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Convergence. Breaking down barriers between disciplines.

Abstract Book of the 7th International Triennial Conference on Healthcare Systems Ergonomics and Patient Safety (HEPS) 2022

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Abstract Book of the 7th International Triennial Conference on Healthcare Systems Ergonomics and Patient Safety (HEPS) 2022

HEPS

HEALTHCARE SYSTEMS ERGONOMICS AND PATIENT SAFETY 2022 @ TU DELFT

CONVERGENCE - *Breaking down barriers between disciplines*

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HEPS2022 is endorsed by the International Ergonomics Association and Human Factors NL.

FOREWORD

HEPS2022 is the 7th edition of the triennial conference on Human Systems Ergonomics and Patient Safety, endorsed by the International Ergonomics Association (IEA) and Human Factors NL and initiated by IEA's Technical Committee Healthcare Ergonomics. The conference theme of this 7th edition is Convergence - Breaking down barriers between disciplines.

Convergence is the integration of knowledge, methods, and expertise from different disciplines and the emergence of novel frameworks to catalyze scientific discovery and innovation. HEPS2022 focuses on the disciplines of Human Factors/Ergonomics and of Medicine and Health to jointly contribute to a safe and humane, high-quality healthcare system.

The 3-day HEPS2022 conference program offers 5 keynotes and 19 sessions. This book presents the abstracts of the presentations in the different sessions. We are convinced that HEPS2022 contributed to the general objective of the HEPS conferences: Creating an international platform for the dissemination and exchange of scientific knowledge between the disciplines of Human Factors/Ergonomics and Medicine and Health, merging the different approaches to create new perspectives and solutions for the evolution of healthcare.

We thank the authors and reviewers for their contribution to this book and making HEPS2022 a success.

Scientific Committee HEPS2022
Marijke Melles
Armaĝan Albayrak
Richard Goossens

2-4 November 2022
Delft, The Netherlands

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1. Value-Based Healthcare: The movement towards outcome measurement based on what matters to patients

Chair: Dr. Nina Zipfel, Amsterdam University Medical Centers, University of Amsterdam, The Netherlands

SPECIAL SESSION

KEYWORDS: value-based healthcare, multidisciplinary approach, patient centered care

SESSION AIM

Healthcare systems worldwide are constantly evolving to adapt to the societal and technological advances that the changing healthcare needs of patients require. A promising concept to solve potential new challenges our healthcare systems are facing is Value-based healthcare. Value-based healthcare is a concept with the aim of organizing health care around patients in the form of care chains that add value. Delivering valuable care for all patients is at the essence of every healthcare organization. Value-based healthcare connects quality and costs in order to focus on what really matters for the patient. One of the core ingredients of value-based healthcare are integrated practice units as an approach of restructuring healthcare organizations to facilitate optimal collaboration between multidisciplinary teams to achieve value. The concept has gained increasing popularity over the past decade as it fosters collaboration between different disciplines in health care with the outcomes that matter to the patients in mind.

This symposium aims to share scientific knowledge of the value-based healthcare movement of the past decade and current research developments, and how the concept contributes to add value to patients.

CONTENT

1.1 An outcome-based mapping approach to facilitate participation and negotiation among multiple stakeholders

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KEYWORDS: healthcare systems, participatory ergonomics, outcomes, systems mapping, network analysis

SUMMARY
This presentation describes the research to develop an outcome-based participatory mapping approach to facilitate a holistic understanding and negotiation of multiple healthcare outcomes. It offers a new perspective on the role of outcomes for the (re)design of healthcare systems and provides practical applications and guidance.

BACKGROUND
Healthcare systems worldwide are facing critical and complex situations due to multiple drivingforces emerging from different stakeholders' purposes, values, outcomes, and regulations. These driving forces are sometimes conflicting, and stakeholders should dedicate time to understand and negotiate them. A participatory understanding of how outcomes are valued/prioritised by different stakeholders is needed to (re)design safer and better-quality healthcare systems; gain a holistic perspective of multiple outcomes, needs, and values; promote a sense of ownership, and engage stakeholders in long-term changes.
Human Factors-based systems analysis frameworks such as the Systems Engineering Initiative forPatient Safety (SEIPS) and Cognitive Work Analysis (CWA) have recognised outcomes as an essentialpart of system analysis. However, there is still a need to provide a holistic understanding of outcome interactions and define their role in healthcare systems design. Furthermore, limited practical approaches exist to understand, gather, discuss, negotiate, and communicate outcomes as interrelated systems.

Given this situation, this research aimed to fill that gap by investigating the role of healthcare outcomes as a system to be applied in the (re) design of healthcare systems and developed an outcome-based mapping approach for multiple stakeholder negotiation.

METHODS
This research followed the Design Research Methodology (DRM) (Figure 1). First, the literature wasreviewed to define a wide range of healthcare outcomes that concentrate on priorities, needs, values, and aims of patients with long-term conditions, families, healthcare providers and authorities. Existing mapping methods in the literature were then critically analysed to develop an initial approach. Subsequently, the outcome-based mapping approach was refined through multiple participatory studies (i.e., graphic facilitated interviews and mapping workshops) in the UK. Overall,87 participants took part in this research. Data that emerged from these studies were analysed in two ways. First, visual data (i.e., outcomebased maps) were synthesised through a bespoken network analysis to build outcome-based networks. Second, narratives and observations of the mapping process and visualisations were analysed using content analysis and map reconstructions to build a robust understanding of participants' reasoning. Finally, values were analysed by applying the Schwartz values framework.

RESULTS AND DISCUSSION
The research resulted in an outcome-based

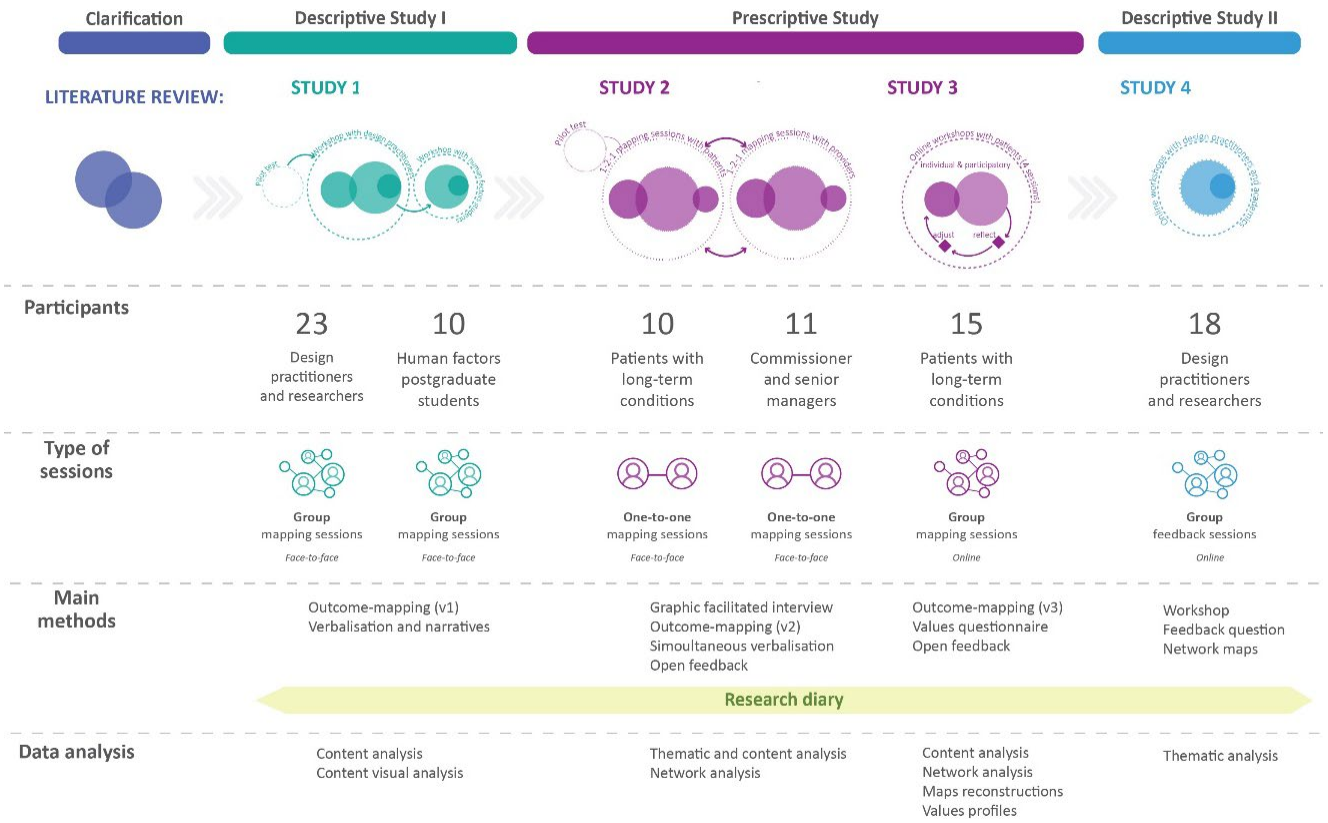

Figure 1. Summary of the methodology

approach that i) proposes a reconceptualisation of healthcare outcomes and ii) offers a practical dialogical mapping method to understand and negotiate outcomes with multiple stakeholders. First, the reconceptualisation acknowledges that outcomes are value-dependent, continuous adaptable and may not respond to the short/long-term structure. The bespoke network analysis accompanying the approach reveals tacit knowledge about outcomes 'as a system' that guides the identification of critical outcomes which can create propagation or become brokers. Furthermore, it identifies the implications of considering wellbeing as the system's purpose. In addition, the clarified role of values enriches participation (complexity sampling) and agrees upon high-level commitments. Secondly, the mapping method discards imposing a visual structure and instead, combines an open mapping strategy and promotes values reflection. This method encourages stakeholders to freely make sense of their priorities and negotiate their conflicts, trade-offs and enduring needs whilst balancing the power dynamics of participation.

CONCLUSION

This research offers a new perspective on the role of outcomes for the (re)design of healthcare systems and translates that knowledge into a practical approach. This approach helps to make sense of multiple outcomes, encourages value-level conversation, and redistributes decision-making.

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1.2 Consensus on bringing value-based healthcare into outpatient consultations

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KEYWORDS: value-based healthcare, VBHC consultation room, delphi, group concept mapping, conceptual map, operationalization

SUMMARY

The aim of this study was to reach consensus among clinicians about their and their patients' activities that underlay the ideal value-based outpatient consultation through a systematic approach, i.e. a Delphi study. After three rounds, an expert panel embracing 19 clinicians reached consensus on 63 activities to be important, two activities to be unimportant and they lacked agreement on 11 activities. Activities were thematically clustered into nine themes regarding: 1) empowerment, 2) patient reported biopsychosocial outcomes, 3) the patient as a person, 4) the patient's kin, 5) shared power and responsibility, 6) optimization, 7) coordination, 8) therapeutic relationships and 9) responsiveness to scarcity of resources in the health system. We conclude that value-based outpatient consultations require contextual decision-making, are person-centered and focus chronic attention to care optimization and wise allocation of scarce resources that benefits patient care as a whole. Results of this study contribute to calibrating, facilitating and strengthening clinicians' and patients' activities in Value-Based HealthCare.

BACKGROUND

Value-based HealthCare (VBHC) aims to organize healthcare around the multidimensional concept of 'value' (Porter & Teisberg, 2006). Overall, VBHC is about equitable provision of healthcare that matters to patients while using resources sustainably.
To provide healthcare that matters to patients, clinicians and patients are sought to communicate about value(s) (van Weert & Hazelzet, 2021). These discussions play a prominent role in outpatient consultations, which is hence considered an important place to pursue VBHC. To date, however, ambiguity prevails regarding what a value-based outpatient consultation ideally entails. This study seeks to reach consensus among clinicians about their and their patients' activities that underlay the ideal value-based outpatient consultation.

METHODS

A three-round online Delphi study was conducted in a Dutch university hospital that identifies itself as being at the national forefront in VBHC. The study took place between March 2022 and June 2022. For the first round, a list with activities was informed by content analysis of internal policy documents, video-recorded discussions and co-reflection with stakeholders. Subsequently, a purposive sample of nineteen clinicians from frontrunner VBHC teams judged each activity dichotomously in terms of importance, i.e. as being important or unimportant, and/or provided a comment. Experts could also suggest new activities. Consensus was declared at 80 per cent agreement. In the second and third round, response rates were 100 per cent and nearly 90 per cent respectively. Finally, thematic analysis was used to derive conceptual themes (Braun & Clarke, 2006).

RESULTS

The expert panel agreed upon 63 activities to be important and two activities to be unimportant

for the ideal value-based consultation. The latter pertained the burden of care for society and for the climate. No group agreement was reached on 11 activities. Disparity pertained, among others, regarding the role of experience measures, aggregated data and cost-consciousness. Thematic analysis of the activities that were considered important revealed nine themes regarding: 1) empowerment, 2) patient reported biopsychosocial outcomes, 3) the patient as a person, 4) the patient's kin, 5) shared power and responsibility, 6) optimization, 7) coordination, 8) therapeutic relationships and 9) responsiveness to scarcity of resources in the health system. Qualitive analysis of experts' comments showed that not all 63 activities are brought into practice in every consultation. On the one hand, clinicians practiced contextual decision-making by selecting activities that are appropriate for the individual patient in a particular situation. On the other hand, consultation system impediments, e.g. the lack of time and flexibility, withheld clinicians in enacting the full range of activities that they deemed value-enhancing.

DISCUSSION

This study reveals that a value-based outpatient consultation embraces a multitude of activities. Context determines what activities are brought into practice. A comparison of our results with previous care concepts shows that a value-based outpatient consultation is person-centered. Next to that, VBHC seeks clinicians to contribute chronic attention to improving care for the individual patient and allocating resources wisely. This implies that clinicians can build upon their person-centered care behaviors in their pursuit of value, supporting the care philosophy 'Person-Centered, Value-Based HealthCare' (PCVBHC) (Bedlington et al., 2021). Tensions may arise between humane care for the individual patient and cost-consciousness. Clinicians seem to circumvent these tensions by focusing on wise resource allocation that results in similar or improved patient outcomes.
Results of this study contribute to calibrating clinicians' and patients' activities in value-based outpatient consultations. Education may focus on how to deal with value trade-offs. Managers and designers may give thought to establishing supportive contextual conditions for VBHC. Implementers and researchers should acknowledge the multidimensionality of VBHC. Moreover, they should account for context, i.e. value depends on the appropriateness of activities as well as the quality of enacting these activities rather than the quantity of value-enhancing activities. Lastly, implementers may question to what extent it is realistic to 'implement' VBHC in its totality or whether their approach should be focused on strengthening value-enhancing behaviors.

CONCLUSIONS

A value-based outpatient consultation requires contextual decision-making, is person-centered and focusses chronic attention to care optimization and wise resource allocation that benefits patient care as a whole. To unleash the potential of VBHC in outpatient care, collaborative effort of clinicians, patients, educators, managers, designers and researchers is warranted.

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1.3 Analyzing the level of and designing interventions for child participation at a Dutch pediatric hospital by combining health management and industrial design

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KEYWORDS: pediatrics, child participation, value-based healthcare, health management, industrial design

SUMMARY
Child participation in pediatric care is generally considered insufficient, even though its value is acknowledged. Therefore, in this research we evaluate the current level of child participation at an academic pediatric hospital, and design interventions to improve it. Our results show that forcefully aiming for high levels of participation is unwanted. Rather, pediatric hospitals should strive for a better execution of desired participation. Our interventions stimulate desired participation by enabling the child to set goals for the meeting, prepare questions and provide personalized input through child-centered PROMS.

BACKGROUND
The value of child participation in healthcare is increasingly recognized in Dutch hospitals. Children do not only want to participate in their care, child participation also positively affects patient outcomes (e.g. Moore and Kirk, 2010). Child participation is a broad concept, which includes listening to the child and a range of decision involvement. In this research, we use the model of Shier (2001), who describes child participation at five levels: 1) children are listened to, 2) children are supported in expressing their views, 3) children's views are taken into account, 4) children are involved in decision-making, and 5) children share power and responsibility for decision-making. One author describes specific interventions for child participation: Schalkers (2016) proposes child-friendly information and tools to support the child to express its opinion during the consultation. Besides this, only general approaches for encouraging child participation can be found (see e.g., Coyne 2008). From this literature it can be derived that interventions could be aimed at providing information, or at acquiring or supporting the participation skills for each person in the child-parent-physician triad. Depending on the targeted person, information can either be focused on the condition and treatment or on child participation.

METHODS
The neurosurgery department of a large academic pediatric hospital in The Netherlands aspires to optimize child participation within their outpatient clinics. This study aimed to evaluate the current child participation level within the outpatient clinic patients, aged 6-12 years, and to design interventions to optimize this level of child

participation. To do this, the first three steps of a design study were conducted in this study: problem definition – analysis and diagnosis – solution design. Health management approaches were used in step 1 and 2 to analyze the level of child participation and explore possibilities for improvement. Data collection consisted of three parts: 1) a quantitative child-participation-survey for patients and their parents to evaluate perceived child participation levels; 2) 12 semi-structured interviews with professionals to get an understanding of their perspective on the current participation level and to discuss optimization possibilities; 3) a focus group with children of the Child Advisory Council to discuss interventions on optimizing participation. Hereafter, we used evidence-based industrial design to generate and evaluate interventions for child participation (step 3). Based on all data, we generated design requirements and designed interventions to meet those requirements. The interventions were evaluated by three experts: an industrial designer, medical professional, and educationalist.

RESULTS

The results from our survey shows that children participate at level 1-3 in Shier's model where they are listed to and their opinion is important but where they do not play a large role in decision making itself (n=31). Interviews with the professionals (n=12) suggest that such a role is not always desired and striving for the highest possible level of participation is unwanted. Our interviews with professionals and focus group with children (n=5) resulted in suggestions to improve child participation, which should focus on better execution of the desired participation levels. The professionals suggest that interventions that develop children's participation skills are needed, as well as child-friendly information about their condition and the upcoming visit. The children also want to develop their skills, especially for preparing the visit, and they want information that is directed at them instead of their parents. Besides this, children want a consultation with the professional without their parent. Our evidence-based industrial design process resulted in three interventions which are best combined for a better execution of the desired level of child participation, namely: a personal pre-visit agenda-setting document, a topic and question preparation aid and a child-appealing PROM.

DISCUSSION

Our results show that in pediatric hospitals, children should be listed to, asked for their opinion and their opinion should be considered in decision making; involving them in decision making and sharing decision power seems to be of lesser importance. This may be because of the complex nature of the healthcare decisions being made in pediatric hospitals, especially the neurosurgery department. Moving on to the interventions, we are the second to propose a child focused solution. Our solutions differ from that of Schalkers (2015) as it gives the child information personal information on its own visit, and it focuses on the acquiring of participation skills before the consultation. We propose to implement and evaluate both interventions in future research (steps 4 and 5 of a design study), to compare their effect on child participation. As the strength of this study is that the triad of child-parent-physician was involved, we advise to involve all stakeholders in implementation and evaluation as well. Limitations to our work also exist, the most prominent being the small sample size for the survey.

CONCLUSIONS

Based on our research, we suggest that interventions for child participation should not forcefully strive to involve children in decision making and to share power for decision making with them. Rather, they should improve the way children are asked for their opinion, listened to and the way their opinion is take into consideration. Interventions that are suitable for this focus on giving personal information and preparing the consultation.

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1.4 Applying the concept of value-based healthcare in insurance medicine: opportunities and challenges

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KEYWORDS: value-based healthcare, occupational health, insurance medicine

SUMMARY

The objective of this study is to identify opportunities and challenges in applying the concept of value-based healthcare within the practice of insurance medicine in The Netherlands. Professionals with an expertise in the field of insurance medicine (N=10) and professionals with expertise in the field of the VBHC concept (N=5) participated in both semi-structured individual interviews (N=15) and focus groups (N=2), for which preparatory information was provided. From the transcripts, opportunities and challenges for applying the VBHC concept in insurance medicine were deductively analysed based on the principles and components of the VBHC concept, including collaboration with other stakeholders, measure and learn from outcomes, measure and get insights in costs, payment system with the incentive towards value creation, and supporting IT platform. Identified opportunities included e.g.: the current client-centeredness within insurance medicine, the space for implementation of this concept given by politics, the improving acknowledgment of the importance of the topic work by the curative care, and the shift towards task delegation in sake of efficiency. However, the challenges considered included e.g.: the value of society does not always match with the clients individual values, limiting laws and privacy regulations, absence of an standardized client-centred outcome set, absence of financial incentive stimulating value creation, and difficulty to specialize on disease groups due to frequent comorbidity. Nonetheless, overall the considerations of the participants to apply the VBHC concept in the practice of insurance medicine were promising.

BACKGROUND

The value-based healthcare (VBHC) concept, focusing on maximizing the value for the patient,

is explained by essential principles (Porter, 2008) and key components (Lee & Porter, 2013) for implementation within the curative care sector. However, an increasing share of healthcare is provided extramurally, such as large parts of occupational healthcare provision including insurance medicine (IM), for which it can be debated whether the original description of the value-based healthcare concept and its principles fit the extramural healthcare setting. Therefore, the objective of this study is to identify potential challenges and opportunities for applying the VBHC concept within the practice of IM in The Netherlands.

METHODS

An explorative qualitative study was executed, in which two groups representing different perspectives were included: First, a group of participants with expertise in the field of IM (n=10). Second, a group of participants with expertise in the field of the VBHC concept and applying the VBHC concept within healthcare delivery (n=5). All participants (N=15) participated in an individual interview discussing opportunities and challenges, followed-up by focus groups which contained a mix of participants from both groups to combine expertise from both perspectives, reflecting and validating the identified opportunities and challenges. For both the individual interview and focus group, all participants received introductory information about insurance medicine or the VBHC concept respectively and an overview of the results from the individual interviews in advance. All individual interviews and focus groups were transcribed verbatim and thematic coding analysis was performed.

RESULTS

Opportunities and challenges for applying the VBHC concept in insurance medicine are identified for each of the VBHC principles and components, including six main themes: 1) The definition of value within insurance medicine, highlighting the current client-centeredness within insurance medicine and existing focus on quantity, 2) Collaboration with other stakeholders, promoted by the improving acknowledgment of the importance of the topic work by the curative care sector, and difficulty to specialize on disease groups due to frequent comorbidity in the IM population, 3) Measure and learn from outcomes, highlighting the need for a standardized outcome set and the difficulty of measuring patient satisfaction because of the influence of the disability benefit assessment outcome, 4) Measure and get insights in costs, calling attention on the shift towards task delegation in sake of efficiency and elimination of existing unnecessary care within insurance medicine, 5) Payment system with the incentive towards value creation collaboration and specialism, in which the absence of financial incentive within insurance medicine and the space for implementation of this concept given by politics is highlighted, and 6) A supporting IT platform connecting all stakeholders, in which one common language for all professionals over the full cycle of care is considered possible, however, implementing an IT platform for all these professionals is considered problematic due to limiting laws and regulations.

DISCUSSION

Because of the differences in structure in the practice of IM compared to the curative care sector, it was questioned whether the VBHC principles and its components could be applicable for utilization within IM practice. The opportunities and challenges identified in this study show that it is expected that applying the VBHC concept within IM would improve client-centered outcomes while reducing the healthcare delivery costs, which also applies for implementation in the curative care. However, more research is needed to gain better understanding of how to get around the structural differences with the curative care.

CONCLUSIONS

The application of the VBHC concept within the practice of IM is considered promising as value can be defined and created by the established principles. However, challenges which are identified

during this study need to be overcome before VBHC can be applied.

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1.5 Team cognition as a lens to evaluate handoff communication

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KEYWORDS: handoffs, care transitions, team cognition, epistemic network analysis (ENA)

SUMMARY

Handoffs are important to patient safety and include communication interactions that are examples of team cognition; thus, approaches to measuring, modeling and improving team cognition may help to measure, model and improve handoffs. In this pilot study, we explore the use of interactive team cognition to evaluate and improve simulated handoffs. Our results show team cognition models may be useful both to evaluate handoffs and to inform the design of improvement interventions.

BACKGROUND

Handoffs are important to safe, high-quality care and involve teams communicating to exchange information, authority and responsibility for patient care (Abraham et al., 2014) – in other words, engaging in team cognition (Wooldridge et al., 2022). Most measures of handoff quality rely on clinical outcomes that may be delayed or perceptions of participating clinicians. Measures of team cognition, based on team communication, would be process-based measures of quality and have been linked to improved team performance in domains outside of health care. In this pilot study, we explore thefeasibility of using measures of team cognition measures to evaluate handoff quality.

METHODS

We conducted five simulated handoffs of a trauma patient from the operating room (OR) to the pediatric intensive care unit (PICU) in a pilot study to relate measures of team cognition with perceived quality of and satisfaction with handoffs. Each simulation was audio and video recorded and transcribed by a transcription service. We conducted correlation analyses between perceived qualityand satisfaction with team cognition measures at the team level (i.e., total number of turns of talk,average number of turns of talk per clinician, average number of words per turn of talk, number ofinterruptions); we also conducted correlation analyses between perceived quality and satisfactionwith the number of clinicians (total), number of clinicians from the OR and number of clinicians fromthe PICU. Spearman rank correlation was used for all correlation analyses. Each turn of talk was coded with a framework of communication behaviors that constitute interactive team cognition; we then used Epistemic Network Analysis (ENA; Marquart et al., 2018) to quantify and visualize the communication interactions.

RESULTS

We found a significant, negative correlation between the average number of turns of talk per clinician and perceived quality of the simulated handoff. We observed negative correlations between total number of turns of talk, average number of words per turn of talk, number of interruptions, and perceived quality and satisfaction, and positive correlations between the average number of turns of talk per clinician with perceived quality and satisfaction. The network diagrams indicated differing patterns of team cognition. insurance medicine or the VBHC concept and an

overview of the results from the individual interviews in advance.

DISCUSSION

This study shows that measures of team cognition could be viable measures of quality in handoffs; similarly, network diagrams may be useful to visualize and evaluate handoff communication going forward. Further, our results support designing handoffs to include a smaller group of critical clinicianswith fewer, longer reports from clinicians in the OR followed by opportunity for read backs and rich interactive discussion to resolve questions. However, reducing the number of clinicians involved in the handoff to the point of creating additional handoffs and limiting interactive discussion could have negative patient safety implications, as each additional handoff is an opportunity for lost and/or incorrect information to be communicated – in other words, there is a tension between including the whole clinical team and overall quality and safety that must be considered.

Of course, this study is limited by the small sample size and nature of the simulated handoffs; further, participants are from one institution in one health care system, necessarily limiting generalizability. However, this was a pilot study to investigate the potential of using interactive team cognition as an approach to study, evaluate and improve handoffs – and our results indicate this is a potentially useful approach. Future work should involve a larger, more rigorously selected and diverse sample, as well as eventually take place in situ. Another potentially promising extension is to engage in more sophisticated, temporal analyses, explore the qualitative content of the handoff (i.e., communication behaviors and content), and relate resulting measures to objective measures of quality.

CONCLUSIONS

Interactive team cognition is a promising approach to study, evaluate and improve handoffs. In this pilot study, we showed that measures of team cognition can be linked to handoff quality – these may be more objective, real-time evaluative measures than retrospective chart review or perceptions. Further, they provide useful guidance to potentially improve handoffs, such as structuring handoff to include longer reports and rich, interactive discussions. However, as when developing any interventions, we must use system-based approaches to anticipate and minimize or eliminate potential negative consequences (e.g., reducing number of clinicians in a team handoff may increase the overall number of handoffs).

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2. Surgical Ergonomics

CONTENT

2.1 Can an ergonomic laparoscopic device with 360 degrees of freedom reduce surgeons' muscular load?

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KEYWORDS: minimally invasive surgery, physical workload, musculoskeletal pain

PURPOSE

Operating in minimally invasive surgery exposes surgeons for high physical and mental work demands. Surgeons report a pain prevalence of up to 93%, with alarming high intensities. The use of laparoscopic devices in the operating theater poses a static and fatiguing muscular load on the lower arm muscles. We investigated the effects of an ergonomically designed device (LAPO) with 360 degrees of freedom on muscular workload, rate of perceived exertion, and system usability scale.

METHODS

Twenty health science university students participated in a cross-sectional experimental setup with a conventional laparoscopic device (CON) and the ergonomically designed laparoscopic device (LAPO). Each device was tested in two simulated surgical sessions challenging fine motor skills and gross motor function, respectively. Surface electromyography (EMG) was recorded from the right forearm muscles, the shoulders, and the neck. EMG was normalized to maximal voluntary contractions, expressed as percentage EMGmax, and presented as static, median, and peak levels in an Amplitude Probability Distribution Function (APDF). In addition, participants were asked to rate perceived exertion (0-10 scale) after each test setup and complete the system usability scale questionnaire (0- 100 sum score). Setup and device were randomized and stratified between participants.

RESULTS

Participants (60% females) were on average 25□3 years old. Overall, the APDF demonstrated a static level of 1.1-6.1%EMGmax, a median level of 2.5-14.3%EMGmax, and a peak level of 3.5-26.4%EMGmax. The muscle activity was in general higher in the lower arm muscles compared with the activity in shoulder and neck muscles. The lower arm flexor muscle showed significantly higher activity in CON compared to LAPO; within the fine motor skills for all levels and within gross motor function for median and peak level. The lower arm extensor muscle showed significantly higher activity at static and median level within the gross motor function in LAPO compared to CON. The rating of perceived exertion increased significantly more during fine motor skill setup with CON (2.2+/-1.4) compared with LAPO (1.0+/-0.8). There was no difference in the sum score of the system usability scale between LAPO (74.5+/-19.4) and CON (74.9+/-13.0).

CONCLUSION

An ergonomic developed device with 360 degrees of freedom was found to have an alleviating effect

on the lower arm flexor muscle activity, as well as rate of perceived exertion compared with the conventional developed device. Further, both instruments were deemed usable. However, these results should be confirmed among experienced surgeons and preferably in real-live settings.

2.2 Experimental investigation of anthropomorphic forms of a forearm support of a surgical arm assistance system in precision tasks

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KEYWORDS: arm assistance system, exoskeleton, human-machine interaction, forearm support, anthropometry, laparoscopic surgery

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Laparoscopic surgery often results in static, uncomfortable arm and upper body postures, which lead to high stress on the surgeons' upper extremities. To counteract this, an interaction-based arm assistance system has been developed to physically unload the surgeon's upper extremities during laparoscopic procedures. This is achieved by actively supporting the forearms with a supporting force following the natural movements without restrictions. The release of the forearms from the system is achieved by a rapid vertical movement of the arms. The assistance system is controlled exclusively by a form fit and frictional connection of the forearms.

Within the scope of this research project, the interface parameter form of the forearm rest is therefore investigated on the basis of five anthropomorphic shape variants of the form with dynamic and static tasks.

The study shows an influence of percentile-adapted forms on the usability of forearm supports at an arm assistance system. The form percentile results in no correlation to the objective parameters examined in this study: the number of errors or errors per second. There are differences in the perception of comfort by different subject percentiles. The post-study survey shows that subjects prefer form percentiles close to their own forearm percentile and, on the other hand, find forms that are too large or small uncomfortable. Design recommendations and dimensional recommendations for the design of open anthropomorphic forms for the interaction with arm assistance systems are derived from the results.

2.3 Comparing the rotation calculations of finger joints: vectors versus local coordinate systems of finger segments

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KEYWORDS: rotation calculation, hand tracking, finger joints, euler angles

INTRODUCTION

Studies of finger movement are challenging due to the high degrees of freedom of human hands, and the knowledge is essential and it supports clinical diagnosis and hand-related designs, e.g., the design of implant replacement for finger joints or rehabilitation devices for finger movement. Current literature reported their measurements based on different measuring systems and rotation calculation methods. In most implementations, the calculation methods can be classified into two methods: representing each finger segment with a 3D vector or a local coordinate system (LCS). The study goal is to evaluate the difference when using these two calculation methods for the same movement

METHOD

We applied a hand tracking system to measure the finger rotation angles using five RGB cameras and nineteen ArUco markers. We adopted the x-orientation of the markers as the vector or the 3D orientation as the LCS to represent the corresponding finger segment. Ten participants were invited to the experiment with their consent. They performed both finger flexion-extension and adductionabduction. The distal interphalangeal joint (DIP), the proximal interphalangeal joint (PIP), and the metacarpal joints (MCP) of the 2nd to 5th finger were calculated using the captured vectors or the LCSs information. We compare the angles calculated from all collected frames and derived the analytical formulae to explain the difference.

