International Journal for Quality in Health Care, 2021, 33(S1), 51–55
doi:10.1093/intqhc/mzaa137
Advance Access Publication Date: 24 November 2020
Original Research Article

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Will the COVID-19 pandemic transform infection prevention and control in surgery? Seeking leverage points for organizational learning

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Received 31 August 2020; Editorial Decision 23 September 2020; Accepted 8 December 2020

Abstract

Background: In response to the coronavirus disease of 2019 (COVID-19) pandemic, healthcare systems worldwide have stepped up their infection prevention and control efforts in order to reduce the spread of the infection. Behaviours, such as hand hygiene, screening and cohorting of patients, and the appropriate use of antibiotics have long been recommended in surgery, but their implementation has often been patchy.

Methods: The current crisis presents an opportunity to learn about how to improve infection prevention and control and surveillance (IPCS) behaviours. The improvements made were mainly informal, quick and stemming from the frontline rather than originating from formal organizational structures.

The adaptations made and the expertise acquired have the potential for triggering deeper learning and to create enduring improvements in the routine identification and management of infections relating to surgery.

Results: This paper aims to illustrate how adopting a human factors and ergonomics perspective can provide insights into how clinical work systems have been adapted and reconfigured in order to keep patients and staff safe.

Conclusion: For achieving sustainable change in IPCS practices in surgery during COVID-19 and beyond we need to enhance organizational learning potentials.

Introduction

The coronavirus disease of 2019 (COVID-19) pandemic is creating conditions for changing the way in which surgical and healthcare services are organized regarding infection prevention and control and surveillance (IPCS) [1]. Many healthcare organizations have transformed the way they provide care in response to these extraordinary circumstances.

Adopting a human factors and ergonomics perspective can provide insights into how clinical work systems have been adapted and reconfigured in order to keep patients and staff safe [2, 3]. The challenge ahead is to create meaningful organizational learning by capturing these adaptations systematically, and by reflecting on them critically, in order to achieve sustainable change that can improve IPCS practices in the longer term. Organizational learning can be described as a continuous cycle of action and reflection, which takes place at different levels (individual, group, organization or even business sector) [4].

Healthcare-associated infection (HAI) and anti-microbial resistance (AMR) are challenges. HAIs are avoidable harm [5], and AMR will likely increase due to the heavy use of antibiotics in COVID-19 patient treatment [6]. Previously, it has been estimated that at any one time, up to 7% of patients in developed countries and 10% in developing countries will contract at least one HAI [7].

Achieving sustainable organizational change requires that individuals value the change and that they have the resources to implement it [8]. The implementation of IPCS and antimicrobial stewardship programmes (ASPs) involves profound changes in the individual, group and organizational behaviour. Approaches and methods of implementation are necessarily an expression of the cultural and organizational context in which they unfold [9, 10]. It is crucial to find a common language among all the actors involved to shape new ways of interaction. It is necessary to transform the discrepancies between partial viewpoints into a common understanding of the problem of HAI and AMR [11, 12].

It could be argued that perceptions of healthcare workers towards IPCS have changed during COVID-19 and that there is now greater perceived value in improved IPCS practices. Resistance to change in IPCS behaviours and practices has been attributed to widespread beliefs that antibiotics could solve problems related to infections, the lack of strength of the evidence supporting interventions to prevent HAIs, the lack of ownership that healthcare staff feel for the problem and the perceived level of intractability of the problem [13]. However, in response to COVID-19, people and healthcare workers worldwide are now practising improved handwashing techniques and have adopted non-pharmaceutical intervention measures to prevent infection, such as environment sanitization. The rapid rise in the number of people infected with COVID-19 might have brought a change in perception of risk with respect to HAI and AMR in as far as an imbalance has been created in the relationship between three different types of risks that the IPCS normally tries to manage [14]. IPCS should consider how healthcare workers perceive risks. The Risks are: the collective risk and how health care workers perceive the probability that patients contaminating or infecting other patients. The individual risk for the single patient, or how the healthcare operator perceives the hazard of an unfortunate outcome following an infection; and the personal risk or how much the individual healthcare worker feels exposed to the risk of contracting the infection.

