2022).

As this relates to social relations, it is worth taking a look at explanations from social science to explain the concept of 'knowing each other' and why this might be beneficial for healthcare. Three different theoretical approaches will be considered: social capital, social constructionism and game theory.

First, social capital is a sociological theory that could provide a clearer view of the concept of 'knowing each other'. Based on the north-American approach by sociologists such as Coleman or Putnam, social

capital is a resource that results from social relations and is a characteristic of social networks (Vonneilich 2020, p. 39). It opens up possibilities for action as well as opportunities to coordinate intentions for collective action. In this context and according to this explanation, social capital is created when frequent interaction occurs between individuals who share norms and values. The concept also refers to network theories such as the one by Granovetter who differentiates between strong and weak ties and the advantages associated with each (Vonneilich 2020, p. 39). One example of applying social capital as an explanatory approach to relations between care providers can be found in a qualitative study by Sampson et al. (2016) who explored relations between GPs and hospital specialist and their influence on patient care. They described how the participants perceive good relations with other care providers as important to enable direct communication, to facilitate care transitions and as a sense of wanting to help each other and how having met someone also affected communication. The authors discuss how the sense of belonging to a team working towards the same goal, which they call team continuity, is necessary to successfully achieve informational and management continuity. They refer to the concept of social capital as an explanation for trusting relationships between care providers as an essential building block to cooperation and patient-centred care (Sampson et al. 2016). Persson et al. (2022) conducted a qualitative study about experiences in care coordination across care sectors in Denmark and found similar results as presented in the qualitative interview study. Similarly to Sampson et al. (2016), the authors also argue that good relations that are built on trust can increase social capital and thus care coordination, as long as they are built on shared goals. The authors also suggest mutual education across care sectors as well as across professions as an instrument to increase social capital by building mutual knowledge and thus facilitating the development of shared, overarching goals, even though each stakeholder is working towards different smaller goals.

Another theoretical approach referring to the emergence of cooperation and collaboration is that of social constructionism, a theory applied in sociology and communications theory. Similar to social constructivism, it builds on the belief that knowledge and other aspects evolve from social interaction (Andrews 2012). Leng et al. (2021) link collaboration with social constructionism in a setting of knowledge construction in education research through asynchronous communication. However, these definitions also allow a transfer to CoC where transfer of information and knowledge about a patient is required when several care providers are involved. For successful information transfer and informational continuity and, eventually, management continuity as mentioned, collaboration is needed, which was also mentioned by the participants in the qualitative interview study who see collaboration as the highest form of cooperation.

In addition, game theory can provide explanations for the formation of network ties, the concept of 'knowing each other' and its influence on cooperation. Game theory, originally a mathematical and

economical theory, models decisions in social conflict situations, where the outcome of the game depends on the decision of each of the parties involved (e.g. two individuals or organisations) and their expectations of each other's decision. In the modelled decision-making situations, individuals strive to maximise their own payoff. However, since the achievement of goals is influenced by others, the strategy considered best for the individual does not lead to an optimal outcome: the group payoff is lowest when both parties decide differently (one decides to cooperate, the other to deflect, leading to a high payoff for one but no payoff for the other), lowest for each of the individuals when both decide to deflect and highest for each of the individuals when both decide to cooperate. There are different variants of the game, e.g. games with imperfect information (where only one party knows about all the previous decisions of their counterpart), cooperative games where binding arguments such as contracts are taken into account or repeated games where several rounds are played in contrast to the original so-called one-shot game (Kim 2014). In repeated games, the parties involved can be informed of the decision that the other made in the previous round. Repeated games show a tendency towards cooperative behaviour, as humans tend to reward cooperation according to the concept of reciprocity (Nishi et al. 2016). If this refers to cooperation between providers in terms of sharing information about patients, providers could reward someone who provides them with comprehensive information, for example at the time of hospital admission and mirror this behaviour by providing comprehensive information at the time of discharge. However, research suggests that as modern communication technologies increase, collaboration decreases (Behrens and Kret 2019). This is supported by the participants in the qualitative interview study who believe that 'knowing someone else's face' increases synchronous communication and motivation to collaborate.

The participants in the study by Sampson et al. (2016) suggested similar efforts to strengthen relations between care providers and the sense of group or team belonging as the participants in the qualitative interview study of this dissertation did, such as work shadowing or joint educational meetings. It was not possible to show the impact of these relations in the social network study (only small effects and little predictive power). However, in the quantitative survey, most of the statements regarding results observed by implementing the VESPEERA care programme (that were derived from the interviews and thus the observations by the participants) concern rather soft factors such as cooperation with other care providers than harder patient and healthcare system-related outcomes and thus point to the relevance of relations between providers regarding patient care. Further research should focus on measuring provider connectedness and its impact on CoC and quality of care. As all of the theoretical approaches described above suggest the relevance of shared goals for successful cooperation and collaboration, concepts such as accountable care organisations or physician care networks that rely on

shared goals and shared financial compensation (Everson et al. 2018; Flemming et al. 2022; Stillfried et al. 2017) could be a starting point for further research.

4.3.3 GP as care coordinator and the role of primary care

The previous chapters have shown the importance of informational and management continuity as well as cooperation between care providers in highly specialised healthcare systems who take care of complex patients with many health problems. If CoC, in particular provider continuity, is one of the main pillars of primary care, this raises the question of what remains of the role of primary care. Przysucha et al. (2018) found that when management continuity is pushed, providers are needed to work in networks where everyone knows the roles and responsibilities of others, but also need one 'single point of coordination' (Przysucha et al. 2018, p. 135), which is typically the GP.

If a second look at provider continuity is taken, it becomes clear that provider continuity has two dimensions: The aspect of a longitudinal relationship with one provider over time, which is what is measured with CoC indices such as the Usual Provider Index. Furthermore, provider continuity includes interpersonal continuity, which refers to trust that is built between a provider and a patient over time (Ridd et al. 2009). Both aspects make the primary care provider a stakeholder that can keep their relevance even in a highly specialised and collaborative healthcare system as coordinator of care and thus fulfilling another one of the four pillars of primary care.

Several studies have shown the importance of patients having someone coordinating their care. For example, in a study by Jowsey et al. (2016), the authors show that when care is not coordinated appropriately and CoC is not given, patients and/ or their relatives who have the capacity become active and find strategies to take over the role of coordinator of their care. This includes keeping medical records and keeping track of all information, writing their own care plans, managing their own medication lists or managing communication between all care providers involved. However, not all patients have the resources to fulfil the gap that the healthcare system has left. Bossert et al. (2020) conducted an interview study with oncological patients in Germany who reported that the patients themselves support taking over an active role, however, if the responsibility is too much for available competencies, this active role can become a burden and impact on patients' quality of life. The authors thus confirm results from a qualitative interview study with patients with multi-morbidity in Denmark. Patients with several chronic conditions report that they are under the impression that because of specialisation, care providers usually take care of only one health problem or condition and patients are not seen holistically which also leads to the fact that some health problems go untreated. Patients feel left alone in coordinating their care. This leads to medical errors and also patients feeling exhausted. With regular GP follow-ups, patients felt that their care was 'under control' (Schiøtz et al. 2016, p. 99).

This type of 'patient-as-professional' (Phillips et al. 2015, p. 2616) involvement can be aimed at but needs a clear definition of the role of both patients and care providers to be supportive of patients rather than a burden. Furthermore, in a qualitative network study based on interviews in Canada, care and support networks after hospital discharge from the viewpoint of patients were pictured. The overall result was that having a GP with a strong and central position who coordinates care is experienced as optimal by patients. In some cases, a specialist may take over the role of the provider who is seen the most and who is seen as central in the care of a patient (depending on the condition, this might be limited to a certain period of care). However, if specialists take over this role as the primary contact person, care is not perceived as well coordinated as would be the case with a GP (Perrault-Sequeira et al. 2021). Complementary to the results by Jowsey et al. (2016), patients in the study by Perrault-Sequeira et al. (2021) reported that one may navigate their care themselves, but would need a strong support network and the capability of self-advocacy to do so. The authors recommend that considering patients' individual care networks (or their type of network) might facilitate patient-centred approaches to optimal hospital discharge management. The studies described show that patients need someone who coordinates their care and that they see their GP as eligible to take on this role. Additionally, Griffiths et al. (2021) found that in the specific case of care after discharge in patients with chronic conditions (COPD, heart failure), patients and their relatives valued follow-up with their primary care provider, however not to avoid readmissions but much rather build on their relationship and thus increase relational continuity and enable coordination of care.

In addition to the statements of patients, physicians also see the primary care provider as a suitable person to take over the coordination of care. In a qualitative study conducted in Norway, GPs report that they see themselves as the ones to coordinate patients' care. However, they feel limited in carrying out this role. A major barrier is lacking exchange with other care providers, which leaves them with incomplete information about the patient and thus limits them in actually coordinating care. Furthermore, they mentioned that other care providers should also recognise their role (Vassbotn et al. 2018). Knowledge about the roles and responsibilities of others has also been identified as a determinant of collaboration in the qualitative study presented here. Additionally, Esteve-Matali et al. (2021) conducted an online survey with GPs and secondary care physicians in Spain who suggested strategies to improve care coordination and thus management continuity. They are similar to the strategies mentioned in the interview study presented here such as direct messaging services but complemented by strategies such as cross-sectoral case conferences or shared protocols.

The call for GPs as care coordinators is loud. However, the question remains as to whether this can be sustained when GP supply is declining. One answer to this question could be team-based primary care.

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For example, even though the number is declining, solo practices are still the common form of organisation in many countries, even though research shows that group practices contribute to better healthcare and improved care coordination (OECD 2016). Furthermore, other health professionals than physicians such as nurses can provide elements of primary care and particularly take on a wide range of coordinating activities (Karam et al. 2021). Advanced practice nurses can take over roles as coordinators of care for patients with specific diseases and, for example, can become COPD care coordinators (Burgess et al. 2013). In the VESPEERA project, not nurses but VERAHs were included to provide case management to patients who are faced with care transitions. A qualitative study based on the interviews from the process evaluation accompanying the VESPEERA project and another case management project situated in the same context showed how engaging VERAHs in such activities strengthens their role and their relationship with patients and colleagues and thus contributes to relieving the workload of physicians and providing optimal care (Forstner et al. 2022b).

Thus, the central role of primary care in coordinating care and thus contributing to high CoC should be maintained. However, up-to-date and innovative approaches, such as shared practices, team-based care and interprofessional care are needed to sustainably take on this role.

4.4 Strengths and limitations[15]

There are strengths and limitations to this dissertation, the underlying methodological approach and data sources used.

First, the overall approach is a key strength. Relying on different study designs, data sources and analytic approaches allowed for a broad but also detailed exploration of the overall topic. The qualitative interviews provided an in-depth understanding of the current state of information flow between hospitals and general practices, of the challenges associated as well as the different perspectives of the stakeholders involved. The analysis revealed the relevance of emotional and social aspects, which are

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[15] Parts of this chapter have already been published in the following publications:

Forstner, J., Bossert, J., Weis, A., Litke, N., Strassner, C., Szecsenyi, J. and Wensing, M. (2021). The role of personalised professional relations across care sectors in achieving high continuity of care. BMC Fam Pract 22, 72, doi: 10.1186/s12875-021-01418-8.

Forstner, J., Koetsenruijjter, J., Arnold, C., Laux, G. and Wensing, M. (2023b). The Influence of Provider Connectedness on Continuity of Care and Hospital Readmissions in Patients With COPD: A Claims Data Based Social Network Study. Chronic Obstr Pulm Dis 10, 77-88, doi: 10.15326/jcopdf.2022.0359.

Forstner, J., Pilz, M., Straßner, C., Weis, A., Litke, N., Uhlmann, L., Peters-Klimm, F., Aluttis, F., Baldauf, A., Kiel, M., Qreini, M., Kaufmann-Kolle, P., Schubert-Haack, J., El-Kurd, N., Tomaschko-Ubeländer, K., Treffert, S., Rück, R., Handlos, B., Karakas, G., Wensing, M. and Szecsenyi, J. (2023c). Hospital Admission and Discharge: Lessons Learned from a Large Programme in Southwest Germany. International Journal of Integrated Care 23, 4, doi: 10.5334/ijic.6534.

a lot less tangible when relying on quantitative (primary or secondary) data. Furthermore, the qualitative interview study relied on a large sample size that included participants from different professional groups as well as different organisations (regarding their type, size, localisation etc.).

Second, the results from the qualitative analysis were used to inform the design of the SNA. With the social network approach it was possible to measure the impact of social relations, which have been explored in detail before, but not quantified and also not analysed in terms of a relevant outcome. By relying on claims data to depict relations between physicians, it was possible to not only include large numbers of GPs and patients in the analyses but also to consider the vast majority of statutory health insurance-approved ambulatory physicians and therefore build a full social network. In the regression models, more than half of the statutory health insurance-approved GPs were included (Kassenärztliche Vereinigung Baden-Württemberg 2017). Furthermore, relying on two different patient populations allowed for measuring CoC and network characteristics independently. Finally, in comparison with the literature, this appears to be the first study that explored the impact of shared-patient networks of ambulatory physicians on CoC and among very few other studies that chose hospital readmissions as an outcome. This study, therefore, makes an important contribution to research on SNA in healthcare.

Another positive aspect to be highlighted is the fact that, amongst the observational studies on factors influencing information flow and communication, this dissertation also includes a quasi-experimental study aiming to improve collaboration between hospitals and general practices. The care programme implemented represents a comprehensive selection of intervention components covering the whole care aspect from admission up to follow-up care after discharge. Also, it is not only addressed at hospitals but also includes primary care. The analysis was based on a dataset including primary and secondary claims data, the latter provide valid and comprehensive data on hospital admissions and do not induce attention bias (or Hawthorne effect) as other types of data-collection might. Also, relying on claims data allowed for the analysis of readmissions within 90 days without a recall bias, a time frame not typically used in evaluations of interventions to reduce readmissions (Facchinetti et al. 2020), as well as to cover a wide range of outcomes. Lastly, the study was accompanied by an in-depth process evaluation exploring the working mechanisms of the intervention components, acceptance of the intervention and intervention fidelity. The questionnaire survey was based on the previously conducted interviews, which allowed for the inclusion of a range of perspectives in the questionnaire survey. Furthermore, as the interviews were based on the Consolidated Framework for Implementation Research (Damschroder et al. 2009), the questionnaire study combined factors to implementation based on previous research as well as those unique to this study.

However, there are also limitations to be mentioned. Regarding the qualitative interview study, there might be a selection bias as the sample of participants was mostly recruited from organisations that participated in the VESPEERA project. Associated with this is a possibly higher readiness for change regarding admission and discharge management, an increased interest in the topic in general as well as a higher interest in research and contributing by sharing their experiences. Including more participants who had not at all implemented the VESPEERA programme might have revealed further aspects that were not covered in this study. Furthermore, the interview guide was not primarily designed with regard to the research question of this study, but the data emerging from the interviews appeared to facilitate the study. Some topics regarding communication and information flow between care providers possibly were not covered deeply enough or at all.

Regarding the social network study, all effect sizes should be interpreted with caution as even though the study was based on assumptions and hypotheses that guided the analysis, it is of explorative character. Additionally, much of the selection of confounders is based on a comprehensive systematic review by Njoku et al. (2020), however, not all of the risk factors for readmission in patients with COPD identified could be considered in the analysis here. For example, persons with inadequate health insurance could not be considered, as the data set is based on claims data by a statutory health insurance company and thus does not offer information on people without health insurance. Also, by using claims data, no information about information flow and the quality of communication is known.

Generally, the utilisation of claims data for research is associated with limitations, as they are secondary data which were not collected for scientific purposes and therefore are only an approximation of the reality of care. For example, there are limitations regarding the validity of diagnoses as well as the severity of diseases such as COPD (Nimptsch et al. 2020). In the social network study, more than a third of diagnoses were coded without specification of the severity of the disease. This is even more than in a study by Petro et al. (2015), who found inadequate coding of severity in 25 % of cases. Furthermore, there are limitations regarding the documentation of hospital stays that are interrupted for example by (re-) transfers between hospitals. In the social network study, this might have resulted in the fact that the identified index stay was in fact not the index stay but a stay in a series of hospital stays. Also, this might lead to an underestimation of the length of stay (Nimptsch et al. 2020). This, however, does not apply to the evaluation of the VESPEERA programme, as each of the admissions was considered. Lastly, people insured with the AOK Baden-Wuerttemberg traditionally have a worse state of health and higher rates of smokers than other health insurers (Hoffmann and Koller 2017). This might lead to an overestimation of COPD prevalence and severity as well as an overestimation of admission rates. However, the federal state of Baden-Wuerttemberg has the lowest prevalence of COPD in Germany.

Thus, the absolute number of readmissions in the social network study might be higher in other federal states and the effect therefore might be stronger.

Additional to the utilisation of claims data, there are other limitations to the evaluation of the VESPEERA programme. First, as a result of the overall small sample size, the analysis could not be performed as originally planned (four study arms, differentiating between planned vs. unplanned admissions and participating vs. non-participating hospitals) (Forstner et al. 2019). Therefore, an evaluation of the effects of the intervention components was not possible and the share of the contribution of the pre-admission intervention could not be assessed. However, this is a difficulty not uncommon in the evaluation of multicomponent interventions (Straßner et al. 2020). For future studies, planning with fewer study arms from the beginning is recommended. Potential shares of the individual intervention components in the overall effect could then be determined based on subgroup analyses. Second, only patients who participated in the HZV were included. This ongoing GP-based care programme was introduced in 2008 and participation for GPs and patients is voluntary. Amongst others, the programme is characterised by continuing education and a gatekeeping function to secondary care. A previous study (Wensing et al. 2018) found that readmission rates among patients participating in the programme were approx. 5 % to 11 % lower than in the control group, the effect increased with a longer duration of participation. Therefore, a potential overlay of the effects of the HZV and the intervention can be expected. Further comparison to non-GP-based care is recommended. Third, the reported pre-selection of patients by general practices presumably led to a selection bias that could not be controlled for by the propensity score matching (such as being willing to participate or having sufficient knowledge of the German language to understand the content of the intervention and its implications). Nevertheless, the most common diagnoses indicate that the study population consists largely of patients who are at high risk for (re-) admissions and are often the subject of intervention programmes (Facchinetti et al. 2020; Freund et al. 2016; van Spall et al. 2017; Yang et al. 2017).

Finally, there are some limitations to the questionnaire survey. First, interventional fidelity was recorded regarding the one-time use of the individual intervention components and not for each patient participating in the VESPEERA programme. Intervention fidelity is a construct that encompasses several dimensions (Carroll et al. 2007; Mihalic 2002); the approach used here is a simplified version to assess fidelity to provide a background for the assessment of the answers in the rest of the questionnaire and should be interpreted with caution (McGee et al. 2018). Furthermore, the sample size was rather low with few participants from hospitals. As hospitals did not apply the VESPEERA programme to any patients, motivation and the belief that one could still contribute to the survey were possibly low.

4.5 Implications for healthcare, politics and research[16]

This dissertation on CoC between primary care providers and other care providers builds on four studies, incorporating a broad spectrum of methodologies, data sources and perspectives on continuity and communication between providers as well as their determinants, an intervention to improve CoC and determinants to the implementation to the intervention, which allows drawing conclusions for healthcare, politics and further research.

First, the qualitative interview study showed that information between care providers is usually transferred via written means or synchronous communication over the telephone. Care providers wish for better information flows and better collaboration between the parties involved. Digitalisation can facilitate information flow between care providers, but knowing each other and having good personal relations are at least as important for good information flow and effective collaboration. Regional initiatives such as joint quality circles and regular tables, as already established among ambulatory physicians, could help to stabilise communication. Cooperation between all organisations who are involved in patient care is needed in the form of an alignment of processes and responsibilities to achieve CoC in its several dimensions.

Then, this assumed impact of personal relations on CoC and readmissions was tested in the social network analysis. The results provide some evidence that provider connectedness has an impact on healthcare. Interaction within a dense network can help develop shared ideas and fewer connections to others help build strong connections. Nevertheless, other factors appear to be more important in influencing CoC and hospital readmission in patients with COPD. This is in accordance with current evidence, which is inconclusive regarding the direction of the impact of network characteristics on patient care as measured by CoC and readmissions, as there are few studies to date and the settings, study populations and definitions of outcomes are heterogeneous (Geva et al. 2019; Mascia et al. 2015; Mundt et al. 2015; She et al. 2020; Uddin et al. 2013; Wyngaerden et al. 2019). Thus, no clear recommendations for investment in provider networks can be derived. This study adds to the literature and

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shows the suitability of SNA to depict personal relations, but further research is needed to provide less heterogeneous evidence.

Third, the VESPEERA programme was developed, implemented and evaluated to improve communication between general practices and hospitals, improve communication and cross-sectoral care and reduce readmissions. The results of the evaluation of the VESPEERA admission, discharge and follow-up programme emphasise the relevance of treating admission and discharge management as a cross-sectoral task. Patients can benefit from the intervention. It is of high importance to not only leave this responsibility to the inpatient sector but to also involve primary care teams in both pre and post-hospital care.

Lastly, the accompanying process evaluation gave insights into factors determining the implementation of the programme. The VESPEERA programme hardly reached clinical decision-makers in hospitals. The parallelism of the implementation of a project and the mandatory implementation of legal regulations aiming at similar outcomes has inhibited the implementation of VESPEERA in hospitals. The focus on patients of one large health insurer (covering 45 % of the population in that region), who were referred by GPs, may have been too narrow to be of interest to hospitals. In Germany, many patients enter the hospital by the admission of specialist physicians or as emergency cases, not as planned hospital admissions by general practitioners. The simultaneity of implementing a new care programme and conducting a study makes acceptance more difficult, as time-consuming additional data collection and other efforts are necessary for the evaluation. Complex interventions with the possibility of including patients in the study at different points in time face particular challenges due to the high workload of physicians in the reality of care. For future studies, the burden of data collection on study participants should be considered and kept low when designing studies. Furthermore, when co-designing care programmes with all relevant stakeholders, care should be taken that, even though efforts are made to consider the requirements and needs of all, the intervention does not become too comprehensive. Another possibility would be to make parts of the programme mandatory and others optional. Additionally, it should be considered to plan with fewer study arms from the beginning and keep the number of intervention components lower. Potential shares of the individual intervention components in the overall effect could then be determined based on subgroup analyses. Further comparison to non-GP-based care is recommended.

Nevertheless, recommendations for practice and policy can be derived. Admission and discharge management should not be reduced to the times of admission and discharge. The provision of more information by GPs at admission, for example through a mandatory and structured admission letter, should be promoted. In addition, GPs should be more involved in follow-up care. Admission and discharge management should become a shared cross-sectoral task and early planning of hospital discharge should start at the time of admission. Risk assessments at discharge provided by either the discharging hospital or the GP providing follow-up care, for example employing the HOSPITAL score, can help identify patients at risk of unplanned readmission. These patients can then be closely monitored and taken care of, for example through telephone follow-up.

5 Summary

This dissertation aimed to provide insight into continuity of care between care providers at the interface between primary and other care providers. More specifically, it explored the impact of continuity of care as a characteristic of strong primary care and its impact on hospital readmissions. For this purpose, three overarching themes were considered in more detail: The current state of communication and information flow between primary care and hospitals, the current state of provider connectedness between primary care physicians and other ambulatory physicians and the development, implementation and evaluation of a care programme (the VESPEERA programme) to improve communication and cooperation between general practices and hospitals. Four studies were conducted to explore the underlying research questions. This includes a qualitative interview study with staff from hospitals and general practices, a claims-based social network study in patients with chronic obstructive pulmonary disease, a quasi-experimental trial evaluating the effectiveness of the VESPEERA programme as well as a quantitative questionnaire survey.

Overall, 49 persons from different groups participated in the qualitative interview study. The result of the qualitative analysis was 16 subthemes across five main themes, which were current cooperation, optimal cooperation, determinants of cooperation and personal emotional and social determinants. The participants described that communication is mostly written and synchronous communication via telephone is rather rare and takes place predominantly to obtain missing information. For the future, the participants wished for better communication and especially cooperation. This includes standardised and electronic information transfer between care providers. Personal emotional and social determinants, such as reciprocal appreciation and understanding of roles and responsibilities were described to impact information flow and communication. Furthermore, especially personal professional relationships, i.e. knowing each other, were mentioned to positively influence information flow.

For the social network analysis, a network between 7,876 general practitioners, pneumologists and cardiologists with 121,750 connections was considered. In the final analysis, 7,294 patients who were nested in 3,673 general practitioners were included. Regarding the impact of network characteristics on continuity of care, closeness centrality and the EI-index showed a significant effect on the SECON in the year after discharge. Beyond that, degree centrality and the EI-index impacted readmission rates within 30 days after discharge from hospital. Additionally, density affected readmission rates within 90 days after discharge. No significant effect of network characteristics on readmission rates between 91 days and one year after discharge was found.