RESULTS

The results of all collected frames are presented as the medium difference over the motion ranges. For the flexion-extension (flx-ext) movement, the differences were 17 / 85 degrees for DIP joints, 16 / 111 degrees for PIP joints, and 23 / 110 for MCP joints; for the adduction-abduction movement, the calculated radius-ulnar (rad-uln) angles deviated 13 /28 for MCP joints. The formulae suggest that the angles (0) calculated using vectors are related to the flx-ext angles (a) and rad-uln angles (b) extracted using the Euler angles, as $\cos(0) = \cos(a) \times \cos(b)$. If the rotation direction is known, the maximum theoretical difference can reach 15.8 degrees which matches the observed difference in the experiment.

INTERPRETATIONS

The assumption of using the vectors is that the joints only rotate along one axis during the movement,thus this method may include the rotation along both axes and overestimate the rotation angle. In conclusion, we suggest using LCSs and Euler angles to calculate finger rotation angles. This method is independent of prior knowledge of the movement, and Euler angles can classify the rotation axes even when the rotation along multiple axes occurs concurrently. Although the method using vectors theoretically agrees with the measurement using (elector) goniometer, the method with LCSs can cover more scenarios in describing the 3D rotation of finger joints efficiently.

2.4 Using inflatable cushions is significantly less straining than manually proning patients

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KEYWORDS: proning, EMG, inflatables, musculoskeletal disorders, health care professionals, patient transfers

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

For many health care professionals, transferring patients poses a substantial risk to develop musculoskeletal disorders. Reducing manual handling during these patient transfers by proper use of adequate tools can lower the number of injuries and the duration of unavailability for work. A challenging case for patient positioning is seen in spine surgery in the procedure that is known as proning: after sedation, the patient is rolled over and then positioned onto supporting thoraco-pelvic supports (the prone position). This way of patient positioning is normally carried out manually, where the patient is either tilted or lifted. In this study, we compare three proning methods: working with inflatables (one for the proning and another one for the prone position), manually lifting and manually tilting the patient onto the thoraco-pelvic supports. Surface electromyography of the m. erector spinae and the m. trapezius pars descendens is used to evaluate the effect of using inflatables for proning and prone positioning in neurosurgical procedures. Prone positioning with inflatables generally results in less strain (lower median as well as peak surface electromyography results) compared to positioning without inflatables. Compared to manual lifting the results where significant for all investigated muscles. Compared to manual tilting the results show also significantly lower muscle strain, except for the peak strain in the lower back. From the comparison between both manual methods (lifting and tilting), no preference can be expressed for either method.

2.5 Effects of intraoperative flow disruptions on provider and patient outcomes: A single-center observation study in robot-assisted surgery

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KEYWORDS: surgery, workflow, patient safety

BACKGROUND

Adoption of novel technological advancements in the Operating Room (OR) comes along with new challenges for surgical professionals, team work, work flows, and patient safety. Flow disruption events (FDs) are highly frequent across all surgical specialties and are suspected to jeopardize surgical quality of care and patient safety. Yet, limited empirical evidence of real world observations exists on the actual effects of FDs on provider and patient outcomes and about moderating factors in the context of the unique sociotechnical working system in the OR.

OBJECTIVE

Our investigation sought to explore the dynamic relationship of intraoperative flow disruptions with patient outcomes, staff workload and surgery duration.

METHOD

We set out a prospective single-center and multi-method study combining direct observations, clinical patient outcomes, staff and patient questionnaires. Ethical approval was obtained prior to data collection and patient consent was collected before day of surgery. Setting was an Academic Department for Urology of an Academic University Hospital. All data were collected in robot-assisted surgeries (da Vinci, Intuitive Surgical Inc.) between 01/2020 and 10/2021. FDs were assessed in the ORs via standardized observations using predefined source categories. Additionally, provider surveys were conducted after each surgery and patient outcome data was derived from hospital records. Linear and logistic regression analyses including multiple system factors were used to explore FDs' impact on surgical outcomes.

RESULTS

61 surgeries were included (all robotic-assisted radical prostatectomies). Altogether, 243 staff questionnaires were filled out (from surgeons, OR nurses, anesthetists). High rates of FDs were found that were comparable to the literature. Our multivariate regressions revealed no significant relationships with of FD rates with patient outcomes, i.e., complication rates. Equipment- and patient-related FDs were associated with increased staff workload. No association was found between higher rates of FDs and procedure duration.

CONCLUSIONS

We found no associations of FDs with patient outcomes of interest in our study. Our findings challenge previous assumptions concerning the detrimental effects of FDs for surgical safety. Despite the various limitations of our investigation, our findings call for further research into the mediating factors in the complex interplay between flow disruptions as well as human factors, OR teamwork and novel technologies in surgery.

2.6 Preventive initiatives are urgently needed – A survey documents high prevalence of pain among Danish Dental Care workers

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KEYWORDS: musculoskeletal pain, ergonomics, work ability

ABSTRACT

Previous studies have shown dentistry to be an occupation associated with prevalence of musculoskeletal pain (MSP) up to 98%, calling for preventive initiatives (Lietz et al., 2018).

PURPOSE

The aims of the present study were to confirm a currently high prevalence of MSP and to identify existing initiatives to reduce and prevent MSP among Danish dentists and dental hygienists.

METHOD

A cross sectional digital survey was conducted in SurveyXact and distributed via e-mail through the Danish Dentists Association and Trade Union of Danish Dental Hygienists. A link to the survey was sent to occupationally active and employed members of the trade unions. Reminders were e-mailed after 7, 14 and 21 days. The survey was composed of validated questionnaires (e.g., Nordic Musculoskeletal Questionnaire, Work Ability Index etc.) and self-made contextual questions tailored for Dental Care workers.

FINDINGS

In total, 1.123 dentists and dental hygienists in active employment responded to the survey, resulting in a response rate of 22%. The survey showed a 3-months MSP prevalence of 97%, and 81% reporting multisite pain. The overall work ability showed a mean of 8.3 on a 0-10 scale, while 92% stated to have a good or better overall health (Sf12- 1 Item). The mean of physical and mental sum score from SF12 were 50 and 48, respectively. Light activity in leisure time was performed for at least 2-4 hours pr. week by 92% of the sample. Surprisingly, 75% of the sample experienced their job demands as not only physically but also mentally demanding. The mean perceived exertion was 5.2 on a 0-10 point scale and 42% of the responders was sometimes or more often feeling stressed. As many as 87% of the responders reported to be sitting for ¾ or more of their working hours. Further, 62% reported doing repetitive arm movements for ¾ or more during working hours. Despite the high levels of physical demands only 20% had been offered physical exercise training as prevention of MSP at their workplace. Other preventive Initiatives such as ergonomic workshops, courses etc. were reported by 36%, while 53% reported ergonomic equipment being purchased.

CONCLUSIONS

The high prevalence of MSP among dentists and dental hygienists and the report of both physical

and mental demands in the occupation call for identification and implementation of effective preventive initiatives. The dental care workers reported an overall good health and were physically active in leisure time but may need exercise training more tailored to their work-related mental and physical exposure. Furthermore, a need for ergonomic initiatives (e.g., education/training) is indicated by the relatively low focus on ergonomic initiatives.

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3. Medication safety from the perspective of human factors: How to design safer systems for protecting patients and workers?

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SPECIAL SESSION

KEYWORDS: patient safety, medication safety, human factors and ergonomics, medication errors, adverse events analysis

SESSION AIM

Medication is one of the main interventions in healthcare. All medicines carry risk, which can harm patients directly. However, sometimes the risk is not caused by the medicine itself but by the complex system in which it is used with the interaction of many stakeholders like:

- Pharma industry: Designing medicines not only to be of adequate quality, but also to have good labelling, packaging and traceability, which all affect medication safety.
- Hospitals and pharmacies: Responsible to include good dispensing processes and assuring access of use for patients.
- Healthcare professionals: Responsible for prescription, dispensing, administration and monitoring. These activities for HCPs requires communication, leadership, teamwork and cognitive processes.
- Patients and Community: Patient engagement is a priority to ensure proper use of medications and optimizing monitoring of their own health condition.

The WHO has prioritized medication errors and issued the challenge "Medication without harm." HFE can play an important role in tackling this challenge. In our session, the attendees can understand:

- What is a complex system in healthcare specifically in relation to medication use?
- How such a system could be designed for medication safety?
- Real life cases of stakeholder initiatives for safer medication use.
- Evidence based decision making strategies for HCP for safe medication use.

For this session we invite you, experts from different disciplines and backgrounds, to join and talk about HFE and medication safety.

CONTENT

3.1 A unique international collaboration between pharmacovigilance and human factorscommunities

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KEYWORDS: pharmacovigilance human factors collaboration

GOAL

To demonstrate the synergy between different volunteer organisation who both want to optimise use of medicines.

INTRODUCTION

The International Society of Pharmacovigilance (ISoP) is a global not for profit organisation that aims to foster science and learning in pharmacovigilance in all countries. The society achieves this mission through networking and support, sharing of experience and knowledge, new research and ideas and arranging meetings, education, and affordable training. Ensuring the safe and effective use healthcare products is a key objective for all those who are members of ISOP. Because of the need reduce and mitigate medication errors, in March 2017, ISoP established a Medication Errors Special Interest Group (SIG) under the leadership of both Dr Brian Edwards and, latterly, Angela Caro. in autumn 2015, under the auspices of the Chartered Institute of Ergonomics and Human Factors, Dr Edwards had created a novel Pharmaceutical Human Factors group aiming to create synergies between the two groups. In addition, at the Annual Meeting of ISOP in 2019 a Latin American human factors network was launched - La Red Latinoamericana de Ergonomía y Factores Humanos (E/FH) en Sistemas de Salud (RELAESA) - who have active pharmacist members investigating medication errors.

METHODS

The ISOP Medication errors SIG has met monthly regularly and virtually. Developing external collaborations has been important with British Pharmacology Society and the International Medication Safety Network.

RESULTS

The activities the ISOP SIG have included

- Developing Social Media activities including infographics and free webinars to celebrate WHO Patient Safety Day across different time zones
- A coding and classification group to address unmet need in error classification
- Promoting Prescribing Safety Assessment Encouraging local activities in India, Egypt, Middle East, UK, China Latin America
- Disseminating and promoting the findings of the UK Healthcare Safety Investigation Branch
- Designing a process for evaluating training videos for adrenaline autoinjectors Developing user support programs by using human factors frameworks to identify gaps and weaknesses in approved product labelling such as incorrect administration of insulin into an arterial line resulting in falsely elevated blood glucose precipitating an inappropriate insulin.
- Sharing evidence about measuring human performance between manufacturing and healthcare

CONCLUSION

Having a chair in common between pharmacovigilance and human factor groups has led to sharing pf knowledge and experience resulting in successful contributions to projects designed to mitigate medication errors. Close collaboration between human factors and pharmacovigilance groups will help breakdown silos and tackle medication errors.

3.2 Using cognitive ergonomics and metacognition processes for understanding and improving medication safety systems

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KEYWORDS: cognitive drgonomics, metacognition, medication safety

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Introduction
Cognitive ergonomics implies understanding how people make decisions, and how to design safer systems for the people involved. Understanding how experts in medication safety management think and make decisions, give a new vision of how to design safer systems.

Methodology
A study was achieved for characterizing ergonomic cognitive and metacognitive processes developed by some experts in medication safety (pharmacists, doctors, nurses) solving problems related to unsafe medication (prescription, preparation, dispensing, and administration). Using a "think aloud" methodology was possible to identify how the experts think and which are the principles to have in mind for designing safer medication management processes.

Results
We found that the experts think about the goal in a task, balancing how to keep a Patient out of risk against it, this requires planning and developing task-oriented thinking in mitigating every risk rather than just performing the task. While monitoring the task, experts reflect on whether the patient is responding in the same way as would be expected. Any alteration of the medication's therapeutic effect may be the result of a possible mistake. They find a better way of controlling the task by taking alternative decisions using their knowledge and previous experiences for developing their task. Using a critical mindset, they modify their actions dynamically in the process. Finally, evaluation includes a metacognition process to identify improvement opportunities, which could be used in situations they might face later.

Conclusion
Using cognitive and metacognitive process descriptions is possible to design a safer medication system.

3.3 Work system analysis to explore the medicines management process in the nursing home setting in Ireland: A qualitative study using the Systems Engineering Initiative for Patient Safety model

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KEYWORDS: medicines management process, nursing homes, patient journey

SUMMARY

The medicines management process (MMP) in nursing homes (NH) is complex as it involves several stakeholders (professional and non-professional) interacting in a variety of work systems (WS) over space and time to attain safe and effective outcomes. Systems-based research can contribute to development of future interventions, policy and practice to enhance processes and outcomes.

BACKGROUND

The MMP encompasses several sub-processes and tasks, including assessing, prescribing, dispensing, delivering, storing, administering, reviewing and monitoring of medicines (Health Information and Quality Authority, 2015). The MMP in NH is inconsistent and challenging, in part due to the system consisting of multiple WSs and their component elements (mis)interacting, with consequent impact on the outcomes for stakeholders. The Systems Engineering Initiative for Patient Safety (SEIPS) is a 'human factor/ ergonomics' model framework developed to illustrate from stakeholders' perspectives, how work systems affect outcomes (Carayon, 2018). The SEIPS 3.0 focuses on the patient journey as they interact with multiple components in the process over space and time. Research approach: The aim of this study is to explore the MMP in Irish NHs using SEIPS 3.0 framework. The objectives are to a) explore the WS elements, interactions, and outcomes b) map the NH MMP c) identify barriers and facilitators to positive outcomes d) investigate the impact of COVID-19 on MMP.

METHODS

A qualitative study involving semi-structured interviews with individual stakeholders, including healthcare professionals (HCPs), residents and their families/relatives using the MS Teams platform is currently underway. Any stakeholder involved in the MMP in NHs is eligible for inclusion if they have at least 2 years' experience of working in, caring for a resident and/or living in NHs. Purposive sampling of stakeholders from a list of NHs and pharmacists is being used. Invitations to participate were also circulated to NHs by representative bodies, on social media and through the research team's personal and professional networks. A snowballing sampling is also being used where participants are

asked to forward research invitations to people who they think have experience of the topic. Four interview guides, based on the SEIPS 3.0, were developed in consultation with a Public and Patient Involvement panel for 1. person-in-charge (PIC), 2. nurses, prescribers and pharmacists, 3. residents and 4. their families. Data are being coded using Nvivo, and deductive analysis of data follows SEIPS 3.0 and the 'seven simple SEIPS tools' matrixes.

RESULTS

To date, interviews have been undertaken with PICs (n=7), pharmacists (n=5) and prescribers (n=1) and iterative data collection is ongoing. Key WS elements identified during the residents' journey in NHs were people, tasks, tools and technologies, and environments; people involved were 1. HCPs: nursing staff, prescribers-namely general practitioners, and pharmacists, and 2. non-HCPs: residents and their family/relatives; Multiple tools and technologies are used by HCPs, including audit tools and criteria, documentation records, phone calls and electronic software (e.g., secure email, Zoom, and medication administration software) to perform their regular MMP tasks; Finally, the journey happen at and are influenced by environmental contexts such as different care organizational conditions:internal organization of the NH, and other organizations of GP practices, hospitals and community pharmacies. These WS elements of the journey are embedded in external environments: professional regulators and legislation, and the COVID-19 pandemic. Our results reveal 3 key emergent properties of the processes that interact:

1. Communication dysfunction identified during interactions between people operating in and between multiple WSs and environments. This has affected HCP and resident outcomes, such as task duplications, increase workload and additional time taken to perform tasks, and reduced integrity of medication safety and increased medications error, respectively.
2. Use of technologies: COVID-19 triggered a change in legislation and allowed the replacement of manual process with the use of technologies, for example, to review medication online, discuss patient cases by video conferencing, and transmit prescriptions electronically using secure email. These changes were reportedly associated with improvements, for example, reduced time to conduct the named tasks, reduced communication burden and thus reduced the workload burden and improved medication safety.

DISCUSSION

The use of SEIPS 3.0 facilitated the identification of WS elements and environments embedding and influencing MMP in the resident journey. Miscommunication between different WSs interacting is a major barrier in the Irish NH context, which could be explained by the distinct identified organizations where HCPs are not formally a team but rather, they opportunistically work together in the shared interest of a single resident. Conversely, the use of technology facilitated the provision of the MMP and resulted in favourable outcomes. These results can assist in future interventions development and improving the practice and policies for stakeholders to aid safe delivery of processes. Further or potentially different attributes might be emerging when further interviews are undertaken and analysed. HCPs, residents and their families/relatives' interviews data will be gathered to help fully capture the MMP map and the residents' journey in Irish NH setting.

CONCLUSIONS

This is the first in-depth exploration and analysis of the MMP and patient journey in the Irish NH setting using a system-based approach. The patient journey in Irish NH care setting is complex and involve multifarious WSs interacting and impacting outcomes experienced by stakeholders.

ACKNOWLEDGEMENTS

The authors want to acknowledge Pharmaceutical Society of Ireland (PSI) and Nursing home Ireland (NHI) for assistance in the recruitment process, Elfrieda Carroll for supporting the interview topic guidedevelopment, and finally study participants for their time and input.

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3.4 Qualitative assessment of a new labelling design of injectable generic medicines

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KEYWORDS: safer medicines, safer labelling, vitalis

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Background
Medication label design is among the frequent contributing factors to medication errors in clinical practice settings. Several safety organisations have published recommendations on the design of optimal medication labels.

Objectives
This study aims to uncover perceptions of the new labelling design developed under those recommendations by a pharmaceutical company compared to its existing labels and characterise participants' opinions of usability and medication safety.

Method
A descriptive study using a structured version of the focus group method was undertaken. A convenience sample of twelve pharmacists and eight nurses with experience in medication management and working at two critical hospital departments (emergency and intensive care unit) were recruited and participated in four focus groups. Group discussions were audio recorded and thematically analysed.

Results
Several positive opinions on the new labelling were identified, from less effort in identifying critical information due to the use of colour, enhanced contrast and tall lettering for LASA medicines to improvements in participants' perceived safety. However, also feedback was received for those labelling features that still need improvement. This study provides evidence of the effectiveness of adopting the human-centred design principles suggested by medication safety agencies.

3.5 Generating design guidelines for alternative medication management tools from medical cannabis patients

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KEYWORDS: patient work, chronic conditions, home, alternative medicine

ABSTRACT

With increasing legalization across the world medical-grade, cannabis is becoming more available to patients as a treatment for chronic conditions. Evidence that cannabis can reduce opioid dependency has also led to recommendations that it be included in public health strategies to reduce the reliance on opioids for people that experience chronic pain. However, little is known about how prospective patients navigate the complex process of researching, procuring, and successfully using medical cannabis.

The purpose of this study was to understand how patients with chronic pain manage their symptoms with cannabis. Our goal was to use human-centered design approaches to develop design guidelines for tools that may support patients' use of alternative medicines. We conducted a secondary data analysis of 11 interviews with patients that consumed cannabis for chronic pain. Interview questions focused on symptom management, self-medication, and engaging with care providers about cannabis. Experience maps and personas were generated from the interviews to identify pain points in their experiences and to inform design guidelines.

Three coders used grounded theory methods to analyze interview transcripts. Coders focused on shared experiences between the patients to generate personas and then developed experience maps based on participants' experiences with using cannabis. Three categories of patients were identified from analyses: 1) Unmoderated and limited use, not monitored by healthcare, 2) Moderated use, some self-monitoring, not monitored by healthcare, and 3) Moderated and extensive use, monitored by healthcare. Out of 11 participants, two participants were identified as Type 1 users, three participants were identified as Type 2, three participants were identified as Type 3, and two fell across the multiple categories.

Experience maps were created based on the participants' prior exposure to cannabis, motivations for using cannabis, the extent of use, and how their consumption was monitored. Challenges identified in the experience maps were: (1) finding information about cannabis for pain vs other medications, (2) finding trusted information, (3) physicians and other clinicians being hesitant to recommend medical cannabis, (4) cost factors (5) need for monitoring by clinicians to advise patients about usage.

Without support from the healthcare system, patients must evaluate the medical research on their own, determine which of the >700 available cannabis products will best serve them, determine their own dosing, and track the effects of each combination of formulation or strain and dose on their symptoms. Patients essentially must take on the jobs of patient, researcher, pharmacist, and physician, with limited information and tools to

support them. Without proper tools or support patients face many risks from disengaging with healthcare professionals to experiencing unexpected side effects due to choosing the wrong dosage. Design guidelines for tools to support medical cannabis patient work will be discussed.

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4. Workforce safety and wellbeing as a driver for healthcare safety and quality: Convergence of human factors, workforce management, and safety management science

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SPECIAL SESSION

KEYWORDS: workforce safety, workforce wellbeing, patient safety, resilient systems, work system design in healthcare, COVID-19

SESSION AIM

Healthcare systems are complex, due to fast-increasing patient acuity, technology, new staff roles emerging, and upskilling of the existing workforce to face demands. Healthcare workers are hailed as "heroes" for managing to navigate this complexity and increasing job demands; nonetheless, reports of staff burnout, fatigue and turnover are at an all-time high, suggesting that praising workers is not an adequate strategy to support and retain them. In this sense, the COVID-19 pandemic has amplified issues of burnout and retention, and it has revealed that the system was already broken. Healthcare systems worldwide increasingly recognize the importance of supporting workforce wellbeing to achieve the best patient and system outcomes, yet most have addressed extreme fatigue and burnout with solutions targeting individual workers. Such solutions can be harmful because they imply that fatigue and burnout are a worker's problem, and it is their job to address it.

Drawing on frameworks from human factors and workforce management, we propose that workforce wellbeing and safety are not only an individual's responsibility, but firstly a product of resilient healthcare systems, that need to be designed to be conducive of workforce wellbeing and safety. We invite presentations for this symposium session that foster discussion and propose solutions on the following questions: How, drawing on safety management science, can we redesign our healthcare systems? What is the starting point if we want to improve workforce wellbeing and safety? What is achievable within the current global underfunding and under resourcing landscape?

CONTENT

4.1 When a patient falls: converging factors in preventing worker injury

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KEYWORDS: falling patient, falls rescue, worker safety

SUMMARY
This study surveyed 8 health professionals working in hospitals, aged care and the community on their experience with falling patients. The study highlighted key factors that are important to these clinicians in preventing an injury to themselves from a falling patient: specifically,the need for clear guidelines and training to support these guidelines.

BACKGROUND
Inpatient falls have been the subject of much research in recent years and considerable work has been done in hospitals, aged care facilities and the community to minimise the risk of patients falling and prevent patient harm from falling (Cameron et al., 2018). Despite these interventions, patients do still fall and for some falls, health workers are present and at risk of injury if they physically intervene to attempt to rescue the patient while falling (Pompeii et al., 2009; Whitby, L & McLachlan, C, 2014). The factors relating to injury risk for workers have not previously been explored. The objective of this study was to survey health professionals working in clinical roles to determine the factors they consider necessary to mitigate the risk to themselves from rescuing a falling patient.

METHODS
This cross-sectional study involved 8 healthcare professions working in the state of New South Wales, Australia during 2015: registered nurses, midwives, physiotherapists, occupational therapists, paramedics, podiatrists, optometrists and medical imaging technicians (radiographers). There were 8 factors identified through the literature that provided potential for reducing the risk of injury for workers, as distinct from the injury risk to patients. The study comprised an online, mixed-format survey, where respondents considered these factors in direct reference to their experience with falls rescue during 2015. The survey was distributed through each of the professional associations in early 2016. Unfortunately, some professional associations did not release information of the number of their NSW members, so sample size and response rate for all the professions surveyed are unknown. Logistic regression examined associations between respondents' characteristics and work-related factors.

RESULTS
The 8 factors identified from the literature were referenced against the healthcare worker's occupation, years' qualified, rescue experience or whether they had sustained an injury. Of those proposed, guidelines for safe practice and training were considered most important by all healthcare workers. Increased falls risk screening was considered less important by allied health professionals ($p < 0.001$, OR 0.53, 95%CI 0.37-0.75) and those who had rescued a falling patient

(p<0.001, OR 0.52 95%CI 0.39-0.67). Improved communication with patients was more important for registered nurses and midwives, and anyone who had rescued a falling patient (p=0.001, OR 0.64, 95%CI 0.49-0.83) or sustained injury (p=0.015, OR 1.96, 95%CI 1.14-3.37)). Improved communication between workers (p<0.001, OR 0.52, 95%CI 0.40-0.68), staffing (p=0.016, OR 1.42, 95%CI 1.07-1.89) and patient monitoring (p=0.014, OR 0.72, 95%CI 0.58-0.94) were more important to those who had had a fall rescue experience than to those who had not. Better workplace design was more important to all nurses and midwives compared with allied health professionals (p<0.001, OR 0.68, 95%CI 0.50-0.94).

CONCLUSION

While specific health professionals favoured particular interventions or considered certain interventions of less value, the study confirmed convergence amongst healthcare workers that preventing injury from a fall rescue requires clear guidance on how a falling patient should be managed, along with training to support that guidance.

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4.2 Patient handling in a general critical unit: an ergonomics evaluation guided by MAPHO tool

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KEYWORDS: patient handling, MAPO tool, ergonomics

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

The objective is to determine the level of exposure of workers to ergonomic risk through the application of the Handling and Assistance to Hospitalized Patient Tool (MAPHO). This is a descriptive cross-sectional study in a General Critical Unit of a private philanthropic hospital in the state of São Paulo. The study was carried out through the evaluation of the environment, work tools, dependency profile and aspects of work organization. A medium level of exposure of workers to ergonomic risk was determined, through the score obtained in the tool, mainly arising from the absence of employee training and insufficient number of assistive devices for lifting patients. The study confirmed the importance of health institutions investing in the acquisition of an adequate number of auxiliary devices for patient handling, in the adequate training of the nursing team and in adequate storage places for them in order to collaborate with occupational health. It is understood that this study will help in the elaboration of proposals for a local intervention directed to the critical information pointed out by the tool.

4.3 A multi-professional approach to investigating musculoskeletal injuries among medical radiation technologists: a case study for new equipment

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KEYWORDS: musculoskeletal, x-ray, multidisciplinary

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

A multi-disciplinary team of professionals applied ergonomic tools, and principles to investigate reports of musculoskeletal injuries among Medical Radiation Technologists (MRT), working in a designated X-ray imaging suite in an academic acute care hospital. Following this investigation, a proposal was submitted for the purchase of new X-ray equipment. This study demonstrates how end-users applied ergonomic and human factor principles during the new equipment selection process.

4.4 Human Computer Interaction (HCI) in general radiography: a case study to consider HCI factors when purchasing X-ray equipment

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KEYWORDS: HCI, x-ray, safety

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Human Computer Interaction (HCI) between medical radiation technologists (MRTs) and x-ray equipment influence the quality and safety of patient care with diagnostic procedures and should be considered during purchase of equipment. Practitioners from London Health Sciences Centre collaborated with a professor and students of the Fanshawe Advanced Ergonomic Program to complete a field study to identify HCI Factors in x-ray equipment that could be used as part of a hospital's centralized purchasing guide.

4.5 Shared Sensemaking and Clinical Decision-Making in Critical Care from a SA-oriented Dashboard

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KEYWORDS: clinical sensemaking, clinical decision support system, decision-making, intensive care unit (ICU), situation awareness

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

At the start of the COVID-19 pandemic, Intensive Care Units (ICUs) admitted an unusually high number of patients suffering from the most severe respiratory effect of the disease. The clinicians worked in teams in a context where resources were limited, and efficient resource management was key to ensure on-time healthcare delivery. Our team of researchers adopted the situation awareness (SA) model to design a SA-oriented dashboard. The main research objective was to improve clinicians' situation awareness, through the visualization of resource management key indicators to perceive on what is going on, comprehend its meaning and project future actions. A total of 17 clinicians participated to the dashboard design. We used the conceptual framework of the staff-stuff-space-system-of-care (4S) factors to resource management in critical care. A usercentred design method allowed to define the dashboard key indicators from the clinicians' situation awareness goals (perceive, comprehend, project) and 4S information requirements. However, the outcomes revealed that little was known on how the 4S factors to the clinician situation awareness contributed to a shared sensemaking and to clinical decision-making among the team members. We found a core factor to a shared sensemaking identified as "health Status at bedside". This 5th "S" factor informsthe clinician team on both the 4S (staff-stuff-space-system regulation) resources in used and the clinical condition at bedside. From then, we identified the 5S factors as the drivers of the clinicians' cognitive processes in critical care. We synthesized the research outcomes in the Situation Awareness and Shared Sensemaking Decision Model (SASS). We conclude by suggesting that much can be gained from the evaluation of the SASS model in critical care.

5. Artificial Intelligence

CONTENT

5.1 The implementation of AI in healthcare – implications for professional boundaries and different forms of boundary work

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KEYWORDS: healthcare professionals, boundaries, AI

SUMMARY

A digital transformation of Swedish healthcare is currently taking place, and artificial intelligence (AI) is meant to solve many of the healthcare sector's challenges. We conducted 26 semi-structured interviews with healthcare leaders and 18 with healthcare managers and professionals. The result shows that the leaders, healthcare managers, and healthcare professionals describe different types of boundary work in regard to the implementation of AI.

BACKGROUND

A digital transformation of Swedish healthcare is currently taking place, and artificial intelligence (AI) is meant to solve many of the healthcare sector's challenges. This change will allow caregivers to develop more accessible and personalized proactive care driven by various forms of AI-generated data. However, research on how employees experience technological development in their workplaces is limited, especially in the healthcare sector, where significant investments are made in digital technology. At the same time, few studies examine the effects of digitalization on the work environment (SAWEE, 2020). Professionals' work is traditionally surrounded by boundaries and construction and maintaining these boundaries around their area of knowledge is a fundamental part of their growth and development. Digitalization and implementation of various technical solutions can change professional boundaries and thus generate boundary work (Petersson, 2020). Langley et al. (2019) identify three conceptually distinct but interrelated forms of boundary work; Competitive boundary work, which involves people that are mobilizing boundaries around themselves, Collaborative boundary work, which involves people realigning the boundaries separating them from others to enable collaboration and Configurational boundary work which involves people designing boundaries to change patterns of differentiation among groups. The three different types of boundary work are often intertwined in practice. Configurational boundary work, however, can be described as a force that drives the other two categories of boundary work since it orients the actives of others (Langley et al., 2019). The authors conclude that there is a need for multilevel studies that establish connections between the different types of boundary work.

This presentation focuses on how the boundaries around the healthcare professionals' work could change in regard to the implementation of AI and what boundary work actors on different levels in a healthcare system foresee when healthcare becomes more data-driven through the use of AI analysis on healthcare data.

METHODS

We conducted semi-structured interviews with

26 healthcare leaders who were in a position to potentially influence the implementation and use of AI systems and 18 healthcare managers and healthcare professionals with connections to the emergency departments where there are plans to implement an AI algorithm to predict unexpected mortality after being discharged from the emergency departments. The interviews were analyzed using abductive qualitative content analysis. The deductive analysis was based on the three forms of boundary work identified by Langley et al. (2019), while the inductive analysis was based on the content of the interviews.

RESULTS

Our findings revealed three kinds of boundary work that the participants described.

1. Configurational boundary work where the leaders describe that they, consciously or unconsciously, want to change the boundaries around the work of primarily the physicians.
2. Collaborative boundary work where the healthcare professionals describe how they could collaborate with the AI system
3. Competitive boundary work where healthcare professionals mobilize boundaries around themselves and their work.

