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Development and testing of an innovative physical activity questionnaire for large-scale epidemiological studies

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Physical activity (PA) is a modifiable lifestyle factor with great public health potential regarding risk reduction for several chronic diseases. It is, however, a behaviour that is complex and multidimensional and therefore not trivial to be assessed correctly. The primary goal of the presented work was therefore to develop and appropriately evaluate an innovative questionnaire (QUAP) assessing PA in a detailed manner, by testing the questionnaire's test-retest reliability and criterion validity. This questionnaire was recently implemented in the German National Cohort (GNC), complementary to an accelerometry device. To reach this goal, this dissertation covered four major objectives.

First, a literature review on the strengths and limitations of questionnaires and electronic devices for the assessment of PA was conducted. Motivated by the fact that there are not many comprehensive literature reviews available and due to the rapid development of technology, there was a need for an up-to-date review on assessment methods. Aim was to give researchers a good overview and discussion of this topic at hand. Findings revealed that questionnaires are good in providing details and context of behaviour patterns, including type of activity, and can differentiate well between settings. Electronic devices, on the other hand, are rapidly becoming better at assessing energy expenditure (EE). They are good at quantifying

the amount and intensity of PA and the amount of sedentary behaviour. Thus, it turned out that questionnaires are not at all becoming obsolete with the availability of electronic devices but should be considered as a complementary tool to electronic activity monitors (EAMs). Due to improvements in technology, the aim and scope of PA assessment needs to be redefined for future research. No single method is suitable to capture PA in all its complexity. For this reason, a combination of the respective methods should be implemented in large-scale epidemiological studies.

Second, a newly developed questionnaire, implemented in a sub-study embedded in the European Prospective Investigation into Cancer and Nutrition (EPIC) project, was improved. Results from the reliability and validation study as well as feedback from the participants helped to optimise and shorten the instrument. Additionally, problems identified during the process of development were taken into consideration in the revised version. Although the final version assessed in this dissertation has fewer questions, only questions which provided supplemental information (e.g. environment) were removed. The core questions remained the same and were in some parts only simplified for better understanding. The current version is therefore more efficient and has an improved understandability. A final version of QUAP (V5.1) with direct practical impact will be implemented in the GNC, marginally adapted for the actual requirements of this large-scale study.

Third, analyses on the reliability of the QUAP were conducted based on data from a random subcohort of 141 subjects. Overall, reliability was acceptable (r=0.64-0.87), with the exception of the domain sedentary behaviour (r=0.43). Reliability tended to be higher in the domains

household (r=0.87), getting to and from places (r=0.77), and total PA (r=0.79) for the entire study population. Fourth, regarding the validity of the QUAP, the present work showed moderate validity (r_s=0.33) in a cohort of 1406 participants. Slightly higher correlations of the questionnaire with the heart rate monitoring and accelerometry device could be seen for males (r_s=0.34) and for participants with a lower BMI (r_s=0.36). Bland-Altman plots suggested moderate agreement between the physical activity level (PAL) value of the questionnaire and the PAL value of the accelerometry device without a mean bias. Observed levels of reliability and validity for the QUAP were comparable to other instruments assessing habitual or global PA.

In summary, the presented findings indicate that PA is too complex to be thoroughly assessed by one device only. Although technology steadily improves, questionnaires still play an important role, especially in large-scale studies. Testing indicates that our questionnaire has the acceptable reliability and validity to be implemented in a large-scale cohort study such as the GNC.