In the VESPEERA trial, 371 patients fulfilled the eligibility criteria. Including the control group, which was matched from claims data, 742 patients were considered in the analysis. Regarding the primary

outcome, readmissions within 90 days after hospital discharge due to the same indication, the rate after the intervention period was almost the same in both groups. In the control group, the readmission rate increased, in the intervention group, a decrease was observed. Altogether, a difference of 6 % regarding readmission rates between the intervention and control groups was thus observed. The primary analysis did not show a significant effect, although the intervention patients showed a slightly better outcome. Therefore, no significance tests were performed for any secondary outcomes.

The questionnaire survey, in which a total of 68 care providers participated, showed that the participants were rather indecisive when asked to rate the benefit over the expenses to use the intervention components with a tendency to a positive balance. The responses of the participants showed several factors affected the implementation of the VESPEERA programme. This includes insufficient resources such as financial compensation and the availability of staff and workplaces. Furthermore, legal regulations relevant at the time hindered implementation and participants saw the implementation as unwieldy, too comprehensive and too complex. However, as a result of working with the VESPEERA programme, almost half of the participants agreed that their awareness of the importance of cross-sectoral cooperation increased.

Even in times of increasing use of modern information technology, social and emotional factors such as personally knowing each other were perceived to be crucially important for information flow and effective collaboration, allowing to improve informational and management continuity of care. A quantitative confirmation of this statement could not be achieved in the social network analysis as the effects of provider connectedness were small, did not improve the overall predictive power of explanatory and were not congruent across outcomes. Furthermore, due to several contextual factors, no statistically significant effect of the VESPEERA programme on patients' hospital readmission rates was found. However, the results of the primary analysis as well as the analyses of secondary outcomes and the subgroups showed trends that patients might have benefitted from the intervention. For most outcomes, the odds ratios are in favour of the intervention group.

The results of this dissertation raise the question of whether continuity of care is and will still be relevant in highly specialised and fragmented healthcare systems that take care of patients with complex health needs. Furthermore, it is unclear whether current measures of continuity of care do justice to the complexity of the matter. The overall results of this dissertation do, however, emphasise the relevance of having a single point of coordination. This is typically the general practitioner, in the future ideally in the form of a primary care team, who thus fulfils the pillars of primary care which include continuity and coordination of care.

6 Deutsche Zusammenfassung

Ziel dieser Dissertation war es, einen Einblick in die Versorgungskontinuität an der Schnittstelle zwischen Primärversorgung und anderen Leistungserbringenden zu geben. Genauer gesagt wurden die Auswirkungen der Versorgungskontinuität als Merkmal einer starken Primärversorgung und ihre Auswirkungen auf Rehospitalisierungen untersucht. Zu diesem Zweck wurden drei übergreifende Themen näher betrachtet: Der aktuelle Stand der Kommunikation und des Informationsflusses zwischen Primärversorgung und Krankenhäusern, der aktuelle Stand der Vernetzung zwischen Hausärzt*innen und anderen ambulanten Ärzt*innen sowie die Entwicklung, Umsetzung und Evaluation eines Versorgungsprogramms (VESPEERA) zur Verbesserung der Kommunikation und Kooperation zwischen Hausarztpraxen und Krankenhäusern. Zur Untersuchung der zugrunde liegenden Forschungsfragen wurden vier Studien durchgeführt. Dazu gehören eine qualitative Interviewstudie mit Mitarbeitenden aus Krankenhäusern und Hausarztpraxen, eine soziale Netzwerkstudie auf Basis von Routinedaten mit Patient*innen mit chronisch obstruktiver Lungenerkrankung, eine quasi-experimentelle Studie zur Bewertung der Wirksamkeit von VESPEERA sowie eine quantitative Fragebogenerhebung.

Insgesamt nahmen 49 Personen an der qualitativen Interviewstudie teil. Das Ergebnis der Analyse waren 16 Unterthemen, die sich auf fünf Hauptthemen erstreckten: aktuelle und optimale Zusammenarbeit sowie deren Determinanten inklusive persönlicher emotionaler und sozialer Determinanten sowie Strategien, um eben diese zu adressieren. Die Teilnehmenden beschrieben, dass die Kommunikation überwiegend schriftlich erfolgt, synchrone Kommunikation per Telefon ist eher selten und findet überwiegend statt, um fehlende Informationen zu erhalten. Für die Zukunft wünschten sich die Teilnehmenden eine bessere Kommunikation und vor allem Kooperation. Dazu gehört ein standardisierter und elektronischer Informationstransfer zwischen den Leistungserbringenden. Als Einflussfaktoren auf den Informationsfluss und die Kommunikation wurden emotionale und soziale Faktoren beschrieben, wie z.B. die gegenseitige Wertschätzung und das Verständnis von Rollen und Zuständigkeiten. Darüber hinaus wurden insbesondere persönliche berufliche Beziehungen, d. h. das gegenseitige Kennen, als positiv für den Informationsfluss genannt.

Für die soziale Netzwerkanalyse wurde ein Netzwerk zwischen 7 876 Hausärzt*innen, Pneumolog*innen und Kardiolog*innen mit 121 750 Verbindungen betrachtet. In die endgültige Analyse wurden 7 294 Patient*innen einbezogen, die in 3 673 Hausärzt*innen geschachtelt waren. Hinsichtlich der Auswirkung von Netzwerkmerkmalen auf die Versorgungskontinuität zeigten die Closeness Centrality und der EI-Index einen signifikanten Effekt auf den SECON im Jahr nach der Entlassung. Darüber hinaus wirkten sich die Degree Centrality und der EI-Index auf die Rehospitalisierungsrate innerhalb von 30 Tagen nach Entlassung aus. Außerdem wirkte sich die Dichte auf die Rehospitalisierungsrate innerhalb von 90 Tagen nach Entlassung aus. Es wurde kein signifikanter Einfluss der Netzwerkcharakteristika auf

die Rehospitalisierungsraten zwischen 91 Tagen und einem Jahr nach Entlassung festgestellt.

An der VESPEERA-Studie nahmen 371 Patient*innen teil. Einschließlich der Kontrollgruppe, die aus Routinedaten gematcht wurde, wurden 742 Patient*innen in die Analyse einbezogen. Hinsichtlich des primären Outcomes, der Rehospitalisierungsrate innerhalb von 90 Tagen nach Entlassung aufgrund derselben Indikation, war diese nach Abschluss der Intervention in beiden Gruppen nahezu gleich. In der Kontrollgruppe stieg diese an, in der Interventionsgruppe wurde ein Rückgang beobachtet. Insgesamt wurde somit ein Unterschied von 6 % zwischen den Gruppen festgestellt. Die primäre Analyse ergab keinen signifikanten Effekt, obwohl die Patient*innen der Interventionsgruppe ein leicht besseres Ergebnis zeigten. Daher wurden keine Signifikanztests für sekundäre Ergebnisse durchgeführt.

Die Fragebogenerhebung, an der insgesamt 68 Leistungserbringende teilnahmen, zeigte, dass diese eher unentschlossen waren, wenn es darum ging, den Nutzen der Interventionskomponenten gegenüber den Kosten abzuwägen, jedoch mit einer Tendenz zur positiven Bilanz. Die Antworten zeigten, dass mehrere Faktoren die Umsetzung des VESPEERA-Programms beeinträchtigten. Dazu gehören unzureichende Ressourcen wie eine finanzielle Entschädigung oder die Verfügbarkeit von Personal und Arbeitsplätzen. Darüber hinaus erschwerten damals in Kraft getretene gesetzliche Bestimmungen die Umsetzung und die Teilnehmenden empfanden die Umsetzung als zu umfassend und zu komplex. Jedoch stimmte fast die Hälfte der Teilnehmenden zu, dass ihr Bewusstsein für die Bedeutung der sektorenübergreifenden Zusammenarbeit durch die Mitarbeit an VESPEERA gestiegen ist.

Selbst in Zeiten der zunehmenden Digitalisierung wurden soziale und emotionale Faktoren wie das persönliche Kennen des anderen als entscheidend für den Informationsfluss und eine effektive Zusammenarbeit angesehen, die eine Verbesserung der Informations- und Managementkontinuität ermöglicht. Eine quantitative Bestätigung dieser Aussage konnte in der sozialen Netzwerkanalyse nicht erreicht werden, da die Effekte der Netzwerkcharakteristika gering waren, sie die allgemeine Vorhersagekraft nicht verbesserten und über die Ergebnisse hinweg nicht kongruent waren. Darüber hinaus wurde aufgrund verschiedener kontextueller Faktoren kein statistisch signifikanter Effekt des VESPEERA-Programms festgestellt. Die Ergebnisse der Analysen zeigten jedoch Tendenzen, dass Patient*innen von der Intervention profitiert haben könnten. Für die meisten Outcomes fielen die Odds Ratios zugunsten der Interventionsgruppe aus.

Die Ergebnisse dieser Dissertation werfen die Frage auf, ob die Versorgungskontinuität in hochspezialisierten und fragmentierten Gesundheitssystemen, die Patient*innen mit komplexen Gesundheitsbedürfnissen versorgen, relevant ist und bleiben wird. Darüber hinaus ist unklar, ob derzeitige Messgrößen der Komplexität der Materie gerecht werden. Die Gesamtergebnisse dieser Dissertation unterstreichen jedoch die Bedeutung einer einzigen Koordinationsstelle. Diese übernehmen typischerweise Haus*ärztinnen, in Zukunft idealerweise in Form eines Primärversorgungsteams, die damit die Säulen der Primärversorgung erfüllen, zu denen Kontinuität und Koordination der Versorgung gehören.

7 Literature

Adams, G., Gulliford, M. C., Ukoumunne, O. C., Eldridge, S., Chinn, S. and Campbell, M. J. (2004). **Patterns of intra-cluster correlation from primary care research to inform study design and analysis.** J Clin Epidemiol *57*, 785-794, doi: 10.1016/j.jclinepi.2003.12.013.

Agarwal, G. and Crooks, V. A. (2008). **The nature of informational continuity of care in general practice.** Br J Gen Pract *58*, e17-24, doi: 10.3399/bjgp08X342624.

Agency for Healthcare Research and Quality (2018). **Chartbook on Care Coordination. Transitions of Care.** URL: https://www.ahrq.gov/research/findings/nhqrdr/chartbooks/carecoordination /measure1.html [Accessed 12-02-2023].

Akmatov, M. K., Steffen, A., Holstiege, J. and Bätzing, J. (2019). **Die chronisch obstruktive Lungenerkrankung (COPD) in der ambulanten Versorgung in Deutschland – Zeitliche Trends und kleinräumige Unterschiede.** Zentralinstitut für die kassenärztliche Versorgung in Deutschland (Zi). Versorgungsatlas-Bericht *19*, doi: 10.20364/VA-19.06.

Albert, H. (2020). **What will it take for Germany to embrace digital health?** BMJ *370*, m2828, doi: 10.1136/bmj.m2828.

Alqahtani, J. S., Njoku, C. M., Bereznicki, B., Wimmer, B. C., Peterson, G. M., Kinsman, L., Aldabayan, Y. S., Alrajeh, A. M., Aldhahir, A. M., Mandal, S. and Hurst, J. R. (2020). **Risk factors for all-cause hospital readmission following exacerbation of COPD: a systematic review and meta-analysis.** Eur Respir Rev *29*, 190166, doi: 10.1183/16000617.0166-2019.

American Academy of Family Physicians (2022). **Primary Care.** URL: https://www.aafp.org/about /policies/all/primary-care.html [Accessed 23-12-2022].

Andrews, T. (2012). **What is social constructionism?** The Grounded Theory Review *11*, 39-46.

AOK Baden-Württemberg (2017). **Das geht. Unternehmensbericht AOK Baden-Württemberg Ausgabe 2017.** URL: https://aok-bw-presse.de/fileadmin/mediathek/dokumente /unternehmensbericht_aok_bw_2017.pdf [Accessed 23-12-2022].

AQUA – Institut für angewandte Qualitätsförderung und Forschung im Gesundheitswesen GmbH (2015). **Entlassungsmanagement – Konzeptskizze für ein Qualitätssicherungsverfahren**, Göttingen. URL: https://sqg.de/sqg/upload/CONTENT/Neue-Verfahren/Entlassungsmanagement /Bericht_Konzeptskizze_Entlassungsmanagement.pdf [Accessed 25-02-2022].

Arnold, C., Hennrich, P., Koetsenruijter, J., van Lieshout, J., Peters-Klimm, F. and Wensing, M. (2020). **Cooperation networks of ambulatory health care providers: exploration of mechanisms that influence coordination and uptake of recommended cardiovascular care (ExKoCare): a mixed-methods study protocol.** BMC Fam Pract *21*, 168, doi: 10.1186/s12875-020-01229-3.

Bae, S.-H., Nikolaev, A., Seo, J. Y. and Castner, J. (2015). **Health care provider social network analysis: A systematic review.** Nursing Outlook *63*, 566-584, doi: 10.1016/j.outlook.2015.05.006.

Bahr, S. J., Solverson, S., Schlidt, A., Hack, D., Smith, J. L. and Ryan, P. (2014). **Integrated literature review of postdischarge telephone calls.** West J Nurs Res *36*, 84-104, doi: 10.1177/0193945913491016.

Balaban, R. B., Weissman, J. S., Samuel, P. A. and Woolhandler, S. (2008). **Redefining and redesigning hospital discharge to enhance patient care: a randomized controlled study.** J GEN INTERN MED *23*, 1228-1233, doi: 10.1007/s11606-008-0618-9.

Barker, I., Steventon, A. and Deeny, S. R. (2017). **Association between continuity of care in general practice and hospital admissions for ambulatory care sensitive conditions: cross sectional study of routinely collected, person level data.** BMJ *356*, j84, doi: 10.1136/bmj.j84.

Barnett, M. L., Landon, B. E., O'Malley, A. J., Keating, N. L. and Christakis, N. A. (2011). **Mapping Physician Networks with Self-Reported and Administrative Data.** Health Serv Res*46*, 1592-1609, doi: 10.1111/j.1475-6773.2011.01262.x.

Bates, D., Mächler, M., Bolker, B. and Walker, S. (2015). **Fitting Linear Mixed-Effects Models Using lme4.** J. Stat. Soft. *67*, 1-48, doi: 10.18637/jss.v067.i01.

Behrens, F. and Kret, M. E. (2019). **The Interplay Between Face-to-Face Contact and Feedback on Cooperation During Real-Life Interactions.** J Nonverbal Behav *43*, 513-528, doi: 10.1007/s10919-019-00314-1.

Bell, C. M., Schnipper, J. L., Auerbach, A. D., Kaboli, P. J., Wetterneck, T. B., Gonzales, D. V., Arora, V. M., Zhang, J. X. and Meltzer, D. O. (2009). **Association of communication between hospital-based physicians and primary care providers with patient outcomes.** J GEN INTERN MED *24*, 381-386, doi: 10.1007/s11606-008-0882-8.

Berendsen, A. J., Benneker, W. H., Meyboom-de Jong, B., Klazinga, N. S. and Schuling, J. (2007). **Motives and preferences of general practitioners for new collaboration models with medical specialists: a qualitative study.** BMC Health Serv Res *7*, 4, doi: 10.1186/1472-6963-7-4.

Bice, T. W. and Boxerman, S. B. (1977). **A Quantitative Measure of Continuity of Care.** Med Care *15*, 347-349.

Billings, J., Zeitel, L., Lukomnik, J., Carey, T. S., Blank, A. E. and Newman, L. (1993). **Impact Of Socioeconomic Status On Hospital Use In New York City.** Health Affairs *12*, 162-173, doi: 10.1377/hlthaff.12.1.162.

Blozik, E., Bähler, C., Näpflin, M. and Scherer, M. (2020). **Continuity of Care in Swiss Cancer Patients Using Claims Data.** Patient Prefer Adherence *14*, 2253-2262, doi: 10.2147/PPA.S266381.

Bossert, J., Forstner, J., Villalobos, M., Siegle, A., Jung, C., Deis, N., Thomas, M., Wensing, M. and Krug, K. (2020). **What patients with lung cancer with comorbidity tell us about interprofessional collaborative care across healthcare sectors: qualitative interview study.** BMJ Open *10*, e036495, doi: 10.1136/bmjopen-2019-036495.

Bramesfeld, A., Ungewitter, C., Böttger, D., El, J. J., Losert, C. and Kilian, R. (2012). **What promotes and inhibits cooperation in mental health care across disciplines, services and service sectors? A qualitative study.** Epidemiol Psychiatr Sci *21*, 63-72, doi: 10.1017/s2045796011000539.

Breslau, N. and Haug, M. R. (1976). **Service Delivery Structure and Continuity of Care: A Case Study of a Pediatric Practice in Process of Reorganization.** J Health Soc Behav *17*, 339-352, doi: 10.2307/2136712.

Breton, M., Haggerty, J., Roberge, D. and Freeman, G. K. (2012). **Management continuity in local health networks.** Int J Integr Care *12*, e14, doi: 10.5334/ijic.682.

Bricard, D. and Or, Z. (2019). **Impact of early primary care follow-up after discharge on hospital readmissions.** Eur J Health Econ *20*, 611-623, doi: 10.1007/s10198-018-1022-y.

Brooke, B. S., Stone, D. H., Cronenwett, J. L., Nolan, B., DeMartino, R. R., MacKenzie, T. A., Goodman, D. C. and Goodney, P. P. (2014). **Early primary care provider follow-up and readmission after high-risk surgery.** JAMA Surg *149*, 821-828, doi: 10.1001/jamasurg.2014.157.

Buhr, R. G., Jackson, N. J., Kominski, G. F., Dubinett, S. M., Ong, M. K. and Mangione, C. M. (2019). **Comorbidity and thirty-day hospital readmission odds in chronic obstructive pulmonary disease: a comparison of the Charlson and Elixhauser comorbidity indices.** BMC Health Serv Res *19*, 701, doi: 10.1186/s12913-019-4549-4.

Bundesärztekammer (BÄK), Kassenärztliche Bundesvereinigung (KBV), Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften (AWMF) (2021). **Nationale VersorgungsLeitlinie COPD – Teilpublikation der Langfassung.** 2. Auflage. Version 1. URL: www.leitlinien.de/copd [Accessed 19-07-2022].

Bundesversicherungsamt (2014). **Festlegungen nach § 31 Absatz 4 RSAV für das Ausgleichsjahr 2013**, Bonn. URL: http://www.bundesversicherungsamt.de/fileadmin/redaktion /Risikostrukturausgleich/Festlegungen/AJ_2013/01_Festlegung_Klassifikation_AJ2013_1.pdf [Accessed 05-02-2023].

Burgess, T., Young, M., Crawford, G. B., Brooksbank, M. A. and Brown, M. (2013). **Best-practice care for people with advanced chronic obstructive pulmonary disease: the potential role of a chronic obstructive pulmonary disease care co-ordinator.** Aust Health Rev *37*, 474-481, doi: 10.1071/AH12044.

Burns, L. R., Nembhard, I. M. and Shortell, S. M. (2022). **Integrating network theory into the study of integrated healthcare.** Social Science & Medicine *296*, 114664, doi: 10.1016/j.socscimed.2021.114664.

Burt, R. S. (1992). **Structural Holes. The Social Structure of Competition**, Harvard University Press. URL: http://www.jstor.org/stable/j.ctv1kz4h78 [Accessed 05-02-2023].

Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J. and Balain, S. (2007). **A conceptual framework for implementation fidelity.** Implement Sci *2*, 40, doi: 10.1186/1748-5908-2-40.

Caumanns, J. (2019). **Zur Diskussion: Stand der Digitalisierung im deutschen Gesundheitswesen.** Z Evid Fortbild Qual Gesundhwes *143*, 22-29, doi: 10.1016/j.zefq.2019.04.002.

Chauhan, B. F., Jeyaraman, M. M., Mann, A. S., Lys, J., Skidmore, B., Sibley, K. M., Abou-Setta, A. M. and Zarychanski, R. (2017). **Behavior change interventions and policies influencing primary healthcare professionals' practice-an overview of reviews.** Implement Sci *12*, 3, doi: 10.1186/s13012-016-0538-8.

Chen, Y., Brennan, N. and Magrabi, F. (2010). **Is email an effective method for hospital discharge communication? A randomized controlled trial to examine delivery of computer-generated discharge summaries by email, fax, post and patient hand delivery.** Int J Med Inform *79*, 167-172, doi: 10.1016/j.ijmedinf.2009.12.006.

Cho, K. H., Kim, Y. S., Nam, C. M., Kim, T. H., Kim, S. J., Han, K.-T. and Park, E.-C. (2015). **The Association between Continuity of Care and All-Cause Mortality in Patients with Newly Diagnosed Obstructive Pulmonary Disease: A Population-Based Retrospective Cohort Study, 2005-2012.** PLoS ONE *10*, e0141465, doi: 10.1371/journal.pone.0141465.

Chongsuvivatwong, V. (2022). **Epidemiological Data Display Package.** URL: https://cran.r-project.org/web/packages/epiDisplay/epiDisplay.pdf [Accessed 05-02-2023].

Coopersmith, J. C. (2014). **STARS: Fax Machines [Scanning Our Past].** Proc. IEEE *102*, 1858-1865, doi: 10.1109/JPROC.2014.2360032.

Csardi, G. and Nepusz, T. (2006). **The igraph software package for complex network research.** Inter-Journal *Complex Systems*, 1695.

Cunningham, F. C., Ranmuthugala, G., Plumb, J., Georgiou, A., Westbrook, J. I. and Braithwaite, J. (2012). **Health professional networks as a vector for improving healthcare quality and safety: a systematic review.** BMJ Qual Saf *21*, 239, doi: 10.1136/bmjqs-2011-000187.

Cusack, M. and Taylor, C. (2010). **A literature review of the potential of telephone follow-up in colorectal cancer.** J Clin Nurs *19*, 2394-2405, doi: 10.1111/j.1365-2702.2010.03253.x.

Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A. and Lowery, J. C. (2009). **Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science.** Implement Sci *4*, 50, doi: 10.1186/1748-5908-4-50.

Danek, R., Blackburn, J., Greene, M., Mazurenko, O. and Menachemi, N. (2022). **Measuring rurality in health services research: a scoping review.** BMC Health Serv Res *22*, 1340, doi: 10.1186/s12913-022-08678-9.

Dijkstra, J. and van Assen, M. A.L.M. (2013). **Network public goods with asymmetric information about cooperation preferences and network degree.** Social Networks *35*, 573-582, doi: 10.1016/j.socnet.2013.08.005.

Dimick, J. B. and Ryan, A. M. (2014). **Methods for evaluating changes in health care policy: the difference-in-differences approach.** JAMA *312*, 2401-2402, doi: 10.1001/jama.2014.16153.

Donzé, J. D., Williams, M. V., Robinson, E. J., Zimlichman, E., Aujesky, D., Vasilevskis, E. E., Kripalani, S., Metlay, J. P., Wallington, T., Fletcher, G. S., Auerbach, A. D. and Schnipper, J. L. (2016). **International Validity of the HOSPITAL Score to Predict 30-Day Potentially Avoidable Hospital Readmissions.** JAMA Intern Med *176*, 496-502, doi: 10.1001/jamainternmed.2015.8462.

DuGoff, E. H., Fernandes-Taylor, S., Weissman, G. E., Huntley, J. H. and Pollack, C. E. (2018). **A scoping review of patient-sharing network studies using administrative data.** Transl Behav Med *8*, 598-625, doi: 10.1093/tbm/ibx015.

Eriksson, E. A. and Mattsson, L.-G. (1983). **Quantitative Measurement of Continuity of Care: Measures in Use and an Alternative Approach.** Med Care *21*, 858-875.

Esteve-Matalí, L., Vargas, I., Amigo, F., Plaja, P., Cots, F., Mayer, E. F., Pérez-Castejón, J.-M. and Vázquez, M.-L. (2021). **Understanding How to Improve the Use of Clinical Coordination Mechanisms between Primary and Secondary Care Doctors: Clues from Catalonia.** Int J Environ Res Public Health *18*, 3224, doi: 10.3390/ijerph18063224.

Everson, J., Adler-Milstein, J., Ryan, A. M. and Hollingsworth, J. M. (2018). **Hospitals Strengthened Relationships With Close Partners After Joining Accountable Care Organizations.** Med Care Res Rev *77*, 549-558, doi: 10.1177/1077558718818336.

Facchinetti, G., D'Angelo, D., Piredda, M., Petitti, T., Matarese, M., Oliveti, A. and Marinis, M. G. de (2020). **Continuity of care interventions for preventing hospital readmission of older people with chronic diseases: A meta-analysis.** Int J Nurs Stud *101*, 103396, doi: 10.1016/j.ijnurstu.2019.103396.

Flemming, R., Schüttig, W., Ng, F., Leve, V. and Sundmacher, L. (2022). **Using social network analysis methods to identify networks of physicians responsible for the care of specific patient populations.** BMC Health Serv Res *22*, 462, doi: 10.1186/s12913-022-07807-8.

