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CASE REPORT



BACKGROUND TO THE REPORT

Hand hygiene plays a vital role in the prevention of infection in healthcare practice, especially for district nurses who are caring for a number of patients in a variety of community environments. In the present hypothetical case, the Glynafonshire Health Board's district nurses were expected to adhere to a strict hand-washing policy before entering a patient's property and after leaving it. All nurses had been trained in the correct procedures and had passed written and practical competency tests. However, some nurses later did not follow the proper procedures such as rushing in the washing process, failing to wash hands properly, or sometimes not washing hands before and after seeing patients. Eight patients had an infection and one patient died as a consequence of these failures.

Importantly, these procedural failures were in the context of significant occupational pressure. These factors led to the increased workload for the nurses, working back-to-back shifts and in some instances caring for about twice as many patients as usual. The incident has raised concerns about the failures of the nurses to translate existing knowledge to a consistent behaviour, especially because they were experienced and had previously proven knowledge and competency in the procedures. An account of such failures of performance may lie in cognitive models that views working memory as a limited-capacity system engaged in the temporary storage and processing of information needed for the ongoing cognitive activities. Baddeley and Hitch (1974) proposed such a model, the Working Memory Model. In the next section, the Working Memory Model and the cognitive mechanisms that might be relevant in comprehending the events in this case are explored.

THE WORKING MEMORY MODEL

Baddeley & Hitch (1974) proposed an alternative to the idea that short-term memory was a single unitary store, the Working Memory Model (WMM). Working memory refers to a limited-capacity cognitive system that temporarily maintains and manipulates information while individuals perform ongoing cognitive activities, such as reasoning, comprehension and problem-solving (Baddeley, 2012). The original model consisted of three components: the central executive, phonological loop and visuospatial sketchpad. Baddeley (2000), later added a fourth component to the model, episodic buffer.

The central executive is the attentional control system that oversees the coordination of the other systems of working memory. It is not primarily used for storage, but is involved in the regulation of cognitive activity by focusing attention and coordinating information processing during concurrent tasks (Baddeley, 2012). This component is especially relevant when people need to perform multiple tasks at once; working memory is limited. As a result, efficiency of performance can become diminished if cognitive demands compete for these resources

The phonological loop is responsible for temporarily maintaining verbal and auditory information. It is comprised of a temporary phonological store and an articulatory rehearsal process that serves to refresh information prior to decay (Baddeley, 2000). Evidence for this component includes the word-length effect. Baddeley et al. (1975) found poorer immediate recall for longer than shorter words, supporting the existence of a limited-capacity verbal storage and rehearsal system.

The visuospatial sketchpad, on the other hand, is a temporary store and manipulator of visual and spatial information that is thought to be relatively independent from the phonological loop (Baddeley, 2012). Dual-task research also supports separate working-memory components. Baddeley and Hitch (1974) found that participants could perform reasoning while remembering digits, although reasoning performance declined as memory load increased, supporting a system of partly separable but limited processing resources.

Then, Baddeley (2000) added the episodic buffer to overcome some of the problems with the original model. Episodic buffer is a temporary memory that temporarily holds a limited amount of information from the phonological loop and visuospatial sketchpad and can retrieve information from LTM. The addition enabled the model to be more explanatory about how information from a number of sources could be integrated into coherent representations. These together, define working memory as an active, but limited capacity system for holding, coordinating and manipulating information needed for current behavior. These mechanisms are useful for thinking about the vulnerability of performance when there are significant and conflicting task demands.

HOW DOES THE THEORY RELATE TO THE CASE STUDY

The Working Memory Model gives a possible cognitive explanation for the lack of consistency in handwashing procedures despite the experienced district nurses' knowledge and training. Baddeley (2012) reported that the WM is limited in capacity, and is responsible for holding and manipulating information and for maintaining cognitive processes. In the current scenario, the nurses had to deal with significantly higher demands because of staff shortages, working long shifts, working back-to-back and having more patients. In this case, the cognitive demands to coordinate and monitor multiple tasks could have increased.

The central executive is of particular importance, as it is the part of the system that can be used to control attention and to coordinate information across concurrent cognitive tasks (Baddeley, 2012). District nursing requires nurses to manage competing demands, including travelling between patients, monitoring patient needs and remembering clinical procedures. Under increased workload, these demands may compete for limited executive resources, reducing the capacity to monitor routine handwashing and increasing the likelihood of rushing, incorrect technique or omission.