DISCUSSION

Overall, the result shows that the leaders, healthcare managers, and healthcare professionals describe different types of boundary work in regard to the implementation of AI. The leaders have the power to conduct configurational boundary work that transforms the boundaries around the healthcare professionals' work. The healthcare professional describes how the boundaries around their work could be changed by the implementation of an AI algorithm in their healthcare practice and what kind of collaborative and competitive boundary work could be the result of such an implementation.

The study's credibility was strengthened by the purposeful sample of participants with various experiences, and dependability was strengthened by using an interview guide to ensure that the same opening questions were put to all participants and that they were encouraged to talk openly. A limitation could be that all interviewees work in the same county council, so transferability to other county councils in Sweden must be considered with caution. The leaders' and the professionals' perspectives are highlighted in this presentation. However, the patients' and the relatives' perspectives are also crucial in the implementation process in healthcare. We look forward to studies where all these groups are included and where it is possible to study the result of implementing an AI system in healthcare practice.

CONCLUSIONS

The implementation of AI in healthcare could change the boundaries around the healthcare professionals' work and generate different kinds of boundary work that could affect the implementation. These findings can inform both practice and policy.

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5.2 Effects of an AI-based software on clinical workflow and clinician outcomes: A prospective observational study in radiological imaging

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KEYWORDS: workflow integration, artificial intelligence, radiology, workload, sociotechnical worksystem

SUMMARY

The study evaluates the implementation an AI software solution in radiology routine workflow. Due to a mixed method approach consisting of standardized observation, clinician questionnaires and interviews, and a pre-post-implementation comparison, a comprehensive picture of the changes in the workflow and their effects on clinicians is acquired. With our research we aim to amplify the knowledge on AI implementation into the sociotechnical work system in clinical care.

BACKGROUND

The use of artificial intelligence (AI) solutions in medicine is constantly increasing and promises the improvement of quality and safety of care, automation of routine tasks and increased efficiency (Ahmad et al., 2021). For largely image-based activities and diagnostic tasks like in radiology, AI promises to assess and process higher amounts of data in shorter time and has already been integrated into clinical routines (Ahmad et al., 2021; He et al., 2019). The successful implementation of novel technologies is not only dependent on technological features but also on a seamless fit into the existent workflow, as it is one of the main barriers in health IT adoption (Wolff et al., 2021). The introduction of AI in a clinical environment impacts a highly complex work system, with a wide variety of actors, technologies, tasks and environmental factors that are closely interrelated. Especially in clinical environments it is important to understand the influence of AI implementation on the different work system elements as they shape provider as well as care outcomes (Salwei & Carayon, 2022). However, systematic and real-world studies on AI introduction and ensuing effects on workflow and clinicians in routine care are scarce - especially as far as prospective studies are concerned. We evaluated over time the introduction of an AI-based software for the detection of abnormalities on prostate MRI-scans in a radiology department.

Our study aims to identify changes that are related to the integration of an AI-based software within this work system and to identify effects on radiologists. Specifically, it aims to: Document changes in the existing workflow in radiology and the interdisciplinary information transfer between radiology and urology, measure changes in physician's workload, stress, and satisfaction, as well as technology-related outcomes such as usability ratings and attitudes towards AI, and identify facilitators and barriers that influence the integration and adoption of AI in clinical practice.

METHODS

A prospective observational study with a multi-method design combining standardized methods of observation, questionnaires and qualitative interviews is conducted at a university hospital in Western Germany. The study population comprises the entire team in the radiology department interacting with the novel AI software, consisting of approximately eleven clinicians. Our observational data draws upon on an interrupted time series study design, treating the different cases as measurements (i.e., before and after implementation with 50 measurements, respectively). Our study consists of two phases: The pre-introduction phase to record work processes through standardized expert observations, measuring workflow throughput-times and obtaining clinicians' standardized appraisals on stress and workload. In addition, radiologists are interviewed on their satisfaction, attitudes towards AI and expectations of the AI-software. In-between the two study phases the AI-software is introduced and sufficient time will be given to familiarize with the software and adapting the workflow. Post-introduction, the identical observation procedure serves to measure potential changes in the workflow. In addition, process factors for the integration of the AI solution are surveyed in interviews with clinicians.

RESULTS

At baseline, we observed 50 prostate MRI case with a mean process duration of 999.58 seconds (approx. 16.5 minutes; SD 380.97 seconds) and mean reported workload of 34.98 (SD 13.78) on the NASA task load index. Qualitative interviews with ten radiologists on different career levels before AI implementation showed an overall positive attitude of the clinicians towards AI in general and the MRI-Software. All interviewed clinicians were hoping for an increase in efficiency and 50% of the interviewees also expected a more standardized workflow and reporting of patient outcomes. 60% of the clinicians mentioned that they do not believe that AI will substitute radiologists in the future. Post-implementation data collection is ongoing (7/2022).

DISCUSSION

This study addresses the current research gap on clinical AI solutions and their impact on the work system and clinicians. Our findings facilitate a deeper understanding of the effects of AI introduction on clinicians and their routine workflow. Our study contributes prospective observational data based on a pre-post-design in a real-world-application of an AI software with very high ecological validity. Even though our study is a single-center study with a specific use case, due to the mixed-method approach we hope to derive valuable information with high external validity to other areas of AI-integration in highly complex sociotechnical work system in clinical care. Moreover, we identify facilitators and barriers of a successful implementation of AI in clinical practice that can be transferred to future implementation processes of AI-based technology in healthcare settings. Our findings may inform best practice recommendations that can be considered during early stages of AI-implementation processes, and therefore increasing the possibility of a successful adoption.

CONCLUSIONS

The study addresses the lack of studies concerning human-factors when evaluating real-world applications of AI in healthcare and assesses prospective effects of AI implementation on clinician outcomes and their workflow.

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5.3 A participatory systems approach to the development of human-centred AI in healthcare: a framework for developing an AI analytic-based care supports for/with people with intellectual disabilities (ID) and multiple long-term conditions (MLTC)

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KEYWORDS: human-centred design, care coordination, learning disabilities

SUMMARY

There is an increasing recognition that it is important to integrate AI into healthcare workflows incollaboration with healthcare professionals and patients/carers. This paper proposes a framework which has been developed to apply a participatory systems approach to the development of a safe, ethical and human-centred AI-based applications in healthcare for people with learning disabilities

BACKGROUND

Expectations for the use of AI in healthcare are high. The focus of AI development has been often narrowly on the performance of AI algorithms, so the aspiration to develop safe, ethical and humancentred AI in healthcare is currently weakened. There is an increasing recognition that it is essentialto consider the real challenges of integrating AI into healthcare workflows in collaboration with healthcare professionals and patients/carers. Some efforts have been made to propose key human factors principles and methods relevant to the design of AI in healthcare (Matheny et al., 2018), but it is important to demonstrate how these principles can be put into practice in AI development.

The aim of this paper is to present a participatory systems approach-based framework the research team developed for their UK's NIHR-funded research project, DECODE (2022-2024). The overall research project aims to apply machine learning approaches to identify clusters and trajectories of multiple long-term conditions in people with intellectual disabilities (ID) and to utilise this new

knowledge to develop actionable insights and practical usage scenarios for effective care coordination to improve the health and wellbeing of people with ID.

METHODS

The research team with expertise in clinical science/ practice, data science, AI, medical informatics, human factors, design, ethics and qualitative research and carers with lived experience of caring people with ID developed this framework for DECODE. It went through several iterations to develop a shared understanding among the team members about data, AI, clinical context and ethical issues.

RESULTS

The AI development framework we are proposing consists of the following five steps.

Steps	Objectives	Methods
1. Context Analysis	Understand the context of AI application by investigating existing barriers and enablers for care coordination	- Narrative review of existing policies - Reflective semi-structured interviews with relevant stakeholders - SEIPS model and tools (Holden & Carayon, 2021) for data collection and analysis
2. Data Cleaning/AI Analytics	Prepare data for AI application and identify clusters and trajectories of multiple long term conditions from data	- Data mining - Bias mitigation - Suitable AI algorithms
3. Visualisation	Develop user-friendly visualisations (interactive dashboard, informatics and narratives) to display the outputs of AI analysis in a meaningful and accessible way	- A series of focus groups with for health and social care professionals and people with ID and carers to iteratively prototype various types
4. Actionable Insights	Co-develop actionable insights and practical usage scenarios	- A series of participatory design workshops with various stakeholder groups: i) patients; ii) family carers; iii) health and social care professionals; iv) charities and policymakers; v) innovators. - Various design methods: persona; 'How Might We' questions; journey maps and interaction maps
5. Feasibility and Risk Assessment	Evaluate the feasibility and ethical/legal risk of the usage scenarios	- World Café approach (Brown & Isaacs, 2005) to engage large groups of participants together from different backgrounds and encourage participants to be actively empowered over the focus of conversations

DISCUSSION

DECODE will be conducted based on this framework and the research team intends to learn about how useful and usable this framework is for this particular project. The team will consider how transferable this framework will be for other AI development in healthcare and beyond.

CONCLUSIONS

A framework has been proposed to apply a participatory systems approach to the development of a human-centred AI-based applications in healthcare

ACKNOWLEDGEMENTS

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5.4 Integration of co-production processes in implementation of Artificial Intelligence in Health Care Practice: A research program

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KEYWORDS: artificial intelligence, co-production, healthcare, implementation, research program

SUMMARY

Research have shown a general lack of AI-specific implementation theories, models, or frameworks that could guide translation of AI applications into daily healthcare practices. This paper outlines the work within a recently initiated research program aiming to address this lack of knowledge to support development of research and practice on co-produced implementation of AI in healthcare.

BACKGROUND

Recent studies have shown a lack of AI-specific implementation theories, models, or frameworks that could provide guidance for how to translate the potential of AI into daily healthcare practices (Gama et al., 2022). For AI to be successfully introduced to change clinical practice, we need to understand current practices and the contexts in which those practices are conducted, as well as how AI would fit with or change those ongoing practices and processes (Petersson et al., 2022). However, the experiences of the professionals and patients who will use a particular AI application are often overlooked (Alhashmi et al., 2020). This has highlighted coproduction as a key factor for successful implementation in healthcare and has put focus on the development of effective strategies to ensure value creation resulting from the use of the implemented AI applications (Batalden et al., 2016). In July 2021, we initiated an eight-year-research program at Halmstad University to conduct multidisciplinary research grounded in co-production with researchers, healthcare professionals, patients, and industry partners. The overall aim of the program is to address lack of knowledge in research and practice on implementation of AI in healthcare.

METHODS

The program is divided into three specific stages, aiming to; 1) develop a theoretically informed framework for AI implementation in health care that can be applied to facilitate such implementation in routine health care practice, 2) carry out empirical AI implementation studies, guided by the framework for AI implementation, and generate learning for enhanced knowledge and operational insights to guide further refinement of the framework, 3) apply the developed framework in clinical practice in order to develop regional capacity to provide the practical resources, competencies, and organizational structure required for AI implementation (Svedberg et al 2022). The program will follow an established process of working in co-production to create understandings based on multiple perspectives and to strengthen stakeholders and users input throughout the research process. The research program is part of a regional and national initiative to build infrastructure to support the

implementation of AI into practice. It builds on multidisciplinary national and international collaboration between academics, public and business partners that have appointed implementation of AI in healthcare as a prioritized cooperation area for research and innovation.

RESULTS

The three stages of the research program constitute components of a logic model focusing on theory driven and co-produced framework development (Svedberg et al 2022). The activities are based on both knowledge development, utilizing existing theory and literature reviews, and method development by means of co-design and empirical investigations. The activities involve researchers, healthcare professionals and other stakeholders, creating multi-perspective understandings of how the implementation of AI systems should be approached to increase the likeliness of successful implementation and application in clinical practice. The framework development spans across the logic model. The first stage, will focus on; a) identifying evidence to inform the methodological framework, b) developing the methodological framework, and in the second stage; c) evaluating and refining the methodological framework through empirical studies (McMeekin et al 2020). The third stage of the logic model focus on the practical application of the developed framework in clinical practice. This stage lies further ahead in time and requires work that is more closely integrated with quality improvement work in clinical practice. For the knowledge developed in this research program to support implementation of AI into practice, the research approach builds on co-production involving all actors who are needed for the practical use of the knowledge in sharing their perspectives, knowledge and experiences. These actors include management roles at political, strategic and tactical level, clinically active healthcare staff representing the various healthcare professions, private actors from business and the non-profit sector as well as people representing patients, relatives and the general public. Their participation and contribution to the results from the two initial stages is crucial for them to be able to take over the ownership of development and management of the continued implementation work in stage three.

DISCUSSION

In summary, the research program will advance theory and empirical evidence on the implementation requirements of AI systems in healthcare, as well bringing opportunity to combine insights from research on the development, introduction, and evaluation of AI systems and existing knowledge from implementation research literature.

CONCLUSIONS

This research program will contribute to the development of AI-specific implementation theories and frameworks developed in co-production with the stakeholders relevant for its use and thereby augment implementation of AI applications in healthcare

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5.5 Accountable risk management in healthcare during the COVID-19 pandemic; the role of STSA and AI

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KEYWORDS: STSA, AI, infection prevention control, COVID-19, accountable risk management

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Effective governance in STS requires the distribution of accountability for all outcomes (positive and negative) and deeper understanding and practices of accountability, beyond the usual perspectives rooted in compliance with rules, regulations and procedures; particularly as adverse events are generally the result of a combination of human, organisational, technological, and economic factors. This study explores the use of STS analysis (STSA) in an Artificial Intelligence platform called Access-Risk-Knowledge to go beyond established accountability frameworks by facilitating the linking of evidence, outcomes and accountability. The aim of this study is to extend and deploy the ARK Platform to support mindful risk governance of infection prevention and control (IPC) for healthcare organisations during the COVID-19 pandemic. The platform was deployed across three healthcare organisations; fire and emergency medical services, outpatient dialysis unit and a large acute hospital. Three organisationally-based projects were compiled into a synthesis project. A set of guidance principles for a pandemic preparedness strategy were proposed. A Community of Practice enabled the successful deployment of ARK, including intense interdisciplinary collaboration and facilitating practitioner-researchers in the implementing organisations. Data governance methods and tools supported a whole organisation and multi-organisation approach. This first full implementation trial of the ARK platform deploying a dedicated STSA within a semantically structured AI framework demonstrates accountable risk management that addresses the complex antecedents of risk, links to evidence, and has the potential for managing the full cycle of risk mitigation and improvement, in the context of a multi-project strategic risk profile.

5.6 Qualitative investigation of the novel use of shopping loyalty card data in medical decision making

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KEYWORDS: medical decision making, qualitative methods, clinical pathways

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

This paper describes early results of a small qualitative study investigating the potential impact of shopping loyalty care data (SLCD) in the diagnostic pathway for ovarian cancer. There is early evidence that pharmaceutical products such as pain relief and medications for irritable bowel syndrome and bloating are bought by women to manage the early symptoms of ovarian cancer. Designed to be a formative interview study, two General Practitioners (GPs) in England were recruited to discuss the current pathway of ovarian cancer from a primary care perspective and to consider the value and impact of SLCD in medical decision making and its potential role in supporting improved referral times and patient outcomes. The findings indicate a potential role for SLCD, specifically in extending the diagnostic pathway to support earlier health information seeking and consultation with GPs. Communication with patients about this would need considering in regards to well established understanding about personal health behaviors and the wider system of primary and community care.

6. Informal Care & Care at Home

CONTENT

6.1 Care partner's experience with care received in the emergency department

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KEYWORDS: patient experience, care partner, emergency department, care transitions

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Patient satisfaction is becoming increasingly viewed as a key component of high-quality care. The literature has shown relationships between high patient satisfaction and improved patient and hospital outcomes, including profitability. During their journey, patients are often accompanied by a significant other, family member or friend (care partner) when they go to a medical setting to receive care. Although very important in the patient work system, we know relatively little about who these care partners are and how they experience the care the patient receives. In this study, we examine the experience of care partners of older patients who present to the emergency department (ED) with a fall.

6.2 Understanding the contextual factors that influence the use of technological interventions that support caregivers of persons living with dementia

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KEYWORDS: work-systems, dementia caregiving, consumer health information technology

SUMMARY

Alzheimer's and dementia caregiving is primarily done by informal caregivers that are often untrained and unsupported. While technology has the potential to help, many existing interventions remain unadopted. Context of potential users influences adoption and hence it is important to understand the contextual factors of informal caregivers of dementia that influence adoption and use of interventions. Our study identifies 36 contextual factors that influence the use of technological interventions that support caregivers of persons living with dementia.

BACKGROUND

An increasing population of 16 million informal caregivers in the United States provide an estimated 15.3 billion hours of unpaid care to persons living with dementia (PLWD) ("2021 Alzheimer's Disease Facts and Figures", 2021). These caregivers provide the majority of care for PLWD but they do not have the training, support, and resources they need. Thus, many caregivers experience suboptimal outcomes such as stress, depression, and burnout as they encounter caregiving challenges. While technological interventions have shown potential to improve certain outcomes, caregivers continue to cite persistent unmet needs and many existing interventions remain unadopted (Christie et al., 2018). Research indicates that the alignment of technology with the context of potential users influences its adoption. Context is conceptualized as a structured work system of interacting components of person, tools, tasks, and environmental factors in which caregiving work takes place. Hence, it is important to understand the contextual factors of caregivers of PLWD to design interventions that are successfully adopted. The objective of this study was to identify contextual factors that influence the use of CareVirtue, a web-based app designed to support dementia caregivers through a communication and coordination platform.

METHODS

We conducted a qualitative descriptive study using semi-structured interviews with 51 self-identified primary caregivers of PLWD conducted after 60 days of CareVirtue use. The purpose of the interviews was to explore factors influencing use of CareVirtue. We conducted a deductive content analysis guided by the Patient Work System (PWS) framework (Holden et al., 2015). The PWS depicts caregiver work as a structured work system consisting of interacting components- tools, tasks, person(s), and socio-cultural, organizational, and physical-spatial

factors. We then used team-based affinity diagramming to categorize the coded data to identify categories of contextual factors within each of the PWS components that influence use of CareVirtue

RESULTS

We identified a total of 36 categories of contextual factors influencing use of CareVirtue across the 6 patient work system components. We identified 15 tool factors including ease of access to other tools and integration of CareVirtue with existing tools, 6 socio-cultural factors including local regulations and resources, family dynamics, and personal norms (e.g., spirituality), 5 person factors related to the primary caregiver including technology trust and technology engagement routines, 2 person factors related to the PLWD including tool preference and dementia stage, 4 organizational factors including number of care network members and existing communication routines, 3 task factors related to integrating CareVirtue with existing routines, and 1 physical-spatial factor related to fixed vs movable devices.

DISCUSSION

Our findings identified the work system factors that influence the use of a technology intervention in the caregiving context. Our findings suggest that to improve adoption, intervention design should consider existing tools and routines of both primary and other caregiving network members. While our study identified many factors that influence use, next steps should identify which are the important factors and how they influence use for more specific design requirements of interventions.

CONCLUSION

Our findings suggest that using a work-system based approach provides an understanding how the caregiving context may influence adoption of caregiver technology interventions. Additionally, it canprovide important insights into design requirements to improve future versions.

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6.3 The use of photo/video elicitation as a method of data collection to explore laypeople's household medication management: a realist synthesis to explore methodological, practical and ethical considerations

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KEYWORDS: value-based healthcare, occupational health, insurance medicine

SUMMARY

Photos and videos have been used to explore medication management tasks performed by laypeople in the household setting. These have predominantly been used to triangulate with other data sources, or to elicit routines or understanding from study participants. The available literature supported the development of several theories across the ethical, methodological and practical domains. These theories may guide and are available to test in future research.

BACKGROUND

Despite its benefits, medication use can cause harm and impose significant 'medication work' burden on patients and laypeople in domiciliary settings. Hazards in the organization and self-management of medication in the home have been identified (Dew et al., 2014). Preventing such hazards requires first understanding the 'work system' in which laypeople organize and use medication at home and in personal spaces. The use of photos and videos may add value to such analysis. However, the use of such sensitive and personal data raises potential ethical, methodological and practical concerns and therefore merits critical appraisal to support future studies.

METHODS

This study employs realist synthesis to explore what works, for whom and in what circumstances about using photos/videos in research investigating medication management in the home. The search string and eligibility criteria addressed five concepts: (1) qualitative study design, (2) photo/video, (3) medication management (4) in a personal context and (5) by laypeople. The search was applied in Ovid Medline, CINAHL, Web of Science, Embase and PsycInfo. Identified studies were combined, de-duplicated and imported into Covidence to support management. Title/abstract and full text screening was independently conducted by both authors. Data were extracted using a pre-defined template. Synthesis used a realist approach to generate theories, expressed as context-mechanism-outcome configurations (CMOCs) explaining methodological, practical and ethical contexts and mechanisms that influence the

outcomes of this approach (Wong et al., 2013).

RESULTS

Of 1119 articles reviewed, 14 manuscripts describing 11 studies were included, with varying data richness to support CMOC generation: rich n=4, moderate n=3 and limited n=7. The 14 manuscripts represented two protocol papers, one reflection paper and 11 findings papers published between 2010–2022 and undertaken in North America (n=5), Europe (n=5), New Zealand (n=2), South Africa (n=1) or across multiple countries (n=1). Photo/video data enhanced exploration of medication self-management (n=7), general self-care behaviours including medication management (n=2), medication adherence (n=2), storage (n=2) or packaging (n=1) and intervention design to optimise medication use (n=1). Most studies were based in the participant's home (n=9), while two explored the home and other personal spaces. Photos/videos were recorded by researchers (n=5), participants (n=4) or both (n=2). Visual data were coded, analysed and triangulated with other data sources (n=8), and/or were used to elicit participants' understanding and insights of the topic under study (n=7). Study participants were either exclusively patients (n=8), householders (n=1) or a mixture of patients and caregivers (n=2). The patient population included children (n=1), householders (n=1), older adults experiencing chronic illness (n=6), people experiencing homecare (n=1), dementia (n=1) and chronic myeloid leukaemia (n=1).

Several program theories were identified. For example,

- PRACTICAL- to support participants to collect adequate photo/video data, researchers should provide camera or recording equipment and deliver training about how to use the equipment; to enable vulnerable patient populations, for example children or people with dementia, to engage with the research, participant dyads of patients and informal caregivers should be recruited.
- METHODOLOGICAL- to optimize the richness of observations, photo/video data should complement other data sources such as interviews, field notes or solicited diaries; to gain a deeper understanding of study participants' routines, knowledge and insights, recorded photo/video data should be presented to participants and discussed; to reduce researcher bias and to increase participant engagement, participants should be invited to take the photos/videos themselves.
- ETHICAL- to comply with data protection regulations and support participants' privacy concerns, photos/video should not capture individuals or personal data, or should "blur" these; to support privacy, those taking the photos/videos should receive instruction about what to/not record; to optimise research governance, study participants should be informed specifically and provide consent explicitly for data to be captured by photo/video.

DISCUSSION

Photo/video data are commonly used in qualitative medication management research in the home and add value, either as a complementary data source or as material to support elicitation. This review was strengthened by dual study selection and extraction. The richness of the data in the included studies was low, which limited the insights gained about photo/video data in this context. Future studies could provide more detail about the methodological approach, outcomes, strengths and limitations of using photo/video data. Future work will elicit further insights by interviewing authors of the included studies.

CONCLUSIONS

Photo/video data are useful for exploring medication work systems in the home and can be used as a source of data themselves or to elicit study participants' views. The theories developed in this study may guide and are available to test in future studies using this approach.

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6.4 Exploring work system barriers and facilitators and family-generated strategies in caring for children with tracheostomies

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KEYWORDS: work systems, caregiving, strategies

SUMMARY

Caring for children with medical complexity (CMC) is burdensome work, rife with challenges that family caregivers must overcome. Using a work systems approach to identify 'barriers' and 'facilitators' (B&F) to the care work that families perform can provide a basis for redesigning the system to better support that care work. We conducted an analysis of in-home contextual inquiry interviews of family caregivers of CMC (n=9) to look for co-occurrences of B&F to, and family-generated strategies for, using tools and technologies. We identified 11 co-occurrences of B&F and strategy codes, 20 co-occurrences of barrier and strategy codes, and 140 co-occurrences of facilitator and strategy codes. Our results indicate a significant overlap in facilitators of tool and technology use and family-generated strategies; suggesting that families capitalize on work system facilitators to design a care work system that fits their life.

BACKGROUND

Families caring for children with medical complexity (CMC)--children with multiple chronic conditions who often use assistive medical devices--face challenges in providing necessary care (Berry et al., 2015). The field of patient ergonomics offers a framework for identifying these challenges or 'barriers' and their counterparts 'facilitators,' by conceptualizing caregiving as work (Holden et al., 2020; Ponnala et al., 2020). A work systems approach can then provide the basis for redesigning the system to better support care work. Our objective was to identify barriers and facilitators (B&F) to using tools and technologies and their influence on the use of strategies to inform system design.

METHODS

We conducted a secondary analysis of in-home contextual inquiry interviews (n=9) with families of CMC enrolled in a Pediatric Complex Care Program in the Midwest United States. Participants were located within a 1.5-hour drive from the hospital, spoke English, and cared for a child with tracheostomy. Families walked interviewers

(n=2) through the home and demonstrated daily care followed by a semi-structured interview. The interview guide was developed using the Systems Engineering Initiative for Patient Safety (SEIPS) 2.0 (Holden et al., 2013). Interviews were recorded, transcribed, and uploaded to NVIVO for analysis.

Data were analyzed using a team-based, directed content analysis for B&F to tool and technology use and related strategies. Strategies were defined as "a goal-driven adaptation to an aspect of the work system to overcome any obstacle percieved as preventing that work system from achieving its goals." Coded text was reviewed for co-occurrences of codes to explore relationships between B&F and strategies.

RESULTS

We identified 11 co-occurrences of B&F and strategy codes, 20 co-occurrences of barrier and strategy codes, and 140 co-occurrences of facilitator and strategy codes.

DISCUSSION

Our results indicate a significant overlap in facilitators of tool and technology use and family-generated strategies. This suggests that families capitalize on work system facilitators to design a care work system that fits their life. Identifying strategies and facilitators may be a more effective way to identify barriers or configurations of barriers that can often be difficult for families to articulate. Thus, studying family-generated strategies can offer deeper insight into the challenges families caring for CMC face in their work system by pointing to the most impactful barriers and by suggesting potential ways to re-design the system.

CONCLUSIONS

Families caring for CMC must develop strategies to provide necessary care. While strategies have traditionally been conceptualized as a response to a work system barrier, our findings suggest that many family-generated strategies capitalize on work system facilitators. Studying work system facilitators in addition to work system barriers could provide insight into family-generated strategies that address barriers and configurations of barriers that are more complex and harder to articulate.

ACKNOWLEDGEMENTS

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6.5 The effect of psychological scarcity on health decisions of rural residents in China: preliminary results

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KEYWORDS: psychological scarcity, cognitive function, health decision-making, health intervention

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Economic studies have shown that living in poverty may produce a subjective feeling of scarcity, which affects people's cognitive functions and decision-making. Understanding this mechanism could inform healthcare designers on designing inclusive health interventions by considering the psychological scarcity and limited cognitive resources of impoverished individuals. We conducted a psychological experiment to test the impact of psychological scarcity on cognitive function and health decisions of rural residents in China. We randomly assign participants to two financial scenarios (hard vs. easy) with the technique of priming to induce their immediate financial worries. Then we measure cognitive function using Raven's Progressive Matrices and uncover their decision-making priorities with a budget allocation task. 301 participants finished the study and 264 were included in the main analysis. The results show that both immediate financial worries and cumulative poverty have negative effects on participants' cognitive performance, while responses to scarcity could lead to attentional focus on limited resources, particularly for the lower income group. Based on the findings, we suggest a number of human factors design considerations that are critical to successful healthcare design.

7. Patient Wellbeing, Experience & Empowerment

CONTENT

7.1 Patient and clinician perspectives on collaborative work in the emergency department

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KEYWORDS: patient-clinician collaboration, multiple perspectives, emergency department

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Older adults who present to the emergency department (ED) sometimes have a negative patient experience. Collaboration between care partners, patients and ED staff is one way to improve the patient experience in the ED, but patient, care partner, and ED clinician perspectives on collaborative work have yet to be studied. The objective of our exploratory study is to compare patient, care partner and clinician perspectives on collaborative work that occurs in the ED. Using data collected from patients, care partners, and ED clinicians during the design of an ED patient journey map, we identified four instances where patients, care partners, and clinicians expressed their perspectives regarding collaborative work. We found that patients, care partners and ED clinicians often had differing perspectives about collaborative work in the ED. For instance, during the intake process, patients report being "checked" by ED clinicians, whereas ED clinicians view this as being "seen". Patients, care partners, and ED clinicians also shared similar perspectives, such as the importance of an ED care team. Older adult patients, care partners and ED clinicians have some similar and some different perspectives of patient-clinician collaboration in the ED that may affect how they interact with each other and the resulting patient experience.

The PJM included 10 activities with the title "care team", i.e. ED clinicians and staff caring for the patient in the ED: for example, activities of intake (e.g., being triaged), assessment and diagnosis (e.g., discussing medical history and medications), and discharge (e.g., reviewing the discharge instructions). ED clinicians and staff considered themselves as members of the patient's "care team", and thus, they suggested that any instance of "ED clinician" or "ED staff" on the PJM should be revised to read as "care team" or "care team member". Further, they indicated that the PJM could serve as a tool to help explain the care team to the patient; for example: various roles that compose the care team (e.g., attending physician, resident physician, nurse). From the patient perspective, the term "care team" was less concrete. As one older adult mentioned in a focus group, "The patient doesn't really see a care team gather. It's one member after another" (Patient 1). Patients and care partners identified various roles for their care team, including ED physicians, nurses, pharmacist, and lab staff. Further, not all patients and care partners considered themselves members of the care team. For example, one care partner said "I wouldn't sort of think of myself really as part of the team" (Patient 3). Despite their divergent perspectives, patients, care partners, and clinicians converged around the idea of the importance of the care team. Patients and care partners agreed that it would "be good" to know that the clinicians were part of a team and clinicians emphasized the importance of the team through wanting to be labeled a "care team".

Using the iterative design of a PJM with systematic data collection, we gained insight into patient, care partner, and clinician's perspectives about who contributes to collaboration in the ED. Future work should continue to understand the perspectives of patients and clinicians on collaborative work in the ED.

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7.2 Work-focused healthcare for people with cardiovascular disease: a qualitative study exploring what matters to the client and identifying opportunities of improvement using client experience journey mapping

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KEYWORDS: youth, health, education, hospitalisation

SUMMARY

In this study, opportunities to improve work-focused healthcare were identified from the perspective of clients living with cardiovascular disease (CVD). Semi-structured interviews, preceded by preparatory assignments, were conducted with 19 workers who experience(d) work participation problems due to CVD. From the data, a generalized Client Experience Journey Map was developed and graphically represented, visualizing the clients' experiences and needs throughout the difference phases of work-focused healthcare, of which the opportunities for improvement were derived from. Opportunities for improvement were e.g. personalize the timing of the first consultation with the occupational physician, and timely clarify the roles of the different stakeholders.

BACKGROUND

The concept of value-based healthcare focuses on maximizing value for patients and promotes a patient-centered healthcare system. Patient-centered healthcare is increasingly being recognized as essential in delivery of health care, by tailoring to the needs and preferences of the patient. People who suffer from cardiovascular

diseases (CVD) often experience work participation problems, such as long-term sick leave, which is related to a decrease in health-related quality of life. Therefore, there is a need for work-focused healthcare by these workers. Work focused healthcare is defined as the support and guidance on, taking an interest in, and addressing obstacles to, work participation by healthcare professionals and health authorities. However, integration of occupational health concepts, and therefore work-focused healthcare, is lacking in primary and secondary care in the Netherlands. Therefore, the aim of this qualitative explorative study was to 1) analyse what matters from the perspective of the clients suffering from CVD, by identifying the experiences and needs regarding work-focused healthcare in a systemic manner, in order to 2) identify opportunities for improvements focussing on better meeting the clients' needs in work-focused healthcare.