Flodgren, G., Eccles, M. P., Shepperd, S., Scott, A., Parmelli, E. and Beyer, F. R. (2011). **An overview of reviews evaluating the effectiveness of financial incentives in changing healthcare professional behaviours and patient outcomes.** Cochrane Database Syst Rev *2011*, CD009255, doi: 10.1002/14651858.CD009255.

Forster, A. J., Clark, H. D., Menard, A., Dupuis, N., Chernish, R., Chandok, N., Khan, A. and van Walraven, C. (2004). **Adverse events among medical patients after discharge from hospital.** Canadian Medical Association Journal *170*, 345-349.

Forstner, J., Litke, N., Weis, A., Straßner, C., Szecsenyi, J. and Wensing, M. (2022a). **How to fall into a new routine: factors influencing the implementation of an admission and discharge programme in hospitals and general practices.** BMC Health Serv Res *22*, 1289, doi: 10.1186/s12913-022-08644-5.

Forstner, J., Mangold, J., Litke, N., Weis, A., Szecsenyi, J., Wensing, M. and Ullrich, C. (2022b). **Zwischen neuer Verantwortung und Routinetätigkeit: Die Rolle der VERAH in der hausärztlichen Versorgung – Eine qualitative Sekundärdatenanalyse am Beispiel des softwaregestützten Case Management.** Gesundheitswesen, under review.

Fox, J. and Weisberg, S. (2019). **An R Companion to Applied Regression.** Third edition, Sage, Thousand Oaks CA.

Foy, R., Hempel, S., Rubenstein, L., Suttorp, M., Seelig, M., Shanman, R. and Shekelle, P. G. (2010). **Meta-analysis: effect of interactive communication between collaborating primary care physicians and specialists.** Ann Intern Med *152*, 247-258, doi: 10.7326/0003-4819-152-4-201002160-00010.

Frandsen, B. R., Joynt, K. E., Rebitzer, J. B. and Jha, A. K. (2015). **Care fragmentation, quality, and costs among chronically ill patients.** Am J Manag Care *21*, 355-362.

Freeman, L. C. (1978). **Centrality in social networks conceptual clarification.** Social Networks *1*, 215-239.

Freeman, G. and Hjortdahl, P. (1997). **What future for continuity of care in general practice?** BMJ *314*, 1870-1873, doi: 10.1136/bmj.314.7098.1870.

Freund, T., Everett, C., Griffiths, P., Hudon, C., Naccarella, L. and Laurant, M. (2015). **Skill mix, roles and remuneration in the primary care workforce: Who are the healthcare professionals in the primary care teams across the world?** Int J Nurs Stud *52*, 727-743, doi: 10.1016/j.ijnurstu.2014.11.014.

Freund, T., Peters-Klimm, F., Boyd, C. M., Mahler, C., Gensichen, J., Erler, A., Beyer, M., Gondan, M., Rochon, J., Gerlach, F. M. and Szecsenyi, J. (2016). **Medical Assistant-Based Care Management for High-Risk Patients in Small Primary Care Practices: A Cluster Randomized Clinical Trial.** Ann Intern Med *164*, 323-330, doi: 10.7326/M14-2403.

Freytag, A., Biermann, J., Ochs, A., Lux, G., Lehmann, T., Ziegler, J., Schulz, S., Wensing, M., Wasem, J. and Gensichen, J. (2016). **The Impact of GP-Centered Healthcare.** Dtsch Arztebl Int *113*, 791-798, doi: 10.3238/arztebl.2016.0791.

Friedrichs, J. (1990). **Methoden empirischer Sozialforschung.** 14th Edition, VS Verlag für Sozialwissenschaften, Wiesbaden.

Gardner, K., Banfield, M., McRae, I., Gillespie, J. and Yen, L. (2014). **Improving coordination through information continuity: a framework for translational research.** BMC Health Serv Res *14*, 590, doi: 10.1186/s12913-014-0590-5.

Garrido, M. V., Zentner, A. and Busse, R. (20). **The effects of gatekeeping: A systematic review of the literature.** Scand J Prim Health Care *29*, 28-38, doi: 10.3109/02813432.2010.537015.

Gemeinsamer Bundesausschuss (2017). **Richtlinie des Gemeinsamen Bundesausschusses über die Verordnung von Krankenhausbehandlung (Krankenhauseinweisungs-Richtlinie/KE-RL).** URL: https://www.g-ba.de/downloads/62-492-1406/KE-RL_2017-03-16_iK-2017-06-08.pdf [Accessed 12-02-2023].

Gerlach, F. M. and Szecsenyi, J. (2013). **Hausarztzentrierte Versorgung in Baden-Württemberg - Konzept und Ergebnisse der kontrollierten Begleitevaluation.** Z Evid Fortbild Qual Gesundhwes *107*, 365-371, doi: 10.1016/j.zefq.2013.07.002.

Geva, A., Olson, K. L., Liu, C. and Mandl, K. D. (2019). **Provider Connectedness to Other Providers Reduces Risk of Readmission After Hospitalization for Heart Failure.** Med Care Res Rev *76*, 115-128, doi: 10.1177/1077558717718626.

Geyman, J. P. (1975). **Continuity of care in family practice. Part 4: implementing continuity in a family practice residency program.** J Fam Pract *2*, 445-447.

Gilhooly, D., Green, S. A., McCann, C., Black, N. and Moonesinghe, S. R. (2019). **Barriers and facilitators to the successful development, implementation and evaluation of care bundles in acute care in hospital: a scoping review.** Implement Sci *14*, 47, doi: 10.1186/s13012-019-0894-2.

Glegg, S. M. N., Jenkins, E. and Kothari, A. (2019). **How the study of networks informs knowledge translation and implementation: a scoping review.** Implement Sci *14*, 34, doi: 10.1186/s13012-019-0879-1.

Gohel, D., Hangler, F., Sander, L., Victorson, A., Calder, J., Harrold, J., Muschelli, J., Denney, B., Beck, N., Moog, S., Leleu, G. and Jia, H. (2023a). **officer: Manipulation of Microsoft Word and PowerPoint Documents.** URL: https://cran.r-project.org/package=officer [Accessed 05-02-2023].

Gohel, D., Jager, C., Skintzos, P., Fazilleau, Q., Nazarov, M., Robert, T., Barrowman, M., Yasumoto, A., Julian, P., Browning, S. and Thériault, R. (2023b). **flextable: Functions for Tabular Reporting.** URL: https://cran.r-project.org/package=flextable [Accessed 05-02-2023].

Gonçalves-Bradley, D. C., Lannin, N. A., Clemson, L. M., Cameron, I. D. and Shepperd, S. (2016). **Discharge planning from hospital.** Cochrane Database Syst Rev, CD000313, doi: 10.1002/14651858.CD000313.pub5.

Griffiths, S., Stephen, G., Kiran, T. and Okrainec, K. (2021). **"She knows me best": a qualitative study of patient and caregiver views on the role of the primary care physician follow-up post-hospital discharge in individuals admitted with chronic obstructive pulmonary disease or congestive heart failure.** BMC Fam Pract *22*, 176, doi: 10.1186/s12875-021-01524-7.

Groenewegen, P. P., Dourgnon, P., Greß, S., Jurgutis, A. and Willems, S. (2013). **Strengthening weak primary care systems: steps towards stronger primary care in selected Western and Eastern European countries.** Health Policy *113*, 170-179, doi: 10.1016/j.healthpol.2013.05.024.

Haggerty, J. L., Pineault, R., Beaulieu, M.-D., Brunelle, Y., Gauthier, J., Goulet, F. and Rodrigue, J. (2008). **Practice features associated with patient-reported accessibility, continuity, and coordination of primary health care.** Ann Fam Med *6*, 116-123, doi: 10.1370/afm.802.

Haggerty, J. L., Reid, R. J., Freeman, G. K., Starfield, B. H., Adair, C. E. and McKendry, R. (2003). **Continuity of care: a multidisciplinary review.** BMJ *327*, 1219-1221, doi: 10.1136/bmj.327.7425.1219.

Haggerty, J. L., Roberge, D., Freeman, G. K. and Beaulieu, C. (2013). **Experienced continuity of care when patients see multiple clinicians: a qualitative metasummary.** Ann Fam Med *11*, 262-271, doi: 10.1370/afm.1499.

Hansen, J., Groenewegen, P. P., Boerma, W. G. W. and Kringos, D. S. (2015). **Living In A Country With A Strong Primary Care System Is Beneficial To People With Chronic Conditions.** Health Aff (Millwood) *34*, 1531-1537, doi: 10.1377/hlthaff.2015.0582.

Hansen, L. O., Young, R. S., Hinami, K., Leung, A. and Williams, M. V. (2011). **Interventions to reduce 30-day rehospitalization: a systematic review.** Ann Intern Med *155*, 520-528, doi: 10.7326/0003-4819-155-8-201110180-00008.

Hansen, M. F. (1975). **Continuity of care in family practice. Part 3: measurement and evaluation of continuity of care.** J Fam Pract *2*, 439-444.

Harrell Jr, F. E. (2018). **Hmisc: Harrell miscellaneous (Version 4.1-1). Cran.** URL: http://CRAN.R-project.org/package=Hmisc [Accessed 05-02-2023].

Härstedt, M., Rogmark, C., Sutton, R., Melander, O. and Fedorowski, A. (2015). **Impact of comorbidity on 6-month hospital readmission and mortality after hip fracture surgery.** Injury *46*, 713-718, doi: 10.1016/j.injury.2014.12.024.

Hausärzteverband BW (2020). **Hausarztzentrierte Versorgung (HZV).**
URL: https://www.hausarzt-bw.de/Hausarzt%20A-Z/Politik%20und%20Organisationen/hausarzt-zentrierte-versorgung~n-47#:~:text=In%20Baden%2DW%C3%BCrttemberg %20nehmen%20rund,Vorreiter%20bei%20der%20Hausarztzentrierten%20Versorgung. [Accessed 04-02-2023].

Heckmann, M. (2015). **Companion to the Forthcoming Book - R you Ready?**
URL: https://cran.r-project.org/package=ryouready [Accessed 05-02-2023].

Hennen, B. K. (1975). **Continuity of care in family practice. Part 1: dimensions of continuity.** J Fam Pract *2*, 371-372.

Hesselink, G., Flink, M., Olsson, M., Barach, P., Dudzik-Urbaniak, E., Orrego, C., Toccafondi, G., Kalkman, C., Johnson, J. K., Schoonhoven, L., Vernooij-Dassen, M. and Wollersheim, H. (2012a). **Are patients discharged with care? A qualitative study of perceptions and experiences of patients, family members and care providers.** BMJ Qual Saf *21 Suppl 1*, i39-49, doi: 10.1136/bmjqs-2012-001165.

Hesselink, G., Schoonhoven, L., Barach, P., Spijker, A., Gademan, P., Kalkman, C., Liefers, J., Vernooij-Dassen, M. and Wollersheim, H. (2012b). **Improving patient handovers from hospital to primary care: a systematic review.** Ann Intern Med *157*, 417-428, doi: 10.7326/0003-4819-157-6-201209180-00006.

Hesselink, G., Zegers, M., Vernooij-Dassen, M., Barach, P., Kalkman, C., Flink, M., Öhlen, G., Olsson, M., Bergenbrant, S., Orrego, C., Suñol, R., Toccafondi, G., Venneri, F., Dudzik-Urbaniak, E., Kutryba, B., Schoonhoven, L. and Wollersheim, H. (2014). **Improving patient discharge and reducing hospital readmissions by using Intervention Mapping.** BMC Health Serv Res *14*, 389, doi: 10.1186/1472-6963-14-389.

Hetlevik, Ø., Holmås, T. H. and Monstad, K. (2021). **Continuity of care, measurement and association with hospital admission and mortality: a registry-based longitudinal cohort study.** BMJ Open *11*, e051958, doi: 10.1136/bmjopen-2021-051958.

Ho, D. E., Imai, K., King, G. and Stuart, E. A. (2011). **MatchIt : Nonparametric Preprocessing for Parametric Causal Inference.** J. Stat. Soft. *42*, 1-28, doi: 10.18637/jss.v042.i08.

Hoffmann, F. and Koller, D. (2017). **Verschiedene Regionen, verschiedene Versichertenpopulationen? Soziodemografische und gesundheitsbezogene Unterschiede zwischen Krankenkassen.** Gesundheitswesen *79*, e1-e9, doi: 10.1055/s-0035-1564074.

Hoffmann, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., Altman, D. G., Barbour, V., Macdonald, H., Johnston, M., Lamb, S. E., Dixon-Woods, M., McCulloch, P., Wyatt, J. C., Chan, A.-W. and Michie, S. (2014). **Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide.** BMJ *348*, g1687, doi: 10.1136/bmj.g1687.

Hofmarcher, M. M., Oxley, H. and Rusticelli, E. (2007). **Improved Health System Performance through better Care Coordination**, Paris.

Huang, Y.-q., Gou, R., Diao, Y.-s., Yin, Q.-h., Fan, W.-x., Liang, Y.-p., Chen, Y., Wu, M., Zang, L., Li, L., Zang, J., Cheng, L., Fu, P. and Liu, F. (2014). **Charlson comorbidity index helps predict the risk of mortality for patients with type 2 diabetic nephropathy.** J. Zhejiang Univ. Sci. B *15*, 58-66, doi: 10.1631/jzus.B1300109.

Hugh-Jones, D. (2022). **huxtable: Easily Create and Style Tables for LaTeX, HTML and Other Formats.** URL: https://cran.r-project.org/package=huxtable [Accessed 05-02-2023].

Huntley, A., Lasserson, D., Wye, L., Morris, R., Checkland, K., England, H., Salisbury, C. and Purdy, S. (2014). **Which features of primary care affect unscheduled secondary care use? A systematic review.** BMJ Open *4*, e004746, doi: 10.1136/bmjopen-2013-004746.

Hustoft, M., Biringer, E., Gjesdal, S., Aβmus, J. and Hetlevik, Ø. (2018). **Relational coordination in interprofessional teams and its effect on patient-reported benefit and continuity of care: a prospective cohort study from rehabilitation centres in Western Norway.** BMC Health Serv Res *18*, 719, doi: 10.1186/s12913-018-3536-5.

Ivers, N., Jamtvedt, G., Flottorp, S., Young, J. M., Odgaard-Jensen, J., French, S. D., O'Brien, M. A., Johansen, M., Grimshaw, J. and Oxman, A. D. (2012). **Audit and feedback: effects on professional practice and healthcare outcomes.** Cochrane Database Syst Rev, CD000259, doi: 10.1002/14651858.CD000259.pub3.

Ivers, N. M., Sales, A., Colquhoun, H., Michie, S., Foy, R., Francis, J. J. and Grimshaw, J. M. (2014). **No more 'business as usual' with audit and feedback interventions: towards an agenda for a reinvigorated intervention.** Implement Sci *9*, 14, doi: 10.1186/1748-5908-9-14.

Jabbour, M., Newton, A. S., Johnson, D. and Curran, J. A. (2018). **Defining barriers and enablers for clinical pathway implementation in complex clinical settings.** Implement Sci *13*, 139, doi: 10.1186/s13012-018-0832-8.

Jackson, C. and Ball, L. (2018). **Continuity of care: Vital, but how do we measure and promote it?** Aust J Gen Pract *47*, 662-664, doi: 10.31128/AJGP-05-18-4568.

Jones, C. D., Vu, M. B., O'Donnell, C. M., Anderson, M. E., Patel, S., Wald, H. L., Coleman, E. A. and DeWalt, D. A. (2015). **A Failure to Communicate: A Qualitative Exploration of Care Coordination Between Hospitalists and Primary Care Providers Around Patient Hospitalizations.** J GEN INTERN MED *30*, 417-424, doi: 10.1007/s11606-014-3056-x.

Jowsey, T., Dennis, S., Yen, L., Mofizul Islam, M., Parkinson, A. and Dawda, P. (2016). **Time to manage: patient strategies for coping with an absence of care coordination and continuity.** Sociol Health Illn *38*, 854-873, doi: 10.1111/1467-9566.12404.

Kao, Y.-H., Tseng, T.-S., Ng, Y.-Y. and Wu, S.-C. (2019). **Association between continuity of care and emergency department visits and hospitalization in senior adults with asthma-COPD overlap.** Health Policy *123*, 222-228, doi: 10.1016/j.healthpol.2018.11.005.

Kaplan, H. C., Brady, P. W., Dritz, M. C., Hooper, D. K., Linam, W. M., Froehle, C. M. and Margolis, P. (2010). **The influence of context on quality improvement success in health care: a systematic review of the literature.** Milbank Q *88*, 500-559, doi: 10.1111/j.1468-0009.2010.00611.x.

Karam, M., Chouinard, M.-C., Poitras, M.-E., Couturier, Y., Vedel, I., Grgurevic, N. and Hudon, C. (2021). **Nursing Care Coordination for Patients with Complex Needs in Primary Healthcare: A Scoping Review.** Int J Integr Care *21*, 16, doi: 10.5334/ijic.5518.

Kassenärztliche Vereinigung Baden-Württemberg (2017). **Die ambulante medizinische Versorgung**, Stuttgart. URL: https://www.kvbawue.de/presse/publikationen/versorgungsbericht [Accessed 14-11-2022].

Kattel, S., Manning, D. M., Erwin, P. J., Wood, H., Kashiwagi, D. T. and Murad, M. H. (2020). **Information Transfer at Hospital Discharge: A Systematic Review.** J Patient Saf *16*, e25-e33, doi: 10.1097/PTS.0000000000000248.

Kim, S. (2014). **Game Theory Applications in Network Design**, IGI Global, Hershey PA.

Kontopantelis, E., Doran, T., Springate, D. A., Buchan, I. and Reeves, D. (2015). **Regression based quasi-experimental approach when randomisation is not an option: interrupted time series analysis.** BMJ *350*, h2750, doi: 10.1136/bmj.h2750.

Kringos, D., Boerma, W., Bourgueil, Y., Cartier, T., Dedeu, T., Hasvold, T., Hutchinson, A., Lember, M., Oleszczyk, M., Rotar Pavlic, D., Svab, I., Tedeschi, P., Wilm, S., Wilson, A., Windak, A., van der Zee, J. and Groenewegen, P. (2013a). **The strength of primary care in Europe: an international comparative study.** Br J Gen Pract *63*, e742-50, doi: 10.3399/bjgp13X674422.

Kringos, D. S., Boerma, W., van der Zee, J. and Groenewegen, P. (2013b). **Europe's strong primary care systems are linked to better population health but also to higher health spending.** Health Aff (Millwood) *32*, 686-694, doi: 10.1377/hlthaff.2012.1242.

Kringos, D. S., Boerma, W. G. W., van der Zee, J. and Groenewegen, P. P. (2013c). **Political, cultural and economic foundations of primary care in Europe.** Soc Sci Med *99*, 9-17, doi: 10.1016/j.socscimed.2013.09.017.

Kringos, D. S., Boerma, W. G. W., Hutchinson, A., van der Zee, J. and Groenewegen, P. P. (2010). **The breadth of primary care: a systematic literature review of its core dimensions.** BMC Health Serv Res *10*, 65, doi: 10.1186/1472-6963-10-65.

Kripalani, S., LeFevre, F., Phillips, C. O., Williams, M. V., Basaviah, P. and Baker, D. W. (2007). **Deficits in communication and information transfer between hospital-based and primary care physicians: implications for patient safety and continuity of care.** JAMA *297*, 831-841, doi: 10.1001/jama.297.8.831.

Kripalani, S., Theobald, C. N., Anctil, B. and Vasilevskis, E. E. (2014). **Reducing Hospital Readmission Rates: Current Strategies and Future Directions.** Annual Review of Medicine *65*, 471-485, doi: 10.1146/annurev-med-022613-090415.

Kuznetsova, A., Brockhoff, P. B. and Christensen, R. H. B. (2017). **lmerTest Package: Tests in Linear Mixed Effects Models.** J. Stat. Soft. *82*, 1-26, doi: 10.18637/jss.v082.i13.

Kwok, C. S., Martinez, S. C., Pancholy, S., Ahmed, W., Al-Shaibi, K., Potts, J., Mohamed, M., Kontopantelis, E., Curzen, N. and Mamas, M. A. (2018). **Effect of Comorbidity On Unplanned Readmissions After Percutaneous Coronary Intervention (From The Nationwide Readmission Database).** Sci Rep *8*, 11156, doi: 10.1038/s41598-018-29303-y.

Lee, K. H., Low, L. L., Allen, J., Barbier, S., Ng, L. B., Ng, M. J. M., Tay, W. Y. and Tan, S. Y. (2015). **Transitional care for the highest risk patients: findings of a randomised control study.** Int J Integr Care *15*, e039, doi: 10.5334/ijic.2003.

Lehnert, T. and König, H.-H. (2012). **Auswirkungen von Multimorbidität auf die Inanspruchnahme medizinischer Versorgungsleistungen und die Versorgungskosten.** Bundesgesundheitsbl *55*, 685-692, doi: 10.1007/s00103-012-1475-6.

Lemmens, K. M. M., Lemmens, L. C., Boom, J. H. C., Drewes, H. W., Meeuwissen, J. A. C., Steuten, L. M. G., Vrijhoef, H. J. M. and Baan, C. A. (2013). **Chronic care management for patients with COPD: a critical review of available evidence.** J Eval Clin Pract *19*, 734-752, doi: 10.1111/j.1365-2753.2011.01805.x.

Leng, J., Yi, Y. and Gu, X. (2021). **From cooperation to collaboration: investigating collaborative group writing and social knowledge construction in pre-service teachers.** Educational Technology Research and Development *69*, 2377-2398, doi: 10.1007/s11423-021-10020-9.

Leppert, M. H., Sillau, S., Lindrooth, R. C., Poisson, S. N., Campbell, J. D. and Simpson, J. R. (2020). **Relationship between early follow-up and readmission within 30 and 90 days after ischemic stroke.** Neurology *94*, e1249-e1258, doi: 10.1212/WNL.0000000000009135.

Leppin, A. L., Gionfriddo, M. R., Kessler, M., Brito, J. P., Mair, F. S., Gallacher, K., Wang, Z., Erwin, P. J., Sylvester, T., Boehmer, K., Ting, H. H., Murad, M. H., Shippee, N. D. and Montori, V. M. (2014). **Preventing 30-day hospital readmissions: a systematic review and meta-analysis of randomized trials.** JAMA Intern Med *174*, 1095-1107, doi: 10.1001/jamainternmed.2014.1608.

Li, S.-A., Jeffs, L., Barwick, M. and Stevens, B. (2018). **Organizational contextual features that influence the implementation of evidence-based practices across healthcare settings: a systematic integrative review.** Syst Rev *7*, 72, doi: 10.1186/s13643-018-0734-5.

Librero, J., Peiró, S. and Ordiñana, R. (1999). **Chronic Comorbidity and Outcomes of Hospital Care.** J Clin Epidemiol *52*, 171-179, doi: 10.1016/S0895-4356(98)00160-7.

Lin, I.-P., Wu, S.-C. and Huang, S.-T. (2015). **Continuity of Care and Avoidable Hospitalizations for Chronic Obstructive Pulmonary Disease (COPD).** J Am Board Fam Med (The Journal of the American Board of Family Medicine) *28*, 222-230, doi: 10.3122/jabfm.2015.02.140141.

Ljungholm, L., Edin-Liljegren, A., Ekstedt, M. and Klinga, C. (2022). **What is needed for continuity of care and how can we achieve it? – Perceptions among multiprofessionals on the chronic care trajectory.** BMC Health Serv Res *22*, 686, doi: 10.1186/s12913-022-08023-0.

Lorah, J. (2018). **Effect size measures for multilevel models: definition, interpretation, and TIMSS example.** Large-scale Assessments in Education *6*, 8, doi: 10.1186/s40536-018-0061-2.

Long, J. A. (2022). **jtools: Analysis and Presentation of Social Scientific Data.** R package version 2.2.0. URL: https://cran.r-project.org/package=jtools [Accessed 05-02-2023].

Lüdecke, D., Ben-Shachar, M., Patil, I., Waggoner, P. and Makowski, D. (2021). **performance: An R Package for Assessment, Comparison and Testing of Statistical Models.** J Open Source Softw *6*, 3139, doi: 10.21105/joss.03139.

Luu, N.-P., Pitts, S., Petty, B., Sawyer, M. D., Dennison-Himmelfarb, C., Boonyasai, R. T. and Maruthur, N. M. (2016). **Provider-to-Provider Communication during Transitions of Care from Outpatient to Acute Care: A Systematic Review.** J GEN INTERN MED *31*, 417-425, doi: 10.1007/s11606-015-3547-4.

