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Process analysis of MRI at the Institute for Clinical Radiology and Nuclear Medicine (Universitätsmedizin Mannheim, Germany) to identify opportunities to reduce long MRI access time

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This study presents a quality improvement project at the Institute for Clinical Radiology and Nuclear Medicine (ICRNM) at Universitätsmedizin Mannheim, Germany. ICRNM was struggling with inadequately long MRI access time, which can be a threat to patient safety and diminish quality of care. Analysis focused on the work flow sub-steps “access time” and “examination” (which was further subdivided into “preparation”, “scan” and “post-processing”). The overall objective of the project was to identify opportunities to reduce MRI access time (defined as the time between a request for an appointment and the scheduled appointment) through a detailed process analysis.

Primary work flow data and process-related factors with potential influence on the MRI work flow were collected in a prospective study over a three-week period. Descriptive statistics and bivariate statistics were conducted. Relying on the prior analyses, variables affecting the workflow were identified and four multivariate linear regression models were created which simulate the variables' influence on preparation time, scan time, post-processing time and total process time.

A total of 447 scheduled examinations were recorded. Access time for outpatients averaged 44 (\pm 45) days and for inpatients 3 (\pm 5) days. Mean waiting time 1 (i.e. time between patient arrives until patient is called in for MRI preparation) was 38 (\pm 39) minutes for outpatients and 23 (\pm 27) minutes for inpatients. Waiting time 2 (i.e. the waiting time between arrival of patient and scan start) averaged 53 (\pm 40) minutes and 33 (\pm 27) minutes for outpatients and inpatients, respectively. Based on the scheduled appointment times, only 38 (13%) of the scans started on time. The large ranges and standard deviations evidenced a high level of variation. The level of occupied capacity varied from 43.7 % to 59.8 % with an average of 50.8 % occupied capacity across all four MRI scanners. The following factors were found to significantly influence total MRI processing time: administration of oral contrast media, performing multiple scans in a single appointment, placement of an intravenous catheter and scanning patients \leq 8 years of age.

Process analysis was found to be an appropriate methodological approach in the study's setting and access time was identified as an eligible quality parameter. In general, the study's results were congruent with the theoretical framework on variation as a basic problem in health care. The finding that variation in MRI processing time was caused by factors of random and non-random variation contradicts the theoretical background in which it is assumed that patient flow variation is in principle non-random variation and may point to an inaccuracy of the model. The presence of variation in the workflow, the finding of low occupied capacity and long access times at ICRNM pointed to major insufficiencies in the existing workflow. Careful analysis indicated that the main cause was an inefficient scheduling system that failed to manage concurrent outpatient/inpatient demand and ignored the impact of the factors causing variation. Based on the results of the process analysis, recommendations with respect to variation reduction principles were presented. These are: implementation of a policy to routinely schedule inpatients, introduction of a priority system, application of tailored appointment slots for defined patient groups and detachment of process steps to optimize management of factors of non-random variation.

As a result, process analysis was found to contribute to reliability and objectivity of process assessment in the frame of quality management. Specifically, the analysis of factors influencing workflow (e.g. regression analysis) may enable targeted tailoring of quality improvement interventions and thus enhance quality improvement accuracy and success. Quality of patient care needs to be at the focus of medicine and accurate and reliable process assessment is essential for achieving outstanding quality.