METHODS

The client experience journey mapping (CEJM) approach (Carayon, et al., 2021) was used to design and graphically represent the clients' experiences and needs throughout work-focused healthcare over time and place. Semi-structured interviews, preceded by preparatory assignments, were conducted with a group of workers (n=19; 16 male), with a mean age of 54.3 (SD 10.8) years old and in different stages after diagnosis of CVD with a variety of different work participation problems and original work functions (e.g. transport and logistics n=4, trade and services n=4, and security and public administration n=3). The interview data was synthesized and mapped in activities, stakeholders, positive and negative experiences, and needs. The opportunities for improvement were derived from the experiences and needs over time and place.

RESULTS

A work-focused healthcare journey of people living with CVD is graphically represented. Employing this CEJM, multiple phases within the work-focused healthcare process are identified, including important touchpoints and involved stakeholders. Positive and negative experiences and the needs are mapped per phase, including an emotion curve showing the boosts and bottlenecks in the journey. For example, needs have been identified in the timing of appointments with careprofessionals, information provision towards the patient, information exchange between stakeholders, and the medical and occupational knowledge among the stakeholders. In addition, opportunities for improvement were identified and included, e.g. personalize the timing of the first consultation with the occupational physician, clarify the roles of the different stakeholders in work-focused healthcare in advance, provide specific person-oriented advice on how to handle work limitations, and put more compelling pressure on the employer to create a suitable work position.

DISCUSSION

The work-focused healthcare CEJM of people living with CVD show the clients' positive and negative experiences and related needs during the multiple phases of work-focused health care, which facilitated the identification of bottlenecks and shortcomings in the healthcare delivery over the full cycle of care and point out possibilities for improvement. Tackling these opportunities of improvements in practice can improve the experienced value of the client within the work-focused healthcare system. However, the implementation of the individual items of the set of opportunities for improvement were not yet put into practice and have not been evaluated yet. Further research and dialogue with the multiple stakeholder groups should investigate the (possibilities for) implementation and their effect on the satisfaction of the client within the work-focused healthcare.

CONCLUSIONS

A CEJM was presented and opportunities to improve work-focused healthcare were derived from this. By providing an understanding of the client's perspective on their work-focused healthcare journey when living with CVD and

suggest opportunities for improvement, this paper contributes to development towards a more client-centred work-focused healthcare delivery.

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7.3 Mapping contextual factors influencing physical activity behavior of people with a physical demanding job

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KEYWORDS: holistic approach, lifestyle intervention, occupational health, physical activity paradox, life-long health, prevention

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ABSTRACT

People with a physically demanding job have an unhealthy disbalance in occupational and leisure-time physical activity (PA). We aimed to understand which contextual factors influence this disbalance, and explore opportunities for lifestyle interventions that could restore this disbalance.
We applied a contextmapping study with six production workers from a Dutch coating department. Participants filled in a sensitizing booklet with PA-related activities, and were interviewed afterwards. Participants reported reasons for (not) being active in leisure-time using an experience sampling method. Our results indicate that main reasons for being inactive during leisure time were their believes that occupational PA is enough for a healthy lifestyle, and the need to rest after work.
Results show that lifestyle interventions should tackle workers inadequate risk perception and over-exhaustion to empower them to shift their PA behavior in a healthier direction. This indicates the need for a holistic approach targeting both home and working environments.

7.4 Co-creation of risk visualizations for personalized breast cancer screening

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KEYWORDS: citizen participation, risk communication, personalized cancer screening, co-creation

ABSTRACT
Communicating personalized, risk-based breast cancer screening information is challenging. In co-creation with women, information needs were assessed and information prototypes and visualizations were developed. Explaining risk-based screening with underlying risk factors should be done through unambiguous information with a cordial/personal tone, accompanied by visualizations. To meet women's needs and experts' views, layered information is recommended.

BACKGROUND
Breast Cancer (BC) screening will likely become more personalized, based on risk categories (i.e., risk stratification) (RIVM, 2022). This implies that complex information needs to be communicated, including multifaceted risk information (i.e. no breast abnormality found, risk category with probability information, and corresponding advice for follow-up screening interval/method). This risk information is difficult for women to understand (Fagerlin et al., 2007; Zikmund-Fisher, 2012), especially for those with lower health literacy (HL) levels. This study aimed to design informational materials, including (interactive) visualizations, of risk information in personalized BC screening through co-creation with women from the target group.

METHODS
Three co-creation sessions were conducted with women between 40-50 yrs not yet invited for BC screening (session 1 n=4, 2 low HL; session 2-3 n=6, 3 low HL) to gain insight into information needs and to co-design informational materials, including risk visualizations. During the sessions, women completed creative assignments (e.g., sensitizing booklet, process mapping of screening process, 5W1H method) and created/evaluated visualizations of risk information. Resulting prototypes were further evaluated by women between 54-62 yrs familiar with BC screening in two additional co-creation sessions (session 1 n=2, 1 low HL; session 2 n=2, 0 low HL). Experts in epidemiology and personalized screening evaluated prototype content on accuracy. Adapted prototypes were tested through think-aloud interviews in a new group of women (n=9, 40-74 yrs). The three-phase structure for generative data analysis was used for analysis (Visser et al., 2005). Notes, photos, created materials, and interviews were summarized, and main themes were identified.

RESULTS
Women had a positive attitude towards personalized, risk-based BC screening. However, the concept of risk-based screening was not fully understood in the initial co-creation sessions.

Women wrongly believed it would help them identify personally relevant and modifiable risk factors. But actually, personalization is at group level (i.e., risk category) and not on individual level, therefore feedback on individual risk factors is not possible. Besides, many risk factors cannot be influenced (e.g. age of first menstruation). Nonetheless, women indicated that they needed an elaboration on the implications of being assigned to a risk category. They said to initially only want information applying to their own risk category, but at the same time also need a comparison to the other categories. There were some inconsistencies between women's and experts' views. For example, the classification of risk categories did not match women's perceptions (i.e., absolute numbers indicating high risk were not perceived as high risk). Experts stressed the importance of precise and nuanced information (e.g., a range to indicate absolute risks instead of one number) where women wanted unambiguous information (e.g., no range to indicate absolute risks but one number). Concerning information presentation, women appreciated comprehensible language with a cordial and personal tone, accompanied by visualizations. Prototypes tested during think-aloud interviews contained layered information to emphasize the personalized risk-based information first and later provide the context information about the risk-based BC screening program. These prototypes were generally well understood and evaluated, although some visualizations (e.g., the risk factors hormones and breast tissue and the flow-chart of the procedure for risk-based screening) need further improvement to improve understanding.

DISCUSSION

The positive attitude towards personalized, risk-based BC screening is in line with previous studies (Rainey et al., 2020). What our study adds are specific insights into information needs and the complexities involved in adequately understanding the complex message that women will receive. Both aspects prioritized by women (e.g., indicating global risk factors) and by experts (e.g., absolute risk categories with explanations) were addressed in the final prototypes created. Layered information seems needed, e.g., providing only the information of the specific risk category with additional information about the other categories for those interested.

CONCLUSIONS

Informational materials about personalized BC screening should emphasize the idea of risk stratification into categories instead of on a personal level, including general instead of personal risk factors. Layered information is recommended to meet both women's needs and experts' views. Developed materials, including the risk visualizations, were well understood and evaluated, although some visualizations need further improvement.

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8. Intelligence in Restorative Environments

Chair: Dr. Elif Ozcan, Prof.dr. Sylvia Pont, Dr. Rene van Egmond, Delft University of Technology, The Netherlands & Dr. Nicolas Misdariis, IRCAM STMS Lab – Paris, France

SPECIAL SESSION

KEYWORDS: perceptual science, AI-technologies, patient wellbeing, restorative qualities

SESSION AIM

Hospitals and care contexts in general are designed to have restorative qualities. From the colour of the patient rooms to the materials selected, it is expected to conform with the evidence-based design of healthcare architecture. However, the technology introduced to support patient organs, or monitoring devices used and caregiving activities in general, threaten the restorative qualities creating anxiety, sleep disorders and high stress amongst the patients.

In this session we will explore how AI-powered technologies can help sustain the restorative qualities of care environments by explaining cause and effect between environmental stressors and patient wellbeing and experience. We will also learn from perceptual sciences to explain the underlying mechanism of cause and effect (e.g., perception of daylight features and sound sources that satisfy fundamental human needs).

CONTENT

8.1 From traumatic to therapeutic: Investigating the potential for the intensive care environment to enhance patients' experiences and recovery from the perspective of healthcare professionals

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KEYWORDS: patient experience, ICU, healing environment, healthcare design

ABSTRACT

This study investigates how the current intensive care environment affects care activities and patients' experiences, and the potential of turning the ICU into a healing environment. A multi-center study consisting of an online survey and a semi-structured interview was conducted with a total of 25 ICU health care professionals from 4 Dutch hospitals. The study results provide an overview of positive and negative factors of patient experience and challenges in care activities. Based on these insights, opportunities are discussed in creating a technology-enabled therapeutic environment.

BACKGROUND

Environmental design factors of healing environments play an important role in the recovery of patients (Ulrich et al., 2008). However, patients' rooms and recovery spaces, especially those in the intensive care environment, are known to be stressful and traumatic leading to negative health outcomes (Bayramzadeh, Ahmadpour, & Aghaei, 2021). Recognizing the importance of the environment in patients' experiences during recovery, efforts have been made to turn the intensive care unit (ICU) into a healing environment (Birdja & Özcan, 2019; Kotfis et al., 2022; Luetz et al., 2019). To enable the ICU environment to provide holistic and personalized care for healing, it is important to obtain a comprehensive view of patients' experiences during their ICU stay and the role of the environment herein. Therefore, we conducted a multi-center study to create an overview of the current state of environmental

support for ICU care activities and to identify both positive and negative factors contributing to patients' experiences in the ICU.

METHODS

A mixed method study was conducted between December 2021 and March 2022. As ICU patients usually have a hard time recalling and reflecting on their experiences (Russell, 1999), this study focuses on the perceived experiences of health care professionals (HCPs) who have frequent interactions with patients. An online survey (n=25) and a semi-structured follow-up interview (n=6) were conducted with ICU HCPs of 4 Dutch hospitals (2 academic and 2 non-academic). The online survey included both closed- and open-end questions covering the following topics i) the current affective qualities of the ICU environment, ii) the perceived level of environmental support for different care activities and challenges, and iii) the perceived mood states of ICU patients and contributing factors. The follow-up interviews were conducted to get in-depth insights into the factors that contribute to patients' experiences and their related needs. Collected data were systematically analyzed with descriptive and thematic analysis methods.

RESULTS

The results revealed that emotional care (e.g., sitting with patients, comfort talk) is the most challenging activity for HCPs due to lack of time and communication barriers. Importantly, although the environment could play an important role in terms of fulfilling patients' emotional needs, the current ICU falls short in conveying affective qualities (e.g., homely, relaxing) and incorporating positive stimuli (e.g., nature view, positively stimulating design elements). Regarding the activities that are directly related to ICU patients, the current ICU environment supports well medical activities while it poorly supports restorative activities. Regarding patients' experiences, HCPs perceived that, in general, ICU patients predominantly experience negative mood states. Ten identified factors contributing to the patients' negative moods were categorized into three overarching themes: psychological (i.e., feeling lost, feeling devastated, being dependent, fear & anxiety, loneliness), physical (i.e., pain, exhaustion & fatigue, losing a sense of body awareness), and environmental (i.e., overstimulating environment, lack of positive stimuli) factors. The most mentioned negative factors were pain and feeling devastated due to the worsening of one's condition and the perceived lack of prospects. Ten identified factors contributing to the patients' positive moods were also categorized: psychological (i.e., feeling of being cared for, feeling in control, feeling like oneself, feeling of being understood, anticipation, interactions with loved ones), physical (i.e., physical comfort, feeling well), and environmental (i.e., relaxing environment, positive distraction) factors. Positive factors were often related to having a conversation with nurses (comfort talk, personal attention, and provision of information) and family visits. While interactions with HCPs and family are the main source of positive patients' experiences, the insights from the interviews showed that these were often disrupted by situational barriers such as HCPs having limited time due to a high workload and restricted family visits, for instance, during COVID.

DISCUSSION

The study provides a comprehensive overview of the positive and negative patient experience factors perceived by HCPs and pinpoints the areas where environmental support is lacking. The insights of this study suggest that the design of a healing environment should aim for more than sensory comfort. For instance, a recent study (Kim, van Rompay, & Ludden, 2022) found that an environment can stimulate positive thoughts (e.g., uplifting rather than depressing thoughts) and facilitate relaxing activities (e.g., supporting family visits to be more pleasant) using positive stimuli inspired by nature. Technologies could amplify the role of the ICU environment in supporting the healing process. For instance, ambient technology could coordinate audio-visual stimuli to create a pleasant wake-up experience and to provide a good night's sleep in the ICU. Interactive digital technology could support patient control by

providing a real-time overview of one's healing journey so patients can celebrate their little steps toward recovery, or a digital family platform supporting patients to remotely interact with their loved ones whenever they want. This study has limitations. Since all participants were recruited from the Netherlands, the findings may not be readily transferrable to ICUs in other countries. Larger scale research is required including ICU survivors to fully explore and validate identified patient experience factors and opportunities for enhancing the ICU environment.

CONCLUSIONS

This study described how the current ICU environment affects care activities and patients' experiences and created an overview of positive and negative patient experience factors. A reflection was offered on the possibility of the ICU environment taking an active role in supporting a healing process by addressing multifaceted patient experience factors and opportunities were discussed in creating a technology-enabled therapeutic ICU environment.

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8.2 Defining environmental intelligence in critical care: A case study on cause-effect in paediatric patient experiences

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KEYWORDS: critical care, paediatric patients, environmental intelligence, patient stress, nursing science

ABSTRACT

Hospitals and care contexts in general are designed to have restorative qualities. From the colour of the patient rooms to the materials selected, it is expected to conform with the evidence-based design of healthcare architecture. However, the technology introduced to support patient organs, or monitoring devices used and caregiving activities in general, threaten the restorative qualities creating anxiety, sleep disorders and high stress amongst the patients. AI-powered technologies can help sustain the restorative qualities of care environments by explaining cause and effect between environmental stressors and patient wellbeing and experience. Perceptual sciences can also help explain the underlying mechanisms of cause and effect (e.g., perception of daylight features and sound sources that satisfy fundamental human needs). However, not much is known about the cause-effect relations for improving patience experience. In this study we want to gain more insights into the causes of (dis) comfort and even stress in hospitals so that we can design better intelligent systems to support the care provision.

The focus of this study is the Paediatric Intensive Care Units in which children between the age of 0-18 years are monitored closely either before/ after a surgery or a trauma. These children are susceptible for stress as they experience anxiety due to their health condition and miss their usual routines, parental care and comfort of their home. Parents also experience anxiety and lack of control. Both parents and children can suffer from a syndrome called PICS (Post-ICU syndrome) which will affect the psychological wellbeing of discharged patients and families years after hospitalization. This study aims to explore the causes of physical and psychological discomfort / stress during hospitalization and link them to other patients and family needs. Some possible research questions may be as follows: do the alarms/light/temperature in PICUs impact patient sleep quality? What patient needs are there and how do the environmental factors, care activities or other PICU routines positively/ negatively affect these needs? Can the patient day/afternoon/night routines be mapped with the environmental factors and needs?

This study primarily requires qualitative research methods as we are exploring the needs of PICU and causes of patient stress. Thus, observations of the environment, patient routines, critical care and social events are conducted in the paediatric ICU of Sophia Children's Hospital in Rotterdam (NL). To support the observations, measurements of the environmental factors such as sounds levels, light intensity, temperature, crowd management are taken. Interviews with nurses verify the critical care needs for extended intelligence to understand young patients in addition to the literature review focused on the perceived quality of the PICU environments, PICU patient needs and physical ergonomics of the PICU environment. The results are further interpreted for designing AI-powered solutions for paediatric intensive care that explain the relationship between stressors and the quality and experience of the PICU environment.

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8.3 Sound, Music / Health relations – The PsySon project and the "musico-caregiver interview"

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KEYWORDS: sound, music, psychiatry, anxiety modulation, sensory biography.

SUMMARY

The PsySon project addresses the issue of anxiety and crisis for psychiatric patients. It stands on the sound envelop concept and it is based on the "musico-caregiver interview" approach. It has been theoretically prototyped in a semantic transformation framework, and then implemented in an operational digital application including an interface for defining the patient's sensory biography and a content creation engine for setting up a playlist, as a potential alternative answer to crisis states.

RESEARCH OBJECTIVES

The PsySon project (registered name) is based on the concept of sound envelope. It addresses issues concerning the effectiveness of a temporal and sonic space for psychiatric patients. It aims at the research and development of a multimodal and multi-sensorial device for sound and music listening dedicated to anxiety modulation.

More precisely, and in a first step, the PsySon project is embodied in a prospective simple-blind randomized interventional study that investigates the effectiveness of a temporal and sonic space in the therapeutic management of crisis states of patients hospitalized in psychiatry. The current view of the project is to design, implement and evaluate a sound device – including physical, digital and experiential artefacts – integrated in the global care program in addition to the medical treatment supervised by the team of caregivers. The aims are to reduce at best incipient anxiety in order to avoid coercive measures as much as possible, to progressively reduce the taking of medication, and if necessary, to accompany the taking of the "if-need" medication.

APPROACH AND METHOD

To do so, at the crossroads of a digital (software, interface) and physical (hardware, space) approach, the PsySon project defines an innovative action-research proposal answering to a fundamental healthcare issue in psychiatry. In fact, it is built along four specific axes (Figure 1, left): the form (movable and spatial device offering a multi-sensorial listening quality), the content (sound and musical production in adequacy with the emotional states of the patient), the interface (interactions between the device, the patient and the caregiver), and finally the scenario of use (iterative mode of work between research and experimentation in the care services, and implementation of standard protocols for clinical evaluation).

In this context, a keystone of PsySon concerns the production of content. It mainly consists in trying to collect the patient's sensory biography by developing the concept of "musico-caregiver interview" which allows a personalized and evolutive musical/sound profile. Basically, this

interview is based on two complementary principles: the encoding of a quantity using basic elements (descriptors), and the use of these descriptors to decode, or extract, the information within an indexed database – or, in the long run, a computer-assisted music composition paradigm. However, the building of this interview requires combined skills between sound sciences and care practices and relies on a significant pedagogical dimension. For that, the first research prototypes of the interview paradigm were designed to operate a semantic transformation between an emotional quantity and sound properties, in order to obtain a semantic portrait of the given quantity. Its modeling follows a collaborative design process that relies on both a tool for defining and illustrating sound properties – based on the SpeaK lexicon previously developed (Carron et al., 2017) –, and mediation objects (cards, game board) for making tangible the semantic portrait. The content creation was theorized to be done in an informed way by using the descriptors of the semantic portrait in a musical/sound content creation engine (Figure 1, right), on the basis of description similarity (using the semantic portrait) or listening analogy (using sound examples of the lexicon).

IMPLEMENTATION

On that theoretical basis, a functional level of prototyping the "musico-caregiver interview" has recentlty been realized, by integrating its two main parts: an interface to design a patient's profile (semantic portrait), and a content creation engine (informed by the portrait) that makes automatic recommendations. At this stage, the prototype has already been iterated in three workshops in order to confront it with the clinical reality, especially by means of simulated scenarios of interviews.
The patients' profile interface is based on the "seed" concept, considered as a basic element of their musical tastes, revealed during the interview. Each seed can be a song title, an artist name or a musical genre and leads to suggestions of similar songs. A profile finally corresponds to various suggestions coming from several seeds. In addition, seeds selection can be refined with descriptors associated by the application in charge of the automatic recommendation process.
The content creation engine – here using Spotify©'s API – automatically generates a playlist (a musical/sound program) from a search-by-similarity process in its whole database. This operation is transparent to the user and results in a listening interface (a player), which can be connected to the physical listening artifact. Moreover, during this listening experience, the patient, and the caregiver if needed, can indicate preferences. These will be taken into account throughout the "musico-caregiver interview" iteration loop process. Updating the suggestions associated with the initially defined seeds, is part of the process of interview at several stages and takes part in

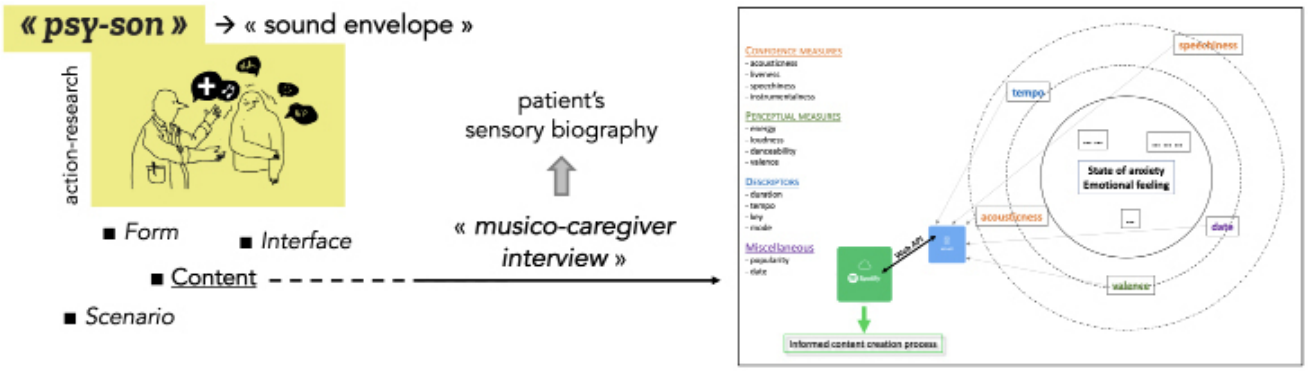

Figure 1. General overview and main parts of the PsySon project: from sound envelop to semantic transformation concepts (©lab-ah/GHU Paris psychiatrie & neurosciences - ©Ircam STMS Lab)

the incremental adjustment of musical and sound recommendations.

CONCLUSION AND PERSPECTIVES

The PsySon project is a typical action-research project, in line with the role of design/sound design in healthcare and medical issues. It is currently implemented in a functional application made available to the concerned medical staff, and already used by some caregivers in full-scale experiments. Thanks to a funding recently obtained from the French PHRIP program, the project will then be able to be deployed in several psychiatric services and be evaluated within standard clinical protocols.

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8.4 Experienced ICU Sounds: A mixed-methods study into the lived experience of the critically ill patient's sound environment

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KEYWORDS: fundamental needs; sound-driven design; intensive care

SUMMARY
Participants rated the fulfilment of thirteen fundamental needs in relation to their shared experiences with sounds of the IC-environment. Early analyses of qualitative accounts supported by rating data indicate a variety of opportunities for design.

BACKGROUND
Although survival rates of critically ill patients on intensive care (IC) wards are positively shifting, the majority of survivors suffer from new or worsening problems (e.g., PTSD/anxiety) a year after IC-discharge (Geense et al, 2021). These effects fall under the umbrella-term post-intensive care syndrome (PICS). Environmental influences (i.e., stressors) are seen as important contributors to PICS by creating a negative experience with the IC-environment, exposing patients to stress (Krampe et al., 2021). These stressors harm the fulfilment of basic psychological needs of patients and call for a "… shift from provider-centric norms to care arranged around individual beliefs and needs" (Van Mol et al., 2019). Cross-cultural studies into psychological needs showed that certain needs are universal and exist regardless of cultural differences (Tay & Diener, 2011). Desmet & Fokkinga (2020) developed a design-focused typology with a focus on user experience and well-being consisting of thirteen of these universal or fundamental human needs (Desmet & Fokkinga, 2020). Examples are an individual's need for Comfort, Security or Fitness. As such, the implementation of needs as a basis for design can support a systematic approach to design for positive experiences and subjective well-being, also in healthcare contexts. Interventions introducing new stimuli to the IC-environment have shown that instead of only removing acoustic and visual influences, the addition of light or sound can be used to the benefit of patients' recovery instead (Luetz et al., 2019). Designing for a more positive experience with IC sounds, however, calls for an understanding of which needs are most (un)fulfilled in their current experiences, as sensory overload and deprivation are common problems (Naef et al., 2022). Having previously shown that there is a relationship between sound and need fulfilment (Louwers et al., 2022), this abstract applies such notions to the ICU by providing an overview of preliminary findings of a mixed-methods descriptive study aimed at understanding patient experiences of IC-sounds and which needs underlie these experiences.

METHODS
25 ICU survivors (m = 18, f = 7) residing on the wards of the Erasmus Medical Center (MC) participated. Patients with hearing impairments or without recollection to IC-admission were excluded. Participants spoke Dutch, and were between 20 to 72 years old (M = 54.6, SD = 14.9). This study was approved by the ethics board of Erasmus MC (MEC-2021-0758). Participants watched/listened to a 360° recording of an Erasmus MC ICU to trigger

their memory. In interviews participants reflected whether any experience with sounds stood out and elaborated on the experience using a laddering approach. Each experience was rated on a scale of 1-5 (Not at all to Extremely) on statements representing the 13 needs, e.g. "During this experience I felt like <I was close and connected to other people>" (i.e., Relatedness).

RESULTS

One participant was physically unable to finish the session and was excluded. After analysis of transcripts, the remaining 24 experiences were divided into positive and negative. Nine participants shared a positive experience: six felt supported by voices or physical sounds (e.g., footsteps) of staff in the room or hallway, and two were about being stimulated by music/radio; one was about sounds from outside the hospital. Fifteen participants shared negative experiences: seven mentioned discomfort, anxiety, hallucinations and sleep disruption due to alarms; four awoke on the ICU and lost grip on reality due to a lack of recognizable sounds; two felt anger and anxiety due to a perceived time waiting after an alarm went off; one mentioned feeling ridiculed due to laughter from the hallway, and one participant felt anxious due to a sound related to a medical intervention. Fulfilment of needs in positive experiences ($M = 2.64$, $SD = 0.67$, $n = 9$) with IC-sounds was significantly higher than for negative experiences ($M = 1.82$, $SD = 0.82$, $n = 15$), $t(22) = 2.5$, $p = .02$, $\square = 0.05$; fulfilment of Purpose ($M_{purpose} = 3.39$), Recognition ($M_{recognition} = 3.22$), Relatedness ($M_{relatedness} = 3.00$) and Community ($M_{community} = 3.39$) were rated high in positive experiences. In negative experiences, needs for Autonomy ($M_{autonomy} = 1.13$), Beauty ($M_{beauty} = 1.43$), and Comfort ($M_{comfort} = 1.33$) were rated as unfulfilled. Similarities were found in positive and negative experiences for the need for Security and Stimulation ($M_{sec\_pos} = 2.56$, $M_{sec\_neg} = 2.47$; $M_{stim\_pos} = 1.61$, $M_{stim\_neg} = 1.37$).

DISCUSSION & CONCLUSIONS

With further analyses once data collection is finished, knowing which needs characterize which experiences with sounds in the IC-environment, additions of new sounds can be designed to strengthen or minimize harm to these needs, incorporated into an intelligent, personalized system. This system can support patients with regards to themes identified in this study, such as sleep, distraction, waking up, or feeling isolated. This system—designed for the needs underlying relevant themes—could lead to a more positive experience with IC-stay and a reduction of the amount and severity of perceived stressors, with a people-centered critical care environment at its core.

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9. From white paper to learning pathway: Progress and challenges in professionalising human factors in UK healthcare

Chairs: Prof. Sue Hignett, Dr. Thomas Jun, Dr. Mike Fray, Loughborough University, UK

SPECIAL SESSION

KEYWORDS: learning pathway, accreditation, competence

SESSION AIM

This session will track the progress of Human Factors/Ergonomics (HFE) education for the UK healthcare sector and share the challenges in the journey. It starts with the White Paper from the Chartered Institute of Ergonomics & Human Factors (CIEHF), launched at the Royal Society of Medicine in 2018.

Loughborough University is leading the development of the Learning Pathway as an accessible HFE training program with many partners. The training program consist of 3 levels. Level 1 (one hour, online) is available free of charge to healthcare (NHS) workers via Health Education England (and Wales) and NHS Education for Scotland Learning platforms.
Level 2 is provided as a series of 9 one day online courses and with topics including Systems, Task Analysis, Incident Investigation, Leadership, etc.
Level 3 is an individual mentorship relationship with a Chartered HF Specialist (1-2 years) to develop a reflective portfolio of HFE practice. On completion of Level 3, the individual will be ready to apply for 'TechCIEHF', CIEHF membership as Technical Specialist (Healthcare).

We are keen to share our experiences and learn from international colleagues about how they are tackling this education and training challenge.

CONTENT

9.1 From white paper to learning pathway: progress and plans in Scotland

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KEYWORDS: human factors, healthcare, education, training

ABSTRACT

In this presentation, we will outline progress with the integration of key Human Factors/Ergonomics principles and practices in healthcare policy, education & training and service improvement in Scotland. In particular, this will focus on:

Embedding a 1-hour e-learning module (Level 1 of the Healthcare Learning Pathway) on a national level for all clinical professions and others
Working with and educating our national adverse event network to 'professionalise' our safety, risk and governance advisors
Building consensus on a training curriculum and programme of continuous professional development for health and social care safety investigators
Creation of our new online Hub for Human Factors in Health and Social Care
Training clinical engineers/technicians to undertake usability evaluations of medical devices
Promoting a series of Learning Briefs on a range of Human Factors topics (e.g. Procurement, Built Environment, Quality Improvement) for regional and strategic decision-makers in health and social care
Outlining our educational development work on introducing the multi-functional SEIPS framework as the 'Swiss Army knife' of Human Factors to the health and social care workforces.

9.2 Bringing HFE education and training closer to healthcare systems: the case of a Latin American network of practitioners and academics

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KEYWORDS: design for sustainability, gloves, user-centred, medisign, Infection Prevention, Intensive Care Unit

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Human Factors and Ergonomics (HFE) has been recognised as a critical strategy for improving the quality and safety of healthcare systems and increasing the wellbeing of the different stakeholders. Despite efforts to integrate HFE training into healthcare worldwide, there is an unequal situation in different parts of the world. This is the case in Latin American countries, where the dissemination and implementation of HFE in healthcare systems have been slow despite the urgency to do it. This paper presents the case of a Latin American Network of Ergonomics and Human Factors in Healthcare (RELAESA) in its journey to address the need to develop and deliver HFE training for the healthcare community. The case presents five key milestones and their learnings, from creating the network in 2019 to the ongoing collaboration to adapt the Learning Pathway for a Latin American context. The lessons learned show that significant progress has been made in creating awareness of HFE among healthcare practitioners that are committed to undertaking training. However, it also recognised the urgency of increasing the capacity and capability of HFE specialists in the region. It also evidenced that existing educational/training content generated outside Latin America and translated into Spanish requires a more in-depth adaptation that is culturally aware of the conditions and limitations of the public health systems. Future work includes partnering with existing training organisations to translate, culturally adapt and provide access to existing guidance (HF in Health and Social Care White Paper) and formal training (Healthcare Learning Pathway).

9.3 From seeing HFE to doing HFE: my journey onto the learning pathway, a personal reflection

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KEYWORDS: healthcare, learning pathway, Human Factors and Ergonomics

SUMMARY

This abstract presents a personal reflection of how I began my Human Factors and Ergonomics Journey. The work presents my achievements and my aspirations.

BACKGROUND

Human behaviour and the way people interact has always fascinated me, hence my choice in undergraduate studies being Psychology and Sociology. In 2008, I embarked on an Operating Department Practice Diploma and worked in this surgical role, unaware that my perception of healthcare, human behaviour, and interactions would be revolutionised through the discipline of Human Factors and Ergonomics (HFE). The introduction of the World Health Organisation Surgical Safety Checklist brought on this shift in mindset, by helping us to know who we were working with, potential issues which might arise, and most importantly it helped to synchronise our plan of action if things did not go as planned. The Safer Surgery Checklist was a simple yet impactful tool which changed the way we practised, I wanted to be a part of this revolutionary change in healthcare.