Lytsy, P., Engström, S., Ekstedt, M., Engström, I., Hansson, L., Ali, L., Fredriksson, M. K., Liliemark, J. and Berg, J. (2022). **Outcomes associated with higher relational continuity in the treatment of persons with asthma or chronic obstructive pulmonary disease: A systematic review.** eClinicalMedicine *49*, 101492, doi: 10.1016/j.eclinm.2022.101492.

Maier, C. B. and Aiken, L. H. (2016). **Task shifting from physicians to nurses in primary care in 39 countries: a cross-country comparative study.** Eur J Public Health *26*, 927-934, doi: 10.1093/eurpub/ckw098.

Majothi, S., Jolly, K., Heneghan, N. R., Price, M. J., Riley, R. D., Turner, A. M., Bayliss, S. E., Moore, D. J., Singh, S. J., Adab, P., Fitzmaurice, D. A. and Jordan, R. E. (2015). **Supported self-management for patients with COPD who have recently been discharged from hospital: a systematic review and meta-analysis.** Int J Chron Obstruct Pulmon Dis *10*, 853-867, doi: 10.2147/COPD.S74162.

Mascia, D., Angeli, F. and Di Vincenzo, F. (2015). **Effect of hospital referral networks on patient read-missions.** Social Science & Medicine *132*, 113-121, doi: 10.1016/j.socscimed.2015.03.029.

McGee, D., Lorencatto, F., Matvienko-Sikar, K. and Toomey, E. (2018). **Surveying knowledge, practice and attitudes towards intervention fidelity within trials of complex healthcare interventions.** Trials *19*, 504, doi: 10.1186/s13063-018-2838-6.

McWhinney, I. R. (1975). **Continuity of care in family practice. Part 2: implications of continuity.** J Fam Pract *2*, 373-374.

Melby, L., Brattheim, B. J. and Hellesø, R. (2015). **Patients in transition—improving hospital-home care collaboration through electronic messaging: providers' perspectives.** J Clin Nurs *24*, 3389-3399, doi: 10.1111/jocn.12991.

Mergenthal, K., Beyer, M., Gerlach, F. M. and Güthlin, C. (2016). **Wie werden Delegationskonzepte in Hausarztpraxen ausgestaltet? Eine Analyse am Beispiel der VERAH in der HzV.** Zeitschrift für Allgemeinmedizin *92*, 402-407, doi: 10.3238/zfa.2016.0402–0407.

Mihalic, S. (2002). **The importance of implementation fidelity.** URL: http://www.incredibleyears.com/wp-content/uploads/fidelity-importance.pdf [Accessed 05-02-2023].

Ministerium für Arbeit und Sozialordnung, Familien und Senioren des Landes Baden-Württemberg (2010). **Krankenhausplan 2010 Baden-Württemberg.** URL: https://sozialministerium.baden-wuerttemberg.de/fileadmin/redaktion/m-sm/intern/downloads/Downloads_Krankenh%C3%A4user/KH-Plan_Textteil_2010.pdf [Accessed 22-01-2021].

Mistiaen, P., Francke, A. L. and Poot, E. (2007). **Interventions aimed at reducing problems in adult patients discharged from hospital to home: a systematic meta-review.** BMC Health Serv Res *7*, 47, doi: 10.1186/1472-6963-7-47.

Moore, C., Wisnivesky, J., Williams, S. and McGinn, T. (2003). **Medical errors related to discontinuity of care from an inpatient to an outpatient setting.** J GEN INTERN MED *18*, 646-651, doi: 10.1046/j.1525-1497.2003.20722.x.

Munchhof, A., Gruber, R., Lane, K. A., Bo, N. and Rattray, N. A. (2020). **Beyond Discharge Summaries: Communication Preferences in Care Transitions Between Hospitalists and Primary Care Providers Using Electronic Medical Records.** J GEN INTERN MED *35*, 1789-1796, doi: 10.1007/s11606-020-05786-2.

Mundt, M. P., Gilchrist, V. J., Fleming, M. F., Zakletskaia, L. I., Tuan, W.-J. and Beasley, J. W. (2015). **Effects of primary care team social networks on quality of care and costs for patients with cardiovascular disease.** Ann Fam Med *13*, 139-148, doi: 10.1370/afm.1754.

Navarro, D. (2015). **Learning statistics with R: A tutorial for psychology students and other beginners. (Version 0.5)**, Adelaide, Australia.

Nimptsch, U., Spoden, M. and Mansky, T. (2020). **Variablendefinition in fallbezogenen Krankenhausabrechnungsdaten – Fallstricke und Lösungsmöglichkeiten.** Gesundheitswesen *82*, S29-S40, doi: 10.1055/a-0977-3332.

Nishi, A., Christakis, N. A., Evans, A. M., O'Malley, A. J. and Rand, D. G. (2016). **Social Environment Shapes the Speed of Cooperation.** Sci Rep *6*, 29622, doi: 10.1038/srep29622.

Njoku, C. M., Alqahtani, J. S., Wimmer, B. C., Peterson, G. M., Kinsman, L., Hurst, J. R. and Bereznicki, B. J. (2020). **Risk factors and associated outcomes of hospital readmission in COPD: A systematic review.** Respir Med *173*, 105988, doi: 10.1016/j.rmed.2020.105988.

Nyweide, D. J. (2014). **Concordance between continuity of care reported by patients and measured from administrative data.** Med Care Res Rev *71*, 138-155, doi: 10.1177/1077558713505685.

OECD (2016). **Strengthening primary care systems.** In: Health at a Glance: Europe 2016: State of Health in the EU Cycle, ed. OECD, OECD Publishing, Paris, pp. 37-53.

O'Malley, A. S. and Cunningham, P. J. (2009). **Patient experiences with coordination of care: the benefit of continuity and primary care physician as referral source.** J GEN INTERN MED *24*, 170-177, doi: 10.1007/s11606-008-0885-5.

Panattoni, L., Stone, A., Chung, S. and Tai-Seale, M. (2015). **Patients report better satisfaction with part-time primary care physicians, despite less continuity of care and access.** J GEN INTERN MED *30*, 327-333, doi: 10.1007/s11606-014-3104-6.

Parkerton, P. H., Smith, D. G. and Straley, H. L. (2004). **Primary care practice coordination versus physician continuity.** Fam Med *36*, 15-21.

Pereira Gray, D. J., Sidaway-Lee, K., White, E., Thorne, A. and Evans, P. H. (2018). **Continuity of care with doctors-a matter of life and death? A systematic review of continuity of care and mortality.** BMJ Open *8*, e021161, doi: 10.1136/bmjopen-2017-021161.

Perrault-Sequeira, L., Torti, J., Appleton, A., Mathews, M. and Goldszmidt, M. (2021). **Discharging the complex patient - changing our focus to patients' networks of care providers.** BMC Health Serv Res *21*, 950, doi: 10.1186/s12913-021-06841-2.

Persson, M. H., Søndergaard, J., Mogensen, C. B., Skjøt-Arkil, H. and Andersen, P. T. (2022). **Healthcare professionals' experiences and attitudes to care coordination across health sectors: an interview study.** BMC Geriatr *22*, 509, doi: 10.1186/s12877-022-03200-6.

Petro, W., Andres, J., Hellmann, A., Hering, T. and Weber, M. (2015). **Aus der Versorgungsforschung des Bundesverbandes der Pneumologen – WINPNEU.** Pneumologe *12*, 244-252, doi: 10.1007/s10405-014-0851-3.

Phillips, R. L., Short, A., Kenning, A., Dugdale, P., Nugus, P., McGowan, R. and Greenfield, D. (2015). **Achieving patient-centred care: the potential and challenge of the patient-as-professional role.** Health Expect *18*, 2616-2628, doi: 10.1111/hex.12234.

Pollack, C. E., Hussey, P. S., Rudin, R. S., Fox, D. S., Lai, J. and Schneider, E. C. (2016). **Measuring Care Continuity: A Comparison of Claims-based Methods.** Med Care *54*, e30-e34, doi: 10.1097/MLR.0000000000000018.

Pollack, C. E., Weissman, G. E., Lemke, K. W., Hussey, P. S. and Weiner, J. P. (2013). **Patient Sharing Among Physicians and Costs of Care: A Network Analytic Approach to Care Coordination Using Claims Data.** J GEN INTERN MED *28*, 459-465, doi: 10.1007/s11606-012-2104-7.

Poot, C. C., Meijer, E., Kruis, A. L., Smidt, N., Chavannes, N. H. and Honkoop, P. J. (2021). **Integrated disease management interventions for patients with chronic obstructive pulmonary disease.** Cochrane Database of Syst Rev, doi: 10.1002/14651858.CD009437.pub3.

Powell, B. J., Waltz, T. J., Chinman, M. J., Damschroder, L. J., Smith, J. L., Matthieu, M. M., Proctor, E. K. and Kirchner, J. E. (2015). **A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project.** Implement Sci *10*, 21, doi: 10.1186/s13012-015-0209-1.

Powell, M. J. D. (2009). **The BOBYQA algorithm for bound constrained optimization without derivatives**, Cambridge. URL: https://www.damtp.cam.ac.uk/user/na/NA_papers/NA2009_06.pdf [Accessed 16-08-2022].

Price, M. and Lau, F. Y. (2013). **Provider connectedness and communication patterns: extending continuity of care in the context of the circle of care.** BMC Health Serv Res *13*, 1-10, doi: 10.1186/1472-6963-13-309.

Proctor, E. K., Powell, B. J. and McMillen, J. C. (2013). **Implementation strategies: recommendations for specifying and reporting.** Implement Sci *8*, 139, doi: 10.1186/1748-5908-8-139.

Przysucha, M., Vogel, S., Hüsers, J., Wache, S., Sellemann, B. and Hübner, U. (2018). **Requirements for Collaborative Decision Support Systems in Wound Care: No Information Continuity Without Management Continuity.** Stud Health Technol Inform *253*, 133-137.

R Core Team (2010). **R. A language and environment for statistical computing : reference index**, R Foundation for Statistical Computing, Vienna. URL: https://www.r-project.org/ [Accessed 05-02-2023].

Raherison, C. and Girodet, P.-O. (2009). **Epidemiology of COPD.** Eur Respir Rev *18*, 213-221, doi: 10.1183/09059180.00003609.

Reid, R., Haggerty, J. and McKendry, R. (2002). **Defusing the confusion: Concepts and Measures of Continuity of Healthcare.** URL: https://www.researchgate.net/publication /245856177_Defusing_the_Confusion_Concepts_and_Measures_of_Continuity_of_Health_Care [Accessed 22-11-2022].

Revelle, W. (2022). **psych: Procedures for Psychological, Psychometric, and Personality Research.** R package version 2.2.5, Evanston, Illinois. URL: https://cran.r-project.org/package=psych [Accessed 05-02-2023].

Ridd, M., Shaw, A., Lewis, G. and Salisbury, C. (2009). **The patient-doctor relationship: a synthesis of the qualitative literature on patients' perspectives.** Br J Gen Pract *59*, e116-33, doi: 10.3399/bjgp09X420248.

Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen (2012). **Wettbewerb an der Schnittstelle zwischen ambulanter und stationärer Gesundheitsversorgung. Sondergutachten 2012**, Bonn. URL: https://dserver.bundestag.de/btd/17/103/1710323.pdf [Accessed 05.02.3023].

Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen (SVR Gesundheit) (2014). **Bedarfsgerechte Versorgung – Perspektiven für ländliche Regionen und ausgewählte Leistungsbereiche. Gutachten 2014**, Bonn/ Berlin. URL: https://www.svr-gesundheit.de/fileadmin /Gutachten/Gutachten_2014/Langfassung2014.pdf [Accessed 22-03-2022].

Salisbury, C., Sampson, F., Ridd, M. and Montgomery, A. A. (2009). **How should continuity of care in primary health care be assessed?** Br J Gen Pract *59*, e134-41, doi: 10.3399/bjgp09X420257.

Saluja, S., Hochman, M., Bourgoin, A. and Maxwell, J. (2019). **Primary Care: the New Frontier for Reducing Readmissions.** J GEN INTERN MED *34*, 2894-2897, doi: 10.1007/s11606-019-05428-2.

Sampson, R., Barbour, R. and Wilson, P. (2016). **The relationship between GPs and hospital consultants and the implications for patient care: a qualitative study.** BMC Fam Pract *17*, 45-56, doi: 10.1186/s12875-016-0442-y.

Saultz, J. W. (2003). **Defining and measuring interpersonal continuity of care.** Ann Fam Med *1*, 134-143, doi: 10.1370/afm.23.

Sawicki, O. A., Mueller, A., Klaaßen-Mielke, R., Glushan, A., Gerlach, F. M., Beyer, M., Wensing, M. and Karimova, K. (2021). **Strong and sustainable primary healthcare is associated with a lower risk of hospitalization in high risk patients.** Sci Rep *11*, 4349, doi: 10.1038/s41598-021-83962-y.

Scaioli, G., Willemijn L. A. Schäfer, Wienke G. W. Boerma, Peter M. M. Spreeuwenberg, François G. Schellevis and Peter P. Groenewegen (2020). **Communication between general practitioners and medical specialists in the referral process: a cross-sectional survey in 34 countries.** BMC Fam Pract *21*, 1-9, doi: 10.1186/s12875-020-01124-x.

Schang, L., Waibel, S. and Thomson, S. (2013). **Measuring care coordination: health system and patient perspectives. Report prepared for the Main Association of Austrian Social Security Institutions**, London. URL: http://eprints.lse.ac.uk/59573/1 /__lse.ac.uk_storage_LIBRARY_Secondary_libfile_shared_repository_Content_Schang, %20L_Schang_Measuring%20care%20coordination_2014.pdf [Accessed 22-12-2022].

Schelhase, T. (2012). **Statistische Krankenhausdaten: Diagnosedaten der Krankenhauspatienten 2009.** In: Krankenhaus-Report 2012. Schwerpunkt: Regionalität, eds. Klauber, J., Geraedts, M., Friedrich, J. and Wasem, J., Schattauer, Stuttgart, pp. 377-405.

Schelhase, T. (2021). **Statistische Krankenhausdaten: Diagnosedaten der Krankenhauspatienten 2018.** In: Krankenhaus-Report 2021: Versorgungsketten – Der Patient im Mittelpunkt, eds. Klauber, J., Wasem, J., Beivers, A. and Mostert, C., Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 405-439.

Schiøtz, M. L., Høst, D. and Frølich, A. (2016). **Involving patients with multimorbidity in service planning: perspectives on continuity and care coordination.** J Comorb *6*, 95-102, doi: 10.15256/joc.2016.6.81.

Schlette, S., Lisac, M. and Blum, K. (2009). **Integrated primary care in Germany: the road ahead.** Int J Integr Care *9*, e14, doi: 10.5334/ijic.311.

Schubert, I., Ihle, P. and Köster, I. (2010). **Interne Validierung von Diagnosen in GKV-Routinedaten: Konzeption mit Beispielen und Falldefinition.** Gesundheitswesen *72*, 316-322, doi: 10.1055/s-0030-1249688.

Scott, I. A. (2010). **Preventing the rebound: improving care transition in hospital discharge processes.** Aust Health Rev *34*, 445-451, doi: 10.1071/AH09777.

She, Z., Gaglioti, A. H., Baltrus, P., Li, C., Moore, M. A., Immergluck, L. C., Rao, A. and Ayer, T. (2020). **Primary Care Comprehensiveness and Care Coordination in Robust Specialist Networks Results in Lower Emergency Department Utilization: A Network Analysis of Medicaid Physician Networks.** J Prim Care Community Health *11*, 2150132720924432, doi: 10.1177/2150132720924432.

Sheehan, J., Laver, K., Bhopti, A., Rahja, M., Usherwood, T., Clemson, L. and Lannin, N. A. (2021). **Methods and Effectiveness of Communication Between Hospital Allied Health and Primary Care Practitioners: A Systematic Narrative Review.** J Multidiscip Healthc *14*, 493-511, doi: 10.2147/JMDH.S295549.

Smith, M. C. and Wrobel, J. P. (2014). **Epidemiology and clinical impact of major comorbidities in patients with COPD.** Int J Chron Obstruct Pulmon Dis *9*, 871-888, doi: 10.2147/COPD.S49621.

Soriano, J. B., Abajobir, A. A., Abate, K. H., Abera, S. F., Agrawal, A., Ahmed, M. B., Aichour, A. N., Aichour, I., Aichour, M. T. E., Alam, K., Alam, N., Alkaabi, J. M., Al-Maskari, F., Alvis-Guzman, N., Amberbir, A., Amoako, Y. A., Ansha, M. G., Antó, J. M., Asayesh, H., Atey, T. M., Avokpaho, Euripide Frinel G Arthur, Barac, A., Basu, S., Bedi, N., Bensenor, I. M., Berhane, A., Beyene, A. S., Bhutta, Z. A., Biryukov, S., Boneya, D. J., Brauer, M., Carpenter, D. O., Casey, D., Christopher, D. J., Dandona, L., Dandona, R., Dharmaratne, S. D., Do, H. P., Fischer, F., Gebrehiwot, T. T., Geleto, A., Ghoshal, A. G., Gillum, R. F., Ginawi, I. A. M., Gupta, V., Hay, S. I., Hedayati, M. T., Horita, N., Hosgood, H. D., Jakovljevic, M. B., James, S. L., Jonas, J. B., Kasaeian, A., Khader, Y. S., Khalil, I. A., Khan, E. A., Khang, Y.-H., Khubchandani, J., Knibbs, L. D., Kosen, S., Koul, P. A., Kumar, G. A., Leshargie, C. T., Liang, X., El Razek, Hassan Magdy Abd, Majeed, A., Malta, D. C., Manhertz, T., Marquez, N., Mehari, A., Mensah, G. A., Miller, T. R., Mohammad, K. A., Mohammed, K. E., Mohammed, S., Mokdad, A. H., Naghavi, M., Nguyen, C. T., Nguyen, G., Le Nguyen, Q., Nguyen, T. H., Ningrum, D. N. A., Nong, V. M., Obi, J. I., Odeyemi, Y. E., Ogbo, F. A., Oren, E., PA, M., Park, E.-K., Patton, G. C., Paulson, K., Qorbani, M., Quansah, R., Rafay, A., Rahman, M. H. U., Rai, R. K., Rawaf, S., Reinig, N., Safiri, S., Sarmiento-Suarez, R., Sartorius, B., Savic, M., Sawhney, M., Shigematsu, M., Smith, M., Tadese, F., Thurston, G. D., Topor-Madry, R., Tran, B. X., Ukwaja, K. N., van Boven, J. F. M., Vlassov, V. V., Vollset, S. E., Wan, X., Werdecker, A., Hanson, S. W., Yano, Y., Yimam, H. H., Yonemoto, N., Yu, C., Zaidi, Z., El Sayed Zaki, M., Lopez, A. D., Murray, C. J. L. and Vos, T. (2017). **Global, regional, and national deaths, prevalence, disability-adjusted life years, and years lived with disability for chronic obstructive pulmonary disease and asthma, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015.** Lancet Respir Med *5*, 691-706, doi: 10.1016/S2213-2600(17)30293-X.

Spencer, R. A. and Singh Punia, H. (2021). **A scoping review of communication tools applicable to patients and their primary care providers after discharge from hospital.** Patient Educ Couns *104*, 1681-1703, doi: 10.1016/j.pec.2020.12.010.

Spivack, S. B., DeWalt, D., Oberlander, J., Trogdon, J., Shah, N., Meara, E., Weinberger, M., Reiter, K., Agravat, D., Colla, C. and Lewis, V. (2022). **The Association of Readmission Reduction Activities with Primary Care Practice Readmission Rates.** J GEN INTERN MED *37*, 3005-3012, doi: 10.1007/s11606-021-07005-y.

Stange, K. C. (2009). **The problem of fragmentation and the need for integrative solutions.** Ann Fam Med *7*, 100-103, doi: 10.1370/afm.971.

Starfield, B. (1992). **Primary care. Concept, evaluation, and policy.** 2nd Edition, Oxford University Press, New York.

Starfield, B., Shi, L. and Macinko, J. (2005). **Contribution of Primary Care to Health Systems and Health.** Milbank Quarterly *83*, 457-502, doi: 10.1111/j.1468-0009.2005.00409.x.

Statistisches Bundesamt (Destatis) (2022). **Grunddaten der Krankenhäuser 2020**, Berlin. URL: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Gesundheit/Krankenhaeuser /Publikationen/Downloads-Krankenhaeuser/grunddaten-krankenhaeuser-2120611207004.pdf?__blob=publicationFile [Accessed 22-08-2022].

Steinwachs, D. M. (1979). **Measuring provider continuity in ambulatory care: an assessment of alternative approaches.** Med Care *17*, 551-565, doi: 10.1097/00005650-197906000-00001.

Stengel, S., Kotowicz, M., Nohl-Deryk, P. and Schwill, S. (2021). **Qualitativ hochwertige hausärztliche Versorgung und begrenzte Arbeitszeit – ein Widerspruch? (Does Limited Working Time Contradict High-Quality of Care in Family Medicine?).** Zeitschrift für Allgemeinmedizin *97*, doi: 10.3238/zfa.2021.0341–0346.

Stillfried, D. von, Ermakova, T., Ng, F. and Czihal, T. (2017). **Virtuelle Behandlernetzwerke : Neue Ansätze zur Analyse und Veränderung räumlicher Versorgungsunterschiede.** Bundesgesundheitsbl *60*, 1356-1371, doi: 10.1007/s00103-017-2641-7.

Straßner, C., Hoffmann, M., Forstner, J., Roth, C., Szecsenyi, J. and Wensing, M. (2020). **Interventions to Improve Hospital Admission and Discharge Management: An Umbrella Review of Systematic Reviews.** Qual Manag Health Care *29*, 67-75, doi: 10.1097/QMH.0000000000000244.

Stratil, J. M., Rieger, M. A. and Voelter-Mahlknecht, S. (2018). **Image and perception of physicians as barriers to inter-disciplinary cooperation? - the example of German occupational health physicians in the rehabilitation process: a qualitative study.** BMC Health Serv Res *18*, 769, doi: 10.1186/s12913-018-3564-1.

Strazdins, E., Dwan, K., Pescud, M. and Strazdins, L. (2019). **Part-time in general practice-a remedy to a time-based problem?** Fam Pract *36*, 511-515, doi: 10.1093/fampra/cmy116.

Sundararajan, V., Henderson, T., Perry, C., Muggivan, A., Quan, H. and Ghali, W. A. (2004). **New ICD-10 version of the Charlson comorbidity index predicted in-hospital mortality.** J Clin Epidemiol *57*, 1288-1294, doi: 10.1016/j.jclinepi.2004.03.012.

Swanson, J. O., Vogt, V., Sundmacher, L., Hagen, T. P. and Moger, T. A. (2018). **Continuity of care and its effect on readmissions for COPD patients: A comparative study of Norway and Germany.** Health Policy *122*, 737-745, doi: 10.1016/j.healthpol.2018.05.013.

Tammes, P., Morris, R. W., Murphy, M. and Salisbury, C. (2021). **Is continuity of primary care declining in England? Practice-level longitudinal study from 2012 to 2017.** Br J Gen Pract *71*, e432-e440, doi: 10.3399/BJGP.2020.0935.

Tasselli, S. (2014). **Social networks of professionals in health care organizations: a review.** Med Care Res Rev *71*, 619-660, doi: 10.1177/1077558714557079.

Tomaschek, R., Gemperli, A. and Essig, S. (2022). **Improving collaboration between specialists and general practitioners in services for individuals with chronic spinal cord injury living in rural areas of Switzerland: Baseline results from the SCI-Co study.** J Spinal Cord Med, 1-9, doi: 10.1080/10790268.2022.2097996.

Uddin, S., Hossain, L., Hamra, J. and Alam, A. (2013). **A study of physician collaborations through social network and exponential random graph.** BMC Health Serv Res *13*, 234, doi: 10.1186/1472-6963-13-234.

Uijen, A. A., Heinst, C. W., Schellevis, F. G., van den Bosch, W. J. H. M., van de Laar, F. A., Terwee, C. B. and Schers, H. J. (2012a). **Measurement properties of questionnaires measuring continuity of care: a systematic review.** PLoS ONE *7*, e42256, doi: 10.1371/journal.pone.0042256.

Uijen, A. A., Schers, H. J., Schellevis, F. G. and van den Bosch, Wil J H M (2012b). **How unique is continuity of care? A review of continuity and related concepts.** Fam Pract *29*, 264-271, doi: 10.1093/fampra/cmr104.

