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Quality & Safety in the time of Coronavirus - Design Better, Learn Faster
Using quality improvement and patient safety science in the COVID-19 pandemic

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Abstract

The COVID-19 pandemic has required health systems to change much faster than normal. Many staff have experienced training in quality improvement and patient safety methods which can be used to support the design of new systems and to accelerate learning about new and adapted practices. This article sets out the principles of quality improvement and patient safety science, applying them in a selection of approaches, methods and tools which may be useful in crisis situations such as the current pandemic. The article also makes reference to several resources which may be of use to those keen to advance their knowledge.

Introduction

Healthcare quality improvement (QI) involves designing, implementing and learning about the system changes necessary to respond to the dynamic health needs of a population.

While QI is usually carried out electively there is no reason why the mindset, concepts and tools of improvement and safety science cannot be applied to acute or emergency situations. The goal of improvement activity in a crisis setting must be to ensure and improve best possible patient outcomes in systems under acute strain, while at the same time placing a minimal, or no, additional burden on stretched healthcare staff. Emergency situations reveal new problems requiring new solutions that may, or may not, work as imagined. Improvement science favours the generation of good ideas before testing, refining and evaluating them for a particular context.

Patient safety science has many interventions developed for use in emergency and crisis situations and recognises that success comes from adapting to varying conditions[1]. In the knowledge that safety emerges from people acting together in complex and moving systems, safety science sets out to act wisely by enhancing teamwork and utilising non-technical skills such as communication, risk management and resilience.

These two fields work together to implement improvement and safety in changing scenarios. Below are some examples of key approaches and tools that teams may find useful to achieve the best for patients and staff during the COVID-19 Pandemic. The nature of this crisis demands new ways of working at an alarming pace. QI can help us learn faster but still be efficient and evidence based in decision making. It also facilitates us to fail better, learning safely, at small scale and at lower cost about the ideas that do not work. It is likely that professional bodies will increasingly recognise that although quality and safety remain at the forefront of intention they may be compromised, and the usual ways of developing practice norms will need to be adapted.

Improvement Science

Improvement Science is based on theories, such as those articulated by W. Edwards Deming, that help to identify the levers of improvement including the nature of systems, the psychology of change, an understanding of variation in processes and their measurement and how new knowledge is discovered[2]. These theories can be used to view and analyse a system or problem, seeing how work really happens and understanding the beliefs of all involved before considering ways to improve.

Rapid learning cycles (RLC)

This approach is at the heart of all improvement work. Even in crisis situations it is important to be clear on the purpose for any improvement effort and on the existing structures and processes at play in a system. When the goal is clear a method, such as the Model for Improvement[3] (Fig.1), can be used to structure an approach by refining an aim, selecting measures and generating change ideas. Iterative Plan-Do-Study-Act (PDSA) cycles are then used to carry out small tests of change that help to validate or augment the intervention.

In rapid learning cycles the goal is to learn quickly with the least possible interruption to clinical work. This can be facilitated by focusing on a short period e.g. test an idea somewhere in the system for 30-60 minutes, observe and gather some data, then immediately give feedback on its feasibility before planning next steps. Once a change is considered viable then quick wide-scale testing can be done, followed by spread to other areas if considered beneficial. There are some examples of rapid learning cycles in Box 2. Look for ways to integrate RLCs into daily work that is already happening such as using data that is already collected or learning from routine huddles or handovers.

Critical to the success of RLCs is the use of measurement. The Model for Improvement challenges us to identify objective measures that are used to support any belief that a change is leading to an improvement. These measures can include the desired *outcome* (e.g. reduction in workplace acquired infection) as well as the *structures* (e.g. availability of appropriate Personal Protective Equipment - PPE) and the *processes* (e.g. correct donning and doffing of PPE) that influence it. It is important to maintain awareness of the natural variation that occurs when a parameter is repeatedly measured and to guard against erroneously interpreting random signals as evidence of improvement. As with other aspects of RLCs there are trade-offs between the burden of effective measurement and the need to support the degree of belief that an improvement is real. There are measurement approaches that balance these demands, including run charts which can be easily set up using paper or basic IT applications. Run charts record data over time and with the addition of a median line allow the application of simple rules to visually interpret the validity of observations.