My clinical practice became more challenging as I decided to work as an Emergency Department Practitioner and continued my academic ventures mainly in Psychology. It was in the Resuscitation room where I realised that numerous interactions occur simultaneously. Often our skills would be tested due to a number of patients presenting with complex airway conditions and we depended extensively on equipment and adjuncts, posing a time critical situation in which, we would have to run to ITU, theatres, or the stock room in the basement for airway adjuncts, until I proposed a solution – the Critical Care Trolley. The Critical Care Trolley consisted of complex airway equipment and adjuncts and is still an integral part of the Resuscitation room. This to me was my first taste of HFE design, and I knew I had more to offer.

I then completed my PhD at Loughborough University, my thesis achieved a better understanding the Emergency Department Response to Chemical, Biological, Radiological, and Nuclear (CBRN) events using HFE theories and methods. One of the findings was that healthcare would have problems with Personal Protective Equipment (Razak, Hignett, & Barnes, 2018) for a CBRN event. The PhD provided ample opportunities to share my work both nationally (Razak, Hignett, & Barnes, 2017; Razak et al., 2018; Razak & Boulden, 2018) and internationally at conferences (Razak et al., 2018; Razak et al., 2019).

I attended the launch of the CIEHF Whitepaper in 2018, and knew I wanted to be a part of it .I now teach on the Level 2 Task Analysis Module and am applying for my Chartered membership CIEHF. Being a part of the Learning Pathway reassures me that we are shifting towards a safer healthcare system in which everyone's plan of action and activities are HFE based.

RESULTS

Human Factors has equipped me with the

confidence to unpack and enhance critical care systems. For example, when I was the Learning from Death and Suicide Reduction Lead at a NHS Mental Health and Community Trust I used my HFE knowledge. Here, I carried out the Trusts first scoping exercise in how to reduce self-harm in amongst adolescents. This exercise catalysed change in term of staffing and observations of patients at risk. This work was presented at the CIEHF conference in April 2022 (Razak, 2022). This project is ongoing and has been extended to include different forms of self-harm behaviour.

I am assured that my Healthcare HFE career will excel through my current work. I am a Human Factors Research Fellow at the University of Oxford. I am Leading the Human Factors System Redesign of escalation for the National institute of health Research Funded RESPOND (Rescue For Emergency Surgery Patients Observed to Undergo Acute Deterioration) programme. The RESPOND Programme aims to analyse how Emergency General Surgery Teams currently treat deteriorating patients, and help them to develop and test better response systems. I am combining my clinical skills, my research skills with Human Factors, in particular Resilience Engineering. My aspiration is to influence healthcare professionals, academics, patients and their carers on the importance HFE plays in healthcare delivery.

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10. Workflow, Training & Resilience

CONTENT

10.1 Multidisciplinary clinicians' perspectives about barriers and facilitators to a team-based OR-to-ICU handoff

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KEYWORDS: team-based care, handoff, patient safety

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Research about operating room (OR)-to-intensive care unit (ICU) handoffs reports barriers and facilitators to the team-based process, but less is known about role-specific challenges and strategies. Based on a secondary analysis of eight interviews with frontline clinicians from two health systems, we identify seven dimensions of role-specific barriers and facilitators to a team-based OR-to-ICU handoff, also referred to as the team huddle in the patient's ICU room. The seven dimensions are related to three factors: (1) preparing for the patient's arrival to the ICU, (2) providing information at the team huddle, and (3) participating in the co-located, synchronous team huddle. The role-specific barriers and facilitators describe challenges related to the timing of the team huddle in the patient's room, which is dependent on the end of the patient's surgery and therefore cannot be scheduled. Another challenge is that busy clinicians with competing priorities are physically separated across the OR and ICU. Thus, the sending roles from the OR are required to travel with the patient to the ICU while receiving roles prepare for the patient's arrival. Identifying role-specific barriers and facilitators to a team-based process can inform the design, or redesign. When implemented, the handoff process can positively impact care quality by ensuring important information is shared among team members.

10.2 Socio-technical systems analysis of medical ward rounds in an acute teaching hospital

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KEYWORDS: circular healthcare, syringe, environmental impact, design

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Ward Rounds (WR) are an essential organisational process at the interface between patients, their families/carers and the clinicians who provide their care. WRs are also complex socio-technical systems (STS) involving interactions between people and technology commonly occurring in environments not fit for purpose. This study was undertaken as part of a longitudinal improvement project in relation to WRs taking an STS approach. A STS analysis (STSA) called the Cube was undertaken to understand current 'AS IS' WR practice from a Human Factors and Safety Science perspective. Key findings are broken into the domains of the Cube and include the following: Time constraints on all disciplines make it difficult for shared sense-making; Goals are not always shared in relation to the purpose of WRs; there is variation in practice in relation to pre-rounds, board rounds and handover; Safari WRs make relationship-building, collaboration and trust between disciplines difficult; there is a lack of defined outcome metrics for 'success' in relation to WRs. This initial STSA has helped us to identify areas which we need to improve. Reforming care for patients who require unscheduled care in acute hospitals is a healthcare priority. Given the resources required by WRs and the pivotal role they play, improving WRs will significantly contribute to this reform.different IT systems, clinician decision making,
and discussing the patient's progress with them on the WR. There is an expectation that following WRs, clinicians can estimate the patient's date of discharge (EDD). Time constraints on all disciplines makes it difficult for shared sense-making or deep situational awareness in relation to the care of each patient.

10.3 A Human Factors approach to aggregated analysis of sentinel events: a retrospective cross-sectional review of events of Dutch general hospitals

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KEYWORDS: Sentinel Event Analysis, Root Cause Analysis, Patient Safety, Human Factors

SUMMARY
Hospitals could improve learning from sentinel events. Aggregate cross-sectional analysis of 69 sentinel events from 28 Dutch general hospitals using the novel and human factors based Generic Analysis Method can help hospitals in learning from sentinel events. It provides insights in patterns and interactions in contributing factors, and helps to expose system issues. This can assist in the formulation of possible recommendations aimed at systemic issues to enhance patient safety.

BACKGROUND
Investigating Sentinel Events (SEs) is common practice in hospitals worldwide, but learning from SEs can be improved. Hospitals now often aim to identify one or a few root causes, often overlook system issues, and focus on isolated events within their own organisation. SEs, however, are more likely to arise from a combination of contributing factors, provoked by system issues, and emerge in the context of wider systems. Learning from SEs might be improved by using a human factors perspective to analyse SEs across hospitals. Therefore, a novel Generic Analysis Method (GAM) was developed (Baartmans et al., 2022), which integrates important elements of existing root cause analysis methods and is operationalized according the Systems Engineering Initiative for Patient Safety (SEIPS) model (Holden et al., 2013). We aim to examine if performing cross-hospital aggregate analysis of SEs applying the GAM, can enhance learning from SEs.

METHODS
A retrospective cross-sectional review of 69 SE-reports from 28 Dutch general hospitals. The comprehensive event descriptions of the SE-reports were reanalysed according to the GAM by hospital representatives and a researcher [MB]. A qualitative approach was used to identify contributing factors and system issues. Findings were discussed among the research team and with a patient safety expert panel from the participating hospitals. Descriptive statistics and measures of associations between socio-technical domains were calculated.

RESULTS

Applying the GAM provided a more holistic SE analysis compared to traditional root cause analysis. It provided insights in multiple contributing factors and interactions between factors. Aggregated analysis of SEs across hospitals resulted in 405 identified contributing factors. The majority related to the persons involved and the organisation. Factors related to the physical and external environment were not often identified (Table 1).
The most frequently recurring pattern was the combination of factors related to the persons involved, the technology used, the tasks of professionals, and organisational factors influencing the event.
Factors recurring across events and hospitals, and those interacting with many other factors, may reflect potential system issues. Examples of system issues that arose in our study are suboptimal cooperation (e.g., poor communication between hospital departments and information transfer between chain partners), limited user- and patient-friendliness of medical technology (e.g., usability problems related to electronic health records and prescription systems, or suboptimal technology design for clinical practice), and poor work structure organization (e.g., high workload, suboptimal scheduling, staffing issues, high staff turnover, or excessive multitasking).
With the patient safety expert panel, possible recommendations were formulated attempting to work on these issues. E.g. to consider appointing a case manager for anticoagulation who can be easily approached by all units for questions regarding the anticoagulation policy, or evaluate and adapt the predefined lists of medication options in administrative systems, making it more intuitive and less prone to mistakes

Table 1. Results of the cross-hospital aggregate analysis of sentinel events using the Generic Analysis Method.
*Number of SEs in which one or more factors of this domain contributed.

Sociotechnical domain	Events* (n=69) n (%)	Factors (n=405) n (%)	Example of contributing factor
Person(s) - Patient	38 (55.1)	45 (11.1)	Does not speak the language, which hampers the physical exam and medical history taking
Person(s) – (Healthcare) Professional	63 (91.3)	103 (25.4)	Minimal experience in specific treatment leading to misapplication of a surgical instrument
Tools & Technology	42 (60.9)	62 (15.3)	Not user-friendly electronic medication prescription system hinders correct medication prescription
Tasks	38 (55.1)	48 (11.9)	Complexities in the diagnostic reasoning process (i.a. tunnel vision) leads to missing a high-risk diagnosis
Organization	59 (85.5)	121 (29.9)	Anticoagulation work instructions are not up-to-date inducing a wrong medication policy
Physical environment	10 (13)	11 (2.7)	Patient room is too small so caregivers get in each other's way during resuscitation
External environment	13 (19.1)	15 (3,7)	Closure of wards in a nearby hospital causes extra bed pressure, contributing to the decision to not admit a patient

DISCUSSION

Main findings such as person(s) and organization being the most prevalent factors, align with previous studies on adverse events(Smits et al., 2021) or sentinel events(Hooker et al., 2018). The combination of cross-hospital aggregate analysis and the human factors perspective, provided new insights and helped to elucidate potential system issues, which typically remain omitted. These could be addressed in possible recommendations. Findings may only be limitedly generalizable, due to purposefully sampling of events and only including Dutch general hospitals. The core findings may be theoretically generalizable though. Reanalyzing existing SE-reports in itself holds some limitations. It might preclude from effectively incorporating the human factors perspective, since in the initial SE-investigation this perspective was not applied and thus some domains -such as the physical and external environment- may be neglected. Nevertheless, the comprehensive event description in the SE-reports provided us with sufficient information to subtract new insights. Further validation and improving usability of the method is recommended. Application of cross-hospital aggregate SE-analysis using the GAM in a wider and greater sample allows to perform more statistical analysis and enhances generalizability.

CONCLUSIONS

Cross-hospital aggregate GAM analysis of SEs helped to perform an holistic analysis, identify contributing factors and potential system issues. This supported proposing more system-oriented overarching recommendations. GAM can be used by hospitals working together in networks to jointly learn from SEs.

ACKNOWLEDGEMENTS

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10.4 Patient vehicle extrication at the entry door of an emergency care: an analysis of nursing activity

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KEYWORDS: Urgency and emergency, Patient Handling, Vehicle Extrication

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

A research was carried out in the Emergency Room of a private hospital in the city of São Paulo, Brazil. This addressed the activity of mobilizing and removing patients from inside the car, when they arrive at the service. The nursing team presented complaints regarding the lack of standardization and institutional guidelines for practice, which support safety and injury prevention for patients and professionals. The study then sought to carry out an evaluation of the nursing work activity in the vehicular extrication of the patient to identify conditions of the activity, barriers, facilitators and variability. The methodology was an exploratory study with the application of a questionnaire to approach and analyze the characteristics of the population and the vision of the nursing professionals, in complementarity with a structured guided observation of the simulation of the activity by 4 different work teams. As results a description of the activities was obtained in relation to: the principle of scene safety, classification of severity according to the patient's assessment, the postures and positioning of the professional's body and the use of equipment. The reflection on this theme points for the need of development of institutional training and care flows, mentioned as being of importance by the professionals participating in the activity. As a conclusion, it was possible, through concrete data, to dialogue in order to seek new options for modes of operation, as well as to promote future comparisons with other reference centers in the world.

10.5 An HFE investigation of patient ID safety events and health IT design for risk mitigation

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KEYWORDS: EHR, Patient Identity, Patient Safety, system design

SUMMARY
This is a human factors study that evaluates a healthcare work system to address a series of patient safety events on patient identifications. With an analysis of the work system and user workflow, we identified the system barriers of various types of patient identification errors. We developed health IT interventions that may reduce the opportunities for such errors. We start to implement the interventions and plan for further system design and development.

BACKGROUND
The change of a patient's core demographics is a common workflow during a patient's stay. When a trauma or critically ill patient arrives in the Emergency Department, an anonymous identity is assigned (e.g., Fortytwo, John Doe, DOB 1/1/1871) so care can begin immediately. Later, the demographics are updated to match the patient's true identity. Other situations include an incorrect entry during registration, such as a spelling error in the patient's first or last name, or a legal name change after the patient's last encounter. For pediatric patients, timely updates of the date of birth are desired during the patient's stay, to set the appropriate age context for decision support rules. Accurate demographics are also required for e-prescribing discharge medications. However, demographic updates are a risky process that must occur only at a safe time, when the patient is stable. This is because any change of the core demographics such as name, sex, and date of birth can create discrepancies among the patient's records (e.g., the wristband, lab product labels and the electronic health record (EHR)). Any change of the core demographics can invalidate the patient's active Type and Screen orders, in which case the blood bank cannot issue cross-matched blood products that may be urgently needed. Therefore, our organization identified safe demographic change as a significant patient safety priority.

METHODS
With a systems analysis, we reviewed the safety events related to the patient IT, and conducted interviews with frontline users, including clinicians in the emergency department, operating room, and pediatric intensive care units, and non-clinicians at registration, patient identity administration departments, and blood bank. With a full understanding of the process and workflow within and outside of the Electronic Health Record (EHR), we identified the system barriers and unintended consequences that can create opportunities for a demographic update error. Based on the analysis, we created a list of design requirements and potential solutions that may address these system barriers.

RESULTS and DISCUSSION
Our analysis uncovered that in the current system, the users were required to choose a safe time to update the core demographics without guidance from the system. There are several unsafe scenarios, including when the patient has an active blood

order, certain pending lab orders, an active Type and Screen order, or an impending procedure or surgical case, during which demographic changes should be prohibited. However, not all clinicians are aware of these unsafe situations when requesting demographic changes. The non-clinical staff also lack the expertise to identify those scenarios when receiving the request. Searching for information from different places in the EHR is not a straightforward process that can easily be trained. Therefore, one of the design requirements we created is that the EHR system should automatically identify when it is safe to make changes to demographics and should prevent updates when it is determined not safe to do so. Based on this requirement, we collaborated on an interdisciplinary team to create algorithms and user interfaces with multiple rounds of testing. We implemented the customized warning messages with scenario-based specification. As a first step, the warning messages targeting the registration users provided needed decision support depending on whether the patient has an active type and screen order and whether they are ready to be discharged. These interventions may reduce the opportunities for human errors in this process.

Going forward, there are other challenges in the process that needs to be resolved. For example, without a timely updated date of birth (DOB), the pediatric patient's medication dosing alert would not be appropriately fired. We plan to develop a process to streamline the DOB update process and build an estimated DOB system. For another example, when the patient is ready for an operation or surgery, the updates of demographics should be strictly restricted. We plan to create rules to disallow the changes in that scenario, or to create alerts to the provider and nurses so that they can reorder the Type and Screen in a timely manner.

CONCLUSIONS

In this study, we utilize a human factors work system design approach to analyze the patient demographic safety events. We developed and implemented technical solutions. This is a work in progress, and additional system challenges may require system build and technical solutions.

10.6 CRM Wars – Storytelling as an unconventional approach to teaching the relevance of human factors in healthcare

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KEYWORDS: Crisis Resource Management, Human Factors, Patient Safety, Safety culture

SUMMARY
In this light-hearted project, we approach the topic of human factors and healthcare safety with a parody of the popular and well-known Star Wars narrative and created several short stories. Each story is mirroring different aspects of the human experience of working in healthcare and the impact of human factors for both patient and physician safety.

BACKGROUND
The last decades saw increasing efforts to shift healthcare towards an environment that delivers more well-being and safety for both patients and staff. Many attempts to implement safety culture in healthcare are reproducing behavioural codes from other seemingly successful high-reliability work environments such as aircrafts, power plants or space travel. The variety of actions to improve patient safety may seem overwhelming for healthcare workers who are not (yet) familiar with the topic. This creative film project aims to invite its audience to dive deeper into the raised issues.

METHODS
Aimed at students and professionals who may not be familiar with core values of Crisis Resource Management (CRM), the choice was made to address simple yet significant issues that are relatable for anyone working in acute care medicine. The uncomfortable topics of making mistakes, facing an overwhelming amount of workload, and experiencing pressure to keep up with peers are just a few of many issues addressed in the short stories. To establish a link with the archetypical Star Wars conflict of Good vs. Evil, the key question of what happens with or rather within us, when faced with the above mentioned challenges, is presented as a dichotomy of favourable vs. unfavourable behaviour. This is in concordance with the famous rivaling entities of the Dark vs. the Light Side, represented by their most popular characters Darth Vader vs. Yoda. The main character, a junior doctor called Y.P. ("Padawan"), faces many critical situations and is often tempted by the "Dark Side" to give in to undesirable emotions such as anger, impatience, and hubris (Figure 2). Highlighting to the viewer that these emotions are inherent to human nature and often arise from unmet needs (such as lack of rest or lack of recognition), however they may jeopardize team performance and obstruct patient care. Opposing the Dark Lord in his attempts to gain the Padawan's trust, the "Medi Master" incorporates everything we know about CRM core values. He gives advice about situation awareness, teamwork, decision making, and task management, in order to deescalate difficult situations and lead the main character back to the "Light side". References about further reading material on human factors in healthcare are given and invite the viewer to

keep engaged in the given subject. In March 2021 a prospective randomized interventional study was initiated among medical students to assess how attitude towards patient safety may be influenced by watching the produced videos compared to conventional textbook teaching. The study is ongoing.

RESULTS

Since the start of the CRM Wars project in 2019, 15 scripts for 15 short stories have been written, each approximately 3 – 5 minutes and entitled with Episodes I – XV. Within the last three years, six of them have finished filming, five have completed editing and have been released on YouTube (Figure 1). These are Episodes VI – X and jump to the mid part of the main character's overall story arc on her epic journey from "Padawan" (i.e. junior doctor) to "Medi" (Figure 2). The choice of the episodes achronological sequence was in concordance to the original Star Wars saga as told by George Lucas. Additionally, a two-minute trailer was added to the collection. In terms of viewing figures, at the time this abstract is written, the trailer was the most popular with approximately 5400 views. Views of Episodes VI – X are 3450 (Episode VI), 2230 (Episode VII), 927 (Episode VIII), 893 (Episode IX), and 1012 (Episode X).

Figure 1. The CRM Wars Story so far

Figure 2. The main character must face both, her Medi master and nemesis, in order to become a Medi and advocate for patient safety

DISCUSSION

The works about Crisis Resource Management (CRM) in Acute Care Medicine (Gaba & Rall, 2005) may be seen as a first response to the devastating report of avoidable patient harm associated with – what was then called - "human error" in 1999 (Kohn, et al., 1999). Fortunately, many things have changed within the last 20 years and today, the benefits of fostering both patient and healthcare staff safety are acknowledged to be evident. For instance, the widely used WHO pre-surgical checklist may compensate for some degree of human error and suggestions from all major medical societies demand the implementation of simulation based team training into any healthcare worker's curriculum. Even though this project does not provide another evidence-based tool or strategy to implement healthcare safety plans, it is meant as a low-threshold invitation to those who are unfamiliar with or even discouraged to face the limits of their own human nature. It is essential to approach the topic of physician (or "human") fallibility without the notion of blaming and shaming. Hence humorous storytelling is an excellent tool: As long as comedy is done in a non-offending fashion, it may speak to individuals who live in fear of retribution and present the occurrence of mistakes as a common and shared experience instead. However, it is paramount that the gravitas of patient harm is not being ridiculed or trivialized: In this context, recognising and laughing about unfavourable behaviour is aimed to fuel conversation about how to improve it, rather than normalising (and excusing) the behaviour itself. For this reason, for each "wrong" turn, the main character is about to choose, her Medi Master points her into the right direction, therefore presenting behaviour as a choice we are in control of, rather than it controls us.

CONCLUSIONS

So far, this unconventional approach has gained some interest on YouTube and Twitter, but the authors consider the project to be an ongoing journey.

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11. Design towards a more sustainable healthcare system

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SPECIAL SESSION

KEYWORDS: design for a circular economy, design for sustainability, design for transition, patient safety

SESSION AIM

The Dutch healthcare sector is responsible for 5-7% of the national ecological footprint. The daily average waste per patient generated at an intensive care unit in a Dutch hospital is seven full waste bags. To a large extent most supplies are disposables, even some high value products. There is an urgent need to develop (design) interventions to reduce the environmental impact of the healthcare system while keeping healthcare standards and patient safety in mind.

Recent design initiatives like the 'Green Operating Room' and the 'Circular Intensive Care Unit' started to map the environmental impact of the current healthcare system and to identify opportunities to transition healthcare towards a more sustainable future. For this, multiple perspectives insights of the current healthcare systems are needed to understand the reason why for example so much disposables are being used: From a human perspective (staff and patient), patient safety (protocols), infrastructure (within hospitals), procurement (suppliers) and more. These insights in combination with emerging technologies (for examples new ways of reprocessing) and design thinking will lead to new sustainable product-service systems. An interdisciplinary approach is essential in this transition to overcome barriers in the healthcare system and between disciplines.

CONTENT

11.1 Going green: waste collection and analyses in pediatric intensive care

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KEYWORDS: pediatric intensive care, waste collection, sustainability

BACKGROUND AND AIM

The Dutch health care system is responsible for 7% of the national CO2 footprint, and has agreed to achieve climate goals as defined by the United Nations and by the "Green Deal" for the healthcare sector. Insight in waste production (amount) and composition (type) is essential to move towards a more circular PICU. The aim of this project was to analyze the waste produced during four days in our PICU.

METHODS

The tertiary PICU is a 28 bed ICU in four units, divided in (1) short stay, (2) cardiothoracic care, (3) general PICU and (4) long stay. Waste was collected for four days and the trash bags were counted. Per day, waste from one of the units was separated by hand and categorized and weighted.

RESULTS

The total amount of waste was 26,9kg/day, with a significant difference between the four units (0.6 - 7.2 bags/patient/day). The amount of waste per category was similar between units, with a high percentage of food products, protective clothing and medical product packaging. Fluid containing bottles such as formula were responsible for a large part of the food products. Six percent of the waste consisted of unused items.

CONCLUSIONS

The amount of waste in our tertiary multidisciplinary PICU was large, differed between type of patients and was lower in short-stay patients. This small study can be used as a hotspot analysis to help gain awareness in our unit, reduce waste, and increase recycling in short term practical changes.

11.2 Towards greener ICUs: redesigning the use of disposable gloves

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KEYWORDS: design for sustainability, gloves, user-centred, medisign, infection prevention, intensive care unit

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

This research and design project is part of the Green ICU initiative and focused on reducing the environmental impact of gloves at the Intensive Care Unit (ICU) of the Erasmus Medical Center (EMC). At the ICU of the EMC around 108 gloves are used per patient per day; to protect the user (healthcare staff) from infections. The high frequency of use and the resource-intensive production define disposable nitrile gloves as one of the 'hotspots' contributing to the environmental impact created by the ICU. This research and design project addressed the problem from three different perspectives: user-centred, product-centred and supply-centred. The extensive research resulted in three design directions on how to reduce the environmental impact of gloves. Subsequently, all insights from the research were brought together into five design building blocks. These design building blocks provided guidance for the design phase of the project. The project resulted in a redesign of the current glove dispensers. The final design is named 'GloVe', a vertical dispense system. By incorporating the five building blocks, the design can provide benefits for multiple stakeholders within the healthcare system. It reduces the environmental impact of gloves in the ICU by dispensing one glove at a time. Furthermore, the gloves are dispensed at the cuff, which comes in little contact with the patient. The vertical movement is pleasant to the user. The use of colour for different sizes makes it clear to the care assistant which box should go in which holder. Also, nurses will see at a glance, which size gloves they are dispensing. The small V-shaped opening makes the undesirable behaviour, of placing gloves back, almost impossible.

11.3 Reducing the environmental impact of syringes at the Intensive Care Unit

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KEYWORDS: circular healthcare, syringe, environmental impact, design

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

This research project, part of the Green Intensive Care Unit (ICU) initiative at the Erasmus University Medical Center (EMC), is focused on reducing the environmental impact of syringes at the ICU by designing solutions based on circular economy principles. Based on a Material Flow Analysis of the EMC ICU, syringes and their packaging have been identified as one of the main environmental impact hotspots. Therefore, this project aimed to redesign the syringes, their packaging, and their use, according to circular design strategies suitable for medical products to decrease their environmental impact, while remaining convenient and safe in use for the healthcare staff and patients. Research was executed to understand the context from multiple perspectives. The outcomes demonstrated that decreasing the impact of syringes is not only related to the design of the syringe itself. Manufacturing, preparation, use and disposal, all contribute to the environmental impact of the syringe. Various possible interventions were derived to reduce its impact:

1. Adapting the infection prevention protocol and behaviour of the staff;
2. Separating infectious waste from general hospital waste;
3. Redesigning the syringe itself;
4. Optimising the filling process of syringes.

The final design is an optimised filling process for prefilled sterilised syringes (PFSs), based on circular strategies such as reduce, reuse, rethink and repurpose. Interventions include: eliminating a redundant sterilisation phase, reducing residual medication and changing from steam to gamma sterilisation. This resulted in decreasing the amount of waste, material, energy and water consumption, while offering similar convenience and safety for the staff and patients of the ICU.

11.4 Towards circular ICUs: circular intubations as a catalyser for systemic change

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KEYWORDS: circular healthcare, systemic design, intensive care unit, intubation

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

This project aims to reduce the environmental impact of the Intensive Care Unit (ICU) of the Erasmus Medical Center (EMC). Systemic design research was executed to map the current waste flow created by the ICU. Literature review, interviews and observations were performed to gather information about the healthcare protocols, hospital procurement process, intubation practices and used devices and consumables. This resulted in a set of challenges which were used to ideate from different perspectives to improve the sustainability of the ICU. A set of opportunities to introduce circularity within the ICU were defined. These opportunities ranged from waste separation to the reduction of the disposal of unused products. The selected circular opportunity was intubation, needed when patients cannot breathe by themselves. For this, a video laryngoscope, which is composed of various plastics, a video camera, and a led light, is used for only a few minutes and disposed of (and incinerated) directly afterwards. The aim of the second part of this research project was: Can we design a circular intubation procedure as a catalyzer for systemic change towards circular ICUs? One of the proposed circular strategies for the video laryngoscope is the reprocessing of intubation devices used at the ICU itself. A transition model toward reprocessing using UV-C radiation technique was further developed. Compared to current reprocessing procedures, UV-C disinfection consumes no water and less electricity and offers the possibility of decentralized reprocessing within the ICU department itself.

This project aims to provoke conversations between the hospital, manufacturers and other stakeholders about how the healthcare sector could start reprocessing valuable medical devices towards a circular ICU.

12. RESPOND - An action research approach to improving surgical outcomes using HF interventions

SPECIAL SESSION

CONTENT

12.1 Collaborative design and development of patient involvement intervention to improve responses to deterioration and decrease failure to rescue in surgical patients

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KEYWORDS: patient involvement, care escalation, collaboration, deterioration, failure to rescue

SUMMARY

The objective of this project was to work with staff and patients to co-develop and test a simple and standardized system that enable patients and their relatives to monitor and escalate any concerning health changes to staff after having undergone surgery, with the aim of prioritizing these health concerns in order to decrease failure to rescue. Our initial experience demonstrated that successful real-world implementation of such system requires significant cooperation and willingness to participate and embrace change from all relevant stakeholders, especially the nursing staff.

BACKGROUND

Despite the significant effort that has been directed towards early recognition of deterioration in patients in acute care settings, such as the introduction in the UK of National Early Warning Scores (NEWS2) and the adoption of medical emergency/outreach or rapid response teams, slow or inadequate responses to clinical deterioration due to postoperative complications continues to occur (Patel et al., 2011; Kolic et al., 2015)). The theory behind NEWS2 and similar efforts is based on evidence that there may be a phase of slow deterioration for a significant period before obvious organ dysfunction markers become apparent, and that early intervention at this stage is likely to be more effective than strenuous efforts once deterioration has reached critical stage (Alam et al., 2014). Mortality following complications has been termed Failure to Rescue and represents an index of surgical care quality (Sujan et al., 2022). Patients have no formal input route into the alert and escalation process when clinical deterioration occurs, except through communication with their allocated staff nurse. Documented instances of delay or failure of response due to distractions, overload or incorrect perceptions that symptoms reflect patient anxiety have shown that a backup channel for patients to raise the alarm if they feel

unwell might be helpful in improving outcomes overall by enhancing the system's speed and sensitivity (Gill et al., 2016)). Therefore, we aimed to develop an intervention that engages patients and their relatives in monitoring and reporting concerning health changes to improve early detection, escalation and response to deterioration in surgical patients. Previous efforts to institute such system either proved ineffective or have had low uptake rates and high levels of inappropriate use (Odell 2019; Sheard et al., 2014). We attempted to address these problems in our intervention design.

METHODS

The intervention was developed as part of a 5-year Patient-Safety project (RESPOND study), which is funded by the National Institute for Health Research (NIHR) [Programme Grants - 200868]. RESPOND is trialling a four-strand Human Factors intervention to improve mortality in patients who deteriorate after major emergency surgery on the abdomen. An intervention to allow patients and carers to trigger the emergency rescue response system directly forms one of these strands. We used a collaborative approach involving relevant stakeholders in the design and development of the intervention. One focus group and 4 workshops were conducted with 24 staff across three National Health Service (NHS) Trusts, and 3 focus groups were held with 10 patients who have experienced complications after major abdominal surgery. Individual unstructured interviews were also conducted with ward managers to identify possible facilitators and barriers to the implementation of the intervention. The final prototype is a 3-staged system termed "Early 35 - See it early, Speak up early, and Save lives early". The intervention was introduced in the Surgical Emergency Unit of three NHS hospitals. Patients were provided with a mobile phone number which they could call directly if they felt their health condition was worsening, and a senior member of the nursing staff on the ward, termed "Respond Person", carried the phone on every shift. Training for the Respond Persons and information for patients and general ward nurse was provided. Patients and relatives were encouraged to call if they felt a patient in their area of the ward, or they themselves, were deteriorating. It was stressed that this number should not be used for concerns unrelated to health. Importantly, they were advised to always consult their staff nurse first, and only call the number if they remained worried after having done this. Respond Persons were asked to, 1) attend timely if called, and speak to the staff nurse caring for the patient and then to the patient themselves; 2) seek resolution for the patient's health concern, and have a debrief of event and plan with the staff team; and 3) make a brief report in the patient's medical record and record the detail of the call in the RESPOND database. A surveillance sampling questionnaire for patients, ward nurses and Respond Persons was carried out weekly during a 12-week Quality Improvement based implementation period, and the results were used to drive the Plan, Do, Study and Act (PDSA) cycles.

RESULTS

Implementation of the system was affected by misunderstandings and concerns from nursing staff in one hospital and by the concurrent introduction of a similar programme in another. In one hospital a pause was required during a particularly difficult period when staff shortages and COVID-19 related challenges led to a feeling amongst staff that the additional stress of the Early 3S system was not sustainable. The number of calls to date has been low, and the surveys show that penetration of the information about the system to patients is also low in two hospitals although good in the third. Nurses remain sceptical about the value of the system, which has caused problems with engagement. We have introduced a nurse champion at each hospital to address this issue, and have trialled several methods of ensuring patients and their relatives are aware of the system without increasing nursing workload. A more complete results from the implementation period will be presented at the conference.