Valente, T. W. and Pitts, S. R. (2017). **An Appraisal of Social Network Theory and Analysis as Applied to Public Health: Challenges and Opportunities.** Annu Rev Public Health *38*, 103-118, doi: 10.1146/annurev-publhealth-031816-044528.

van den Bussche, H. (2019). **Die Zukunftsprobleme der hausärztlichen Versorgung in Deutschland: Aktuelle Trends und notwendige Maßnahmen.** Bundesgesundheitsbl *62*, 1129-1137, doi: 10.1007/s00103-019-02997-9.

van Houdt, S., Heyrman, J., Vanhaecht, K., Sermeus, W. and Lepeleire, J. de (2013). **An in-depth analysis of theoretical frameworks for the study of care coordination.** Int J Integr Care *13*, e024, doi: 10.5334/ijic.1068.

van Loenen, T., van den Berg, M. J., Heinemann, S., Baker, R., Faber, M. J. and Westert, G. P. (2016). **Trends towards stronger primary care in three western European countries; 2006-2012.** BMC Fam Pract *17*, 59, doi: 10.1186/s12875-016-0458-3.

van Loenen, T., van den Berg, M. J., Westert, G. P. and Faber, M. J. (2014). **Organizational aspects of primary care related to avoidable hospitalization: a systematic review.** Fam Pract *31*, 502-516, doi: 10.1093/fampra/cmu053.

van Spall, H. G. C., Rahman, T., Mytton, O., Ramasundarahettige, C., Ibrahim, Q., Kabali, C., Coppens, M., Brian Haynes, R. and Connolly, S. (2017). **Comparative effectiveness of transitional care services in patients discharged from the hospital with heart failure: a systematic review and network meta-analysis.** Eur J Heart Fail *19*, 1427-1443, doi: 10.1002/ejhf.765.

van Walraven, C., Oake, N., Jennings, A. and Forster, A. J. (2010a). **The association between continuity of care and outcomes: a systematic and critical review.** J Eval Clin Pract *16*, 947-956, doi: 10.1111/j.1365-2753.2009.01235.x.

van Walraven, C., Seth, R., Austin, P. C. and Laupacis, A. (2002). **Effect of discharge summary availability during post-discharge visits on hospital readmission.** J GEN INTERN MED *17*, 186-192, doi: 10.1046/j.1525-1497.2002.10741.x.

van Walraven, C., Taljaard, M., Etchells, E., Bell, C. M., Stiell, I. G., Zarnke, K. and Forster, A. J. (2010b). **The independent association of provider and information continuity on outcomes after hospital discharge: Implications for hospitalists.** J Hosp Med *5*, 398-405, doi: 10.1002/jhm.716.

Vargas, I., Garcia-Subirats, I., Mogollón-Pérez, A.-S., Ferreira-de-Medeiros-Mendes, M., Eguiguren, P., Cisneros, A.-I., Muruaga, M.-C., Bertolotto, F. and Vázquez, M.-L. (2018). **Understanding communication breakdown in the outpatient referral process in Latin America: a cross-sectional study on the use of clinical correspondence in public healthcare networks of six countries.** Health Policy Plan *33*, 494-504, doi: 10.1093/heapol/czy016.

Vassbotn, A. D., Sjøvik, H., Tjerbo, T., Frich, J. and Spehar, I. (2018). **General practitioners' perspectives on care coordination in primary health care: A qualitative study.** Int J Care Coord *21*, 153-159, doi: 10.1177/2053434518816792.

Verhaegh, K. J., MacNeil-Vroomen, J. L., Eslami, S., Geerlings, S. E., Rooij, S. E. de and Buurman, B. M. (2014). **Transitional Care Interventions Prevent Hospital Readmissions For Adults With Chronic Illnesses.** Health Affairs *33*, 1531-1539, doi: 10.1377/hlthaff.2014.0160.

Vogelmeier, C., Buhl, R., Burghuber, O., Criée, C.-P., Ewig, S., Godnic-Cvar, J., Hartl, S., Herth, F., Kardos, P., Kenn, K., Nowak, D., Rabe, K. F., Studnicka, M., Watz, H., Welte, T., Windisch, W. and Worth, H. (2018). **Leitlinie zur Diagnostik und Therapie von Patienten mit chronisch obstruktiver Bronchitis und Lungenemphysem (COPD).** Pneumologie *72*, 253-308, doi: 10.1055/s-0043-125031.

Vonneilich, N. (2020). **Soziale Beziehungen, soziales Kapital und soziale Netzwerke – eine begriffliche Einordnung.** In: Soziale Netzwerke und gesundheitliche Ungleichheiten: Eine neue Perspektive für die Forschung, eds. Klärner, A., Gamper, M., Keim-Klärner, S., Moor, I., Lippe, H. von der and Vonneilich, N., Springer Fachmedien Wiesbaden, Wiesbaden, pp. 33-48.

Voskuijl, T., Hageman, M. and Ring, D. (2014). **Higher Charlson Comorbidity Index Scores are associated with readmission after orthopaedic surgery.** Clin Orthop Relat Res *472*, 1638-1644, doi: 10.1007/s11999-013-3394-8.

Waibel, S., Henao, D., Aller, M.-B., Vargas, I. and Vázquez, M.-L. (2012). **What do we know about patients' perceptions of continuity of care? A meta-synthesis of qualitative studies.** Int J Qual Health Care *24*, 39-48, doi: 10.1093/intqhc/mzr068.

Waibel, S., Vargas, I., Coderch, J. and Vázquez, M.-L. (2018). **Relational continuity with primary and secondary care doctors: a qualitative study of perceptions of users of the Catalan national health system.** BMC Health Serv Res *18*, 257, doi: 10.1186/s12913-018-3042-9.

Waters, A. (2022). **General practice: Policy makers must value continuity of care over access and targets, GP conference hears.** BMJ *377*, o1202, doi: 10.1136/bmj.o1202.

Wensing, M., Kolle, P. K., Szecsenyi, J., Stock, C. and Laux, G. (2018). **Effects of a program to strengthen general practice care on hospitalisation rates: a comparative observational study.** Scand J Prim Health Care *36*, 109-114, doi: 10.1080/02813432.2018.1459429.

Wensing, M., Szecsenyi, J. and Laux, G. (2021). **Continuity in general practice and hospitalization patterns: an observational study.** BMC Fam Pract *22*, 21, doi: 10.1186/s12875-020-01361-0.

Wensing, M., Szecsenyi, J., Stock, C., Kaufmann Kolle, P. and Laux, G. (2017). **Evaluation of a program to strengthen general practice care for patients with chronic disease in Germany.** BMC Health Serv Res *17*, 62, doi: 10.1186/s12913-017-2000-2.

White, D. R. and Harary, F. (2001). **The Cohesiveness of Blocks In Social Networks: Node Connectivity and Conditional Density.** Socioll Methodol*31*, 305-359, doi: 10.1111/0081-1750.00098.

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T., Miller, E., Bache, S., Müller, K., Ooms, J., Robinson, D., Seidel, D., Spinu, V., Takahashi, K., Vaughan, D., Wilke, C., Woo, K. and Yutani, H. (2019). **Welcome to the Tidyverse.** J Ooen Source Softw *4*, 1686, doi: 10.21105/joss.01686.

Wilfling, D., Warkentin, N., Laag, S. and Goetz, K. (2021). **"I Have Such a Great Care" - Geriatric Patients' Experiences with a New Healthcare Model: A Qualitative Study.** Patient Prefer Adherence *15*, 309-315, doi: 10.2147/PPA.S296204.

Wilson, E. B. (1927). **Probable Inference, the Law of Succession, and Statistical Inference.** J Am Stat Assoc *22*, 209, doi: 10.2307/2276774.

Woods, C. E., Jones, R., O'Shea, E., Grist, E., Wiggers, J. and Usher, K. (2019). **Nurse-led postdischarge telephone follow-up calls: A mixed study systematic review.** J Clin Nurs *28*, 3386-3399, doi: 10.1111/jocn.14951.

World Health Organization (1978). **Primary Health Care. Report of the International Conference on Primary Health Care Alma-Ata, USSR, 6-12 September 1978**, Geneva. URL: https://www.who.int/publications/i/item/9241800011 [Accessed 23-12-2022].

World Health Organization (2018). **Continuity and coordination of care. A practice brief to support implementation A practice brief to support implementation of the WHO Framework on integrated people-centred health services.** URL: https://apps.who.int/iris/bitstream /handle/10665/274628/9789241514033-eng.pdf?ua=1 [Accessed 22-12-2022].

World Health Organization. Regional Office for Europe (2015). **Ambulatory care sensitive conditions in Germany.** URL: https://apps.who.int/iris/handle/10665/349099 [Accessed 25-04-2022].

World Health Organization. Regional Office for Europe (2016). **Integrated care models: an overview.** URL: https://www.euro.who.int/__data/assets/pdf_file/0005/322475 /Integrated-care-models-overview.pdf [Accessed 22-12-2022].

World Health Organization. Regional Office for Europe, European Observatory on Health Systems and Policies, Busse, R. and Riesberg, A. (2004). **Health care systems in transition: Germany**, World Health Organization. Regional Office for Europe, Copenhagen.

Wright, M. and Mainous, A. (2018). **Can continuity of care in primary care be sustained in the modern health system?** Aust J Gen Pract *47*, 667-669, doi: 10.31128/AJGP-06-18-4618.

Wyngaerden, F., Nicaise, P., Dubois, V. and Lorant, V. (2019). **Social support network and continuity of care: an ego-network study of psychiatric service users.** Soc Psychiatry Psychiatr Epidemiol *54*, 725-735, doi: 10.1007/s00127-019-01660-7.

Yang, F., Xiong, Z.-F., Yang, C., Li, L., Qiao, G., Wang, Y., Zheng, T., He, H. and Hu, H. (2017). **Continuity of Care to Prevent Readmissions for Patients with Chronic Obstructive Pulmonary Disease: A Systematic Review and Meta-Analysis.** COPD *14*, 251-261, doi: 10.1080/15412555.2016.1256384.

Yao, S., Lix, L., Teare, G., Evans, C. and Blackburn, D. (2022). **An integrated continuity of care measure improves performance in models predicting medication adherence using population-based administrative data.** PLoS ONE *17*, e0264170, doi: 10.1371/journal.pone.0264170.

Zentner, A., Velasco Garrido, M. and Busse, R. (2010). **Macht der Hausarzt als Lotse die Gesundheitsversorgung wirklich besser und billiger? Ein systematischer Review zum Konzept Gatekeeping.** Gesundheitswesen *72*, e38-44, doi: 10.1055/s-0029-1234126.

8 Eigenanteil an Datenerhebung und -auswertung und eigene Veröffentlichungen

Diese Arbeit wurde im Rahmen des vom Innovationsfonds geförderten Projekts VESPEERA durchgeführt. Das Projekt wurde unter der Konsortialführung der AOK Baden-Württemberg und mit den weiteren Konsortialpartnern Hausärztliche Vertragsgemeinschaft AG (HÄVG) Regionaldirektion Süd, dem aQua-Institut für angewandte Qualitätsförderung und Forschung im Gesundheitswesen in Göttingen, dem Institut für Medizinische Biometrie am Universitätsklinikum in Heidelberg (IMBI) sowie dem Gesundheitstreffpunkt Mannheim e.V. durchgeführt. Die Aufgaben der Abteilung Allgemeinmedizin und Versorgungsforschung (AMED) umfassten die Entwicklung der Interventionskomponenten sowie deren Implementierung in den Hausarztpraxen und Krankenhäusern, die Studienleitung, die Auswertung der Patientenbefragung sowie die Prozessevaluation. Meine Rolle im Projekt war die der internen Projektkoordinatorin, ich war somit mit sämtlichen inhaltlichen und analytischen Aufgaben im Verantwortungsbereich der AMED betraut.

Im Rahmen der ersten Auswertung der Interviews der Prozessevaluation ist die eigene Idee zur wissenschaftlichen Fragestellung dieser Doktorarbeit entstanden, die zudem um die auf Routinedaten basierte soziale Netzwerkanalyse ergänzt wurde.

Teile der vorliegenden Arbeit wurden bereits in folgenden Aufsätzen vorab publiziert:

1. Forstner, J. and Arnold, C. (2023a). **Continuity of care: new approaches to a classic topic of Health Services Research.** In: Foundations of Health Services Research: Principles, Methods, and Topics, eds. Wensing, M. and Ullrich, C., Springer (with publisher).

2. **Forstner, J.**, Bossert, J., Weis, A., Litke, N., Strassner, C., Szecsenyi, J. und Wensing, M. (2021). **The role of personalised professional relations across care sectors in achieving high continuity of care.** BMC Fam Pract *22*, 72, doi: 10.1186/s12875-021-01418-8.

3. **Forstner, J.**, Koetsenruijjter, J., Arnold, C., Laux, G. and Wensing, M. (2023b). **The Influence of Provider Connectedness on Continuity of Care and Hospital Readmissions in Patients With COPD: A Claims Data Based Social Network Study.** Chronic Obstr Pulm Dis *10*, 77-88, doi: 10.15326/jcopdf.2022.0359.

4. **Forstner, J**., Straßner, C., Kunz, A., Uhlmann, L., Freund, T., Peters-Klimm, F., Wensing, M., Kümmel, S., El-Kurd, N., Rück, R., Handlos, B. und Szecsenyi, J. (2019a). **Improving continuity of patient care across sectors: study protocol of a quasi-experimental multi-centre study regarding an admission and discharge model in Germany (VESPEERA).** BMC Health Serv Res *19*, 206, doi: 10.1186/s12913-019-4022-4.

5. **Forstner, J**., Kunz, A., Straßner, C., Uhlmann, L., Kuemmel, S., Szecsenyi, J. und Wensing, M. (2019b). **Improving Continuity of Patient Care Across Sectors: Study Protocol of the Process Evaluation of a Quasi-Experimental Multi-Centre Study Regarding an Admission and Discharge Model in Germany (VESPEERA).** BMJ Open *9,* e031245, doi: 10.1136/bmjopen-2019-031245.

6. **Forstner, J.**, Pilz, M., Straßner, C., Weis, A., Litke, N., Uhlmann, L., Peters-Klimm, F., Aluttis, F., Baldauf, A., Kiel, M., Qreini, M., Kaufmann-Kolle, P., Schubert-Haack, J., El-Kurd, N., Tomaschko-Ubeländer, K., Treffert, S., Rück, R., Handlos, B., Karakas, G., Wensing, M. and Szecsenyi, J. (2023c). **Hospital Admission and Discharge: Lessons Learned from a Large Programme in Southwest Germany.** International Journal of Integrated Care *23*, 4, doi: 10.5334/ijic.6534.

Bei Publikation 1 handelt es sich um ein Lehrbuchkapitel zum Thema Versorgungskontinuität, dessen Inhalte in Kapitel 1.1 eingeflossen sind. Das Lehrbuchkapitel habe ich zu gleichen Teilen gemeinsam mit Christine Arnold geschrieben, wobei mein Eigenanteil in der Beschreibung der Versorgungskontinuität und Rückmeldungen zum Teil von Frau Arnold bestand, die das Thema Koordination der Versorgung beschrieben hat. Darüber hinaus haben die Herausgeber*innen, Prof. Dr. Michel Wensing und Dr. Charlotte Ullrich, Anregungen zum Kapitel gegeben.

Publikation 2 basiert auf den Ergebnissen der Substudie A (Kapitel 2.1, 3.1 und 4.1). Die Entwicklung der Leitfäden erfolgte durch mich, wobei ich von Kolleg*innen beratend unterstützt wurde. Die Datenerhebung erfolgte größtenteils durch mich, nur wenige Interviews wurden von meinen Kolleginnen Dr. Aline Weis und Nicola Litke geführt. Die Entwicklung der Fragestellung und dahingehende Auswertung der Daten und Darstellung des Kategoriensystems erfolgte eigenständig durch mich, das Gegencodieren übernahm meine Kollegin Dr. Jasmin Bossert. Die Publikation habe ich selbst, unter Berücksichtigung der Anregungen der Ko-Autor*innen geschrieben.

Publikation 3 basiert auf den Ergebnissen der Substudie B (Kapitel 2.2, 3.2 und 4.2). Die Bereitstellung der Daten erfolgte zunächst durch die AOK Baden-Württemberg, die initiale Aufbereitung im Rahmen der Evaluation der hausarztzentrierten Versorgung erfolgte durch das aQua-Institut, die Aufbereitung

für die weitere interne Verarbeitung erfolgte durch Prof. Dr. Gunter Laux und Markus Qreini. Die Forschungsidee, deren Umsetzung in einen Analyseplan, die analysespezifische Aufbereitung der Daten sowie deren Auswertung und Interpretation erfolgte durch mich, immer unterstützt und beraten von Dr. Jan Koetsenruijter. Lediglich der SECON wurde von Prof. Dr. Gunter Laux berechnet. Die Publikation habe ich selbst, unter Berücksichtigung der Anregungen der Ko-Autor*innen geschrieben.

Die Publikationen 4 und 5 stellen die Studienprotokolle der VESPEERA Hauptstudie (ohne Peer-Review-Verfahren) sowie der VESPEERA Prozessevaluation (mit Peer-Review-Verfahren) dar. Die Projektidee sowie das Evaluationskonzept waren bereits vorhanden, die konkrete Ausgestaltung der Interventionskomponenten, der Implementierungsstrategien und der Studiendurchführung sowie deren umfassende Verschriftlichung erfolgten durch mich. Die Beschreibung der Methodik in den Kapiteln 2.2, 2.3 und 2.4 basiert zu großen Teilen auf diesen beiden Publikationen.

Letztlich stellt Publikation 6 das Hauptpaper der VESPEERA-Studie dar und umfasst eine gemeinsame Betrachtung der Ergebnis- und der Prozessevaluation. Die Aufbereitung der Daten für die Ergebnisevaluation erfolgte durch das aQua-Institut, die Auswertung durch Dr. Maximilian Pilz am IMBI. Im Rahmen der Datenaufbereitung und –auswertung erfolgte jedoch ein regelmäßiger Austausch zwischen aQua, IMBI und AMED. Die erste Interpretation der Ergebnisse erfolgte durch mich, in Abstimmung mit Herrn Dr. Pilz, die finale Interpretation erfolgte in Abstimmung und Konsens im gesamten Projektteam und Konsortium. Die Entwicklung der Fragebögen erfolgte durch mich in Abstimmung mit dem internen Projektteam, die Rekrutierung und Datenerhebung sowie deren Auswertung erfolgte durch mich, die Interpretation in Abstimmung mit dem Projektteam. Die Verschriftlichung der Ergebnisse beider Evaluationsteile in einem Manuskript erfolgten federführend durch mich, Herr Dr. Pilz hat bei der Darstellung der Methodik und der Ergebnisse unterstützt.

Darüber hinaus sind im Rahmen des Projektes VESPEERA verschiedene andere Qualifikationsarbeiten entstanden, die von mir als Projektkoordinatorin betreut und bewertet wurden. Eine Überschneidung zur vorliegenden Arbeit besteht nicht. Um folgende Arbeiten handelt es sich:

- Masterarbeit im Studiengang Versorgungsforschung und Implementierungswissenschaft im Gesundheitswesen (Lina Weinert, 2020): „Specialist physicians' behavior in hospital admission and communication with other care providers. An exploratory, qualitative study from the perspective of outpatient specialist physicians on intersectoral communication during hospital admission and discharge". Die Arbeit entstand in Ergänzung zum Projekt, jedoch unter einem eigenen Ethikvotum. Eine Publikation erfolgte nicht.

| Eigenanteil an Datenerhebung und -auswertung und eigene Veröffentlichungen

- Masterarbeit im Studiengang Versorgungsforschung und Implementierungswissenschaft im Gesundheitswesen (Simone Hatebur, 2021): „Patient empowerment in the context of hospital admissions and discharges exemplified by the VESPEERA project – a mixed methods study". Die Arbeit umfasst die Auswertung der Interviews und Fragebögen mit Patient*innen im Rahmen der Prozessevaluation, es handelt sich somit um eine andere Zielgruppe und Datenquelle als in der vorliegenden Arbeit. Eine Publikation ist derzeit in Arbeit.

- Masterarbeit im Studiengang Versorgungsforschung und Implementierungswissenschaft im Gesundheitswesen (Jasmin Mangold, 2021): „Die Rolle der VERAH im softwaregestützten Case Management – eine qualitative Studie". Die Arbeit basiert auf Interviews mit Hausärzt*innen und VERAHs, die auch in die vorliegende Arbeit eingeflossen sind und wurden durch Fokusgruppen aus dem Projekt TelePraCMan ergänzt. Der Fokus der Arbeit war ein anderer als der der hier vorliegenden Arbeit, die Erkenntnisse aus der Masterarbeit wurden jedoch zur Argumentation in der Diskussion herangezogen (Forstner et al. 2022). Die Verschriftlichung im Manuskript, das derzeit das Peer-Review-Verfahren durchläuft, erfolgte, basierend auf der Masterarbeit, durch mich und Dr. Charlotte Ullrich.

- Masterarbeit im Studiengang Versorgungsforschung und Implementierungswissenschaft im Gesundheitswesen (Ann-Kathrin Rottmann, 2022): „Explorative Anwendung des HOSPITAL Scores im Rahmen des VESPEERA-Projekts". Die Arbeit umfasst eine explorative Analyse des HOSPITAL-Scores, der im Rahmen des VESPEERA-Projekts von den teilnehmenden Hausarztpraxen erhoben wurde. Es bestehen keine Überschneidungen zu den Fragestellungen in der hier vorliegenden Arbeit. Eine Publikation ist geplant.

Weitere eigene Veröffentlichungen im Rahmen des Projekts:

Forstner, J., Mangold, J., Litke, N., Weis, A., Szecsenyi, J., Wensing, M. und Ullrich, C. (2022). **Zwischen neuer Verantwortung und Routinetätigkeit: Die Rolle der VERAH in der hausärztlichen Versorgung – Eine qualitative Sekundärdatenanalyse am Beispiel des softwaregestützten Case Management.** Gesundheitswesen, under review.

Forstner, J., Litke, N., Weis, A., Straßner, C., Szecsenyi, J. und Wensing, M. (2022). **How to fall into a new routine: factors influencing the implementation of an admission and discharge programme in hospitals and general practices.** BMC Health Serv Res *22*, 1289, doi: 10.1186/s12913-022-08644-5.

Forstner, J. (2021). **Wie kann die Hausarztpraxis Patient*innen rund um einen Krankenhausaufenthalt gut betreuen? Ergebnisse des VESPEERA-Projekts.** Monitor Versorgungsforschung *16*.

Straßner, C., Hoffmann, M., **Forstner, J.**, Roth, C., Szecsenyi, J. und Wensing, M. (2020). **Interventions to Improve Hospital Admission and Discharge Management: An Umbrella Review of Systematic Reviews.** Qual Manag Health Care *29*, 67-75, doi: 10.1097/QMH.0000000000000244.

Straßner, C., **Forstner, J.**, Szecsenyi, J., Wensing, M., Kaufmann Kolle, P. und Günther, W. (2020). **Patientenerfahrungen bezüglich Einweisung, Entlassung und Weiterversorgung im Rahmen einer Krankenhausbehandlung.** Zeitschrift für Allgemeinmedizin *96*, 69-71, doi: 10.3238/zfa.2020.0069-0076.

Weitere eigene Veröffentlichungen außerhalb des Projekts:

Michels, J., Meis, J., Sturm, N., Bornitz, F., Schumann, S. von, Weis, A., Neetz, B., Bentner, M., **Forstner, J.**, Litke, N., Wensing, M., Erdmann, S., Grobe, T., Frerk, T., Kempa, A., Neurohr, C., Schneider, A., Müller, M., Herth, F., Szecsenyi, J. und Trudzinsi, Franziska and the PRiVENT-Study Group. (2023). **Prevention of invasive ventilation (PRiVENT) - a prospective, mixed-methods interventional, mul-ticentre study with a parallel comparison group: study protocol.** BMC Health Serv Res, under review.

Hoffmann, M., Stengel, S., **Forstner, J.**, Baldauf, A., Aluttis, F., Qreini, M., Laux, G., Szecsenyi, J. und Peters-Klimm, F. (2021). **Software-based COVID-19 monitoring.** Zeitschrift für Allgemeinmedizin *12*, 497-501, doi: 10.3238/zfa.2021.0497-0501.

Hoffmann, M., Stengel, S., **Forstner, J.**, Baldauf, A., Laux, G., Aluttis, F., Qreini, M., Engeser, P., Szecsenyi, J. und Peters-Klimm, F. (2021). **Surveillance and care for confirmed and suspected patients with COVID-19 in general practice (CovidCare): study protocol for an observational trial.** BMC Fam Pract *22*, 173, doi: 10.1186/s12875-021-01515-8.

Arnold, C., Koetsenruijter, J., **Forstner, J.**, Peters-Klimm, F. und Wensing, M. (2021). **Influence of physician networks on prescribing a new ingredient combination in heart failure: a longitudinal claim data-based study.** Implement Sci *16*, 84, doi: 10.1186/s13012-021-01150-y.

Cordes, L., Loukanova, S. und **Forstner, J.** (2020). **Scoping Review über die Wirksamkeit einer Screen-to-Screen-Therapie im Vergleich zu einer Face-to-Face-Therapie bei Patient*innen mit Aphasie auf die Benennleistungen.** Z Evid Fortbild Qual Gesundhwes *156-157*, 1-8, doi: 10.1016/j.zefq.2020.08.002.

