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A system to improve the hand sanitation in clinical environments

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Regarding the high numbers of nosocomial infections in todays clinical routine, our team proposes a system to automatically detect the need to sanitize hands and remember the healthcare professionals to use a dispencer. Our solution consists of a Bluetooth beacon for fencing the contaminated areas. Ultra-low-power electronics and optimized algorithms are used to conserve energy. A wristband registers entering or leaving a certain area around the patient bed and reminds to sanitize after leaving by visual and tactile stimulation. We use a simple RSSI based measurement for coarse distance estimation between wristband and our beacon (ca. 10 cm – 200 cm). When the medical staff sanitizes its hands, the wristband next to the dispenser receives a message via Bluetooth. At the same time gyroscopic data is collected to record the sanitation process. The dispenser module is based on the same Bluetooth beacon used for fencing contaminated areas. The beacon as well as the wristband will be completly encased in silicone to ease the sanitation of the whole system. For the purpose of powering the system the qi wireless charging standard is employed. As outcome, non-personal data will be collected on the wristbands memory during the work shift. This data will contain the information wether the personal has sanitized hands after leaving the contaminated area. Furthermore the data collected by the gyroscope sensor will allow to make a statement whether the personal has sanitized hands the proper way. The collected data could be used to compare the sanitizing habits of various wards and to create statistics for quality management. As the central hub of the system the wristband serves a dual purpose. It is collecting sanitation information during work shift and it bridges the gap between a central server infrastructure and the beacons. With the help of the data and the reminder function of our system we plan to improve sanitizing habits in hospitals.

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Establishment of a quality control system in diagnostic imaging in Northern Iraq

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Quality assurance is an important aspect in diagnostic imaging. In Germany, a system for quality assurance in diagnostic imaging is well established with standards for acceptance testing and for constancy testing for the whole variety in X-ray imaging. In quality assurance, a check must be performed, if an appropriate image quality is achievable at a given dose. In Kurdistan in Northern Iraq a quality assurance system should be set up.
The hospitals in Kurdistan are equipped with mostly new equipment. However, there is no quality program. Using the German standards, especially the DIN 6868-150 for acceptance testing and DIN 6868-4 for constancy testing should be established. A master student of the University of Duhok was trained in Germany and once back, he tested the equipment in Kurdistan. In addition, the measurement equipment (dosimeter, test phantom and accessories), which was donated by a German company, was brought to Duhok. Moreover, a training course for the technologists including theoretical and practical parts were given.
The quality assurance program was well accepted and in the tests of the equipment a few minor errors of the machine were found which have been unnoticed during clinical routine. The technologists need further regular training on the constancy test. In addition, a training to fix minor errors would be beneficial.
To setup a quality assurance system in the hospitals of Kurdistan, Northern Iraq is a difficult task. The benefits in doing the quality tests are obvious for all. However, when the quality assurance in not required by law, it is difficult to pay for the personnel to do these tests. Still, the benefits in the easier location of problems will achieve, that the test will be performed occasionally.

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Risks related to infusion pumps - first steps towards building up a device-specific ontology

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Despite their huge benefit for the controlled administration of drugs, infusion pumps are also being seen as one of the most top health technology hazards as just recently again been emphasized by the ECRI Institute's Health Hazards Report 2017. In the years from 2012 to 2016 the Federal Institute for Drugs and Medical Devices (BfArM), which is the competent authority in charge for scientific risk assessment of most of the critical incidents that occur with medical devices in Germany, has received more than 1300 critical incident reports related to infusion pumps.
By examining 479 selected incident reports, 60 risk-related patterns grouped in eight top categories were determined in agreement with the in-house vigilance device experts. The five major categories for failure modes identified were functional, electrical, mechanical and software-related failures as well as incorrect labelling. For each of the risk patterns a list of phrases describing the risk as well as a list of specific risk-related keywords was compiled. The latter will later be used as a basis for the ontology to be developed.
To guarantee the completeness of each list of pattern-specific keywords, all 479 reports were independently classified using all categories identified beforehand. Converting all incident descriptions to a single corpus then allowed calculating a similarity-measure between each report and a corpus of each keyword list to automatically classify the report. As expected a high sensitivity of more than 0.9 was achieved in every category therefore the keywords for each pattern have been identified correctly. The clear drawback of this simplistic approach is the very poor precision with an IQR between 0.02 and 0.19, which is caused by misclassification due to the list of keywords not being specific enough. In this respect the initial approach serves as a baseline for comparison with a full ontology to be used for automatic classification which is to be developed next.
This research is part of the OntoPMS project: a collaborative effort by medical device manufacturers and BfArM together with ontology and search specialists funded by the Federal Ministry of Education and Research (BMBF) within the program KMU-Innovativ/IKT (01IS15056G).

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Implementing risk management or safety management in a radiotherapy institution – challenges, ideas and examples for solutions

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When implementing risk management in a radiotherapy institution one will meet some challenges. Inconsistent national standards, small data base and missing experience in that field require looking over the plate rim and learning from other disciplines like nuclear power, reliability or aerospace engineering even though their methods have to be adapted for radiotherapy. First the frame for the risk management system has to be set for each institution in its individual context. Then all known and conceivable hazards have to be identified for all interested parties included in this frame (e.g. patients as well as staff, referrers, shareholders or cost payers). Even risks resulting from missed opportunities should be considered. Using existing data from internal and external CIRS, publications, experts brainstorming and top-down hazard analyzing methods are useful tools for that issue. Combinations of factors, situations and sequences (scenarios) should also been taken into account. For all identified hazards severities and probabilities must be determined. Using half-quantitative methods with clearly defined classification scores instead of qualitative methods leads to higher objectivity and better comparability. As solid data is rare likelihoods often have to be estimated reasonably. After identifying all hazards and analyzing all risks appropriate risk treatment actions have to be taken to reduce risks under a certain level. While some regulations require that risks to patient or personal safety must always be reduced as far as reasonably achievable each institution can define acceptable risk levels for other hazards. Risk treatment actions can produce new risks which also must been managed. Reevaluation of all risks after the risk treatment actions is essential. If remaining risks are above the defined acceptance level additional actions will have to been taken. This might be a multi-step process. Even the failure of risk treatment actions has to be considered.

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The Human operator: transfer function of the motor control behavior

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Many daily routine activities of the human are supported by machines which must be controlled by the user, like a car for moving, a milling-machine for mechanical part construction, a microsurgery-tool for minimal invasive operation, etc.. In all cases, the human has to control the technical device, and the question arises "Which tasks should be conducted by the human operator, and which tasks should be delegated to the device because of its superior performance?", which refers to the Human Factors field. To determine the capacity of the human operator in general terms, the concept of control theory is to determine the transfer function of the human operator. Doing this by a tracking task in a driving simulator results in a low pass behavior of the human with a cutoff frequency of 0.8 Hz. Thus, all control tasks of a process requiring a dynamic performance beyond this cutoff frequency should be dedicated to the automation because the human operator will be overstrained by them.