DISCUSSION AND CONCLUSION

Early 3S is a simple and standardized system generated through collaborative design with

frontline staff and patients. It aims to enhance partnership between patients and staff and increase awareness and engagement of patients in monitoring and reporting health problems with the goal of improving responses to deterioration and decreasing Failure to Rescue in surgical patients. Initial experience suggests that there is significant resistance amongst nursing staff to the model we have developed, based on concerns about effects on workload and doubts about effectiveness. To allow a fair trial of the model, improved nursing engagement is needed, and we are currently trialling ways of achieving this. The next step involves further piloting and evaluation of the intervention at 3 NHS trusts using the PDSA model for further refinement and optimization.

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This study/project is funded by the National Institute for Health Research (NIHR) [Programme Grants for Applied Research (PGfAR) NIHR 200868]. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

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12.2 A team is more than a group of individuals - “like strings that twist together into a rope” (Dan Carter) Lessons learned from elite sports and the military to inform a surgical team

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KEYWORDS: team work, patient safety, culture

SUMMARY
The overall focus of this study was to identify principles/behaviours which allow elite military and sporting teams to produce and maintain cultures of high performance, with a view to generating long lasting change in the culture of their teams. The objectives were to; evaluate those teamwork approaches used by elite sport teams and military units and; to assess if these methods could be translated to the teamwork challenges involved in the care of surgical patients.

BACKGROUND
Much of the work on teamwork in healthcare is based on the Crew Resource Management (CRM) model developed in civil aviation. Although this model has achieved significant uptake in healthcare, evidence for improved patient outcomes is weak (McCulloch, Rathbone, & Catchpole 2011). The major differences in environment, culture and resources makes the successful transfer of aviation approaches to healthcare a challenging proposition (Vincent & Amalberti, 2015).

In the surgical environment CRM has had some success (Gerstle, 2018) but the benefits of CRMbased training decay rapidly, and there is little evidence that better team working behaviours are being adopted, despite widespread implementation of such training across healthcare in the UK.

We hypothesise that disciplines which successfully focus on reliably producing high performance under high pressure may hold lessons which could produce longer lasting improvements in teamwork behaviours in surgery. Such environments can be readily found in the supervision/coaching structures of elite military and sporting teams. We therefore conducted a series of interviews with individuals involved in such teams, focusing on what makes these teams successful and how this knowledge could be applied to a surgical environment.

METHODS
We conducted semi-structured interviews with 12 high profile players or coaches and leaders of

military and sporting teams from the UK, Europe and Australasia using convenience sampling until thematic saturation was achieved.

Seven interviewees from the sporting arena came from elite players or coaches in rugby, field hockey, netball, rowing, and F1 motor racing, and included Olympians or World Cup winning teams from both the Southern and Northern hemisphere, with a mix of male and female teams and coaches. Five mhe military leaders included the Chief of Staff of the Royal Marines training depot,The head of the Army school of Leadership and a Wing Commander from the Red Arrows fast jet display team. An initial pilot interview was conducted with an elite rowing coach and used as a template which was adjusted as required. Follow up interviews were conducted with 2 participants for clarity to check for resonance of themes and to probe any emerging constructs.

The analysis was conducted using two methods of thematic analysis: NVIVO was employed by one of the lead researchers using transcripted data and corroborated by the other lead researcher using inductive coding as suggested by Boyatzis, 1998; Frith & Gleeson, 2004. In this method the researcher codes responses from field notes without attempting to fit them into any pre-existing coding frames or preconceived paradigms. The process was data driven to retain as much of the inherent richness as possible and thus helped researchers to recognise the significance and broader meaning of emerging patterns.

Being unbound by theoretical constraints, thematic analysis offers a highly accessible form of qualitative data analysis (Braun & Clarke, 2006), and can facilitate the analysis of rich and detailed data following a contextualist paradigm, acknowledging how individuals derive meaning from their experiences (Vaismoradi, Turunen, & Bondar, 2013; Willig, 1999). The two approaches were combined by constructing a final narrative in which concepts and beliefs salient in the output of both approaches were emphasised.

The developing themes were used to inform the development of a team strengthening intervention for testing in surgical units.

RESULTS

There was considerable repetition of themes amongst the interviews from both backgrounds, such as co design of a vision and purpose, a collective and inclusive culture, a positive group mindset, mentoring and buddying structures, intensive and realistic training together and learning from mistakes instead of condemning individuals. Emerging themes included: ensuring psychological safety and belonging; a collective culture embracing different strands "like strings that twist together into a rope" (Dan Carter, personal communication (interview), 24 Nov, 2021); clear communication with shared goals; embracing pressure; socialising; uniform symbols and verbal expressions to reinforce team ethos; maintenance of values by "senior players" or NCOs and valuing the team more than the individual.

DISCUSSION

Teamwork is an array of interconnected behaviours, cognitions, and attitudes that make coordinated and adaptive performance possible (Salas, Wilson, Murphy, King, & Salisbury 2008). Previous teamwork research in healthcare has, arguably, concentrated on adapting a model from a very different environment which focuses on defending against cognitive, perceptual and cultural weaknesses rather than examining the strengths which are associated with highly successful team collaboration under pressure. An outline for an approach to team training applicable in healthcare emerged from this study and is currently being trialled in live clinical environments in the RESPOND study of rescue processes for patients who deteriorate after major surgery.

CONCLUSIONS

There is a need for a more sophisticated understanding of teamwork both in the surgical arena and in the wider healthcare setting (de Vries, Ramrattan, Smorenburg, Gouma, & Boermeester,

2010). Successful team training in sporting military settings involves collaboration, communication, and acknowledgment of a common purpose. As with efforts to learn from aviation, adaptation of the lessons to healthcare will face challenges posed by the differences in work environments, and careful studies of effectiveness using patient benefit as the key outcome will be required to determine the effectiveness of this model in healthcare settings.

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12.3 Design and development of RESPOND Games League: Can gamifying team building process be an effective strategy to improve performance of a surgical team

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KEYWORDS: teamwork, games, emergency surgery

SUMMARY

The focus of the study was to employ gamification as a team strengthening strategy to improve responses to deteriorating post-operative patients by surgical teams.

BACKGROUND

Effective communication and collaboration are important in the escalation process for responding to deteriorating surgical patients. However, achieving high team performance can be challenging within a complex, multifaceted surgical team with a rapid turnover of members. To address this, there has been an increase of teamwork training programmes directed at healthcare providers over the last decade. However, such programmes are costly, and evidence regarding their efficacy is weak, highlighting the need for a novel team-training method with an alternate cost-effective mode of delivery (McCulloch et al., 2011).

The term gamification can be defined as the application of playful thinking, and game mechanics, in non-game contexts, to engage users in problem-solving or task completion. Its use has gained recent popularity especially in the context of education in healthcare. A growing body of empirical research suggests that the effective use of game elements may extend beyond learning and can be used as a team building tool (Keith et al., 2018 & Keith et al., 2021). Games or gamified activities encourage players to collaborate and engage as a team to successfully complete shared objectives. This helps to achieve greater goal commitment, team cohesion, and promote prosocial behaviour. We hypothesize that these effects will enhance surgical team function in emergency situations. As part of a 5-year National Institute for Health Research (NIHR) funded programme (RESPOND), intended to improve responses to deteriorating post-operative patients, we are conducting an experiment to test the value of gamification in enhancing team climate amongst emergency surgical teams.

METHODS

Insights gained from work with trainers of elite sport teams and military units were used to identify key themes for optimising teamwork. One of these was the need for frequent, brief training experiences which required team cooperation to achieve success. Another was the enhancing effect of successful cooperation on team cohesiveness. We therefore designed a voluntary cooperative online games league for the members of surgical teams from 3 National Health Service (NHS) Trusts, by combining these themes with principles of game theory, and incorporating team member feedback into an iterative process of development. The resulting competitive games league involves small (4-8 people) teams which must contain a mix of roles and seniority. The online games require co-operation for success, mostly require no clinical knowledge, and are changed weekly. A league table is updated with team scores, and small non-monetary rewards plus extensive recognition will be awarded for the highest scoring teams, consistent team engagement and exemplary collaboration.

Individual player and team Safety Attitudes Questionnaire (SAQ) scores will be used to evaluate team climate before and after participation. This will be supplemented by qualitative examination of the perceived value of the league in semi-structured interviews conducted as part of an overall RESPOND Process Evaluation. Aspects of the league logistics, communications and incentives will be reviewed and modified weekly during a 3 month pilot study using a PDSA cycle Quality Improvement approach to implementation.

RESULTS

Initial experience was positive with 6 of 7 teams engaging regularly with the league. Participants' surveys were conducted at a pre-defined interval to assess this engagement data. In the first survey, conducted after 4 weeks, 58% of the responders felt that they have participated in the league 'very frequently' and 48% of the responders had collaborated with their team members to achieve a better score at frequent intervals.

Games included spelling bees, word finding games, 20 questions and quizzes about music and cinema designed to require a team with a range of ages and cultural background for success.

DISCUSSION

Results from this study in progress will be presented at the conference.

CONCLUSION

The RESPOND Games League aims to offer a time-efficient, low-cost team strengthening activity with limited use of resources. We envision this as a 'fun, fast and focused' way to improve team collaboration. If successful it may provide a useful tool to help improve clinical team function. There is little evidence about effectiveness of this approach in the Human Factors literature, but a good deal of evidence which documents the expense and relatively weak effect on patient outcomes of existing teamwork training paradigms, so there appears to be scope for exploration of simpler and cheaper methods for improving team cooperation and mutual support.

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12.4 The RESPOND study: Introducing resilient operating procedures to reduce failure to rescue rates

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KEYWORDS: resilience engineering, failure to rescue, resilient operating procedure

SUMMARY

Emergency Surgery for Acute abdominal pain (laparotomy) presents the highest mortality risk of any category of commonly performed surgery, and deficiencies in systems for rescuing deteriorating patients after surgery are well recognised. Safety 1-based Human Factors approaches to improving practice rely developing a standardised operating procedure which is rigid and often unrealistic. We developed a framework for a safety-II based "Resilient Operating Procedure" for rescue attempts, and are now trialling this in clinical environments.

BACKGROUND

Patients having emergency surgery for acute abdominal pain (laparotomy) suffer the highest mortality risk of any category of commonly performed surgery. The recognised causes of this include not only the severity and acuteness of their illness but also multiple systems factors. Operations are commonly performed outside normal working hours when hospital services are greatly reduced, and surgical teams are often ad hoc, inexperienced, and fatigued. A persistent feature of analyses of adverse outcomes in emergency surgery is failure of teams to act correctly and with adequate speed when patients develop post-operative complications. The RESPOND programme aims to analyse current response systems and propose, develop, and test improved ones using a Safety-II inspired Human Factors approach. One of the four intervention strands isto redesign the rescue process by developing the "Resilient Operating Procedure" – a new type of guidance to staff which adopts a flexible approach based on resilience theory.

The aim of this study was to develop a framework for building Resilient Operating Procedures (ROP) for escalation of treatment in patients who deteriorate following emergency laparotomy for abdominal pain, and to test the performance of this framework in pilot studies.

METHODS

We used observations on Surgical Emergency Units in 3 NHS Trust hospitals to develop a Functional Resonance Analysis Method (FRAM) analysis of their rescue systems for patients who deteriorate after surgery (Sujan et al., 2022). An experienced Human Factors practitioner provided additional information on Work as Done (WAD) by observing 8 full shifts (100 hours) including night and weekend shifts across all 3 units. A descriptive observation approach was interpreted using the Systems Engineering Initiative for Patient Safety (SEIPS) 101 (Holden & Carayon, 2021) model. During the observations work flow, tasks, and care processes were recorded under a diverse range of conditions, and clinical staff were questioned about the emergency response process. The observations

were discussed with the Chief investigator, and further questions such as "what do you do when things do not go to plan?" were asked of frontline staff. A general description of escalation processes, including trade-offs and compromises, was developed across all three Trusts. From this, a set of principles were derived for developing a prototype Resilient Operating Procedure for escalation with a distinct care goal for each component.

RESULTS

The components of an effective rescue process were envisioned as Monitoring, Detection of Deterioration, Initial Treatment, Information Gathering, Escalation, Planning Management, Implementation and Communication, and Review and Learning. Components interact and proceed in parallel, rather than following each other in sequence. A ROP clarifies the objective of each component, evaluates the trade-offs involved in each way of achieving it, and invites staff to select the pathway with the best combination of speed, effectiveness and lack of negative impacts on other rescue components or staff resilience. This "SatNav" format set of options permits different path choices depending on circumstances, providing realistic solutions to complex, time critical decision making in urgent clinical situations. Human Factors features designed to improve process performance include timelines for completion of stages and mandatory steps intended to overcome barriers to communication rooted in healthcare culture. Maximising resilience was considered at each step in the design of the ROP guideline. Task and finish groups are now implementing ROPs at all three sites, with close observation of the effects of adopting the model on process and outcomes.

DISCUSSION

Healthcare systems need to be redesigned to provide care that is safe, effective and efficient, and meets the multiple needs of patients (Xie & Carayon, 2015) and minimises environmental obstacles faced by staff. This study presents a bottom up approach to unpacking systems complexity in a highrisk surgical setting. By combining qualitive methods with a practical Human Factors framework, unique insights were obtained which informed development of the ROP Safety-2 based approach.

This approach is in line with Chartered Institute of Ergonomics and Human Factors (CIEHF) guidance on designing procedures (CIEHF, 2020). The method implemented in creating the ROP focuses on key components of CIEHF guidance such as involving the whole team and capturing Work as Done.

Using observation provided insight into Work as Done allowing the observer to understand actions, processes, and the challenges involved in caring for surgically deteriorating patents. This approach presents specific limitations which are associated with the person performing the observations, who has varied access to different actors, experience, and knowledge. This limitation was mitigated by cross checking observations the Chief Investigator of the programme.

The flexibility of the ROP approach and the emphasis on objectives rather than pathway standardization provides a better fit for complex healthcare environments than an SOP approach. Troubleshooting implementation work will be required to evaluate and optimise the approach in each unique environment.

CONCLUSIONS

A logically coherent method was developed for creating a flexible resilience-based approach to selection and implementation of optimal rescue procedures for deteriorating patients. Pilot testing in three hospitals will be used to refine and improve the method, and results of this will be presented.

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12.5 The shared language tool: An intervention to enhance shared ownership with service departments in rescue pathways for acutely deteriorating patients

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KEYWORDS: shared ownership, collaboration, deterioration

BACKGROUND

Mortality following emergency abdominal exploration for acute abdominal pain (laparotomy) is the highest for any commonly performed surgical operation. Patients undergoing this type of surgery are prone to the development of postoperative complications, and these are a major contribution to the mortality figure. Rescue pathways for acutely deteriorating surgical patients often entail input from other specialty departments for complete assessment, support, and treatment of patients beyond the surgical unit. We are currently conducting a research programme (RESPOND) focused on improving the recuse process for patients who deteriorate after major surgery. Rescue attempts involve the need for rapid and effective inter-specialty collaboration between departments and services in the hospital, and failures in communication and collaboration between these groups is recognised as a source of delays and failures in response effectiveness. Departments whose help is needed, such as Radiology, Anaesthesia and intensive care have to deal with multiple other tasks and priorities, and like surgery, have greatly reduced staffing and services outside the daytime working hours. Friction in communication is worsened by the fact that junior medical staff in surgery, who request service department expertise for surgical patients during the process of rescue are frequently inexperienced and unable to formulate the problem and the case for priority in a manner which is understood and accepted by more experienced specialist staff in service departments. This is frequent source of misunderstanding, rework and delay, as more senior staff are frequently called on to intervene, which may lead to delay if they are otherwise engaged, as is commonly the case. Interviews with staff involved in the rescue process highlighted the potential value of a common language for describing critically ill patients which would help identify the degree of urgency required in a way which was understood by all stakeholders. Since the quality of requests submitted by junior doctors is the most important source of this problem, we were interested in using a Human factors approach to resolve this problem by developing a standardised template. We aim to develop an intervention that enhances co-ordination of inter-specialty work in rescue attempts for acutely deteriorating patients using a shared language tool that provides a framework for more precise, briefer, and less stressful requests.

METHODS

The tool was developed as part of the Shared Ownership intervention, one of four strands in the NIHR funded 5-year RESPOND study. It was co-developed with foundation year 1 doctors

(FY1s) in the surgical emergency units and with senior specialists in the service departments (ICU, Anaesthesia, Radiology, and Theatres) from three National Health Service (NHS) Trusts. Focus groups discussed the problems of communication between the most junior trainees (FY 1 and 2 doctors), who are frequently tasked with communication with other departments in emergencies, and the staff in the departments most frequently involved in surgical rescue responses. The results were used to identify a core information set which would be of value to specialists to whim requests were being made, and who often need to prioritise requests according to urgency. Through iterative co-design, a template was developed which divided information into three categories: (a) Perceived clinical problem and request, (b) evidence of critical illness and (c) background patient condition and risk status. A standardised format was developed which allowed even the most inexperienced junior staff to deliver this key information in a coherent fashion in less than one minute. Specialists receiving calls were requested to allow the FY doctors time to deliver the full information template without interruption, sand to respond after discussion by giving a clear indication of whether the request was (a) accepted – with a timeline for action (b) required further information to be provided for a decision (with a specification of what was needed) or (c) rejected (with an explanation of the reason. Training sessions and pre-implementation practise sessions were conducted with over 25 FY1s and several senior medical staff from service departments across all three trusts. The system was then introduced into use in the three hospitals in the RESPOND pilot intervention programme. Qualitative assessment of effectiveness and ease of use was obtained by regular questionnaires circulated to both FY doctors and specialists during and after a 12 week Quality Improvement based implementation period, and were used in the PDCA cycle to inform iterative improvement of the system.

RESULTS

The participants were able to use the tool on case scenarios and participants provided feedback on the utility of the tool. The rationale for the tool was seen as strong by most participants, although some specialists remained sceptical about whether it would improve communication in practice. Junior doctors reported finding it difficult to remember to use the tool, and several instances were discovered where recent changes in practice (often related to movement of communication from telephone and bleep systems to an electronic patient record platform. We simplified the process by asking FYs to use the template n all communications about critically ill or deteriorating patients whether by telephone, face to face or by electronic messaging means. The pilot study is currently in cycle 4 of 12, and full results will be presented at the conference. To date, questionnaire return is over 70% and the most recent results suggest increased uptake and comfort with use.

CONCLUSION

The shared language tool is a communication tool co-developed by surgical FY1s and service department specialists for precise and focused requests concerning acutely deteriorating patients. It uses a Human Factors approach to systems redesign and aims to improve co-ordination and shared ownership of inter-departmental rescue efforts by empowering FY1s to produce coherent, standardised and structured requests. It also allows for active listening and structured feedback from service departments. Qualitative results from the pilot study will be presented at the conference.

ACKNOWLEDGEMENTS

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13. The Systems Engineering Initiative for Patient Safety (SEIPS): Designing the past, present, and future of healthcare

Chair: Dr. Abigail R. Wooldridge, University of Illinois at Urbana-Champaign, USA

SPECIAL SESSION

KEYWORDS: work systems, sociotechnical systems, patient safety, health care human factors and ergonomics

SESSION AIM

The Systems Engineering Initiative for Patient Safety (SEIPS) model, developed by Pascale Carayon and colleagues, converges human factors/ergonomics (HFE) work systems theory with health sciences approaches to health care quality and has been widely used by HFE and healthcare researchers and practitioners. This session celebrates Professor Carayon's contributions to the science and practice of HFE in health care, focused on SEIPS. Its intent is forward-looking as presenters consider the foundations, needs, and opportunities for HFE applications in patient safety, quality, health care professional wellbeing, health information technology, and patient/family engagement. Attendees will learn about current inroads such as the adoption of SEIPS by health systems in the US and abroad. The session will critically appraise failed efforts to disseminate HFE and opportunities to increase HFE penetration by catering to practitioners, embracing a whole systems approach, leveraging design thinking, and understanding health care processes as intertwined patient and professional journeys.

Clinical leaders, collaborators, and students/trainees of Professor Carayon, and Professor Carayon will present, discuss, and debate in an interactive format.

14. Better in-Better out: (p)rehabilitation with patients preparing for and recovering from elective surgery

Chairs: Dr. Lottie F.M. Kuijt-Evers and dr. Mark Scheper, The Hague University of Applied Sciences, Medical Delta Living Lab Better in-Better out, The Netherlands,

SPECIAL SESSION

KEYWORDS: (p)rehabilitation, patient journey, daily functioning, oncological care, perioperative health and care

SESSION AIM

One of the missions of the Dutch government is that care will be organized and provided to people in one's own living environment.

As the survival rate of people with cancer increases, the number of people living with cancer and with the consequences of cancer treatments is growing as well. Months and even years after treatments are finished, people still report complications (e.g. fatigue, pain, emotional distress) resulting in less societal participation, both in work and leisure, and consequently negatively affect their general perceived health related quality of life.

To prevent these negative side effects of cancer(treatments), (p)rehabilitation programs are developed and validated. Most of these include dietary advice, physical exercise, smoke and alcohol cessation and psychosocial support. The implementation of these programs in the own living environment of the patient, faces several Convergence-related challenges: 1) Transdisciplinary collaboration in (p)rehabilitation in primary care, 2) Providing (p)rehabilitation programs in people's own living environment in collaboration with people's informal networks using e.g., self-monitoring technology; 3) Adapting the (p)rehabilitation programs to the talents of people with different backgrounds and different social and physical living environments supported by (remote) sensor- and data technology.

In this session we will share knowledge on these challenges regarding either oncological care pathways or other care pathways.

CONTENT

Effect of preoperative multimodal lifestyle interventions on functional capacity in colorectal cancer patients and the importance of personalization

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KEYWORDS: colorectal cancer, lifestyle intervention, prehabilitation, functional capacity, personalization

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

IIn recent years the preoperative phase of a patient undergoing colorectal cancer surgery is increasingly studied, due to the increasing evidence of "better in, better out" prehabilitation programs, as a means to improve patients outcomes in recovery after surgery. Multimodal programs seem to be of additional benefit to these patient outcomes. Questions remain however which interventions are best suited for increasing patient outcomes and to what extent these are tailored to personal capabilities and personal preferences. This systematic literature review analysed, after a thorough search through four different databases, six studies of which four randomized clinical trials. Results showed that most patients benefited from participating in a multimodal prehabilitation program, increasing their functional capacities before and after surgery. Yet frail elderly seemed to benefit less from a prehabilitation program while inactive patients showed greater improvements compared to the more active patients. Furthermore, adherence was higher in the prehabilitation program compared to rehabilitation and personalization of the program appeared to improve adherence. It seems to be of importance to identify which colorectal cancer patients benefit most from a prehabilitation program and how personalization can further increase the benefits of prehabilitation.

14.2 Selective taste management: An innovative and feasible selfcare intervention for adult cancer outpatients suffering chemotherapy-induced dysgeusia

Marleen Corremans[a], Andy Verroeye[b], Lobke Van den Wijngaert[b], Edwig Goossens[b], Geertrui Vlaemynck[c], Dimitri Mortelmans[a] and Bart Geurden[a]

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KEYWORDS: cancer, chemotherapy, dysgeusia, selective taste management, selfcare, malnutrition

INTRODUCTION AND AIM

Currently, limited evidence-based guidelines exist for the effective management of chemotherapy-induced dysgeusia in cancer outpatients. In this pilot study, we used innovative insights from gastrological sciences such as selective taste management to improve the taste of bread for cancer outpatients. We investigated whether it is feasible for cancer outpatients and family caregivers to bake personalized bread themselves at home and whether such bread is considered tasty despite their burdensome taste disorder.

DESIGN

All adult cancer outpatients suffering chemotherapy induced taste disorders were eligible. Included patients (N=112) are randomly divided in a bread-baking group (N=54) and a control group (N=58). The individual taste thresholds profile of all bread baking patients is assessed using the innovative O-Box. Using an algorithm, these profiles are processed into a recipe for personalized bread. Structured questionnaires are used to compare the taste experiences and the feasibility of baking personalized bread after one month follow-up.

MAJOR FINDINGS

Despite their stressful taste disorder, more than 80% of the bread-baking patients experienced the taste of personalized bread as equally or even better than the usual bread before the start of the chemotherapy and the related dysgeusia.
Only 17% of the patients in the bread-baking group required some telephone or online assistance in order to correctly apply their personalized recipe.
In 60% of the cases, the bread was prepared by the family caregiver. Compliance was high and no side effects were observed. These findings confirm the feasibility of this self-care intervention.

CONCLUSION

Adult cancer outpatients suffering chemotherapy-induced dysgeusia enjoyed the taste of bread again by self-applying selective taste management at home. All findings in this pilot confirm the feasibility of this very promising self-care intervention.
In the coming two years, this innovative gastrological approach will be studied more in depth using whole meals in a larger cancer outpatient population in Belgian and Dutch cancer centers.

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14.3 Better in – Better out; What about the hospital stay?

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KEYWORDS: mobilisation, hospitalization, colorectal surgery, nurses, patients.

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Early mobilisation after abdominal surgery is necessary to avoid complications and increase recovery. However, due to a variety of factors, failure of early mobilisation is seen in clinical practice. The aim of this study is to investigate the perspectives of nurses and patients of the Haaglanden Medical Center (HMC) how to increase mobilisation frequency after colorectal surgery in the oncological surgery ward. This explorative study employed qualitative data collection and analysis by means of semi-structured interviews with patients and nurses. Patients were included when they had a colorectal resection, were older than 18 years and spoke Dutch. The interviews were audiotaped and verbatum transcribed. A thematic content analysis was performed. It was concluded that mobilisation can be increased when it is incorporated in daily care activities and family support during visting hours. Appropriate information about mobilisation and physical activity is needed for nurses, patients and family and the hospital environment should stimulate mobilisation.

14.4 Patient safety after bariatric surgery: the influence of the quality of care transition and patients' health-related control beliefs

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KEYWORDS: care transition, discharge, patient safety, bariatric surgery

SUMMARY
Our study investigated the influence of the quality of care transition on patient safety and health-related outcomes in patients after bariatric surgery and examined the role of health-related control beliefs. Our results confirm the significance of a patient-centered care transition in order to foster patients' control beliefs, prevent safety incidents and improve health status after discharge.

BACKGROUND
Bariatric surgery is a final option for many obese patients, as patients have usually experienced a long history of suffering and a large number of unsuccessful non-surgical therapy attempts prior to such an operation (Wharton et al., 2016). Moreover, patients' health-related control beliefs (HCB) are often diminished. With discharge to home after surgery, patients are expected to take over high degrees of responsibility for their health in order to ensure post-operative outcomes and, ultimately, achieve therapeutic success. Thus, patient-centered care (PCC) after bariatric surgery is of particular importance when patients resume an active role in their health. To this end, since quality of care transition (QCT) plays a central role across various specialties and diseases (Braet et al., 2016), further investigations into PCC, transitional safety and process outcomes are necessary, particularly in vulnerable patient groups. Our study thus aimed to determine associations between QCT and patient outcomes and patient safety as well as to scrutinize the influence on patients' HCB.

METHODS
Data for this cross-sectional study were collected via a self-assessment questionnaire distributed in social networks and self-help groups for patients after bariatric surgery in Germany. The final sample considered for statistical analysis was N=488 (89% female). The standardized questionnaire included items to assess QCT (Coleman et al., 2005) and patients' HCB (Ferring, 2003). Further, we assessed post-discharge patient safety indicators (i.e. unplanned readmissions and medication complications) and health-related indicators (i.e. physical and mental health status, quality of life). We conducted binomial regression analyses to reveal interrelations between QCT and patient safety indicators. Linear regressions were deployed for evaluation of the relation between QCT and health-related indicators. Further, we conducted mediation analyses to test for a possible mediation effect of patient's HCB. We z-scaled QCT to improve interpretability of the results.

RESULTS
Data analyses revealed that QCT was associated with lower likelihoods of patient safety incidents and better health-related outcomes. Precisely,

the risk of unplanned hospital readmission as well as medication complications were lower among those who reported high quality of care transition (OR 0.73, p<.01, and 0.60, p<.001, respectively). Moreover, physical and mental health as well as quality of life were significantly related to QCT (B=.20, B=.21, and B=.23, respectively; all p<.001). All associations were partly mediated by the patients' HCB, except for likelihood of readmissions. Patients' HCB and QCT were strongly interrelated (r=.28, r<.001). Summary of analyses regarding the patient safety related indicators are provided in table 1. Table 2 shows the results of analyses regarding health-related indicators.

Table 1. Binomial regression analyses for mediation of HCB between QCT and patient safety indicators

	readmission risk			medication complication		
Variable	B	OR	R^2	B	OR	R^2
Step 1			0.023			0.057
QCT	-0.32**	0.73		-0.51***	0.6	
Step 2			0.023			0.071
QCT	-0.31**	0.73		-0.45***	0.64	
HCB	-0.01	0.99		-0.28*	0.76	

QCT: quality of care transition, HCB: health-related control beliefs; *<.05, **<.01, ***<.001

Table 2. Linear regression analyses for mediation of HCB between QCT and health-related outcomes

	physical health			mental health			quality of life		
Variable	B	SE (B)	R^2	B	SE (B)	R^2	B	SE (B)	R^2
Step 1			0.039			0.042			0.051
QCT	0.20***	0.04		0.21***	0.04		0.23***	0.04	
Step 2			0.051			0.062			0.087
QCT	0.17***	0.05		0.17***	0.05		0.17***	0.05	
HCB	0.12***	0.05		0.15***	0.05		0.20***	0.05	

QCT: quality of care transition, HCB: health-related control beliefs; ***<.001

DISCUSSION

Our results confirm that QCT is significantly related to patient safety as well as health-related indicators in patients after bariatric surgery. Moreover, our results suggest that patients' health control beliefs serve an important mediator in how quality of care transitions affects physical and mental health outcomes as well as quality of life. Nevertheless, our study is limited in generalizability due to its correlational nature and due its specific sample characteristics.

CONCLUSIONS

Our results corroborate that QCT plays an important role in safe post-inpatient care after bariatric surgery. Looking from the PCC perspective, it is evident that patient involvement in the discharge process promotes accountability in the meaning of patients' HCB, thereby reducing the likelihood of patient safety incidents and improving health-related outcomes.

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15. Use-related risk management for medical devices and combination products

Chairs: Dr. Thomas Stüdeli Eur.Erg. (La Roche Ltd, Switzerland), Torsten Gruchmann (Use-Lab GmbH), Florian Schauderna (Bayer AG), Stefan Horst (Boehringer Ingelheim Pharma GmbH)

SPECIAL SESSION

KEYWORDS: IEC/ISO 62366, ISO 14971, risk assessment, usability testing

SESSION AIM

The combination of a risk-based and a user-centered design approach is of key importance to design complex, high-risk products. For Medical Devices (MD) the journey started in the nineties when the US FDA was pushing a risk management approach to MD design. Today, after more than three decades the industry and the health authorities gathered experiences, and multiple established guidelines around the topic have been written. Nevertheless, the consideration of use-related risks in MD product design as well as the management of those during the product life cycle is an ongoing challenge for practitioners.

In this special session we will share recent experiences, current state-of-the-art practices and remaining knowledge gaps and challenges. Where can academia contribute and what research is needed for the future?

PROGRAM

15.1 Requirements for use-related risks assessments - an Ergonomics perspective - *Thomas Stuedeli*

15.2 Linking HF/Usability testing with use-related risk analyses – best practices and pitfalls - *Florian Schauderna*

15.3 SE-related risk analyses for a medicinal product with a simple co-packaged device – A case study - *Stephan Horst*

15.4 Design of an evidence-based checklist to help prevent use error with auto-injector pens - *Jessica Schiro, Sylvia Pelayo, Louise Heyndels and Romaric Marcilly*

15.5 Instruction for use as risk mitigation - challenges and opportunities - *Torsten Gruchmann and Stephanie Schwenke*

15.1 Requirements for use-related risks assessments: an ergonomics perspective

Thomas Stuedeli, La Roche Ltd, Switzerland

KEYWORDS: human centered design, use-related risks, failure mode and effect analysis, medical device development process

ABSTRACT

The combination of risk based and user centered design approach is of key importance for the design of complex or high-risk products in healthcare. Over the last three decades, the industry and the health authorities gathered experiences and established multiple guidelines around this topic.