Bossert, J., **Forstner, J.**, Villalobos, M., Siegle, A., Jung, C., Deis, N., Thomas, M., Wensing, M. und Krug, K. (2020). **What patients with lung cancer with comorbidity tell us about interprofessional collaborative care across healthcare sectors: qualitative interview study.** BMJ Open *10*, e036495, doi: 10.1136/bmjopen-2019-036495.

Forstner, J., Wensing, M., Koetsenruijter, J. und Wronski, P. (2019). **Claims data-based analysis of the influence of individual and regional characteristics on the utilisation of long-term care by people with dementia in Baden-Wurttemberg, Germany.** BMC Geriatri *19*, 358, doi: 10.1186/s12877-019-1370-1.

Ullrich, C., Mahler, C., **Forstner, J.**, Szecsenyi, J. und Wensing, M. (2017). **Teaching implementation science in a new Master of Science Program in Germany: a survey of stakeholder expectations.** Implement Sci *12*, 55, doi: 10.1186/s13012-017-0583-y.

Appendix

Appendix I – German original quotes from the interviews

[i] German original: 'Das sind dann so spezielle Sachen da telefonieren dann die Ärzte untereinander. Aber vieles ist eben halt Routine und da wird nicht telefoniert'

[ii] German original: 'Das kam witziger Weise bisher noch nie vor, außer letzte Woche hat einer angerufen [...] Ja, dass der entlassen wird und es ist ja Freitag [...] und ja das war echt super aber sonst kam das wirklich nie vor. Also bei mir nicht, ja.'

[iii] German original: 'Aber wenn wir das Gefühl haben, dass der Hausarzt informiert sein muss um die Situation besser einschätzen zu können, dann ist es halt ein probates Mittel, so ein kurzes Telefonat hilft da mehr als ein zweiseitiger Brief.'

[iv] German original: 'Also in der Regel ist es sowieso dass wir hinterhertelefonieren nachfragen versuchen irgendwelche Sachen rauszukriegen.'

[v] German original: 'Aber ich sage mal die Kommunikation, die Kommunikation läuft vorsintflutlich [...] ja ist einfach Telefon und Fax. [...]. Email funktioniert, ja, nur sehr eingeschränkt mit ausgewählten, quasi wo man das extra vereinbart, dass man diesen Kommunikationsweg geht.'

[vi] German original: 'Also mein Eindruck, es kann natürlich immer besser sein aber es sind etablierte Strukturen die sich bewährt haben und im Großen und Ganzen funktioniert das Zusammenarbeiten da ganz gut.'

[vii] German original: 'Mit den Haus-, also mit den Hausarztpraxen in der Regel, also ich kann mich nicht erinnern, dass das einmal nicht geklappt hätte [...] wenn die Hausarztanbindung funktioniert hat war nach meinem Wissen auch dieses Interesse in der Regel groß genug. Ich weiß aber, dass das jetzt meine Situation abbildet, ich weiß es von anderen Bereichen, dass das nicht immer so gut läuft.'

[viii] German original: 'Geht's jetzt um was speziell Medizinisches oder halt eher pflegerisch oder so, übernehmen die [physician assistants] auch Anrufe und dadurch ist die Kommunikation auch besser, ja. Weil die natürlich auch die Ärzte entlasten und - ja.'

[ix] German original: 'Und da haben wir jetzt per Telefon wirklich zusammengearbeitet. Aber das sind echt die absoluten Ausnahmen.'

[x] German original: 'Erstens muss man sich an die eigene Nase fassen, ja? Ich glaube dass wir auch besser informieren können wenn wir Patienten entlassen.'

xi German original: 'Dass jetzt mehr telefoniert wird sehe ich jetzt auch nicht unbedingt...nein also eher weniger. Bin ich eher enttäuscht ehrlich gesagt. […] Also verschlechtert nicht aber es ist jetzt auch nicht besser geworden.'

xii German original: 'Der Kontakt ist schwierig.'

xiii German original: 'Dann versucht man da einen Kontakt aufzubauen und denen dann halt einfach zu erklären, [...] es geht ja auch oft um diese, ja, gute Überleitung, ja? Und da ist es manchmal schwierig, aber, ja.'

xiv German original: 'Was – wahnsinnig verbesserungsfähig ist, ist im Grunde der Kontakt zwischen Zuweisern und Klinik, das ist in jedem Land so.'

xv German original: 'Ich glaube eh, dass an der Stelle wir überholt werden weil wir mit dem Datenschutz und den Krankenhäusern und der Abrechnung so detailliert unterwegs sind, dass uns da WhatsApp überholt und irgendwann privater Anbieter 'Ich verwalte Ihre – Patientendaten, die können Sie überall hin mitnehmen' und dann stehen die Patienten mit dem kleinen Smartphone vor uns und sagen 'Da ist alles drauf, bitte lese es an diesem kleinen Bildschirm'.'

xvi German original: 'Ja und dann drucke ich den Arztbrief aus, stecke den in den Fax rein, faxe den rüber, und schmeiße die ganze Sache danach in den Datenmüll.'

xvii German original: 'Also in der Zukunft ist es ganz klar, wir brauchen da […] weg vom Papier, auch weg vom digitalisierten Papier.'

xviii German original: 'Von Einweisungsseite würde ich mir wünschen dass einfach auch ein Kopf für soziale Situationen, so wie es eigentlich im Rahmenvertrag auch drinnen steht, auch von den Hausärzten ins Krankenhaus mitgeliefert wird. Sprich: was hat der Patient für einen Pflegegrad, sprich: wie ist er zu Hause versorgt, wann kommt der Pflegedienst. Dass das einfach auch Informationen sind, die von draußen auch mit ins Krankenhaus kommen.'

xix German original: 'Dort [in den regionalen Häuslichen, kommunalen Quartiersstrukturen] kommen sie immer wieder hin, dort sind die meisten Informationen über sie und deswegen wäre das für mich nur schlüssig, wenn diese Versorgungsstrukturen am Aufnahmeprozess und Entlassprozess letztlich dann nachher auch damit mit aktiv beteiligt sind, ja.'

xx German original: 'Also ich denke da haben wir so einen großen Schwerpunkt und eine ganz große Aufgabe in der Koordination, Planung, Versorgung, Nachsorge.'

xxi German original: 'Die unterschiedlichen Zeitschienen wo man sich im Krankenhaus bewegt und in der Praxis […] wenn bei uns Visiten stattfinden und die Case-Manager tätig werden, das...das passt halt wie gesagt häufig nicht zu den Abläufen in der Praxis.'

xxii German original: 'Die Hausärzte sind im Grunde da organisatorisch überfordert. Die haben die Zeit nicht.'

xxiii German original: 'Also ich glaub nicht, dass bei den großen Kliniken irgendwann anfangen, die Ärzte anzurufen. Das glaube ich nicht. Ich glaub, das geht dann schon eher bei so kleineren Kliniken.'

xxiv German original: 'Es gibt so ein paar wenige Praxen wo die, ich glaube, dass die gut organisiert sind, ja? Wo das sehr gut aufbereitet wird, ja, wo die MFAs da sehr viel machen, ja? Und auch sehr konkret arbeiten und auch die Unterlagen die ich dann geschickt kriege, wo das vom Umfang und von der Form her Sinn macht, ja?'

xxv German original: 'Und dann muss man mal anrufen und dann wird ein Fax hergeschickt und man muss es wieder bestätigen, dass man es wirklich ist und zurück und Datenschutz, ne, kennt man ja alles. Und...ja das ist immer ein Akt.'

xxvi German original: '[…] mit dem Risiko, dass wir dafür Geld in die Hand nehmen und mit der Weiterentwicklung der IT-Infrastruktur außerhalb des Krankenhauses irgendwann umstellen müssen […].'

xxvii German original: 'Es kommt auch immer wieder vor, dass bei Patienten, bei denen die Entlasssituation schwierig ist oder komplex ist und man weiß, dass manche Probleme eben ja noch wackelig sind, ja, unsicher sind wie sich das entwickelt, versuchen wir mit den weiterbetreuenden Ärzten vorher Telefonkontakt aufzunehmen, dass wir sagen 'Das und das waren unsere Überlegungen. Wir gehen davon aus, dass es so weiterläuft, könnte aber auch Probleme geben'. Dass der betreuende Hausarzt da einfach auch telefonisch informiert ist, sich vielleicht auch überlegen kann, ob er dann die Nachbetreuung engmaschiger durchführt und den Patienten am nächsten Tag gleich sieht, wenn es Hausbesuche sind.'

xxviii German original: 'Also ich könnte Ihnen jetzt so quasi sagen, also Kollegen die quasi immer anrufen, weil sie das für sinnvoll halten, da sie so quasi ihre Nöte oder konkrete Fragestellungen einfach an den weiterbehandelnden Arzt weitergeben möchten. Ja und es gibt Kollegen die das quasi nie machen, ja.'

xxix German original: 'Wie sie (die Assistenzärzte) uns Hausärzte einschätzen. - Guck mal durch und wie und was der heute wieder schickt oder sowas <lachen beide> macht uns nur Arbeit <lachen>.'

xxx German original: 'Und dann halt ich das für ganz arg schwierig eine Kommunikation herzustellen wo ich überhaupt gar nicht weiß wie der andere tickt, was der andere für Möglichkeiten hat.'

xxxi German original: 'Naja ich denke einfach der Kulturwandel - in den Köpfen [...] sondern, dass sich da halt einfach, ja, dass man sich auf einander zu bewegt, das sehe ich schon als sehr wichtig an.'

xxxii German original: 'Wir haben ja zwei junge Doktoren, die lange in der oder eben aus der Klinik kommen, die haben das total auf dem Schirm, dass sie sagen man braucht halt die Befunde.'

xxxiii German original: 'Man hat ganz deutlich gemerkt, wenn man so gemeinsam am Tisch sitzt und sich gesehen hat, greift man schneller zum Telefon, nimmt den Kontakt persönlich auf und manche Dinge die laufen dann einfach problemloser.'

xxxiv German original: 'Naja also angestoßen hat es unser früherer Geschäftsführer hier von der [KRANKENKASSE] [ORT] und der im Ruhestand ist aber halt als Berater noch unterwegs ist, den ich von früher gut kenne und mit dem war ich Abendessen >lacht<.'

xxxv German original: 'Man weiß wie man aussieht, man kennt sich man spricht auch mal über was Anderes, man sitzt auch mal beim Bier zusammen und insofern da ist ein guter Kontakt [...] Er ruft dann schon mal an und sagt zum Beispiel ich hab da... du hast mir den und den geschickt und das und das hab ich gemacht das war - so und so und das ist alles in Ordnung oder ihr müsst noch mal guck mal oder so, das läuft ganz gut, ja.'

xxxvi German original: 'Das Vorteilhafte war halt, dass die Case Managerin, mit der wir ursprünglich an den Start gegangen sind, eine langjährig etablierte, leitende Pflegekraft hier im Hause war und das ist wahrscheinlich in jeder Stadt das gleiche, die jungen Mediziner machen ihren Facharzt in der Klinik, die kannte die alle irgendwann mal und die gehen dann nach draußen und übernehmen eine Praxis. Und das war dann einfach aus, man kannte sich daher schon. Die meisten kannte sie, also ich glaube sie kennt die meisten Niedergelassenen und da ist natürlich auch die Hürde 'Ich greif jetzt zum Hörer, ruf da an, spreche mit den persönlich oder über seine Sprechstundenmitarbeiter' das geht eigentlich ziemlich problemlos.'

xxxvii German original: 'Haben ein Gesicht vor sich, genau. [ORT] ist jetzt keine Großstadt, das heißt man kennt sich [...] und weiß sich dann auch zu nehmen, das ist sicherlich ein Vorteil.'

xxviii German original: 'Ich meine hier in der Uniklinik, das ist so wie in [ORT] auch. Da könnten Sie von früh bis spät irgendwelche Weiterbildungsveranstaltungen besuchen, die natürlich auch für die niedergelassenen Ärzte zugänglich sind, aber - die sind oft sehr speziell auf komplexe Erkrankungen auch ausgerichtet. In [ORT], so wie in [ORT] auch, gibt es den Hausärztetag einmal im halben Jahr, wo dann auch Interessierte kommen können. Also solche Veranstaltungen denke ich könnten schon helfen so Hürden oder Schranken niedriger zu machen oder abzubauen.'

Appendix II – Interview guides and sociodemographic questionnaires

VESPEERA-Prozessevaluation

Leitfaden zum Interview mit <u>Ärzten und Pflegekräften nicht-teilnehmender</u> Krankenhäuser

Vorbereitung

- Einleitende Worte:

  „Derzeit führen wir das Projekt VESPEERA durch, dass es sich zum Ziel gesetzt hat, die Zusammenarbeit zwischen Krankenhäusern und Hausarztpraxen im Rahmen des Einweisungs- und Entlassmanagements zu verbessern. Um die Ergebnisse der Studie besser interpretieren zu können und einen Einblick in die Umsetzung zu bekommen, führen wir begleitend eine Prozessevaluation durch. Um vergleichen zu können, möchten wir auch Personen befragen, deren Einrichtung nicht an VESPEERA teilnimmt.

  Bitte erzählen Sie doch alles, was Ihnen zu den einzelnen Fragen einfällt. Nehmen Sie sich dafür so viel Zeit wie Sie möchten."

- Hinweis auf Aufzeichnung (Audio), Datenschutz: pseudonymisierte Auswertung, keine Weitergabe der Namen der Teilnehmer, die Tonaufnahmen werden nicht an Personen außerhalb der Forschergruppe weitergegeben. Dritte erhalten keinen Einblick in die Originalunterlagen. Nach Beendigung der Studie werden die Tonaufzeichnungen unwiderruflich gelöscht. Die Bestimmungen des Bundesdatenschutzgesetzes werden eingehalten.

- Freiwilligkeit der Teilnahme, Möglichkeit das Gespräch jederzeit zu beenden; Erklärung zum Ablauf des Interviews

- Nachfrage: Ist noch etwas unklar?

Darstellung der umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

1. Erzählen Sie doch mal, wie in Ihrem (Kranken-)Haus mit Einweisungen und Entlassungen umgegangen wird.

Backup

- Welche konkreten Maßnahmen des Einweisungs- und Entlassmanagements gibt es denn in Ihrem Haus?

- Wer ist zuständig für die Koordination der Aufnahme und Entlassung?

- Was sind die Aufgaben dieser Personen?

- Wie ist Ihre Einschätzung: unterscheiden sich Prozesse und Zuständigkeiten zwischen einzelnen Abteilungen?

- Wie klappt es mit der Umsetzung im Arbeitsalltag?

- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Wahrgenommene Auswirkungen der Maßnahmen im Einweisungs- und Entlassmanagement / Bezug zu VESPEERA-Studienkomponenten

2. Vielleicht haben Sie mitbekommen, dass es in den letzten Jahren geänderte gesetzliche Rahmenbedingungen gab. Haben Sie den Eindruck, dass diese sich auch in Ihrem Arbeitskontext ausgewirkt haben?

Backup

- Falls es nicht von selbst angesprochen wird, bitte gezielt nachfragen (Bezug zu Interventionskomponenten in VESPEERA):

   Haben sich Abläufe verändert?

   - (Wie) haben Sie den geforderten Entlassplan umgesetzt?

   - (Falls ja,) Wie sieht dieser aus?

   - Was beinhaltet er?

   - Wie haben Sie das geforderte Eingangsassessment umgesetzt?

Ausgangssituation und Unterstützung

3. Wie fühlten Sie sich für die Umsetzung der gesetzlichen Vorgaben gewappnet?

Backup

- Gab es in Ihrem Hause im Vorfeld bereits Vorüberlegungen zu den Themen Einweisungs- und Entlassmanagement?

- An welcher Stelle hätten Sie sich mehr Unterstützung oder weiterführende Informationen gewünscht?

- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Auswirkungen auf die Zusammenarbeit mit anderen Leistungserbringern, z.B. im ambulanten Sektor, und mit Kostenträgern

4a. Beschreiben Sie doch mal Ihre Zusammenarbeit mit anderen Leistungsbringern, z.B. des ambulanten Sektors. Hat sich hier in den vergangenen Jahren etwas verändert? Bitte erzählen Sie, welche Entwicklungen es aus Ihrer Sicht gab.

4b. Und wenn Sie nun an die Zusammenarbeit mit Kostenträgern denken - hat sich hier etwas getan?

Backup

- Von woher werden Patienten eingewiesen bzw. aufgenommen?
- Wohin werden Sie entlassen?
- Wer sind die Leistungserbringen, die in die Behandlung Ihrer Patienten involviert sind?
- Wie läuft die Kommunikation mit diesen ab? Wer kommuniziert?
- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Verbesserungsvorschläge im Hinblick auf die umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

5. Was wünschen Sie sich denn im Hinblick auf Einweisungs- und Entlassprozesse für die Zukunft?

Backup

- Wenn man nun an EDV-basierte Lösungen denkt, die die Kommunikation rund um den Einweisungs- und Entlassprozess in den Blick nehmen: Wie stellen Sie sich die optimale Lösung vor?
- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Schlussfragen

Fällt Ihnen noch etwas ein, was wichtig zu erwähnen ist und heute noch nicht ange-sprochen wurde?

Was hat Sie denn dazu motiviert an dieser Studie teilzunehmen?

Und wie haben Sie dieses Interview empfunden?

Backup

- Verwendung der Daten erläutern

- Fragen ob Interesse besteht nach Beendigung der Studie Informationen zur Verfügung gestellt zu bekommen.

- Für die Teilnahme bedanken und Wertschätzung entgegenbringen für die gewonnenen Einblicke.

VESPEERA-Prozessevaluation

Leitfaden zum Interview mit Mitarbeitern aus dem <u>Management nicht-teilnehmender</u> Krankenhäuser

Vorbereitung

- Einleitende Worte:

„Derzeit führen wir das Projekt VESPEERA durch, dass es sich zum Ziel gesetzt hat, die Zusammenarbeit zwischen Krankenhäusern und Hausarztpraxen im Rahmen des Einweisungs- und Entlassmanagements zu verbessern. Um die Ergebnisse der Studie besser interpretieren zu können und einen Einblick in die Umsetzung zu bekommen, führen wir begleitend eine Prozessevaluation durch. Um vergleichen zu können, möchten wir auch Personen befragen, deren Einrichtung nicht an VESPEERA teilnimmt.

Bitte erzählen Sie doch alles, was Ihnen zu den einzelnen Fragen einfällt. Nehmen Sie sich dafür so viel Zeit wie Sie möchten."

- Hinweis auf Aufzeichnung (Audio), Datenschutz: pseudonymisierte Auswertung, keine Weitergabe der Namen der Teilnehmer, die Tonaufnahmen werden nicht an Personen außerhalb der Forschergruppe weitergegeben. Dritte erhalten keinen Einblick in die Originalunterlagen. Nach Beendigung der Studie werden die Tonaufzeichnungen unwiderruflich gelöscht. Die Bestimmungen des Bundesdatenschutzgesetzes werden eingehalten.

- Freiwilligkeit der Teilnahme, Möglichkeit das Gespräch jederzeit zu beenden; Erklärung zum Ablauf des Interviews

- Nachfrage: Ist noch etwas unklar?

Darstellung der umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

1. Erzählen Sie doch mal, wie in Ihrem (Kranken-)Haus mit Einweisungen und Entlassungen umgegangen wird.

Backup

- Welche konkreten Maßnahmen des Einweisungs- und Entlassmanagements gibt es denn in Ihrem Haus?

- Wer ist zuständig für die Koordination der Aufnahme und Entlassung?

- Was sind die Aufgaben dieser Personen?

- Wie ist Ihre Einschätzung: unterscheiden sich Prozesse und Zuständigkeiten zwischen einzelnen Abteilungen?

- Wie klappt es mit der Umsetzung im Arbeitsalltag?

- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Wahrgenommene Auswirkungen der Maßnahmen im Einweisungs- und Entlassmanagement / Bezug zu VESPEERA-Studienkomponenten

2. Sie wissen vielleicht, dass sich in den vergangenen Jahren gesetzlich einiges getan hat. Inwiefern haben sich denn diese geänderten Rahmenbedingungen auf die Abläufe in Ihrem Haus ausgewirkt?

Backup

- Falls es nicht von selbst angesprochen wird, bitte gezielt nachfragen (Bezug zu Interventionskomponenten in VESPEERA):

  - (Wie) haben Sie den geforderten Entlassplan umgesetzt?

  - (Falls ja,) Wie sieht dieser aus?

  - Was beinhaltet er?

  - Wie haben Sie das geforderte Eingangsassessment umgesetzt?

Ausgangssituation und Unterstützung

- **3. Wie fühlten Sie sich für die Umsetzung der gesetzlichen Vorgaben gewappnet?**

Backup

- Gab es in Ihrem Hause im Vorfeld bereits Vorüberlegungen zu den Themen Einweisungs- und Entlassmanagement?

- An welcher Stelle hätten Sie sich mehr Unterstützung oder weiterführende Informationen gewünscht?

- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Auswirkungen auf die Zusammenarbeit mit anderen Leistungserbringern, z.B. im ambulanten Sektor, und mit Kostenträgern

4a. Beschreiben Sie doch mal Ihre Zusammenarbeit mit anderen Leistungsbringern, z.B. des ambulanten Sektors. Hat sich hier in den vergangenen Jahren etwas verändert? Bitte erzählen Sie, welche Entwicklungen es aus Ihrer Sicht gab.

4b. Und wenn Sie nun an die Zusammenarbeit mit Kostenträgern denken - hat sich hier etwas getan?

Backup

- Von woher werden Patienten eingewiesen bzw. aufgenommen?
- Wohin werden Sie entlassen?
- Wer sind die Leistungserbringen, die in die Behandlung Ihrer Patienten involviert sind?
- Wie läuft die Kommunikation mit diesen ab? Wer kommuniziert?
- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Verbesserungsvorschläge im Hinblick auf die umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

5. Was wünschen Sie sich denn im Hinblick auf Einweisungs- und Entlassprozesse für die Zukunft?

Backup

- Wenn man nun an EDV-basierte Lösungen denkt, die die Kommunikation rund um den Einweisungs- und Entlassprozess in den Blick nehmen: Wie stellen Sie sich die optimale Lösung vor?
- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Vom Studienmitarbeiter auszufüllen:	
Screening-Nr.:	_____
Datum:	_____

Schlussfragen

Fällt Ihnen noch etwas ein, was wichtig zu erwähnen ist und heute noch nicht ange-sprochen wurde?

Was hat Sie denn dazu motiviert an dieser Studie teilzunehmen?

Und wie haben Sie dieses Interview empfunden?

Backup

- Verwendung der Daten erläutern

- Fragen ob Interesse besteht nach Beendigung der Studie Informationen zur Verfügung gestellt zu bekommen.

- Für die Teilnahme bedanken und Wertschätzung entgegenbringen für die gewonnenen Einblicke.

VESPEERA-Prozessevaluation

Leitfaden zum Interview mit Mitarbeitern aus dem <u>Management teilnehmender</u> Krankenhäuser

Vorbereitung

- Einleitende Worte:

  „Derzeit führen wir das Projekt VESPEERA durch, dass es sich zum Ziel gesetzt hat, die Zusammenarbeit zwischen Krankenhäusern und Hausarztpraxen im Rahmen des Einweisungs- und Entlassmanagements zu verbessern. Um die Ergebnisse der Studie besser interpretieren zu können und einen Einblick in die Umsetzung zu bekommen, führen wir begleitend eine Prozessevaluation durch.

  Bitte erzählen Sie doch alles, was Ihnen zu den einzelnen Fragen einfällt. Nehmen Sie sich dafür so viel Zeit wie Sie möchten."

- Hinweis auf Aufzeichnung (Audio), Datenschutz: pseudonymisierte Auswertung, keine Weitergabe der Namen der Teilnehmer, die Tonaufnahmen werden nicht an Personen außerhalb der Forschergruppe weitergegeben. Dritte erhalten keinen Einblick in die Originalunterlagen. Nach Beendigung der Studie werden die Tonaufzeichnungen unwiderruflich gelöscht. Die Bestimmungen des Bundesdatenschutzgesetzes werden eingehalten.

- Freiwilligkeit der Teilnahme, Möglichkeit das Gespräch jederzeit zu beenden; Erklärung zum Ablauf des Interviews

- Nachfrage: Ist noch etwas unklar?

- Hinweis: zu Beginn wird die Screening-Nummer genannt

Darstellung der umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

1. Erzählen Sie doch mal, wie in Ihrem (Kranken-)Haus Einweisungen und Entlassungen organisiert werden (unabhängig von VESPEERA).

Backup

- Welche konkreten Maßnahmen des Einweisungs- und Entlassmanagements gibt es denn in Ihrem Haus?

- Wer ist zuständig für die Koordination der Aufnahme und Entlassung?