In this way, COVID-19 has opened a window of opportunity for implementing and sustaining improved IPCS practices in surgery. The momentum of improved public knowledge regarding infection prevention and control should be maintained and reinforced. It is timely to consider how the adaptations to IPCS practices and the changes in perceptions about IPCS can be sustained in the longer term.

Preventing infection in surgery—the enabling factors after COVID-19

Surgical site infections (SSIs) are the most common HAIs among surgical patients. Preventing SSIs is a global priority. SSIs are a major clinical burden in terms of morbidity, mortality, length of hospital stay and overall costs worldwide. Bacteria are becoming increasingly resistant to antibiotics, making SSI prevention even more important nowadays. SSI prevention is complex and requires the integration of a range of measures before, during and after surgery. In the last years, both the World Health Organization (WHO) [15, 16] and the Centers for Disease Control and Prevention (CDC) [17] have published guidelines for the prevention of SSIs. The 2016 WHO Global guidelines include 13 recommendations for the pre-operative period, and 16 for preventing infections during (intra-operative period) and after surgery (post-operative period). They range from simple precautions such as ensuring that patients bathe or shower before surgery, appropriate ways for surgical teams to clean their hands, guidance on when to use prophylactic antibiotics, which disinfectants to use before incision and which sutures to use. We identified three crucial behaviours of IPCS for controlling the pandemic, which can be considered enabling factors to improve adherence to IPCS in surgery [18].

Hand hygiene

Hand hygiene is the cornerstone of COVID-19 IPC. Healthcare institutions had reminded healthcare workers of the usefulness of hand washing, and despite the acknowledgement of the critically important role of hand hygiene in reducing the transmission of microorganisms, overall compliance had been less than optimal [19]. Proper hand hygiene is the most important, simplest and least expensive mean of reducing the prevalence of HAIs and the spread of AMR. By cleaning hands, healthcare workers can prevent the spread of microorganisms, including those that are resistant to antibiotics and are becoming difficult, if not impossible, to treat.

The five moments for hand hygiene approach define the key moments when healthcare workers should perform hand hygiene [20].

- before touching a patient,
- before clean/aseptic procedures,
- after body fluid exposure/risk,
- after touching a patient, and
- after touching patients' surroundings.

Screening and cohorting patients

The identification and isolation of COVID-19-positive patients are crucial for the containment of the pandemic. Contact tracing has been an important method for health authorities to determine the source of an infection and to prevent further transmission. It is well known that early detection of multidrug-resistant organisms is an important component of any infection control programme. There is good evidence that active screening of pre-operative patients for MRSA, with decolonization of carriers, results in reductions in post-operative infections caused by MRSA. It has been described in patients decolonized with nasal mupirocin. Global guidelines for the prevention of SSIs [15, 16] recommend that patients undergoing cardiothoracic and orthopaedic surgery with known nasal carriage *of Staphylococcus aureus* should receive perioperative intranasal applications of mupirocin 2% ointment with or without a combination of chlorhexidine gluconate body wash. Moreover, the guidelines suggest considering to treat also

patients with known nasal carriage of *S. aureus* undergoing other types of surgery with perioperative intranasal applications of mupirocin 2% ointment with or without a combination of chlorhexidine gluconate body wash.

Appropriate use of antibiotics

The successful containment of AMR in acute care facilities requires an appropriate antibiotic use [21]. Nevertheless, the risk of antibiotic misuse leading to AMR became higher during the most uncertain phases of the COVID-19 pandemic [6].