This paper introduces the risk management process for medical devices for medical devices and maps out its link to the User Centered Design approach.

It also points out some associated practical challenges for a Human Factors Engineer:

- When to perform use-related risks analysis in what depth?
- How to define acceptance criteria?
- Risk mitigation "as far as possible", what is reasonable or practically possible?
- Probability for use-related risks, how do we deal with numbers?
- Sequence of events, what are reasonable hazardous scenarios?
- Residual use-related risks and the risks-benefit analysis

This overview aims to serve as a basis for the discussion among practitioners and between practitioners and academia.

15.2 Linking HF/usability testing with use-related risk analyses: Best practices and pitfalls

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KEYWORDS: use-related risk analysis, usability evaluation, hazard-related use scenarios, critical tasks

SUMMARY
As part of the special session "Use-related Risk Management for Medical Devices and Combination Products", this presentation focuses on practical experiences when applying an integrated Risk Management (RM) and Human Factors / Usability Engineering approach (HF/UE). With examples from the context of HF/usability testing, the author outlines current best practices and potential pitfalls for the interaction between these two disciplines.

BACKGROUND
With the current ISO 14971, the IEC 62366 series and FDA's human factors (HF) guidance documents, industry is provided with a solid framework for applying a risk-based HF/UE approach to the design and development of medical devices and drug-device combination products. In companies where these processes are well established, RM and HF/UE are often interweaved into design controls and into each other. This constitutes the highest level of process maturity and compliance, with a high probability for achieving safe and effective products as well as avoiding issues during agency reviews.

When applying such integrated RM and HF/UE approaches, companies are facing practical challenges– the devil is often in the details of the interaction between the two processes.

METHODS
The presentation is based on challenges observed by industry representatives from pharmaceutical companies when applying RM and HF/UE for medical devices and combination products.

RESULTS
While many more pitfalls and devils in the details may exist, the presenter focuses on two exemplary challenges that industry is facing in the context of HF/usability testing. He outlines industry's current best practices and indicates potential for scientific follow-up.

Example 1 – Avoiding that everything becomes a critical task / a hazard-related use scenario:
IEC 62366-1:2015 and FDA's HF guidance documents suggest that the identification of hazardrelated use scenarios and critical tasks is performed based on the severity of harm. In an integrated approach however, use-related risk analyses (URRAs) are typically created to also satisfy requirements as per ISO 14971:2019, that is, including the probability of a given hazardous situation to occur (often referred to as P1).

When identifying hazard-related use scenarios and critical tasks based on severity of harm and ignoring P1, risk management teams often find themselves confronted with many if not most tasks/scenarios becoming critical / hazard-related. This jeopardizes the purpose to tailor and prioritize development activities, especially summative HF/usability evaluations efforts.

Risk management teams are typically experiencing this pitfall when they…
a) … either include extremely unlikely sequences of events into their risk analyses, i.e., associated with a very low P1 rating, but a high severity of harm.
b) … and/or associate a hazardous situation with several harms, including those that are very unlikely to occur for the given hazardous situation (P2), but with a high severity of harm.

The related industry practice is to embrace the focus on reasonably foreseeable cases – both when identifying (sequences of) events pertaining to hazardous situations and/or when identifying the harms associated with hazardous situations.

Example 2 – Correctly transferring results from HF/usability evaluations into risk analyses:
In an integrated RM-HF/UE approach, when transferring results from HF/usability evaluations (simulated use testing) back into URRAS, risk management team are often inclined to covert occurrence rates observed in the evaluation into P1 ratings – e.g.:
a) 3 use errors in n=15 --> P1 = remote
b) 12 use errors in n=15 --> P1 = probable

This not adequate since analyzing results from qualitative HF/usability evaluations as per IEC 62366-1:2015 and FDA's HF guidance documents only allows concluding on the associated severity of harm. The sample size of such HF/usability evaluations is typically not large enough to allow for statistical analyses on occurrence rates. The latter are heavily influenced by the characteristics of the selected sample and the selected test conditions. Also, in an URRA, P1 typically includes different or additional events pertaining to a hazardous situation, which may not have been the ones that led to the observed use error in the testing (sometimes because they cannot be simulated).

Industry's practice is to use a binary approach for transferring results from HF/usability evaluation to the URRA:
a) Was no use error/difficulty observed on a given task (or none that were caused by the respective user interface elements)?
> The assessed risk control measure in the user interface can be deemed effective.
> The risk management team applies an afore-agreed reduction of P1 for the given risk control measure.
b) Was a use error/difficulty observed and caused by the user interface?
> The related risk control measure in the user interface cannot be deemed effective.
> The risk management team keeps the P1 rating as it is defined for before mitigation and determines whether additional risk control is necessary and practicable.

DISCUSSION

While the industry practice in the 2nd example is based on clear rules, the one in the 1st example is rather consensus-driven and therefore prone to human bias and group dynamics. In a worst case, this could lead to tasks/scenarios not being evaluated in HF/usability testing that could lead to harm.

Therefore, potential topics for scientific follow-up and input to industry are evolving around rendering the determination of "reasonably foreseeable" more data-based, e.g., by helping industry determine scientific rationales for the threshold towards "not reasonably foreseeable".

ACKNOWLEDGEMENTS

The presentation is an excerpt of discussions in the European Pharma Human Factors Forum, an industry forum for sharing experiences related to the application of Human Factors and Usability Engineering principles in the development of pharmaceutical drug-device combination products.

15.3 Use-related risk analyses for a medicinal product with a simple co-packaged device – A case study

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KEYWORDS: paediatric, oral liquid, dosing error, risk mitigation.

SUMMARY

As part of the special session "Use-related Risk Management for Medical Devices and Combination Products", this presentation focuses on practical of challenges experienced with the development of a suitable medication for children. The case study shows that hurdles to overcome may lead to a more complex medication then intended and residual risks remain.

BACKGROUND

The development of paediatric formulations and presentations is a mandatory regulatory requirement and presents a significant challenge to the pharmaceutical companies. Even though, it is a necessary effort to ensure that children of all ages and their caregivers have access to safe and accurate dosage forms of medicines. The development of paediatric formulations and presentations is a mandatory regulatory requirement and presents a significant challenge to the pharmaceutical companies. Even though, it is a necessary effort to ensure that children of all ages and their caregivers have access to safe and accurate dosage forms of medicines. Infancy and childhood is a period of rapid growth and development [1]. In this period the child faces a rapid change in physical, metabolic and psychological processes inherent to growth. It is important to note, that children cannot be regarded as small adults and not even as homogeneous group. The body and its organs, body systems and enzymes are developing at a different pace. Drug metabolism and pharmacokinetics as well as adverse reactions differ and could vary with age. Hence, the dose varies throughout infancy and childhood. The dosing regimen often follows changes in body surface area and weight. Furthermore, it is to be considered that the medicine should be suitable to be administered by lay caregivers at home to guarantee the most convenient treatment for the child.

DEVELOPMENT APPROACH

In this case a formulation for infants from birth to 1 year of age was needed. All other age ranges were already be covered by different formulation alternatives. In order to develop a formulation suitable for the youngest general recommendations according the "Reflection Paper: Formulations Of Choice For The Paediatric Population" [1] and the considerations given in the "Good practice guide on risk minimisation and prevention of medication errors" [2] were considered. It was decided to develop an oral solution to provide a suitable alternative for the youngest due to the following reasons:

The oral route of administration is commonly used for dosing medicinal products to paediatric patients

According to [1], liquid formulations are most approprioate … (include solutions, syrups, suspensions and emulsions) and are most appropriate for younger paediatric patients (e.g. birth to 8 years). For a liquid formulation it is important that acceptable diluents are needed to ensure satisfactory stability. Furthermore, an acceptable taste is critical for compliance and concordance.

DRUG RELATE CHALLENGES AND MITIGATION

In the course of the development a number of challenges were changing the situation and the development was to be adapted multiple times to meet the development target liquid oral medication.

A specific diluent was developed to dissolve the drug entirely and to improve bioavailability. The dissolved drug showed a very short stability and a packaging system for the drug was required. Stability studies revealed that the drug was much more moisture sensitive than expected. Although an aluminum sachet was selected as a high barrier packaging system, stability issues required an additional moisture barrier. An aluminum bag to hold the aluminum sachets were introduced but still not sufficient for stability. Hence, in addition a desiccant is used inside of the bag to assure the drug quality over the shelf life. Since the taste of the drug is unacceptable for a pediatric formulation, taste masking was required. A non-sugar based sweetener was selected, considering risk of dental caries. Several sweeteners were tested due to incompatibilities with the drug and the solvent. The drug degraded in contact with the sweetener and the diluent reacted with the sweetener forming an unwanted substance. A separate package for the sweetener couldn't be avoided.

In order to mitigate potential medication errors several measures have been taken:

- The drug, sweetener and diluent quantity for preparing the oral solution was provided premeasured to avoid a wrong oral solution concentration.
- The color and size of the sweetener package has been selected to differ from the drug package to avoid mix-up.
- The desiccant pouch added to the aluminum bag was changed to a desiccant canister to avoid confusion with the drug sachet.
- An oral dosing syringe has been established to ease accurate dosing and administration, as it is considered as the most accurate dosing device with proven usability in the target group
- The oral syringe was designed to be incompatible with needles for injection.
- The oral syringe was named dosing pipette so that it should not be mistaken as a syringe for injection.
- An oral syringe adapter for insertion into the bottle neck was added to ease the withdrawal of oral solution for the user.

RISK ANALYSIS AND CONCLUSION

A convenience pack was developed to hold all items necessary to prepare and give the daily dose. However, due to the afore mentioned stability issues, the drug itself needed to be presented in a separate box. Eventually the package design comprises a 30 day kit box containing one medicinal product pack (folding box) containing 1 aluminum bag with 30 aluminum sachets plus 1 desiccant, and 30 preparation packs (each for one day of administration). The preparation pack consists of a folding box containing the diluent bottle, the sweetener sachet, 2 oral syringes and adapter. Due to the oral syringes and the adapter the requirements for co-packed combination products apply. In particular human factor engineering is required per US regulations. The FDA encourages applicants to submit their HF validation protocol prior to conducting the study. The HF validation package comprises in addition to testing details, of background information consisting of use specification, description of the device user interface, summary of known use problems and preliminary analysis and evaluations. An important part of the submission is the use risk analysis, i.e. analysis of hazards and risks associated with use of the device.

As a first step to the risk analysis a task analysis will be conducted, and critical tasks identified. It is to be noted, that the critical task definition in FDA guidelines ([3] and [4]) differs significantly, since a critical task is defined as task that could cause serious harm [3] compared to a task that could

cause any harm at all [4]. The identification of a critical task is not always straight forward and can be discussed controversially. For example, it is a likely discussion if the task "User reads IFU" or "User understands IFU" are to be defined as critical tasks. In the end it is to be considered that solely not to read or not to understand the IFU is not a use error per se. Use errors should be specific to product use and the manufacturer needs to be able to pinpoint where during use was a use-related issue. Hence, not reading or understanding the IFU is not a use error in the strict sense and does not always lead to incorrect use of the product. Users might still use the product correctly without reading or understanding the IFU.

An important step of the risk analysis is the hazard list and the categorization of severity. In a hazard list, hazards and hazardous situations, the resulting harm and the severity of the harm will be identified. The severity can be categorized for example into 5 classifications according to ISO 14971 [5]. Here the severity is classified from neglible (harm results in inconvenience or temporary discomfort, e.g., temporary eye irritation, skin irritation), minor /harm results in temporary injury or impairment not requiring professional medical or surgical intervention, e.g., minor cut, minor bruising, abrasion), serious /major (harm results in injury or impairment requiring professional medical or surgical intervention, e.g., severe burning, cut), critical (harm results in permanent impairment or irreversible injury, e.g., serious eye injury with permanent loss of sight) to catastrophic/ fatal (results in death).
In the case of dosing errors, the categorization of the severity depends on the therapeutic window of the medicinal product, if it is used for chronic treatment or emergency cases, if it is a treatment or prevention medication. Furthermore, it should be differentiated between an underdose and an overdose as well as the extent of under-/overdosing (e.g < 10%, 50, > 50%) and if it is a one time or a repeated dosing error. In this case, only a repeatedly missed dose and a repeated overdoses exceeding 110% of the nominal dose were expected to lead to a serious (major) harm. Hence, all tasks leading to a dosing error causing serious harm were categorized as a critical task and accordingly translated into the Human Factor validation study protocol. However, the feedback received after submission of the HF protocol was, that all dosing errors have to be considered as a critical task no matter if categorized as leading to serious harm or not. In consequence it is to be expected, that more critical use errors will be observed in Human Factor studies which have to be discussed and evaluated. A high number of critical use errors may lead to the impression, that the product is not safe to use, especially in the light of AFAR approach (all risks shall be mitigated "as far as possible"). Nevertheless, it is also important to consider that further mitigation may adversely affect the benefit-risk ratio. An oral syringe for example is established as the most accurate administration device of oral liquids by lay users, e.g. compared to spoons and cups. However, a certain variability in the administered dose is immanent to the system. There are (acceptable) tolerances of the drug concentration of about (90% to 110%), the technical tolerances of the oral syringe (± x %). Even use errors like the user is not hitting the mark exactly or priming errors (removal of air bubbles) are to be considered as system immanent as well. This raises the question if an established oral syringe complies with a risk reduction "as far as possible". That would lead to the follow up questions, e.g. if risk mitigation has to go beyond state of the art or is the use to be restrict to HealthCare Professionals or is a mandatory training for all users needed and if these measures would adversely affect the benefit – risk ratio. However, the benefits must outweigh the residual risk, where benefits may include user empowerment and cost acceptability by health insurance systems as well. It may be not beneficial to address every tiny risk in the Instructions for use and the state of the art is not to be confused with the state of science. A newer device may offer greater benefits but also greater risks, since it has often not been tried and tested in the field. An alternative device may be superior in one aspect, but not in

other aspects. So, in conclusion, a newer or an alternative device does not necessarily offer a better benefit-risk ratio.

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15.4 Design of an evidence-based checklist to help prevent use errors with auto-injector pens

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KEYWORDS: human factors engineering, errors, design, injector pen, checklist, risk management

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ABSTRACT

Auto-injector pens (AIPs) can improve a patient's quality of life. However, some human factors problems in AIP design can prompt the occurrence of use errors with sometimes dramatic consequences. AIP manufacturers are required to identify characteristics of the user interface that might lead to use errors. This identification can be time-consuming and fastidious. Here, we report on the initial steps in the design of a checklist for identifying AIP use errors (CAPU). The checklist is intended to help professionals in charge of the design and risk management of disposable AIPs to determine the likelihood of use errors more easily.

A review of the literature (57 publications) enabled us to identify 341 semantic units that were representative of use errors. These errors were grouped into 50 categories and covered all the steps in AIP use (i.e. from storage to injection and disposal). Initial feedback on CAPU from human factors engineers enabled us to clarify the list's content and the way in which the use errors were listed.

CAPU is intended to simplify certain tasks for risk management professionals working on AIPs. It is not intended to replace the involvement of human factors experts in AIP design, evaluation and risk management. The next steps in the project consist in developing a software version of the checklist and extending the volume and type of data underpinning it. Lastly, the checklist's usefulness and psychometric qualities should be evaluated with risk management professionals working on AIPs.

15.5 Instruction for use as risk mitigation - Challenges and opportunities

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KEYWORDS: risk-mitigation, instructions for use overwarning, legibility, readability comprehensibility, MDR, IEC 62366-1:2015

ABSTRACT

Instructions for use are often called superfluous. Manufacturers often assume users don't read the instructions and many users don't bother with them. This was confirmed by several studies performed by our team. Clinicians mostly consult the manual in case of troubleshooting and when colleagues cannot help. But why?

BACKGROUND

In a clinical setting, instructions for use are often not available when users need them or information cannot be found quickly and easily enough. Inside the clinic and out, users don't want to page through thick manuals in multiple languages or strain their eyes with small text, confusing images and a bunch of safety information.

Even assuming users might not use the instructions for use, manufacturers of medical products often use them as a measure to mitigate potential use-related risks.

Instructions for use contain important safety information for users using signal words like "danger", "warning" and "caution". To truly mitigate risk, users must read this information about how to use the product safely before using the device. The challenge is, as described above: Users don't read manuals proactively but mainly in case of troubleshooting.

For the manufacturer safety information is important from a legal perspective following the risk management process described in ISO 14971. The standard lists information for safety as the third of three options how manufacturers can mitigate risks. That said, safety information can be used as a juristic exculpation to ensure that the manufacturer has done everything to inform the user about potential hazards and risks. But are instructions for use an effective risk mitigation?

METHODOLOGY

Depending on the complexity of the product, instructions for use can include dozens of pages of safety information. Users may not recognize what's important, let alone see it at the right time or even be motivated to keep reading the instructions. More often than not, an overwarning effect can be expected and users avoid reading any of the safety messages. Perpetually we are confronted with manuals containing up to thirty pages of safety information in a row. Often some of this information is repeated later on in the instructions for use. Added to this, warnings and safety information are often presented in off-putting manners ranging from pages of small grey boxes to unsorted bullet point lists that are difficult even for motivated readers to follow.

Effective risk mitigation requires information for safety to be effectively integrated into the instructions for use. The way information for safety is presented should not encourage users to skip it, rather it must be softly integrated in the reading flow and effectively placed where a risk can occur in case of a wrong use of the product. A chaining of safety information over pages just to ensure that it is printed, needs to be avoided. Onlooking to the the layout, the graphic to text ratio can ensure effective and useful instructions which are more likely to be read; manufacturers should consider which pieces of safety information can also be included as an

image, something many users prefer to look at before reading text. If text is unavoidable, it should be clear and unambiguous, but also offer sufficient information – if users are told not to do a thing that might be intuitive, knowing why can go a long way to helping them remember.

Warnings often include negations, these short but essential words (e.g., not or don't) are often overlooked and missed, printing them in bold can help readers see them; however, if a sentence can be phrased telling users what to do, that is always preferable.

Not to be forgotten: Instructions for use need to consider the different user groups, e.g. with respect to the depth of information and the terminology. A huge number of standards and guidances support the manufacturer on how to write accompanying documents to comply with the regulatory requirements. To avoid overwarning and to ensure useful instructions for use, e.g. IEC 62366-1:2015 requires manufacturers to provide evidence that each piece of safety information that is used as a risk mitigator in the instructions for use is adequate. Additional requirements in the MDR 745/2017 ask for legibility and comprehensiveness of instructions for use. Further information on the layout and quality of instructions for use can be found in IEC 82079-1 and especially the design of warning messages is specified in the ANSI Z535 series. While this information can be helpful, it can also be frustrating for manufacturers. Some warnings, for example regarding electrical hazards or certain mechanical risks are proscribed by relevant standards and yet…they don't always work. In multiple studies we have seen users stumped by what these warnings mean. This is why testing is so important, manufacturers are free to supplement additional in such cases to provide greater clarity. Adequacy of risk mitigations, effectiveness of warning messages, readability and understandability can be evaluated in a human factors study. Such studies can be performed early on in the product development cycle to determine how best to instruct users to operate a device, but should also be conducted later on, to ensure that users can follow the instructions and recognize information relevant to them for safe and effective handling.

The presentation will highlight some lessons learned from various human factors studies focusing on effectiveness of risk mitigations via information for safety in the instructions for use.

RESULTS

Instructions for use do not need to be superfluous, if they are written and designed well, they can play an important role as a risk mitigation and in ensuring user and patient safety.

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16. COVID 19 and beyond: Impact on work system design

CONTENT

16.1 User-centred design of work procedures to support healthcare during COVID-19 and beyond

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KEYWORDS: work procedures, COVID-1, healthcare

ABSTRACT

The overall purpose of the study and the research problem(s) investigated
The inadequate design of work procedures is often cited as a contributory factor in healthcare safety incidents. Furthermore, the COVID-19 pandemic has necessarily witnessed a proliferation of new and re-designed work procedures introduced as staff adapted to altered working conditions, work environments and expanded job roles. In response, this study aimed to rapidly develop guidance on the user-centred design of work procedures by and for healthcare teams worldwide.

The design of the study
A rapid, pragmatic consensus building study using a modified-Delphi involving international multi-professional 'experts' was undertaken during April 2020. 66 study participants comprising healthcare professionals (n=49) and Human Factors/Safety specialists (n=17), in six countries, were identified from healthcare networks and contributed to the rapid guidance development.

Major findings
Ten key guidance steps and descriptors were identified and agreed upon by the expert group on how to better develop and implement work procedures based on Human Factors design principles. Examples include: 'Ensure a procedure is needed'; 'Involve the whole team'; 'Identify the hazards'; 'Capture work-as-done'; 'Test it out'; 'Train people'; 'Put it into practice' and 'Keep it under review'. A guidance document and interactive infographic were designed to promote this development.

Brief summary of interpretations and conclusions.
The developed guidance addresses a significant learning need by outlining a series of principles and approaches for healthcare teams and others that are conducive to good practice in the safe and effective design of work procedures – particularly as exposure to education in the design work procedures appears to be absent from clinical training curricula and as part of professional development. The guidance document and interactive infographic are freely accessible and will be of interest to healthcare organisations and teams, risk and safety advisor and clinical educators internationally both in response to the ongoing COVID-19 situation and post-pandemic.

Ideally, work procedure development should be informed by rigorous and systematic studies of work-as-done, supported by appropriate Human Factors methods e.g. hierarchical task analysis and a prospective hazard assessment process. But related knowledge is limited in the healthcare workforce and this learning need will have to addressed if a more rigorous approach to procedure design is to be taken. Finally, making available accessible guidance on the design of work procedures is only the first step in trying to achieve the goal of making work procedures more usable and effective. Like any complex intervention, the implementation uptake and impact of the guidance, in both educational and frontline care settings, will require significant study to better inform the contexts and mechanisms underpinning if and how it 'works', where, when and for whom.

16.2 Analyzing the work system elements impacting burnout of health care professionals in a COVID-19 testing laboratory

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KEYWORDS: work system design, burnout, COVID-19 testing, diagnostic laboratory management

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ABSTRACT

Diagnostic laboratories have faced unprecedented challenges during the COVID-19 pandemic, being under immense pressure to maintain workplace safety while remaining operational and providing the best quality of diagnostic testing. In this study, we analyzed the work system (WS) elements impacting the burnout of three health care professionals (HCPs) working in a COVID-19 testing laboratory. Data collection took place between July and August of 2021 and used surveys to capture the participants' burnout and job and organizational characteristics. We performed correlation analyses to identify the job and organizational characteristics associated with higher burnout scores and used the Systems Engineering for Patient Safety (SEIPS) framework to analyze the WS elements influencing the burnout of these HCPs. The variables highly correlated with burnout were: physical environment, social support from supervisor, social support from family/friends, control, skill underutilization, role conflict, role ambiguity, intragroup and intergroup conflict, and responsibility for people. Sixty percent of them (role conflict, role ambiguity, intragroup and intergroup conflict, social support from supervisor, and responsibility for people) were part of the organization element of the WS model, likely as a direct consequence of the abrupt and rapidly evolving status of the COVID-19 pandemic, which saw diagnostic laboratories redesigning their workflow, policies, and procedures to introduce adequate guidelines against virus diffusion. Future research will expand the sample size and timeframe of data collection to holistically explore WS design requirements (i.e., systems-based interventions) to prevent burnout of laboratory workers, a very important, and often overlooked, group of HCPs during the COVID-19 pandemic.

16.3 Identifying work system barriers and facilitators to the interdisciplinary design process in disaster response teams

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KEYWORDS: sociotechnical system design, disaster response, interdisciplinary teamwork

ABSTRACT

Disaster response teams operating during the COVID-19 pandemic faced additional challenges compared to traditional disaster response teams. This study analyzes the work system of mobileSHIELD, an interdisciplinary disaster response team designing a diagnostic testing system for the COVID-19 virus. We conducted interviews with 18 team members to understand the work system barriers and facilitators related to the design process and team structure. Our findings indicate that distributed decision-making, iterative design and process diagrams can support the performance of disaster response teams.

BACKGROUND

Disaster response teams respond to complex and rapidly evolving disasters, both natural and human-made (Comfort et al., 2004). The teams responding to the COVID-19 pandemic faced additional challenges compared to traditional disaster response teams, including the surveillance, detection, and containment of a deadly airborne virus (Sasangohar et al., 2020). During the COVID-19 pandemic, disaster response teams conducted interdisciplinary design to develop an effective response, relying on the expertise of several disciplines, e.g., engineers, software developers, public health officials, etc. (Hale-Lopez et al., 2021). This study aims to understand the work system barriers, i.e., factors that impede project work, and facilitators, i.e., factors that enable project work, (Carayon & Gurses, 2005) related to the design process and team structure of an interdisciplinary disaster response team named mobileSHIELD. The mobileSHIELD team is a disaster response team that designed a mobile diagnostic testing system capable of conducting laboratory testing for the COVID-19 virus and notifying users of their test results.

METHODS

We conducted semi-structured interviews with 18 team members via Zoom to understand how the sociotechnical system, design process, and team structure influenced team performance. To minimize recall bias, we performed interviews when the project task work was close to completion, in November 2020. Each interview averaged 49 minutes in length (total: 12 hours, 46 minutes), was audio-recorded, and transcribed by a professional service. The sample contained individuals with expertise in Lab and Testing, Data and IT, Finance, System Design, Community Outreach, and Project Management (Hale-Lopez et al., 2021). The first two authors inductively analyzed the transcripts to identify work system barriers, i.e., factors that hinder task progress, and facilitators, i.e., factors that aid task completion, using a consensus-based process to resolve disagreements. We then categorized the barriers and facilitators into dimensions. These dimensions were developed by

the research team and represent specific concepts within macroergonomics, team science and design methodology literature (Hale-Lopez et al., under review).

RESULTS

This analysis resulted in three dimensions of work system barriers and facilitators related to the design processes and team structure: task development (10 barriers, 10 facilitators), interdisciplinary design (8 barriers, 12 facilitators), and team structure and leadership (11 barriers, 15 facilitators). The dimension of task development refers to the relationship between emerging design requirements and project work (Hale-Lopez et al., under review). The barriers resulted from the uncertainty of the pandemic, which frequently caused dynamic, changing project requirements; the facilitators related to implementing an iterative design process to address emerging project requirements. The dimension of interdisciplinary design refers to the factors that support or hinder interdisciplinary design work (Hale-Lopez et al., under review). The barriers related to a lack of technical expertise and difficulties learning the domain by observation; the facilitators related to using process diagrams, simulations and high-fidelity mock-ups to describe the sociotechnical process to experts across disciplines. The dimension of team structure and leadership refers to the interactions between the leader and the team (Hale-Lopez et al., under review). The barriers resulted from mismatched expectations between the team lead and the team members; the facilitators described a distributed decision-making structure that empowered experts to make design decisions and facilitated communication and idea-sharing.

DISCUSSION

Three key findings emerged from our results. First, an iterative approach to design can be implemented to account for emerging requirements. While the concept of iterative design is well known, the novelty of our findings is that iterative design can be extended to the disaster response domain. The operationalization of iterative design may enable disaster response teams to operate more efficiently in unpredictable environments with emerging requirements. Second, process diagrams to model the sociotechnical process can be incorporated to facilitate communication, and build awareness and shared understanding. Thirdly, to facilitate a quick and efficient response, a distributed decision-making structure should be implemented to empower experts to make design decisions while cultivating team situational awareness to avoid project scope creep. Future research will holistically explore work system design to support future disaster response teams charged with developing an interdisciplinary design response.

CONCLUSIONS

This study analyzed the work system barriers and facilitators related to the design process and team structure of mobileSHIELD, an interdisciplinary disaster response team. These findings are applicable to disaster response teams and may extend to other complex teams, e.g., emergency departments, aviation, and military operations. We recommend that future work system design incorporate a distributed decision-making structure, an iterative design process, and process diagrams to facilitate interdisciplinary communication.

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16.4 Impact of COVID-19 on clinical training and reported burnout rates in Scotland's national health service: a cross sectional survey of clinicians-in-training

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KEYWORDS: COVID-19, clinical training, burnout

ABSTRACT

The overall purpose of the study and the research problem(s) investigated
The COVID-19 pandemic has caused significant disruption to health services in the United Kingdom (UK) and internationally. This study aimed to determine the training, service work and psychological impacts of the pandemic on clinicians-in-training programmes, with a focus on reported levels of 'burnout'.

The design of the study
Cross-sectional online questionnaire surveys were undertaken involving clinicians-in-training in the medical, dental, pharmacy, healthcare science and psychology professions in Scotland during July 2020 and September 2021. A multivariate regression analysis was performed to ascertain variables predicting reported trainee burnout.

Major findings
7694 trainees were surveyed and 5545 responded (72.1%). 192 trainees reported that they were shielding at home (3.5%) but 69% were able to work from home. 1194 reported they had felt unwell during this time (22%). Of these, 190 trainees tested positive for COVID-19 (16%), while 665 (55%) reported symptoms suspected to be COVID-19, and 409 reported having another illness/health issue (34%). Around one third of trainees (n=1790, 32%) reported feeling at 'extreme' or 'considerable' risk of contracting COVID-19 at work. 69% of trainees (n=3825) believed their training progression had been negatively affected through the impact of Covid-19. Experiencing burnout symptoms more than once a week was reported by 32% of trainees. Overall, 23% of variance in burnout was predicted (adj R sq = .23, F (7, 3482) = 154.9, p<.001). Poorer quality of clinical supervision, more negative workplace behaviours, less ability to raise concerns, a greater perceived impact of COVID-19 on health and wellbeing, feeling busier and less useful at work, and a greater perceived risk of contracting COVID-19 were related to higher reported burnout.

Comparative data with the 2021 survey is being analysed and will be presented at conference.

Brief summary of interpretations and conclusions
Trainees were impacted educationally, professionally and psychologically because of the COVID-19 pandemic. The findings provide a valuable snapshot during a time of significant disruption and stressful conditions for most in clinical training programes and working in dynamically-challenging healthcare services during this period

17. Guiding principles for human performance for the healthcare product system

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SPECIAL SESSION
KEYWORDS: guiding principles, human performance, pharmaceuticals

WHAT IS THE BACKGROUND TO THE WORKSHOP?

Human performance impacts how all forms of medical products are manufactured, how hospital and community services work effectively, and how patients use medicines and drug-device combination products. However, Human Factors is not well established as a discipline throughout the healthcare product systems. Adopting the principles and practices of human performance has led to valuable business and safety performance improvements in high-risk high-consequence industry sectors, such as energy and aviation. Eager to realize similar levels of improvement, several companies in the pharmaceutical and biopharmaceutical manufacturing sector have begun the adoption of human performance within their operations. We propose international harmonisation of the systems for both pharmaceuticals and devices through guiding principles and we invite others to join our international community of practice as these principles can equally be applied to all those who use healthcare products. We propose five principles for discussion:

INCLUSION: Help everyone to have a voice to share ideas and concerns safely and constructively. Key groups would include Patients, Healthcare providers, Regulators, Pharmaceutical Industry.

VALUES: show that a values-based implementation of the principles of human performance can result in beneficial / positive outcomes where leaders focus on improvement

SET PEOPLE UP FOR SUCCESS: Embracing the excellence of our people as they are the solution rather than the problem to solve. We should identify practical examples of everyday activities, where measures, supported by growth mindset, drive continuous improvement.