- Was sind die Aufgaben dieser Personen?

- Wie ist Ihre Einschätzung: unterscheiden sich Prozesse und Zuständigkeiten zwischen einzelnen Abteilungen?

- Wie gut kann das Konzept, das Sie eben geschildet haben, im Arbeitsalltag umgesetzt werden? Was klappt gut, was klappt schlecht?

- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Wahrgenommene Auswirkungen der Maßnahmen im Einweisungs- und Entlassmanagement / Bezug zu VESPEERA-Studienkomponenten

2. Sie wissen vielleicht, dass Krankenhäuser seit Oktober 2017 dazu verpflichtet sind, allen Patienten ein Entlassmanagement anzubieten wie im Rahmenvertrag Entlassmanagement beschrieben. Inwiefern haben sich denn diese geänderten Rahmenbedingungen auf die Abläufe in Ihrem Haus ausgewirkt?

Backup

- Falls es nicht von selbst angesprochen wird, bitte gezielt nachfragen (Bezug zu Interventionskomponenten in VESPEERA):

    - (Wie) haben Sie den geforderten Entlassplan umgesetzt? *(siehe Info RV)*

    - (Falls ja,) Wie sieht dieser aus?

    - Was beinhaltet er?

    - Wie haben Sie das geforderte Eingangsassessment umgesetzt? *(siehe Info RV)*

Ausgangssituation und Unterstützung

3. Wie fühlten Sie sich für die Umsetzung der gesetzlichen Vorgaben gewappnet?

Backup

- Gab es in Ihrem Hause im Vorfeld bereits Vorüberlegungen zu den Themen Einweisungs- und Entlassmanagement?

- An welcher Stelle hätten Sie sich mehr Unterstützung oder weiterführende Informationen gewünscht?

- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Umsetzung VESPEERA

4. Nun setzen Sie ja seit einigen Monaten VESPEERA um. Wie haben Sie denn die Einführung von VESPEERA in Ihrem Haus erlebt?

Backup

- Wer ist verantwortlich für die Umsetzung? Wer war darüber hinaus involviert? Wie haben Sie Ihre Mitarbeiter auf VESPEERA vorbereitet?
- In welchen Abteilungen wird VESPEERA umgesetzt? Wie wurde diese Entscheidung gefällt?
- Wie haben Sie die Vorgaben umgesetzt? (Identifikation von VESPEERA-Patienten, Aufbewahrung des Einweisungsbriefs, Durchführung des Telefonats mit der Hausarztpraxis, Ausfüllen des Dokumentationsbogens)
- Was hat gut geklappt bei der Umsetzung?
- An welcher Stelle hätten Sie sich mehr Informationen und Unterstützung gewünscht?
- Wie erleben Sie die Durchführung von VESPEERA im Klinikalltag?

| Vom Studienmitarbeiter auszufüllen: |
| Screening-Nr.: _____ |
| Datum: _____ |

Auswirkungen auf die Zusammenarbeit mit anderen Leistungserbringern, z.B. im ambulanten Sektor, und mit Kostenträgern

5a. Beschreiben Sie doch mal Ihre Zusammenarbeit mit anderen Leistungsbringern, z.B. des ambulanten Sektors. Hat sich hier in den vergangenen Jahren etwas verändert? Bitte erzählen Sie, welche Entwicklungen es aus Ihrer Sicht gab.

5b. Und wenn Sie nun an die Zusammenarbeit mit Kostenträgern denken - hat sich hier etwas getan?

Backup

- Wer sind die Leistungserbringen, die in die Behandlung Ihrer Patienten involviert sind?
- Wie läuft die Kommunikation mit diesen ab? Wer kommuniziert?
- Hat sich durch VESPEERA etwas an der Kommunikation verändert?
- Welchen Einfluss hat der VESPEERA-Einweisungsbrief auf die Kommunikation mit anderen Leistungserbringern?
- Welchen Einfluss hat das VESPEERA-Telefonat auf die Kommunikation mit der Hausarztpraxis?
- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Verbesserungsvorschläge im Hinblick auf die umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

6. Welche Auswirkungen hat VESPEERA Ihrer Einschätzung nach auf die Versorgung Ihrer Patienten?

Backup
- Was können positive Auswirkungen sein?
- Was können negative Auswirkungen sein?
- Warum?
- Welche Maßnahmen tragen dazu bei?
- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) ange-sprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gespro-chen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Verbesserungsvorschläge im Hinblick auf die umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

7. Was wünschen Sie sich denn im Hinblick auf Einweisungs- und Entlassprozesse für die Zukunft?

Backup

- Welche Rolle könnte VESPEERA aus Ihrer Sicht an dieser Stelle spielen?
- Was würden Sie sich für eine langfristige Implementierung von VESPEERA in die Regelversorgung wünschen?
- Für welche Patienten würden Sie VESPEERA in der Regelversorgung am geeignetsten sehen?
- *Falls schwerpunktmäßig nur ein Themenaspekt (Einweisung ODER Entlassung) angesprochen wurde, bitte noch einmal gezielt nachhaken:*
  Nun haben wir ja schon sehr viel über das Thema Entlassung / Einweisung gesprochen. Wie sieht es denn mit den Einweisungen / Entlassungen aus?

Vom Studienmitarbeiter auszufüllen:
Screening-Nr.: _____
Datum: _____

Motivation

9. Was war Ihre Motivation an VESPEERA teilzunehmen?

Backup
- Würden Sie anderen Kolleginnen und Kollegen eine Teilnahme an VESPEERA empfehlen?
- Warum? / Warum nicht?

Schlussfragen

Fällt Ihnen noch etwas ein, was wichtig zu erwähnen ist und heute noch nicht angesprochen wurde?

Was hat Sie denn dazu motiviert an dieser Studie teilzunehmen?

Und wie haben Sie dieses Interview empfunden?

Backup

- Verwendung der Daten erläutern

- Fragen ob Interesse besteht nach Beendigung der Studie Informationen zur Verfügung gestellt zu bekommen.

- Für die Teilnahme bedanken und Wertschätzung entgegenbringen für die gewonnenen Einblicke.

Soziodemografische Daten

1. Ihr Alter:	|__|__|__| Jahre	
2. Ihr Geschlecht	□ männlich	□ weiblich
3. Ihre Muttersprache	□ Deutsch	□ eine andere Sprache
4. Welcher ist Ihr höchster Schulabschluss?	□ Hauptschulabschluss/Volksschulabschluss □ Realschulabschluss (Mittlere Reife) □ Fachhochschulreife/Abschluss einer Fachoberschule □ Abitur/Hochschulreife □ Anderes	
5. Welcher ist Ihr höchster Berufsabschluss?	□ Noch in beruflicher Ausbildung (einschließlich Auszubildende/r, Praktikant/-in, Student/-in) □ Schüler/-in und besuche eine berufsorientierte Aufbau-, Fachschule o. Ä. □ Berufsausbildung abgeschlossen □ Ausbildung an einer Fach-, Meister-, Technikerschule, Berufs-, Fachakademie abgeschlossen □ Bachelor an Fachhochschule abgeschlossen □ Bachelor an Universität abgeschlossen □ Fachhochschulabschluss (z. B. Diplom, Master) □ Universitätsabschluss (z. B. Diplom, Magister, Staatsexamen, Master) □ Einen anderen beruflichen Abschluss / Sonstiges: _____	
6. Wie ist Ihre derzeitige Erwerbssituation?	□ Erwerbstätigkeit Vollzeit (35 Std. pro Woche oder mehr) □ Erwerbstätigkeit Teilzeit (weniger als 35 Std. pro Woche)	

7. Ist der Landkreis, in dem das Krankenhaus, in dem Sie arbeiten, liegt, eher ländlich oder eher städtisch?	☐ städtisch ☐ ländlich
8. Welcher Versorgungsstufe ist Ihr Krankenhaus zuzuordnen?	☐ Grund- und Regelversorgung ☐ Maximalversorgung ☐ Sonstiges: _____
9. In welchem Bereich sind Sie tätig?	☐ Krankenhausmanagement ☐ Ärztlicher Dienst ☐ Pflege ☐ Sonstiges: _____
10. Wie lange sind Sie schon in diesem Bereich tätig?	|__|__|__| Jahre

Vom Studienmitarbeiter auszufüllen:

Screening-Nr.: _____

Datum: _____

VESPEERA-Prozessevaluation

Leitfaden zum Interview mit <u>Hausärzten und VERAHs teilnehmender Hausarztpraxen</u>

Vorbereitung

- Einleitende Worte:

  „Derzeit führen wir das Projekt VESPEERA durch, dass es sich zum Ziel gesetzt hat, die Zusammenarbeit zwischen Krankenhäusern und Hausarztpraxen im Rahmen des Einweisungs- und Entlassmanagements zu verbessern. Um die Ergebnisse der Studie besser interpretieren zu können und einen Einblick in die Umsetzung zu bekommen, führen wir begleitend eine Prozessevaluation durch. Uns interessiert heute Ihre Erfahrungen, sowohl positiv als auch negativ.

  Bitte erzählen Sie doch alles, was Ihnen zu den einzelnen Fragen einfällt. Nehmen Sie sich dafür so viel Zeit wie Sie möchten.“

- Hinweis auf Aufzeichnung (Audio), Datenschutz: pseudonymisierte Auswertung, keine Weitergabe der Namen der Teilnehmer, die Tonaufnahmen werden nicht an Personen außerhalb der Forschergruppe weitergegeben. Dritte erhalten keinen Einblick in die Originalunterlagen. Nach Beendigung der Studie werden die Tonaufzeichnungen unwiderruflich gelöscht. Die Bestimmungen des Bundesdatenschutzgesetzes werden eingehalten.

- Freiwilligkeit der Teilnahme, Möglichkeit das Gespräch jederzeit zu beenden; Erklärung zum Ablauf des Interviews

- Zu Beginn wird kurz die Screening-Nummer genannt, um das Interview später zuordnen zu können

- Nachfrage: Ist noch etwas unklar?

[HINWEIS: Falls Fragen kommen, die nicht Teil des Interviews sein sollen:

Ich notiere mir Ihre Frage, gerne können wir im Anschluss an das Interview über Fragen zur Umsetzung/ zum CareCockpit/ … sprechen. Mich würde noch interessieren …]

Darstellung der umgesetzten Maßnahmen im Einweisungs- und Entlassmanagement

1. **Erzählen Sie doch mal, wie Sie in der Praxis mit Einweisungen und Entlassungen umgehen. (unabhängig von VESPEERA)**

Backup

- Was machen Sie in der Praxis vor einer geplanten Einweisung, um den Patienten so- wie die weiterbehandelnden Leistungserbringer zu informieren und vorzubereiten?
- Was machen Sie in der Praxis bei einer dringlichen/ notfallmäßigen Einweisung? Wie läuft das in Ihrer Praxis ab?
  - Wie sehen Einweisungsscheine/ -briefe aus?
  - Welche Information geben Sie dem Patienten mit?

- Wie sieht die Weiterbehandlung nach einer Entlassung aus dem Krankenhaus in Ihrer Praxis aus?
  - Sprechen Sie mit behandelnden Krankenhausärzten? Wann/ Bei welchen Patienten? Wer ruft an? Wie erfolgt die weitere Planung der Behandlung?
  - Gibt es Patienten, die Sie dann auch engmaschiger betreuen? Welche Patienten sind das? Wie sieht diese Betreuung aus?

2. **Bei einer Einweisung ist es sehr wichtig, dem Krankenhaus die Medikation des Patienten zu übermitteln.**

   a. **In welcher Form machen Sie das üblicherweise?**

   b. **Welche Erfahrungen haben Sie mit dem Bundesmedikationsplan gemacht?**

Backup

- Nutzen Sie den Bundesmedikationsplan? Wenn ja, warum? Wenn nein, warum nicht? Nutzen die Patienten ihn? Ist er hilfreich?

Darstellung der Meinung zu den VESPEERA-Maßnahmen

3. **In VESPEERA gibt es ja auch verschiedene Maßnahmen vor der Einweisung und nach der Entlassung, die durchgeführt werden sollen. Wie haben Sie diese umgesetzt? Was ist neu / unterscheidet sich von der bisherigen Umsetzung in Ihrer Praxis? Was davon halten Sie für sinnvoll?**

Backup
- Wie sind Sie mit der Software (CareCockpit) zurechtgekommen?
- Wie haben die Patienten auf die Einweisungsbroschüre reagiert?
- Welche Rückmeldungen haben Sie von Patienten oder den Kliniken zum Einweisungsbrief erhalten? Was ist Ihre Meinung zum Einweisungsbrief?
- Haben Sie telefonische Entlassgespräche für VESPEERA-Patienten mit Kliniken geführt? Wenn ja, wie sind die Telefonate abgelaufen? Waren sie hilfreich?
- War die Behandlungsplanung nach Entlassung hilfreich für die strukturierte Planung der weiteren Versorgung des Patienten?
- War der HOSPITAL-Score hilfreich, um geeignete Patienten für das Telefonmonitoring zu finden?
- Welche Erfahrungen haben Sie beim Telefonmonitoring gemacht?
- Wie haben Sie die Medikation im Rahmen von VESPEERA übermittelt?

Wahrgenommene Auswirkungen der Maßnahmen im Einweisungs- und Entlassmanagement / Bezug zu VESPEERA-Studienkomponenten

4. **Welche Auswirkungen von VESPEERA auf die Versorgung Ihrer Patienten stellen Sie sich vor (positiv/ negativ)? Warum? Welche Maßnahmen tragen dazu bei?**

5. **Sie wissen vielleicht, dass sich in den vergangenen Jahren gesetzlich einiges getan hat. Krankenhäuser sind seit Oktober 2017 dazu verpflichtet, verschiedene Maßnahmen des Entlassmanagements anzubieten. Haben Sie seitdem Veränderungen feststellen können? Welche?**

Backup

- In der Zusammenarbeit mit Krankenhäusern?

- In der Versorgung Ihrer Patienten?

- Im Rahmen von Klinikaufenthalten wird die Medikation von Patienten häufig geändert. Die Änderungen sind für Hausärzte oft schwer nachvollziehbar. Haben Sie den Eindruck, dass sich der Umgang mit der Medikation in den Kliniken seit Einführung des Rahmenvertrags Entlassmanagement verändert hat? Wie?

- Haben sich die Informationen im Entlassbrief, z.B. zur Medikation, verändert?

- Haben Sie den Eindruck, dass die Patienten besser oder schlechter über ihre Medikation informiert sind als zuvor?

Determinanten

6. Wie haben Sie die Einführung von VESPEERA in Ihrer Praxis erlebt? Gibt es Dinge, die die Umsetzung von VESPEERA im Praxisalltag erleichtern oder erschweren? Welche?

Backup

- Was hat gut geklappt bei der Einführung?

- An welcher Stelle hätten Sie sich mehr Unterstützung und Information gewünscht?

- Wie sind Sie bei der Einführung vorgegangen?

- Wie erleben Sie die Durchführung im Praxisalltag?

Vom Studienmitarbeiter auszufüllen:
Screening-Nr.: _____
Datum: _____

VESPEERA-Patienten

7. Welche sind in Ihrer Praxis die Patiententypen, die häufig ins Krankenhaus eingewiesen werden, unabhängig von der Diagnose?

Backup

- Gibt es besondere Begleitumstände, z.B. soziale, pflegerische oder finanzielle, die zu einer Krankenhauseinweisung führen?

Schlussfragen

9. **Wo sehen Sie in VESPEERA speziell bzw. im Entlassmanagement ganz allgemein die Rolle der Allgemeinmedizin/ der VERAH? Wohin sollte sich Ihrer Meinung nach die Hausarztmedizin an dieser Stelle weiterentwickeln?**

Fällt Ihnen noch etwas ein, was wichtig zu erwähnen ist und heute noch nicht angesprochen wurde?

Was hat Sie denn dazu motiviert an dieser Studie teilzunehmen?

Und wie haben Sie dieses Interview empfunden?

Backup

- Verwendung der Daten erläutern

- Fragen ob Interesse besteht nach Beendigung der Studie Informationen zur Verfügung gestellt zu bekommen.

- Für die Teilnahme bedanken und Wertschätzung entgegenbringen für die gewonnenen Einblicke.

- Um Patientenrekrutierung bitten

VESPEERA
Einweisungs- und Entlassmanagement

Soziodemografische Daten

1. Ihr Alter:	|__|__|__| Jahre	
2. Ihr Geschlecht	□ männlich	□ weiblich
3. Ihre Muttersprache	□ Deutsch	□ eine andere Sprache
4. Welcher ist Ihr höchster Schulabschluss?	□ Hauptschulabschluss/Volksschulabschluss □ Realschulabschluss (Mittlere Reife) □ Fachhochschulreife/Abschluss einer Fachoberschule □ Abitur/Hochschulreife □ Anderes	
5. Welcher ist Ihr höchster Berufsabschluss?	□ Noch in beruflicher Ausbildung (einschließlich Auszubildende/r, Praktikant/-in, Student/-in) □ Schüler/-in und besuche eine berufsorientierte Aufbau-, Fachschule o. Ä. □ Berufsausbildung abgeschlossen □ Ausbildung an einer Fach-, Meister-, Technikerschule, Berufs-, Fachakademie abgeschlossen □ Bachelor an Fachhochschule abgeschlossen □ Bachelor an Universität abgeschlossen □ Fachhochschulabschluss (z. B. Diplom, Master) □ Universitätsabschluss (z. B. Diplom, Magister, Staatsexamen, Master) □ Einen anderen beruflichen Abschluss / Sonstiges: _____	
6. Wie ist Ihre derzeitige Erwerbssituation?	□ Erwerbstätigkeit Vollzeit (35 Std. pro Woche oder mehr) □ Erwerbstätigkeit Teilzeit (weniger als 35 Std. pro Woche)	

7. Ist der Landkreis, in dem die Praxis, in der Sie arbeiten, liegt, eher ländlich oder eher städtisch?	□ städtisch □ ländlich
8. Wie viele Patienten werden in Ihrer Praxis versorgt?	|__|__|__| Patienten
9. Welcher Berufsgruppe Sind Sie zugehörig?	□ Arzt □ VERAH □ Sonstiges: _____
10. Welcher Verwaltungsform ist Ihre Praxis zuzuordnen?	□ Einzelpraxis □ Gemeinschaftspraxis □ Praxisgemeinschaft □ Medizinisches Versorgungszentrum □ Sonstiges: _____
11. Wie lange sind Sie schon in dieser Praxis tätig?	|__|__|__| Jahre

Vom Studienmitarbeiter auszufüllen:

Screening-Nr.: _____

Datum: _____

Appendix III – List of ambulatory care sensitive conditions

Supplemental Table 1. List of ICD 10-GM Codes Used to Identify Hospitalizations for Ambulatory Care–Sensitive Conditions	
Ambulatory Care Sensitive Condition	*ICD10-GM Code*
Angina	I20, I24.0, I24.8, I24.9
Asthma	J45, J46
Cellulitis	L03, L04, L08.0, L08.8, L08.9, L88, L98.0
Congestive heart failure	I11.0, I50, J81
Convulsion and epilepsy	G40, G41, R56, O15
Chronic obstructive pulmonary disease	J20, J41, J42, J43, J47
Dehydration and gastroenteritis	E86, K52.2, K52.8, K52.9
Dental conditions	A69.0, K02, K03, K04, K05, K06, K08, K09.8, K09.9, K12, K13
Diabetes complications	E10.0–E10.8, E11.0–E11.8, E12.0–E12.8, E13.0–E13.8, E14.0– E14.8
Ear, nose and throat infections	H66, H67, J02, J03, J06, J31.2
Gangrene	R02
Hypertension	I10, I11.9
Influenza and pneumonia	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.9, J16.8, J18.1, J18
Iron-deficiency anemia	D50.1, D50.8, D50.9
Nutritional deficiency	E40, E41, E42, E43, E55.0, E64.3
Other vaccine-preventable diseases	A35, A36, A37, A80, B05, B06, B16.1, B16.9, B18.0, B18.1, B26, G00.0, M01.4
Pelvic inflammatory disease	N70, N73, N74
Perforated/bleeding ulcer	K25.0–K25.2, K25.4–K25.6, K26.0–K26.2, K26.4–K26.6, K27.0–K27.2, K27.4–K27.6, K280–282, K284–K286
Pyelonephritis	N10, N11, N12, N13.6
Alcohol-related diseases	F10
Atrial fibrillation and flutter	I47.1, I47.9, I49.5, I49.8, I49.9, R00.0, R002, R00.8
Constipation	K59.0
Fractured proximal femur	S72.0, S72.1, S72.2
Dyspepsia and other stomach function disorders	K30, K21
Hypokalemia	E87.6
Migraine/acute headache	G43, G44.0, G44.1, G44.3, G44.4, G44.8, R51x
ICD-10-GM = International Classification of Diseases-, 10th Revision – German Modification.	

Appendix IV – Questionnaire used in the process evaluation

UNIVERSITÄTS KLINIKUM HEIDELBERG

VESPEERA
Einweisungs- und Entlassmanagement

Einrichtungs-/Teilnehmer-ID: _____	Datum: _ _ / _ _ / _ _ _ _

Fragebogen für Leistungserbringer

zur Prozessevaluation der Studie

„Versorgungskontinuität sichern: Patientenorientiertes Einweisungs- und Entlassmanagement in Hausarztpraxen und Krankenhäusern (VESPEERA)"

Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,

mit Hilfe dieses Fragebogens möchten wir gerne mehr über Ihre persönlichen Erlebnisse und Eindrücke erfahren, welche Sie im Rahmen Ihrer Teilnahme an der VESPEERA-Studie gemacht haben. Darüber hinaus interessieren uns Ihre Erfahrungen im Rahmen des Einweisungs- und Entlassmanagements. Wir möchten Sie bitten, sich 15 bis 20 Minuten Zeit zu nehmen, um diesen Fragebogen auszufüllen.

Bitte beachten Sie die Übersicht über die VESPEERA-Komponenten auf Seite 2 dieses Fragebogens.

Bitte kreuzen Sie diejenige Antwortmöglichkeit an, die Ihnen spontan in den Sinn kommt. Sie können sich jederzeit entscheiden, einzelne Fragen im Fragebogen nicht zu beantworten. Bitte bedenken Sie jedoch, dass eine vollständige Beantwortung aller Fragen für die wissenschaftliche Auswertung von großer Bedeutung ist. Die Angaben stehen ausschließlich den an der Studie beteiligten Wissenschaftlern in pseudonymisierter* Form zu Verfügung. [*Pseudonym bedeutet, dass Ihr Name und alle anderen Identifikationsmerkmale, die auf Ihre Person schließen lassen, durch ein Kennzeichen ersetzt werden.]

Bitte stecken Sie den ausgefüllten Fragebogen in das beiliegende, vorfrankierte Rücksendekuvert und verschließen Sie dieses. Das verschlossene Kuvert geben Sie bitte in die Post.

Bei Fragen oder Problemen beim Ausfüllen des Bogens wenden Sie sich bitte an das Studienteam, Frau Johanna Forstner (Tel.: 06221/56-35559, E-Mail: vespeera.amed@med.uni-heidelberg.de).

Vielen Dank für Ihre Teilnahme an der Befragung!

Bitte beachten Sie folgende **Hinweise**:

- ▪ Verwenden Sie bitte <u>nur</u> Kugelschreiber.
- ▪ Bitte geben Sie Freitextangaben in Druckbuchstaben an.
- ▪ Zum Ausfüllen des Fragebogens:
  - – Bitte machen Sie das Kreuz direkt im Kästchen, nicht neben dem Kästchen: ⊠
  - – Wenn Sie eine Angabe rückgängig machen wollen, füllen Sie das Kästchen ganz aus ■ und kreuzen Sie die aus Ihrer Sicht richtige Auswahl an ⊠.

Hausarztpraxis vor Einweisung

Assessment vor Einweisung: Patientenstammdaten, Einweisungsdiagnose, medizinische Vorgeschichte, Medikationsplan, soziale Situation, rechtliche Lage, pflegerische Versorgung, Ansprechpartner

Einweisungsbrief: automatisch generiert aus dem Assessment vor Einweisung

Patientenbegleitinformation zum Krankenhausaufenthalt: Informationen, die bei der Vorbereitung auf den Krankenhausaufenthalt helfen

EINWEISUNG

Krankenhausaufenthalt

Erhebung des **HOSPITAL-Scores:** wird errechnet aus 7 Items und gibt Hinweise auf das Risiko einer Rehospitalisierung [3]

Telefonisches Entlassgespräch mit Hausarztpraxis vor Entlassung (im Bedarfsfall)

Patientenbegleitinformation zur Entlassung: Zusammenfassung der mitgegebenen Unterlagen, Hinweise auf die nächsten Schritte, Kontaktdaten für Anlaufstellen bei Fragen

ENTLASSUNG

Weiterversorgung in der Hausarztpraxis

Behandlungsplanung nach Entlassung: Zustand des Patienten nach Entlassung, Planung der weiteren Versorgung, Einschluss ins (Telefon-) Monitoring für Patienten mit erhöhtem Risiko für eine Rehospitalisierung

(Telefon-)Monitoring: bis zu 90 Tage nach Entlassung; frühzeitige Erkennung einer Verschlechterung des Zustands des Patienten

! Der Fragebogen deckt den hier aufgezeigten Gesamtprozess ab und richtet sich an alle involvierten Leistungserbringer. Aus diesem Grund kann es vorkommen, dass einige Fragen nicht direkt auf Sie zutreffen. Wir bitten Sie, in diesen Fällen dennoch eine Antwort abzugeben. Bitte nehmen Sie hierfür eine Einschätzung vor, welche Ihre Erwartung an das Projekt abbildet. Fragen, die sich explizit an eine Zielgruppe (Hausarztpraxis/Krankenhaus) richten, sind als solche gekennzeichnet und dürfen übersprungen werden.