Additionally, ASPs can contribute to the prevention of SSIs via the optimized use of perioperative antibiotic prophylaxis (PAP) [22]. PAP has been demonstrated in multiple randomized controlled trials and meta-analyses to reduce the risk of SSIs across different types of surgical procedures [23]. Given the evidence, systemic PAP is considered to be a key component of perioperative infection prevention strategies [24]. Although compliance with appropriate timing and spectrum of PAP has improved as a result of quality improvement initiatives, there remain significant deficiencies in compliance with other aspects of PAP such as duration of post-operative antibiotics [25].

Proposal for an enhanced IPC approach for the prevention of SSI based on lesson learnt from COVID-19

A framework for organizational learning

Organizational learning is an essential tool for improving patient safety, staff well-being and for making processes of care more productive and efficient. However, the practical implementation of organizational learning for improving patient safety has often been reduced to the investigation of serious untoward incidents or never events, and this has limited its effectiveness at bringing about positive organizational change [26]. There is now a wealth of the literature that demonstrates that healthcare organizations continue to struggle to generate useful learning from past experiences and that they routinely fail to translate learning into meaningful and sustainable improvements in practice [27]. Organizations are often reasonably good at collecting, analysing and disseminating a lot of incident data, but then fail to link this to meaningful learning and changes to practice, because they focus on a limited set of interventions that neglect the social and informal aspects of the learning process [28].

The COVID-19 pandemic has put health systems under unprecedented strain, but despite some concerns and predictions to the contrary, so far, most health systems have coped with the demands and challenges of this crisis. To a significant extent this has been achieved by dedicated healthcare workers going the extra mile and beyond. However, the mechanisms of resilience in this crisis go beyond the individual. We have seen adaptations at all levels of health systems, such as reintegrating recently retired staff, rapid uptake of technology to enhance infection control [29], and repurposing of wards for acutely ill patients.

Successful organizations are able to anticipate changes, opportunities and challenges, to monitor their short-term impact, to adapt their behaviour and functioning accordingly, and to reflect on and learn from experience. In this view, performance variability, i.e. the manifold adaptations and trade-offs of everyday clinical work, is the basis for success, rather than a threat [30].

The proposed organizational learning framework is based on the guidance on 'Achieving sustainable change: capturing learning from COVID-19' [31], which has been developed by the Chartered Institute of Ergonomics and Human Factors (CIEHF) in order to help organizations learn from the positive changes made as we continue to adapt to the pandemic. The organizational learning framework aims to encourage people to think about how they navigate successfully difficult situations that are full of uncertainty and where there is always a lack of resources and seemingly endless demand. Looking at how people anticipate changes, how they monitor situations and how they adapt the way they work to the specific context, can help organizations to become more resilient.

The organizational learning framework provides prompts for organizations to reflect on what goes well even when situations are challenging, and how safe spaces can be created where staff can contribute to organizational learning, and where they can take ownership of improvement and change.

The framework aims to support organizations by describing organizational learning in terms of the mindset and the actions needed to achieve sustainable change, see Figure 1. The mindset—or learning structure—is about how an organization approaches organizational learning. The action—or learning process—describes how organizational learning actually takes place in an organization or how it is carried out. Finally, any changes that are implemented will likely require further adjustments over time, and therefore, the learning process should be continuous and feedback from staff should be sought and given.

Areas for improvement

The pressure on healthcare organizations has led to the rapid adoption of containment measures largely based on imitation of compliant behaviours immediately embedded into the routine activity. The impact of COVID-19 on elective surgery set a benchmark during the 'acute phase' useful to manage the 'transition phase' [32].

Figure 1 The CIEHF framework for organizational learning.

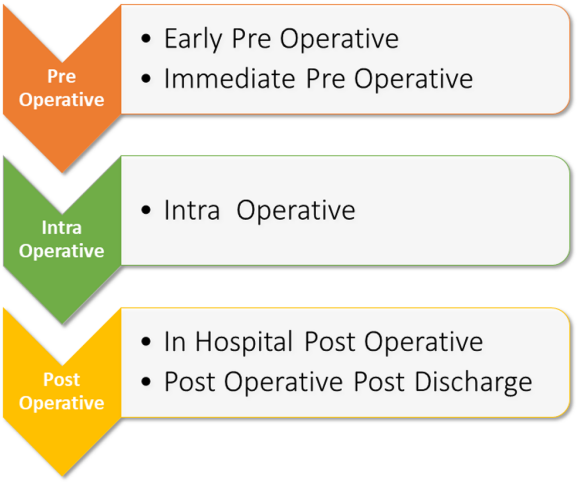

Figure 2 Enhanced SSI three areas of intervention.