FOCUS ON IMPORTANT: Balancing financial, compliance and human benefits against reactive fixes, always linking back to positive patient and organisational outcomes

MEANINGFUL MEASURES: Measurements of performance that that provide positive reinforcement for patient outcomes, regulatory ambitions, and pharmaceutical industry goals. The lead measures should be patient focused, helpful and can be acted upon.

18. Digital Health

CONTENT

18.1 Digital technologies in home healthcare – implications for job demands, job control, and support among healthcare professionals

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KEYWORDS: registered nurse, nursing assistant, work environment, digitalization, JDCS-model, home healthcare

SUMMARY

Increased use of digital technologies in healthcare offers healthcare professionals multiple ways to perform tasks and interact with patients and colleagues. We used the JDCS-model to identify employee´s well-being in relation to the use of an eMar. The analysis indicated that the specific technology influenced the work environment for registered nurses and nursing assistants in different ways.

BACKGROUND

Research has recognized that digital technologies change working methods and professional roles unintendedly (Gregory et al., 2022; Karnehed et al., 2022). We seek to examine the benefits and drawbacks of an electronic medication administration record (eMar), concerning the work environment for healthcare professionals. These understandings are important when developing digital system designs and maintaining a healthy workforce. Therefore, we explored how registered nurses (RNs) and nursing assistants (NAs) experienced their work environment in a Swedish home healthcare setting where an eMar was implemented to facilitate the division of labor through delegation.

METHODS

RNs and NAs employed in a municipality where an eMar had been used since May 2019, were included in the study. Interviews were conducted from November 2019 to April 2020. RNs (n 16) and NAs (n 9) were interviewed separately in focus groups. The interview data was analysed using Constructivist grounded theory (Charmaz, 2006). The job demand-control-support model (JDCS) (Karasek, 1992) was used to define experienced job demands, decision latitude, and social support among the participants in relation to the specific technology.

RESULTS

NAs described that the eMar brought higher demands such as time pressure on their work. The fact that RNs monitored them through the app was described as stressful. NAs also experienced higher demands to perform tasks that they felt was outside their scope of competence. This was because the app facilitated delegation of tasks to NAs and an experienced pressure from managers, colleagues, and RNs to accept delegation. Moreover, a lack of control concerning decision-making about how to meet the demands was described. The app and (other) colleagues were perceived to have both a supportive and a less supportive function. NAs

had many social relations in their work, and many obligations but little freedom of action.

RNs felt that their responsibility for the delegated tasks became more apparent when they used the app. Demands to check, follow up and make decisions about delegated tasks increased. The RNs felt that the eMar gave them a high level of control as they had the possibility to monitor the NAs through the app. At the same time, they described that they had influence on how to handle those demands and could deal with situations in accordance with their professional judgement.

DISCUSSION

The findings indicate that NAs experienced that their use of the eMar resulted in higher levels of job demands, such as time pressure, and lower levels of job decision latitude. Increased time pressure and reduced possibilities to control over the task is the job characteristic found to create high risks of ill health according to the JDSC-model. Earlier studies show that working conditions for home healthcare workers are characterized by high physical and psychosocial demands such as timepressure, ergonomic hazards, and lack of influence at work (Genet et al., 2011; Sousa-Ribeiro et al., 2022). It is therefore important that interventions increase perceived job control and social support at the workplace which could improve occupational well-being of NAs.

The results showed that the eMar brought increased demands on administration and measurements for both professional groups. A comparison of the work situation in Swedish home healthcare, describe that administrative task and internal control systems more than doubled between 2005 and 2015 (Strandell, 2020), which indicate that increased administration has been a trend even before the expansion of digital technologies in Swedish home healthcare. Researchers have acknowledged that standardization and measures in healthcare can inhibit employee creativity and motivation (Bringselius, 2021). Advocates for New Public Management (NPM) noticed early that the constant focus on reducing deviations and limited possibilities to influence work was not educative in the long run. Social support was therefore of great importance to make work bearable. This is also a crucial point in the JDSC-model which describes learning and creativity as an outcome of high control.

The study has many limitations. The home healthcare sector is regarded as complex and characterized by continuous reorganizations which limit possibilities to draw valid conclusions about cause and effects of particular interventions such as implementation of digital technologies.

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18.2 Investigating the design of online health consultation platforms and patient experience: An exploratory study

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KEYWORDS: online health consultation, interface design, patient experience, OHC journey

Full paper will be available in the HEPS2022 Conference Proceedings

BACKGROUND

Online health consultation (OHC) platforms have been extensively used since the outbreak of COVID-19, that the number of active users has been increasing dramatically in China. OHC interfaces require a more immersive environment to support the entire medical consultation journey. This study intends to explore the design features of existing OHC platforms, and how they relate to patient experience and patient OHC journey. A literature review of design features, patient experience, and patient OHC journey was conducted to generate a framework to guide the study. Then, semi-structured interviews with 10 participants were carried out. The notions of "Design Features" were interpreted differently by individuals. For example, 'graphic design' was viewed as colour, font, icon, etc. Design Features have varying degrees of influence on "Patient Experience" and "Patient OHC Journey". This study explores what comprises Design Features of OHC platforms. The associations between Design Features and Patient Experience found in this study are different from the associations that have been found in other contexts, like e-commerce. The design on telemedicine platforms especially OHC should be studied as an independent topic to inform the design of a better patient experience throughout the OHC journey.

18.3 Materiality and digitalisation: Observations on eHealth solutions for care

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KEYWORDS: eHealth solutions, lived experience, healthcare workers, mediating role, Sweden

SUMMARY

This presentation brings light on how the materiality of three eHealth solutions affects care and care work. We conducted 92 semi-structured interviews with healthcare workers from the south of Sweden. The analysis of the data was interpretive with focus on the participants' experiences. By exploring the lived experiences of the participants, we found that all the three solutions (1) changed the boundaries between patients and colleagues; (2) enabled augmented information- and knowledge processes; and (3) reconfigured professional control.

BACKGROUND

Since the beginning of the 21st century, eHealth solutions have been considered a paradigm shift towards improved healthcare through the use of technology. Recent studies highlight a growing need to consider the materiality of technologies (Esmonde, 2019; Keen et al., 2021; Leonardi, 2012), i.e., the ways in which technologies impact care and care work. The bare functions or technical aspects of eHealth solutions do not automatically lead to cost efficiency and increased quality of care, as technology shapes and influences the way healthcare workers conduct their work and provide care. Care and care work co-emerge through the production and re-productions of arrangements between patients, actions, values, care workers, institutions and eHealth solutions. In this presentation we explore the mediating roles of three different eHealth solutions. The study provides us with knowledge about what eHealth solutions do in a certain context and how they change the very nature of care work.

THREE EHEALTH SOLUTIONS

We explored three different eHealth solutions. The first one, the Tablet, is an eHealth solution for monitoring patients who have home peritoneal dialysis (i.e., treatment for kidney failure). The Tablet enables patients to have dialysis in their homes and to share their data digitally and simultaneously with nurses and doctors at the dialysis department at the regional hospital. The second studied tool, the Pod, is an eHealth solution for patients who have been diagnosed with heart failure and patients with chronic obstructive pulmonary disease (COPD). The Pod offer possibilities for healthcare workers to monitor patients in their homes. It enables patients to enter their data and chat with the healthcare professionals. Third, the Flow, is an eHealth solution for digital pathways to primary care. In contrast to traditional Swedish primary care routines, the Flow enables digital patient contact. Communication and patient meetings take place either synchronously or asynchronously in the form of digital (video or chat). It is also possible to book physical meetings with different categories of healthcare professionals.

METHODS

The study was designed and conducted by a multidisciplinary team of researchers. Data were collected over a 36-month period (2020–2022). 92 semi-structured interviews were conducted with a variety of healthcare professionals (i.e., nurses,

general practitioners, medical administrators, psychologists, line managers) at four primary healthcare centres, seven hospital departments and one heart failure clinic. The semi-structured interviews were conducted as a conversation with a specific aim (i.e., understanding the lived experience of care work while using the eHealth solution); they lasted 30–75 minutes and were audio recorded and transcribed verbatim. The analysis of the data was interpretive and focusing on the participants words and narratives on the mediating role of the eHealth solutions (Daymon & Holloway, 2010).

RESULTS

Our findings revealed three interrelated paradoxes in the mediating roles of the eHealth solutions studied:

1. Changing boundaries between patients and colleagues: the eHealth solutions mediated closeness to patients and colleagues across space and time, and perpetuated at the same time power relations between patients and between colleagues.
2. (Dis)enabling augmented information- and knowledge processes: the eHealth solutions enabled augmented information- and knowledge processes through data visualisations of patient generated data, and at the same time diminished nonverbal clues.
3. Reconfiguring professional control: The eHealth solutions mediated increased healthcare professionals' control of their work and autonomy as the asynchronic communication and patient generated data permitted them to decide when, and which patient to attend to. Meanwhile, the solutions mediated decreased professional control as the healthcare professionals needed to rely on the patients and their data input, as well as the embedded scripts of the technological solution on which data to collect and how it was categorised.

LIMITATIONS

The professionals' perspectives are highlighted in this presentation. Thus, the empirical material has its limitations in that it provides a rather one-sided view, albeit important, on the part of the professionals. The patient perspective is, of course, important, and we look forward to studies where the experiences of professionals and patients are compared.

CONCLUSIONS

Our study identified general consequences of all three solutions, such as, increased feeling of closeness to patients and colleagues over time and space; increased 'understanding' of patients through patient-generated data; and increased autonomy, since asynchronous communication makes it possible to decide when and which patient to attend to. We also identified general unintended consequences of the solutions, such as, maintenance of power relations due to organizational structures and professional relations, disrupted information and knowledge processes due to the lack of non-verbal clues, reduced professional autonomy due to technical scripts determining what data is collected and how it is categorised, and uneven workload due to the dependency on patient input and compliance

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18.4 eUlift: patient handling for caregivers with mobile technology

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KEYWORDS: safe patient handling, ergonomics, mobile technology

ABSTRACT

Patient handling still has a strong influence on work-related injuries in caregivers. Workplace interventions, more specific safe patient handling strategies, can reduce these injuries. An evidence-based, free and accessible training tool with an eye to future learning is lacking.

Therefore, we developed eUlift (see eUlift-app.com), an innovative app combining evidence and best-practice from basic ergonomics, to patient mobility assessment, to 3D detailed demonstration of different patient handling transfers. This application has been designed to be used as educational and vocational training or for revising techniques.

During the development, we included several professionals, students and critical friends to meet the co-design principles. It was a continuous quality check. In different care settings, the eUlift app was evaluated through a pilot run, implementing the app in practice and follow-up in time. When evaluating the caregivers, their perceptions of the use of the app were gathered, along with observations and interviews. The app was as well presented to department heads to evaluate their view of integrating innovation in practice.

As a result, the app was positively evaluated and easy to work with. A healthy critical attitude was noted in caregivers and department heads, with time and efficiency as a major concern. Although results were positive, the implementation of novelty in practice relies on the support of the organization.

The eUlift app is a unique and innovative tool to support caregivers in patient handling techniques. It is a free app, available in English, Dutch, Hungarian and Spanish.

The following 3 years we will expand our app with specific patient handling techniques applicable to patients with obesity and the use of aids will be integrated. The care tasks and mobility assessment will be updated and we hope to offer the app in even more languages. As well we will develop an e-learning path for all modules.

18.5 Building understanding of experience design in digital health: preliminary results based on semi-structured interviews

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KEYWORDS: digital patient experience; user experience; patient experience; healthcare design; human-centered design; human computer interaction

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Background: Design is expanding its influence on shaping future healthcare. Ideally, designers apply human-centered design and human factors that introduce theory, principles, and methods to design to optimize people's healthcare experiences in both digital and non-digital environments. To discuss and implement experience design in healthcare, consensus about experience design in healthcare is needed. Objectives: Therefore, the purpose of this study is to investigate designers' views on experience design in health, and to uncover their understanding about three experience design concepts, ie, user experience (UX), patient experience (PEx), and digital patient experience (dPEx).

Methods: We conducted online semi-structured interviews study with convenience samples who met the eligibility. We used ATLAS.ti for an in-depth data coding following thematic analysis.

Results: 24 international designers of digital health solutions, either in industry or in academia took part in the interviews. We found the similarities and differences mentioned between healthcare design and non-healthcare design relate to 1) design principles, 2) user attributes, and 3) design contexts. Furthermore, the differences between UX, PEx, and dPEx can be mapped on five dimensions: people, contexts, purposes, means, and usage scenarios.

Conclusions: These insights can help designers and human factors specialists build a common design language for experience design in healthcare. Our study can also assist designers and human factors specialists with experience design in digital health by pointing out the areas where design thinking generally is appropriate and the places where particular expertise in healthcare design is needed.

18.6 Professional differences in use and perceptions of an augmented reality code cart application

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KEYWORDS: pediatric resuscitation, augmented reality, system design and analysis.

Full paper will be available in the HEPS2022 Conference Proceedings

ABSTRACT

Medication and equipment must be located and retrieved quickly during resuscitation to ensure good patient outcomes; code carts are often used to store commonly used items and may be standardized to support faster retrieval. An augmented reality (AR) application to teach clinicians about the contents and organization of a standardized pediatric code cart was developed for mobile devices to improve the speed and accuracy of retrieval of items from the code cart. In this study, we explore the use, usability, and satisfaction of users of that application. We conducted surveys (n=56) with physicians, physicians in training, nurses and nurse educators who used the application. The surveys collected self-reported use, usability with the System Usability Scale (SUS) and satisfaction. We compared results from different clinical roles. The application had acceptable usability (average SUS score =75.9) and average satisfaction of 74.9 on a scale from 0-100 reported after an average of nearly 3 hours of application use, with no significant differences between clinical roles. While the application was acceptable, improving the interface design, features and function of the application could enhance the experience of users. Future work could include participants from other health care systems to gain a more generalizable understanding of user experience and compare the experience of users of the AR application with their experiences with other training methods.

19. Healthcare Services and Management

CONTENT

19.1 A Human Factors assessment of the COVID-19 mass vaccination service delivery in Scotland

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KEYWORDS: COVID-19, vaccination, human factors

ABSTRACT

The overall purpose of the study and the research problem(s) investigated

In Scotland and internationally, health systems are rapidly responding to a significant public health need to design and implement mass COVID-19 vaccination facilities for national populations that are both safe and efficient for patients and the care workforce. It was anticipated that this activity would benefit from expert input from Human Factors specialists given the limited expertise in this area in healthcare generally. The study purpose was to:
Identify mitigations to reduce the potential for errors in the delivery of the vaccination service, and
Capture relevant information that can be shared with health services in Scotland, the United Kingdom and internationally.

The design of the study

A Human Reliability Assessment (HRA) was undertaken of the mass vaccination rollout delivery in response to the COVID-19 pandemic in a Scottish health board region. The HRA was informed by the Systematic Human Error Reduction and Prediction Approach (SHERPA) method and a Hierarchical Task Analysis (HTA) which also identified relevant performance influencing factors (PIFs) that potentially supported or hindered performance. Site visits were conducted by two Human Factors specialists who used observations and walk-through-talk-through analysis with vaccination team members. Eight HRA workshops involving 25 team members were also undertaken using MS Teams.

Major findings

Specific areas of good practice were identified which were implemented to guard against system failure. The analysis also revealed 18 issues which require additional risk control. These issues were grouped into three risk control themes:

Improve staff training and awareness, and the management of expectations.
Improve equipment and information provision.
Implement additional checks and contingencies.

A series of recommendations are presented related to:
Sharing learnings and improvements for future programmes
Issues requiring further risk control.
Task 1: Plan/Prepare for the Service Delivery
Task 2: Manage Patient Bookings
Task 3: Vaccinate Patients
Task 4: Monitor the Service

Brief summary of interpretations and conclusions

The regional health board implemented many recovery mechanisms and risk control measures to guard against the errors identified, which is impressive given the nature of the challenges, scale of the operation and the rapid response required. Multiple recommendations for current and future improvements were also identified which will also be of interest to COVID-19 vaccination facilities globally.

19.2 Interpretation and understanding of building regulations 'Part M' by currently active housing professionals for the design of UK homes to support people living with dementia

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KEYWORDS: dementia, home, housing, design, standards

SUMMARY

Designing for dementia ideally includes principles that are applicable for the ageing population. This research identified several key areas for the development of new design standards to help ensure future housing in the UK can be adapted to support the needs of people living with dementia.

BACKGROUND

Longer life expectancy, increased prevalence of dementia, and a preference for people to age at home for as long as possible rather than in a care setting to maintain their independence and quality of life, whilst reducing demand on healthcare system, means there is a need to design and adapt homes that are more supportive of people living with dementia (PLwD).

A systematic literature review found there is insufficient published research about inclusive design for dementia, and that current Building Regulations (England) Approved Document M (ADM) provides for minimum standards for access to buildings but principally only for physical disabilities. Previous research shows there is a need for guidance for designing homes that support PLwD.

This research aims to produce a framework of Patient and Public Involvement and Engagement (PPIE) UK standards for designing new homes that enable adaptations to support PLwD. This paper reviews the current guidance in the Building Regulations (England) Part M: Access To and Use of Building and its accompanying guidance (ADM) to identify the provisions that meet the needs for PLwD, necessary improvements, and what further provisions may be required.

METHODS

Data were collected using semi-structured interviews and online questionnaires with participants recruited through academic and professional networks. The objectives were: a) to understand participants' interpretation of Part M / ADM relating to inclusivity, home adaptations and physical and cognitive health considerations; and b) acquire participants' recommendations for dementia design standards.

Interviews (n=31) were conducted with three cohorts of professionals; Cohort 1 (n=14) housing professionals familiar with Part M/ADM including architects, designers, consultants, building control, and housebuilders; Cohort 2 (n=13) occupational therapists and specialist dementia nurses providing care to PLwD; and Cohort 3 (n=3) technical policy and national standards officials.

The interview and questionnaire responses were analysed thematically using NVivo.

RESULTS

The analysis established the current industry view on the suitability of current standards and identified several provisions of home design that should be included in the future Inclusive Design for Dementia Standards to improve provisions for PLwD, for example;

- Scope for interpretations: the drawings within ADM are not to scale and do not correspond to the requirements stated, the requirements could be expanded further.
- Recommended aspects of the home that would benefit from further focus on dementia: 1) main entry access; 2) ground floor bathroom with level access shower; 3) assisted technology; and 4) lighting.

DISCUSSION

Main entry access requires significant improvements to enable a person with dementia to identify their home, approach with confidence and enter with ease. Furthermore, providing a mobility aid-accessible ground floor bathroom with space to accommodate two people at minimum (thereby allowing space for a carer) and a flexible design so that the space can be redesigned as a wet room or with a level-access shower is a necessity. The ground floor layout should be flexibly designed to accommodate living solely on the ground floor; e.g., a bedroom can be created by converting a dining room or a study, or constructing a new internal partition within a large spacious room to create a bedroom.

The level of expertise and knowledge of the participants varied considerably as did their interpretations of Part M/ADM. A limitation of this study is that planning policies vary between different local authorities, so it would be useful to speak to professionals from all counties and local authorities especially as the minimum accessibility standard vary outside of London (as of August 2022).

The next stage of the project will investigate retired people ageing-in-place, with homes of differing ages and characteristics. Data will be collected to evaluate how aspects of their homes have been adapted or if they require adapting, including plans, if any, for future adaptation(s). This focus will enable a better understanding of which environmental features and strategies are effective and perceived as helpful for people with different forms of dementia, as well as to support carers. The final output will be an Inclusive Design for Dementia Standard (Version 2.0) which will be reviewed and evaluated at either a dementia-friendly test location(s) or the homes of participants/people living with dementia.

CONCLUSIONS

People with dementia are subject to the normal ageing process, such as mobility issues, and deterioration in vision and hearing. Consequently, the principles for designing for dementia ideally include principles that are applicable for the ageing population in general. This research has already identified several key areas to focus on the development of new design for dementia standards to help ensure future housing in the UK can be successfully adapted to meet the needs of PLwD.

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19.3 Behavioural and systems change in Nursing Homes with an integrated training intervention

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KEYWORDS: risk management, patient safety, training intervention, system change, human factors, nursing homes, long term care

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ABSTRACT

Training of healthcare professionals in nursing homes (NH) is fundamental to improve quality and safety. This project (funding by 2 resolutions) is carried out at a sample of 7 NHs of Tuscany Region (Italy), for evaluate a participatory approach to reduce preventable incidents and implement good practices, through behavioral and systems change. The inclusion criteria were defined to represent the different areas of the Region. The method for training sessions is based on what emerged in the literature, according to the principles of andragogy and management of human factors. It is based on interactive class, that follow action research method, with bottom-up approach to multidisciplinary groups. Each session lead by a nurse and a psychologist takes 8 hours. Participants' experience of a good or a bad day of practice is elicited to let the tacit knowledge on strengths and weaknesses emerge, to help the group envision a joint commitment to improve on the more relevant themes for patient safety. Evaluation included participant reactions, learning and change in practice. Staff who attended responded very well. In the majority they appreciated training but above all the intention to change and improve their job. Follow-up (up to 2 months) was carried out in all NHs through field observations and a second meeting. In some cases, we were able to observe changes in care and organizational practices, in other no changes emerged. In all NHs we have found the need for supported in working practices, the request to continue to be followed over time.

19.4 Making the most with what you have: Using simple, low-cost mock-ups and simulations to support hospital redevelopment

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KEYWORDS: simulation, mock-up, low-cost, redevelopment, facility design, interdisciplinary collaboration

ABSTRACT

A large tertiary hospital in Toronto, Canada, is undergoing a multi-year redevelopment project that will see most of the hospital's facilities and clinical units completely redesigned and rebuilt. To support this effort, their embedded human factors team has been applying user-centred design methods through leading simulations and mock-ups to inform and validate environmental and process design changes. We discuss how meaningful changes and cost savings are achievable through simple, quick, and low cost mock-ups - demonstrated by their application across various areas in an active hospital setting.

BACKGROUND

A large tertiary hospital in Toronto, Canada is undergoing a multi-year redevelopment project that will see most of its facilities and clinical units completely redesigned and rebuilt. As a human factors team embedded within the hospital, this redevelopment work provides the unique opportunity to advocate for user-centered design methods such as simulations and mock-ups to inform physical space design and technology integration within a range of clinical spaces. While detailed mock-ups and simulation-based evaluations are valuable (Health Quality Council of Alberta, 2016), they can be prohibitively expensive and time-consuming within the constraints of a fast-paced, operational healthcare facility. We demonstrate how meaningful design changes and cost savings are achievable through simple, quick, and low cost mock-up and simulation activities in various areas of an active hospital setting.

METHODS

Over a dozen mock-up and simulation sessions, varying in project and design phase (design development or construction/commissioning phases), were conducted to support clinical and operational objectives. The objectives informed whether the approach taken was simulation-based or a simple mock-up focusing on physical design and device requirements. These mock-ups and simulation sessions were carried out in existing hospital areas with limited capital resources, often within short periods of time to meet construction and change request deadlines. Planning lead time ranged from 1 day to 6 months depending on the urgency and scope of the project. Many of the activities were undertaken within proxy space (e.g. on-site meeting rooms and classrooms) using recycled cardboard and repurposed equipment, while others took place in the live environment. Front line staff and key hospital stakeholders with differing priorities and perspectives were brought together for these sessions to interact with the space, simulate workflows, and participate in collaborative discussions. These sessions examined patient care workflows, administrative duties, Infection Protection and Control guidelines,

Occupational Health recommendations, and how the space will be longitudinally supported by IT, Security, and Service Staff.

RESULTS

As seen in Table 1, simulations and mock-ups varied in project application, development stage, mock-up fidelity, and evaluation format.

Actionable outcomes included space and furniture redesign and/or relocation, infrastructure layout modifications (e.g. power, data, and medical gases), identification of additional technology requirements (e.g. queuing system), and process design recommendations.

DISCUSSION

Despite the simplicity necessitated by operational limitations, conducting simple, low-cost simulations and mock-ups yielded design changes that better support clinical workflows, mitigate risks, and minimize disruptions post go-live. Lessons learned from these activities to benefit future redevelopment work include strategies for prioritization of risks and recommendations, leveraging existing supplies such as decommissioned equipment, the value of three-dimensional mockups compared to two-dimensional mockups where tape is used on the floor, and the challenges of engaging frontline clinical staff compared to other hospital administrative/support roles. Next steps for the team involve determining an operational plan to support post-occupancy evaluations, and conducting cost-savings analyses to display the value of the mock-ups.

CONCLUSIONS

For institutions constrained by cost, resource, or time limitations that prevent detailed, high-fidelity simulation-based evaluations, simple mock-ups remain a valuable tool to engage and empower staff, save costs, mitigate risks, and improve patient and staff experience.

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Table 1. Mock-up and simulation activities performed to support hospital redevelopment

Clinical Area/Project	Design Stage	Mock-up Fidelity (Location/Infrastructure/Equipment)	Evaluation Format
Emergency Department Medical boom configuration	Schematic Design	Proxy space / Room perimeter taped on floor / Cardboard boom and repurposed equipment	Task evaluation, stakeholder walkthrough
Day Oncology Treatment bays and communication stations	Design Development	Proxy space / Movable partitions / Cardboard and repurposed equipment	Task evaluation, feedback with thematic analysis, stakeholder walkthrough
Intensive Care Unit Patient rooms	Design Development	Proxy space / Movable partitions / Cardboard boom and repurposed equipment	Clinical scenario simulation, video review
Intensive Care Unit Medication room	Design Development	Proxy space / Movable partitions / Plywood boom and repurposed equipment	Stakeholder walkthrough
Emergency Department Triage bays	Design Development	Manufacturers warehouse / Manufacturer built mock-up / Representative equipment	Clinical scenario simulation
Emergency Department Triage bay	Construction/ Commissioning	Final space / Final infrastructure / Final equipment	Clinical scenario simulation, video review
Endoscopy Procedure room layout	Construction/ Commissioning	Active construction site / Unfinished walls / Cardboard equipment footprints	Stakeholder walkthrough

19.5 Prediction of nursing burnout – a scoping review of the literature from 1980 to 2019

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KEYWORDS: burnout prediction, nursing, patient safety

SUMMARY
The objective of this scoping review was to describe current approaches to predict nurse burnout. All papers reviewed used surveys to assess burnout and its predictors. Surveys are subjective, create additional workload, and are reactive. Tools to support unobtrusive, real-time monitoring and prediction of burnout are needed, so that individuals and organizations can take preventive measures to reduce and ultimately eliminate nursing burnout.

BACKGROUND
Burnout is an occupational syndrome resulting from chronic workplace stress (Janeway, 2020) with negative implications for individuals, health care organizations, and recipients of care (National Academies of Sciences, 2019). Besides resulting in psychological distress and somatic complaints for individuals, burnout strains organizations, increasing turnover, tardiness, absenteeism, and difficulty in retaining staff (Vahey et al., 2004). Nurses are particularly at risk of experiencing burnout, and the condition is estimated to affect between 35% to 45% of registered nurses in the United States (U.S.) and 9% to 14% globally (Janeway, 2020; Woo et al., 2020). Already a public health concern (National Academies of Sciences, 2019), nurse burnout was exacerbated by the COVID-19 pandemic, which brought additional stressors and increased risk of burnout (Galanis et al., 2021). In this scoping review, our objective is to describe current approaches to predict nurse burnout to identify opportunities for health care organizations to proactively address the issue.

METHODS
We searched three online databases – Scopus, ScienceDirect, and PubMed – for peer-reviewed publications written in English and published between January 01, 1980, and December 31, 2019 that contained in their titles the terms "nurs*", "burnout", and "predict*". The initial search, conducted between December 2020 and February 2021, returned 46 papers. Two researchers reviewed them and, in a consensus-based process, decided which ones met the inclusion/exclusion criteria. Thirty-seven papers were used in further analyses.

RESULTS
The number of publications increased dramatically over decades – almost 70% were published between 2010 and 2019. All publications applied surveys to assess burnout, and 68% of them used the Maslach Burnout Inventory (MBI; Maslach et al., 1997). In trying to predict burnout, studies collected data related to one or more of the following categories: demographics, personality traits, and job and organizational characteristics (e.g., job satisfaction, job stress, role ambiguity, role conflict, job autonomy). The category that most often predicted burnout involved job and organizational characteristics – 32 studies had predictors of this type.

DISCUSSION

Nurse burnout has been gaining increased attention over the years, hence the upward trend in the number of publications over time. The fact that over 80% of the studies investigated the relationship between job and organizational characteristics and burnout is hardly a surprise; previous studies suggest that characteristics of the work environment are more strongly related to burnout than personality traits or demographic factors (Shirom, 2005).

A major limitation revealed through these findings relates to the primary instrument used to capture both the predictors of burnout and the phenomenon of burnout itself – surveys. Surveys are subjective and add extra work to the already high workload of nursing professionals. Moreover, they detect burnout after the individual is burnt out. Future work should investigate tools to support unobtrusive monitoring and prediction of burnout in a timely manner, without creating additional job demands, so that individuals and organizations can take preventive, and not corrective, measures to reduce and ultimately eliminate the development of burnout among nurses.

This literature review does have limitations. The search was not exhaustive. We only searched by the title of publications; searching the abstract as well would likely yield additional results. Likewise, by restricting our search to papers published before December 31, 2019, we ended up not considering the new influx of papers published in 2020 and 2021 as response to the ongoing COVID-19 pandemic. However, it is likely that these studies will still rely on the same surveys, which is certainly an important limitation to future research.

CONCLUSIONS

Current approaches use surveys to assess burnout and the job and organizational characteristics commonly used as its predictors. Surveys are subjective, reactive, and increase workload. Tools to support unobtrusive, real-time monitoring and prediction of burnout are needed to allow individuals and organizations to proactively address the issue.

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19.6 A qualitative study of previous training, experiences and learning needs of healthcare safety investigators in Scotland

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ABSTRACT

The overall purpose of the study and the research problem(s) investigated

Knowledge and application of a Human Factors systems approach to safety investigations and learning reviews are limited in healthcare. The study explored previous training, experiences and perspectives of those in Scotland's health and social care workforces who currently undertake safety investigations and to explore specifically:
The nature of their current job roles, responsibilities and range of investigation tasks performed
Previous training related to their investigation job roles
Exposure to continuing professional development opportunities and any perceived learning needs related to their investigation roles.

The design of the study

Online focus group interviews (via Microsoft Teams) were undertaken in March 2022. Participant volunteers with leadership and advisory job roles related to patient safety, clinical governance and clinical risk from all regions of Scotland's health and social care system were represented. Interviews were transcribed and data were subjected to a thematic analysis.

Major findings

Seven focus groups involving 71 safety investigators were conducted. Fifty-one (72%) were female and 16 (76%) of the 21 territorial and special health boards were represented. A total of five principal themes were generated from analysis of the data.

Impact of Previous Investigator Training e.g. many respondents suggested training by itself was not enough because too much time elapsed before participation in in investigations since leading to a loss of confidence. The need for continuous support and mentoring was highlighted.

Perceived Characteristics and Attributes of a "Good Investigator" (e.g. a variety of important attributes were broadly split into personal characteristics (such as honesty, having difficult conversations and people skills) and workplace skills such as teamworking and interviewing and report writing skills.

"Good Practice" in Relation to Safety Investigations e.g. agreeing clarity of scope (clear parameters), fully involving those directly affected by the safety incident, and incorporating measures to ensure a quality investigation,

Barriers to "Good Practice" in Conducting Safety Investigations. e.g. the national adverse event policy framework was reported as overlong, lacking clarity and confusing. The lack of focus on 'near miss' events needed to be re-considered.

Support Requirements and Professional Development. e.g. supervision and support from

others (eg adverse event groups) was noted as important and the ability to shadow experienced staff was considered supportive. A national support network was mentioned as helpful, where staff can share experiences, gain advice and obtain external, unbiased support. Emotional support for staff dealing with the personal impact of investigating a potentially traumatic event was noted as important.

Brief summary of interpretations and conclusions

The outcome of this study supports existing knowledge that greater consistency is required in the delivery of training programmes and in the implementation and application of process that supports safety investigators and safety incident management across Scotland.