A. Maßnahmen der VESPEERA-Studie

Haben Sie das Assessment zur Erstellung des VESPEERA-Einweisungsbriefs mindestens einmal genutzt?

☐ Ja ☐ Nein

Haben Sie den VESPEERA-Einweisungsbrief mindestens einmal genutzt?

☐ Ja ☐ Nein

Falls nein: Bitte beantworten Sie die nachfolgenden Fragen dennoch gemäß Ihrer Einschätzung.

A-1: Das Assessment zur Erstellung des VESPEERA-Einweisungsbriefs sowie der VESPEERA-Einweisungsbrief…	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
… hilft, neue relevante Informationen über die Patienten zu bekommen.	☐	☐	☐	☐	☐
… hilft, die Dokumentation der Patientendaten in meiner Praxis/ Klinik zu vervollständigen.	☐	☐	☐	☐	☐
… führt dazu, dass die Indikation für den Krankenhausaufenthalt klarer kommuniziert wird.	☐	☐	☐	☐	☐
… hilft, ein besseres Verständnis über die soziale Situation des Patienten vor einem Krankenhausaufenthalt zu bekommen.	☐	☐	☐	☐	☐

Fortsetzung A-1: Das Assessment zur Erstellung des VESPEERA-Einweisungsbriefs sowie der VESPEERA-Einweisungsbrief...	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
... führt zu einer Beschleunigung des Aufnahmeprozesses in der Klinik.	☐	☐	☐	☐	☐
... enthält Informationen, die für die Entlassplanung des Patienten relevant sind.	☐	☐	☐	☐	☐
... enthält wichtige Informationen für das Pflegepersonal.	☐	☐	☐	☐	☐
... enthält wichtige Informationen für die Klinikärzte.	☐	☐	☐	☐	☐
... enthält wichtige Informationen für den Sozialdienst / das Case Management.	☐	☐	☐	☐	☐
Insgesamt übersteigt der Nutzen des Einweisungsbriefs den Aufwand.	☐	☐	☐	☐	☐

Haben Sie den HOSPITAL-Score mindestens einmal erhoben?

☐ Ja ☐ Nein

Falls nein: Bitte beantworten Sie die nachfolgenden Fragen dennoch gemäß Ihrer Einschätzung.

A-3: Der HOSPITAL-Score...	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
... ist einfach zu erheben.	☐	☐	☐	☐	☐
... hilft, Patienten mit einem erhöhten Risiko für eine Rehospitalisierung zu identifizieren.	☐	☐	☐	☐	☐
... hilft, Patienten mit einem erhöhten Unterstützungsbedarf zu identifizieren.	☐	☐	☐	☐	☐
... hilft, Patienten für den Einschluss ins Telefonmonitoring zu identifizieren.	☐	☐	☐	☐	☐
Insgesamt übersteigt der Nutzen des HOSPITAL-Scores den Aufwand.	☐	☐	☐	☐	☐

Haben Sie das telefonische Entlassgespräch zwischen Krankenhaus und Hausarztpraxis mindestens einmal durchgeführt?

☐ Ja ☐ Nein

Falls nein: Bitte beantworten Sie die nachfolgenden Fragen dennoch gemäß Ihrer Einschätzung.

A-4: Das telefonische Entlassgespräch des Krankenhauses mit der Hausarztpraxis...	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
... fördert die allgemeine Zusammenarbeit zwischen Krankenhaus und Hausarztpraxis.	☐	☐	☐	☐	☐
... empfinde ich als hilfreich für komplexe oder vulnerable Patienten	☐	☐	☐	☐	☐
... sollte generell für alle Patienten durchgeführt werden/ ist für fast alle Patienten hilfreich.	☐	☐	☐	☐	☐
Insgesamt übersteigt der Nutzen des telefonischen Entlassgesprächs den Aufwand.	☐	☐	☐	☐	☐

Nur für Kliniken:

Ist Ihnen mindestens ein Fall bekannt, in dem die Patienten-Begleitinformation bei Entlassung verwendet wurde?

☐ Ja ☐ Nein

Falls ja: In welcher Form wurde die Patienten-Begleitinformation verwendet?

☐ Vorlage des VESPEERA-Projekts

☐ Eine abgewandelte Version der Vorlage

☐ Ein eigenes Dokument

Sind Sie mit den Inhalten der Patienten-Begleitinformation bei Entlassung des VESPEERA-Projekts vertraut?

☐ Ja ☐ Nein

Falls nein: Bitte beantworten Sie die nachfolgenden Fragen dennoch gemäß Ihrer <u>Einschätzung</u>.

A-5: Die VESPEERA-Patienten-Begleitinformation bei Entlassung…	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
… hilft, Patienten darüber zu informieren, was sie selbst zu einer effektiven Anschlussbehandlung beitragen können.	☐	☐	☐	☐	☐
… hilft, Patienten auf die ersten Tage nach Entlassung aus dem Krankenhaus vorzubereiten.	☐	☐	☐	☐	☐
… ist eine sinnvolle Ergänzung zum Entlassgespräch.	☐	☐	☐	☐	☐
… vermittelt die richtigen Ansprechpartner an den Patienten.	☐	☐	☐	☐	☐
Insgesamt übersteigt der Nutzen der Patienten-Begleitinformation bei Entlassung des VESPEERA-Projekts den Aufwand.	☐	☐	☐	☐	☐

Nur für Hausärzte/ -ärztinnen und VERAHS:

Haben Sie die Einweisungsbroschüre mindestens einmal ausgeteilt?

☐ Ja ☐ Nein

Sind Sie mit den Inhalten der Einweisungsbroschüre vertraut?

☐ Ja ☐ Nein

Falls nein: Bitte beantworten Sie die nachfolgenden Fragen dennoch gemäß Ihrer <u>Einschätzung</u>.

A-2: Die Einweisungsbroschüre…	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
… hilft, Patienten zu motivieren, ihre Rechte während des Krankenhausaufenthalts einzufordern.	☐	☐	☐	☐	☐
… hilft, Patienten dazu zu motivieren, aktiv - im Rahmen ihrer Möglichkeiten - zu ihrem Genesungsprozess beizutragen.	☐	☐	☐	☐	☐
Insgesamt hilft die Einweisungsbroschüre, Patienten auf einen Krankenhausaufenthalt vorzubereiten	☐	☐	☐	☐	☐

Nur für Hausärzte/ -ärztinnen und VERAHS:

Haben Sie die Behandlungsplanung nach Entlassung mindestens einmal durchgeführt?

☐ Ja   ☐ Nein

Falls nein: Bitte beantworten Sie die nachfolgenden Fragen dennoch gemäß Ihrer Einschätzung.

A-6: Die Behandlungsplanung nach Entlassung...	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
... hilft, dem Patienten Raum zu geben, von seinem Krankenhausaufenthalt zu berichten.	☐	☐	☐	☐	☐
... hilft, mir einen Überblick über die Medikation des Patienten nach Entlassung zu verschaffen.	☐	☐	☐	☐	☐
... hilft, an alle Maßnahmen zu denken, die nach Entlassung eingeleitet werden müssen.	☐	☐	☐	☐	☐
... hilft, weitere Versorgungs- und Behandlungsbedarfe frühzeitig zu erkennen.	☐	☐	☐	☐	☐
Insgesamt übersteigt der Nutzen der Behandlungsplanung nach Entlassung den Aufwand.	☐	☐	☐	☐	☐

Nur für Hausärzte/ -ärztinnen und VERAHS:

Haben Sie das Telefonmonitoring für Patienten mit einem erhöhten Risiko für eine Rehospitalisierung mindestens einmal durchgeführt?

☐ Ja   ☐ Nein

Falls nein: Bitte beantworten Sie die nachfolgenden Fragen dennoch gemäß Ihrer Einschätzung.

A-7: Das Telefonmonitoring für Patienten mit einem erhöhten Risiko für eine Rehospitalisierung...	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
... hilft, die Therapietreue des Patienten zu überprüfen.	☐	☐	☐	☐	☐
... hilft, weitere Versorgungs- und Behandlungsbedarfe frühzeitig zu erkennen.	☐	☐	☐	☐	☐
... hilft, frühzeitige Wiederaufnahmen im Krankenhaus zu vermeiden.	☐	☐	☐	☐	☐
... hilft bei komplexen oder vulnerablen Patienten.	☐	☐	☐	☐	☐
... wäre auch für Patienten ohne erhöhten HOSPITAL-Score hilfreich.	☐	☐	☐	☐	☐
Insgesamt übersteigt der Nutzen des Telefonmonitorings den Aufwand.	☐	☐	☐	☐	☐

B. Kontextfaktoren

Die folgenden Fragen bitte:

aus Sicht der Hausarztpraxen: Bitte immer in Bezug auf Krankenhäuser anwenden
aus Krankenhaussicht: Bitte immer in Bezug auf Hausarztpraxen anwenden

B-1: Vernetzung	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
Der Großteil der Patienten in der Region geht in dasselbe Krankenhaus.	☐	☐	☐	☐	☐
Das Krankenhaus, in das der Großteil der Patienten geht, ist das einzige Krankenhaus in der Region.	☐	☐	☐	☐	☐
Mit dem ortsansässigen Krankenhaus/ den Hausärzten/ -ärztinnen in der Region arbeite ich bereits seit vielen Jahren zusammen.	☐	☐	☐	☐	☐
Ich nehme Angebote zum Austausch zwischen Hausarztpraxen und Krankenhäusern wahr.	☐	☐	☐	☐	☐
Ich habe persönliche Kontakte mit einigen Hausärzten in der Region/ in der Klinik (z.B. über Qualitätszirkel, Weiterbildung, etc.).	☐	☐	☐	☐	☐

B-2: Ressourcen	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
Die Vergütung für Maßnahmen des Einweisungs- und Entlassmanagements empfinde ich als angemessen.	☐	☐	☐	☐	☐
Die Abrechnungsziffern und -modalitäten in VESPEERA waren gut verständlich.	☐	☐	☐	☐	☐
Für die Durchführung der VESPEERA-Maßnahmen ist in meiner Klinik/Praxis ausreichend Personal vorhanden.	☐	☐	☐	☐	☐
Für die Durchführung der VESPEERA-Maßnahmen sind in meiner Klinik/Praxis ausreichend Arbeitsplätze vorhanden.	☐	☐	☐	☐	☐

B-3: Externe Politik und externe Vorgaben.	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
Die Umsetzung der Vorgaben des Rahmenvertrag Entlassmanagement erschwert die Umsetzung der VESPEERA-Maßnahmen.	☐	☐	☐	☐	☐
Die EU DS-GVO* erschwert einrichtungs- und sektorenübergreifende Zusammenarbeit.	☐	☐	☐	☐	☐
Die EU DS-GVO* erschwert die Umsetzung der VESPEERA-Maßnahmen.	☐	☐	☐	☐	☐
Die Entscheidung zur Teilnahme war eine strategische Entscheidung aufgrund des hohen Marktanteils der AOK Baden-Württemberg.	☐	☐	☐	☐	☐

* Europäische Datenschutz-Grundverordnung

B-4: Projektmanagement in VESPEERA	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
Ich habe das Gefühl, dass ich das Projekt VESPEERA mit seinen Zielen und Inhalten komplett verstanden habe.	☐	☐	☐	☐	☐
Die Zuständigkeiten der einzelnen Projektpartner waren klar verständlich.	☐	☐	☐	☐	☐
Von Seiten der Projektpartner hatte ich ausreichend Information und Unterstützung, die ich zur Durchführung von VESPEERA brauche.	☐	☐	☐	☐	☐
Ich vertraue einem oder mehreren der an der Projektorganisation beteiligten Institutionen (z.B. HÄVG, Uniklinikum Heidelberg, AOK, etc.).	☐	☐	☐	☐	☐
Mir war von Anfang an bewusst, dass es sich bei VESPEERA um eine Studie handelt.	☐	☐	☐	☐	☐
Mir war von Anfang an bewusst, dass das Projekt VESPEERA eine begrenzte Laufzeit hat.	☐	☐	☐	☐	☐

Nur für Hausärzte/ -ärztinnen und VERAHs:
Wie sind Sie beim Einschluss von VESPEERA-Patienten vorgegangen?

☐ Ich habe eine Teilnahme an VESPEERA allen Patienten vor bzw. nach einem Krankenhausaufenthalt angeboten

☐ Ich habe bei der Ansprache von Patienten eine Vorauswahl getroffen

☐ Ich habe eine Teilnahme an VESPEERA nur auf Nachfrage von Patienten angeboten

☐ Ich habe keinem meiner Patienten eine Teilnahme an VESPEERA angeboten

B-5: Einschluss von VESPEERA-Patienten	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
Es ist schwierig, geeignete Patienten für eine Teilnahme an VESPEERA zu identifizieren.	☐	☐	☐	☐	☐
Es ist schwierig, geeignete Patienten erfolgreich zu einer Teilnahme an VESPEERA zu motivieren.	☐	☐	☐	☐	☐
Es fällt mir leicht, geeigneten Patienten die Ziele und Inhalte von VESPEERA verständlich zu vermitteln.	☐	☐	☐	☐	☐
Die VESPEERA-Maßnahmen entsprechen den Bedürfnissen meiner Patienten.	☐	☐	☐	☐	☐

C. Wahrgenommene Ergebnisse

	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
Durch VESPEERA konnte der Kontakt zu Patienten intensiviert werden.	☐	☐	☐	☐	☐
Durch VESPEERA konnte engerer Kontakt zu den einweisenden Ärzten/ den entlassenden Kliniken aufgebaut werden.	☐	☐	☐	☐	☐
Durch VESPEERA sind die VERAHs besser in die Versorgung eingebunden als bisher.	☐	☐	☐	☐	☐
Durch VESPEERA konnten Patienten besser in Entscheidungen bezüglich der weiteren Versorgung eingebunden werden als bisher.	☐	☐	☐	☐	☐
Durch VESPEERA hatten Patienten ein besseres Verständnis über ihre eigene Versorgung als bisher.	☐	☐	☐	☐	☐
Durch VESPEERA wurden Patienten auf an VESPEERA teilnehmende Krankenhausabteilungen hingewiesen.	☐	☐	☐	☐	☐
Die VESPEERA-Feedbacktreffen haben die Vernetzung zwischen Krankenhäusern und Hausärzten unterstützt.	☐	☐	☐	☐	☐
Durch VESPEERA arbeiten teilweise Hausarztpraxen/ Krankenhäuser zusammen, die vorher nicht zusammengearbeitet hätten.	☐	☐	☐	☐	☐
Durch VESPEERA fand ein besserer Informationsaustausch zwischen Hausarztpraxis und Klinik statt.	☐	☐	☐	☐	☐
Durch VESPEERA wurde die Zusammenarbeit über die Sektoren hinweg verbessert.	☐	☐	☐	☐	☐
Durch VESPEERA wurde mein Bewusstsein gefördert, dass Zusammenarbeit mit anderen Leistungserbringern wichtig ist.	☐	☐	☐	☐	☐

Während der Umsetzung von VESPEERA war ich mit folgenden Schwierigkeiten konfrontiert:

In folgenden Bereichen hätte ich mir mehr Unterstützung für die Umsetzung von VESPEERA gewünscht:

D. Attraktivität und Akzeptanz

D-1: Eine Teilnahme an VESPEERA…	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
… würde ich Kolleginnen und Kollegen empfehlen	☐	☐	☐	☐	☐
… würde ich allen meinen Patientinnen und Patienten empfehlen	☐	☐	☐	☐	☐
… würde ich mir für alle Hausarztpraxen wünschen	☐	☐	☐	☐	☐
… würde ich mir für alle Krankenhäuser wünschen	☐	☐	☐	☐	☐
… würde ich mir für alle Krankenkassen wünschen	☐	☐	☐	☐	☐
… stärkt die Rolle der Hausarztmedizin	☐	☐	☐	☐	☐
… stärkt die Rolle der VERAH	☐	☐	☐	☐	☐

D-2: Die Durchführung der VESPEERA-Maßnahmen…	Trifft gar nicht zu	Trifft eher nicht zu	Teils / teils	Trifft eher zu	Trifft voll und ganz zu
… kann in weiten Teilen an VERAHS/Pflegekräfte delegiert werden.	☐	☐	☐	☐	☐
… ist zu bürokratisch.	☐	☐	☐	☐	☐
… führt zu Doppeldokumentation.	☐	☐	☐	☐	☐
… lässt sich gut in interne Prozesse integrieren.	☐	☐	☐	☐	☐

Sonstige Kommentare/Anmerkungen:

E. Allgemeine Angaben zur Person und Organisation

Welcher Berufsgruppe gehören Sie an?	**Hausarztpraxis** ☐ Arzt/ Ärztin ☐ VERAH ☐ Sonstiges, und zwar: _____	**Krankenhaus** ☐ Management ☐ Pflege ☐ Arzt/ Ärztin in Weiterbildung ☐ Facharzt/ -ärztin ☐ Sonstiges, und zwar: _____ Abteilung: _____
Berufserfahrung in Jahren		
Ist der Landkreis, in dem Ihre Einrichtung liegt, eher städtisch oder ländlich?	☐ eher städtisch ☐ eher ländlich	
Wie groß ist die Einrichtung, in der Sie arbeiten?	**Hausarztpraxis** _____ Patienten pro Quartal *(geschätzte Angabe)*	**Krankenhaus** _____ Betten in meiner Abteilung *(geschätzte Angabe)*
Wie viele VESPEERA-Patienten hatten Sie in Ihrer Einrichtung insgesamt?		
Ihr Geburtsjahr?		
Ihr Geschlecht?	☐ männlich ☐ weiblich ☐ divers	

Vielen Dank für Ihre Mitarbeit!

Appendix V – SNA results: Single-level models

Table A1: Single-level models of bivariate analyses regarding hospital readmission

	90-day readmission		180-day readmission	
	OR	CI	OR	CI
Density	**0.897** [**]	**0.831; 0.968**	0.935	0.861; 1.015
Degree centrality	1.023	0.948; 1.103	1.046	0.966; 1.133
Closeness centrality	1.055	0.977; 1.140	1.038	0.956; 1.127
EI-index	1.032	0.955; 1.116	0.995	0.917; 1.081
Cohesion	**0.919** [*]	**0.849; 0.995**	0.940	0.864; 1.022
N *(patients)*	6,569		5,681	

Separate models were computed for each of the predictors.

[***] $p < 0.001$; [**] $p < 0.01$; [*] $p < 0.05$

OR: Odds ratio, CI: Confidence interval, EI: External-internal

Table A2: Single-level-models of the analysis of the predictors regarding hospital readmission, adjusted for confounders (overall, subgroup analyses for urban & rural areas)

	30-day readmission		90-day readmission		180-day readmission	
	OR	CI	OR	CI	OR	CI
Density						
Overall					0.921	0.831; 1.021
Urban					0.923	0.806; 1.056
Rural			0.898	0.770; 1.047	0.914	0.776; 1.077
Degree centrality						
Overall					0.992	0.879; 1.118
Urban					1.031	0.893; 1.190
Rural			0.845	0.656; 1.087	0.984	0.769; 1.261
Closeness centrality						
Overall					1.038	0.946; 1.139
Urban	1.113	0.971; 1.277			1.100	0.965; 1.253
Rural			1.043	0.921; 1.181	0.976	0.854; 1.115
EI-index						
Overall					1.035	0.939; 1.142
Urban					1.061	0.936; 1.203
Rural			**1.209 ***	**1.028; 1.423**	0.987	0.842; 1.156
Cohesion						
Overall					0.922	0.843; 1.008
Urban	0.909	0.807; 1.023			0.919	0.821; 1.028
Rural			**0.850 ***	**0.737; 0.981**	0.930	0.801; 1.079
N (patients) – overall/ urban/ rural	/ 3,835 /		/ / 3,027		5,639/ 2,946 / 2,693	

Separate models were computed for each of the predictors, with the overall study population as well as for subgroups divided into GPs working in an urban or rural area.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Models adjusted for: patient sex, patient age, asthma-COPD-overlap, nursing home, COPD severity, number of hospital stays in the previous year, number of contacts with the usual provider in the year after discharge, CCI, length of index stay, share of physician contacts that are with a specialist, SECON, GP sex, area of GP working place (overall only), GP participation in HZV, GP participation in DMP, GP experience in practice years, GPs' average number of patients. Some models regarding 30-day readmission were not adjusted for: COPD severity, share of physician contacts that are with a specialist and the SECON due to problems with model convergence.

OR: Odds ratio, CI: Confidence interval, EI: External-internal, GP: General practitioner, COPD: Chronic obstructive pulmonary disease, CCI: Charlson Comorbidity Index, SECON: Sequential Continuity Index, HZV: German: 'Hausarztzentrierte Versorgung', strong primary care programme, DMP: Disease management programme

Table A3: Single-level-models of the final multivariate regression analyses regarding hospital readmission

	180-day readmission	
	OR	CI
Constant	**0.022 *****	**0.011; 0.044**
Patient characteristics		
Sex *(female)*	0.932	0.781; 1.112
Nursing home *(ref: no)*	1.372	0.878; 2.143
Asthma-COPD-overlap	0.987	0.806; 1.207
Severity *(ref: mild COPD)*		
moderate COPD	**2.784 ****	**1.453; 5.335**
severe COPD	**2.926 ****	**1.537; 5.569**
very severe COPD	**6.814 *****	**3.649; 12.723**
COPD, severity unspecified	**2.691 ****	**1.433; 5.051**
Age	0.925	0.841; 1.018
Number of hospital stays in the previous year	**1.453 *****	**1.330; 1.588**
Number of visits with the UP after discharge	**0.558 *****	**0.491; 0.635**
CCI	1.082	0.982; 1.192
Length of the index stay	**1.124 ****	**1.035; 1.222**
SECON	1.080	0.974; 1.197
Share of physician contacts that are with a specialist	1.035	0.939; 1.139
GP characteristics		
Area *(ref: rural)*	1.032	0.859; 1.241
Sex *(ref: male)*	1.108	0.913; 1.345
DMP *(ref: no)*	1.173	0.827; 1.665
HZV *(ref: no)*	**1.371 ****	**1.099; 1.712**
Experience in practice	1.058	0.967; 1.156
Average number of patients	1.006	0.887; 1.141
Density	0.928	0.803; 1.072
Degree Centrality	0.951	0.792; 1.141
Closeness centrality	1.015	0.917; 1.123
EI-index	1.008	0.883; 1.152
Cohesion	0.952	0.856; 1.058
N *(patients)*	5,639	

*** p < 0.001, ** p < 0.01, * p < 0.05

OR: Odds ratio, CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, UP: Usual provider, CCI: Charlson Comorbidity Index, SECON: Sequential Continuity Index, DMP: Disease management programme, HZV: German: 'Hausarztzentrierte Versorgung', strong primary care programme, EI: External-internal, GP: General practitioner, ICC: Intraclass correlation coefficient, NA: not applicable

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Eidesstattliche Versicherung

1. Bei der eingereichten Dissertation zu dem Thema „Continuity of care at the interface of primary care and other healthcare providers" handelt es sich um meine eigenständig erbrachte Leistung.

2. Ich habe nur die angegebenen Quellen und Hilfsmittel benutzt und mich keiner unzulässigen Hilfe Dritter bedient. Insbesondere habe ich wörtlich oder sinngemäß aus anderen Werken übernommene Inhalte als solche kenntlich gemacht.

3. Die Arbeit oder Teile davon habe ich bislang nicht an einer Hochschule des In- oder Auslands als Bestandteil einer Prüfungs- oder Qualifikationsleistung vorgelegt.

4. Die Richtigkeit der vorstehenden Erklärungen bestätige ich.

5. Die Bedeutung der eidesstattlichen Versicherung und die strafrechtlichen Folgen einer unrichtigen oder unvollständigen eidesstattlichen Versicherung sind mir bekannt. Ich versichere an Eides statt, dass ich nach bestem Wissen die reine Wahrheit erklärt und nichts verschwiegen habe.

Heidelberg, 13. März 2023

Ort und Datum   Unterschrift