The cognitive impairments could have been exacerbated by fatigue from longer shifts of work. Esmaily et al. (2022) compared cognitive performance of nurses in different work shifts at the start and at the end of their shifts. Working memory was greatly impaired at the end of shifts; most marked after night shifts. Attention was also negatively

affected. The present case is significant insofar as the district nurses were working long and back-to-back shifts. However, their failures in procedure could have been due to difficulties in maintaining attention and controlling behaviour reliably, driven by the high demands of the working conditions, rather than a lack of knowledge.

EVIDENCE FROM NURSING AND HEALTHCARE RESEARCH

Empirical studies from the field of nursing find additional evidence for the link between demanding working conditions, working memory and procedural performance. To directly assess the impact of interference on the working memory of nurses, Hu et al. (2023) analysed their behaviour and electroencephalograms. Working-memory tasks were carried out by the nurses with the interruptions, distractions, and without interruptions. Working-memory performance was significantly affected by interruptions, whereas task accuracy was related to attentional control. The findings demonstrate that interference can disrupt cognitive processing even in trained nurses.

Similarly, Thomas et al. (2017) found that interruptions, distractions and increased cognitive load were associated with procedural failures and medication administration errors. Although medication administration differs from handwashing, both require healthcare professionals to perform familiar procedures under competing cognitive demands.

However, it was important to note that the Working Memory Model did not imply that failure to wash hands was a direct consequence of working-memory limitations. There is no direct measurement of the cognitive state and working memory for the nurses at the time of the incidents in the case study. Instead, the model offers a theoretically sound explanation of why the higher workload and fatigue may lead to greater likelihood of procedural failures. This is significant because other factors, such as organisational pressures, staffing levels, workplace culture, can also have influenced the incident.

SUGGESTIONS FOR NEW PROCEDURES BASED ON THE THEORY

The fact that the working memory is limited highlights the need for more than just giving nurses more training to prevent similar incidents. In the present case, the nurses were already knowledgeable and competent in hand washing techniques. In contrast, procedures should minimise unnecessary working memory demands and help guide nurses to perform necessary behaviour regularly, when workload is high and they are tired.

The approach could be to include external cues and reminders at appropriate points in the nurses' routine. For instance, hand hygiene reminders could be included in the electronic patient record, mobile work devices or visit checklists, prompting nurses to confirm hand hygiene before and after every patient visit. These prompts serve as an external representation of information that is relevant to the task and act as a cognitive aid for the nurse that would otherwise have to maintain these procedural intentions internally. This is consistent with the Working Memory Model, as maintaining less information in working memory could reduce demands on limited working-memory resources (Baddeley, 2012). Healthcare evidence confirms the use of such cues. Gould et al. (2017) reported that interventions with reminders, feedback, and enhanced access to hand-hygiene products were associated with increased hand-hygiene compliance among healthcare workers, but the level of certainty was different for each intervention.

A second recommendation is improved workload and shift management. The Health Board could provide adequate recovery between shifts and avoid substantially increased patient loads where possible. Di Muzio et al. (2019) identified fatigue, workload, night shifts, staffing levels and interruptions as factors associated with medication errors and poorer performance, while Clendon and Gibbons (2015) found increased error risk during shifts of 12 hours or longer. Managing workload may therefore help preserve the attentional and executive resources required for routine safety procedures.

A third measure would be implementing a multimodal hand-hygiene intervention instead of a single intervention. This may include easy-to-access hand hygiene resources, strategic reminders, frequent checks,

positive feedback during performance and further training. The multimodal approach, which includes system change, education, observation and feedback, reminders and organisational safety climate, was shown to be effective by Luangasanatip et al. (2015) to improve hand hygiene compliance. Environmental cues and readily available resources decrease the need to cognitively process information in the working memory while feedback can reinforce the consistent execution of procedures. It is important to note that the intent of retraining should not be to remind the nurse of the policy, but to assist with the performance in challenging clinical situations.

Caution should be taken in implementing these procedures on an ethical level. While electronic prompts and observation and monitoring may enhance patient safety, too much monitoring may jeopardize nurses' privacy, autonomy and professional trust. The data collected for monitoring must therefore not be interpreted as a straightforward indictment of individual misuses, but rather be used as a basis for identifying system-level issues and giving supportive feedback. Nurses should also be told what information is collected, how this will be used and who will have access to it.