It was experienced that the normal pathway for patients through surgery designed as three areas of intervention (pre-, intra- and post-operative) in IPC was actually ineffective in covering new aspects of quality and safety: patients and healthcare workers infection (COVID-19) status, in-hospital transmission risk, operating room environment and PPE.

Resilient forms of behaviour referring to the IPCS activity in surgery emerged, and these need to achieve a wider and more detailed coverage of patient's and healthcare workers safety and to ensure quality standards after the COVID-19 pandemic. In order to be enhanced the pre-operative phase should be split into early and immediate phases, and the post-operative into an in-hospital and a post-discharge phase. In the early pre-operative, new assessments are needed for COVID-19-related illness and for re-evaluation of postponed patients, considering telemedicine, new consent forms and updated consent for surgery and anaesthesia. Before resuming any surgical activity, clear pre-operative protocols should be implemented (see Figure 2).

In the immediate pre-operative phase a pre-surgery gap evaluation and nursing, anaesthesia and surgical assessment checklist are strictly necessary, postponing patients with COVID-19 infection. The intra-operative period, defined as the time spent into the operating room area, including transport from and to the ward and/or intensive care unit has dramatically changed in many different aspects and rise architectural concerns for segregation of COVID-19 patient routes and reconsidering ventilation and pressures in the operating theatres, changing the way we think the built environment.

As the first wave of infections was largely due to intra-hospital transmission, it is clear that the hospital environment has played a role in the infection transmissions. The design approach of the surgical department, where controlling the movement of the contaminated air coming from the operating rooms is key to contain the infection spread, should now take the COVID-19 rules into consideration to ensure the healthcare workers to operate in a safe environment. Dedicated theatres should be used for COVID-19-positive patients, preferably located in a corner of the Operating Room department, to limit cross-contamination of flows with non-COVID-19 theatres. The design of a ventilation system plays a key role in mitigating the risks associated with airborne contamination, which is of particular relevance when considering the hospitalization of COVID-19 patients. To mitigate the risk of cross contamination, the Healthcare Technical Memorandum [33] recommends that all operating theatre suites should be ventilated via dedicated air handling units, providing a minimum of 25 air changes per hour of outside fresh air in both conventional and ultraclean ventilation systems modifications should be defined with the existing systems to contain airflows within a defined number of rooms in treating both COVID and non-COVID patients within the same hospital. Organizational learning needs to accompany these efforts to ensure that lessons are not lost and that healthcare providers do not go back to the old ways once the worst of the crisis has been overcome.

Conclusion

In response to the COVID-19, pandemic healthcare systems worldwide have stepped up their infection prevention and control efforts in order to reduce the spread of the infection. These behaviours, such as hand hygiene, screening and cohorting of patients, and the appropriate use of antibiotics have long been recommended in surgery, but their implementation has often been patchy. The current crisis presents an opportunity to learn about how to improve IPCS behaviours.

For this to be successful, organizational learning needs to ask questions not only about what went wrong (even though these will be important), but should also aim to ensure that organizations learn from what went well—how did the health system cope in this time of crisis? How did people and organizations anticipate what would be required? How did they monitor the immediate situation and how did they adapt to this quickly evolving pandemic? Capturing these resilient forms of behaviour and reflecting on them will be key in improving IPCS practices in the future and in ensuring better outcomes for patients and for staff.

Funding

The papers were funded by ISQua.

Data availability

No new data were generated or analysed in support of this review.

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