Also, there's an ethical responsibility to not expect the individual nurse to absorb the blame when organisational factors may have played a role. Rushing through callouts and filling long checklists to cover for nurse staffing and workload may add to the cognitive load. Thus the most appropriate would be the integration of cognitive supports with organizational measures dealing with workload, staffing and recovery time. This approach acknowledges the duty of the Health Board to safeguard patients from avoidable harm as well as the duty to ensure working conditions are in place that allow nurses to carry out their necessary work safely and consistently.

EVALUATION AND CRITIQUE OF THEORY

The Working Memory Model is a helpful model for understanding how limited cognitive resources could cause a failure in performing a task. The model has been well supported by the many empirical data which show the existence of several working memory components, not just a single short-term memory system. The results of dual-task studies have shown that a number of tasks can be executed concurrently with relatively small interference, especially if they depend on different cognitive resources (Baddeley, 2012). Evidence from neuropsychology also supports for separable aspects of working memory. For instance, Baddeley and Wilson (2002) studied a patient with a very poor long-term memory but who could recall prose longer than the phonological loop can hold. These results provided support for episodic buffer as a component that has the ability to integrate information from multiple sources.

However, the model has its limitations. The central executive is less clearly defined than the phonological loop and visuospatial sketchpad components. Baddeley (1996) conceded that the central executive needed more elaboration and proposed that it could be subdivided into various executive processes, such as focusing and switching attention. This poses a problem for the extension of the model to complex real world behaviours as it does not necessarily point towards the exact cognitive process in which the error is made.

One limitation is the application of laboratory findings to complex clinical environments. District nurses may simultaneously experience fatigue, interruptions, time pressure and organisational demands that laboratory working-memory tasks cannot fully represent. Importantly, the case provides no direct measure of nurses' working memory performance. Although Esmaily et al. (2022) found reductions in nurses' working memory following shifts, this does not demonstrate that working memory limitations caused the handwashing failures.

Moreover, purely cognitive explanations may underestimate the role of organizational factors. The nurses were already trained, experienced and had successfully demonstrated their competency. The subsequent failures were in times of staff shortages, and a significant rise in workloads. Thus, the incident could be a symptom of a larger problem at the systems level rather than a person's cognitive deficit. Excessive demands may help account

for susceptibility to procedure failures, but the theory of working memory does not provide a sufficient explanation for how such conditions for repeated back-to-back shifts and significantly higher caseloads had arisen within the organisation.

The proposed interventions are also constrained by the above limitations. Theoretically, external reminders and checklists should reduce the need for cognitive resources, but the more reminders given, the more cognitive load could be introduced, or build alert fatigue. There is evidence that over-alerting can cause healthcare professionals to ignore or override alerts, diminishing the potential for their safety benefits (Ancker et al., 2017). Thus, interventions should not be the addition of more information for nurses to process. Cognitive supports should be thoughtfully planned and linked to changes in organisation practices to support staffing, workload and recovery time.

In sum, the Working Memory Model provides a plausible, but incomplete explanation of the case. It most importantly shows that the possession of knowledge of a procedure does not always lead to faithful execution in the presence of high demands on cognition. Working-memory limitations should be considered as one mechanism among several that is part of a larger relationship between individual cognition and organisational working conditions, however. The best recommendations are those that involve both the cognitive supports and environmental/organisational changes that can be implemented to support the work of the nurse.

CONCLUSION AND RECOMMENDATIONS

In the present case, knowledge and experience, in isolation, do not ensure uniform compliance with the critical healthcare procedures in the case of high cognitive and occupational demands. The district nurses had been properly trained and competent to perform handwashing, but increased patient numbers, staff shortages, long working hours and back-to-back shifts, did increase the risk of handwashing procedures not being followed. These failures can be understood within a plausible cognitive framework, the Working Memory Model, as increased working-memory and executive-attentional demands may make individuals more susceptible to errors when managing several competing demands. Working-memory limitations, however, cannot be the only reason for the incident as staffing, workload, working conditions and other organisational factors may also have played a role. Therefore, a combined strategy of hand-hygiene prompts and procedure supports, as well as effective workload management, sufficient staffing and recovery between shifts are recommended to be adopted by the Health Board. Nurses' rights to privacy, autonomy and their dignity should also be protected in any monitoring and feedback processes. Finally, working-memory interventions might help promote

safer practice; however, this is likely to be achieved by addressing broader organizational factors which affect nurses' capacity to regularly adhere to standardized practice.

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Presented in standard APA format

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