In addition to measurement there are several key tools that help with RLCs, a selection of which are included in Box 1. The links at bottom of the Box 1. provide further guidance on these and other tools as well as more detailed information on measurement for improvement.

Box 1: Quality Improvement tools that help generate ideas and guide efforts	
Process mapping	Captures the sequence of steps in a process in a flow diagram to support shared understanding and identify improvement opportunities. It allows us to see how work is being done and then designing how it could be done to achieve better outcomes.
Fishbone Diagram *also known as a cause and effect*	Displays the various inputs that effect a particular outcome. These are usually explored under the following

diagram	headings; Materials, Methods, Equipment, Environment, and People, and can be used to analyse the process.
5 Whys	Directs good questioning by recognising that the first explanation is rarely the right one. This approach can be used as issues are identified with the above tools.
Driver Diagram	A strategic tool that works by breaking down a goals critical factors and actions and identifying supporting activities and providing a theory of change.
These and other QI tools are available at :	
QI Toolkit, Health Service Executive, Ireland	www.hse.ie/eng/about/who/qid/nationalsafetyprogrammes/national-quality-improvement-toolkit.html
Institute for Healthcare Improvement (IHI)	www.ihi.org/resources/Pages/Tools/Quality-Improvement-Essentials-Toolkit.aspx
East London NHS Foundation Trust	https://qi.elft.nhs.uk/resources/improvement-tools/
Quality Improvement Zone, Turas, NHS Education Scotland	https://learn.nes.nhs.scot/1262/quality-improvement-zone/qi-tools

Figure 1: Model for Improvement[2]

Box 2: Examples of rapid learning cycles
It is likely these RLCs would make use of many additional PDSA cycles to test small changes and continue beyond the steps described below. All scenarios could take place over a few days. *These examples are not step by step guides as each individual project gives rise to their own cycles depending on the learning from each preceding PDSA.*

In the ICU – increased utilisation of nursing staff with limited ICU experience

- Aim - Reorganise provision of care in ICU to meet demand
- Measures - Safety experience at handover, nurse interviews, safety outcomes
- Change ideas - Use experienced nurses to supervise inexperienced ICU staff

PDSA1 – Team of ICU staff plan redesign of ICU care based on need to provide for increased numbers of patients while providing safe, effective care and supporting staff. Key tasks identified, supervision ratio suggested. Test by discussing with other staff.

PDSA2 – Checklists suggested for new staff and supervisors

PDSA3 – Checklists updated and re-tested

PDSA4 – Question of which ratio is correct for experienced nurse supervision, 2:1 or 3:1. Decision made to observe what 2:1 supervision experience is like over 1 hour with feedback collected from all staff involved.

PDSA5 – Suggestion that for most patients 2:1 is manageable but some patient groups more challenging. Observe a further 1 hour specifically in identified patient groups

In Training – Improving personal protective equipment (PPE) training

- Aim -All staff can safely and efficiently use and remove PPE
- Measure – Survey of trainers and trainees and observation of PPE use
- Change ideas – video and in person training (with social distancing)

PDSA1 - With experts (infection control/microbiology) identify critical steps and problems with PPE use. Review some training videos and choose best features. Test within expert group.

PDSA2 - Use learning to develop training and test on 1 person, 3 people then 5.

PDSA3 - Decide what elements of training can be put into video before attending PPE practice. Test video on 1, 3 and 5 persons and adapt from feedback.

PDSA4 - Test on group of 20 and adapt from feedback. Use widely and monitor.

In Communication – Roll out of a triage & testing decision line

- Aim - To design and implement risk based remote decision phoneline
- Measures – comparison with expert decision making, user experience
- Change ideas – Develop and refine decision algorithms

PDSA1 – With expert guidance develop an algorithm to assist non-medically trained staff to answer specific queries. Test pathways with colleagues.

PDSA2 – Develop mock caller scenarios and play out with staff. Some issues identified for non-algorithm questions. Algorithm updated.

PDSA3 – Test algorithms with real callers and medical expert back-up. Some non-algorithm issues remain. Decision to measure frequency of non-algorithm questions with real patient testing and expert back up. Suggestions that 1:10 callers requires expert help.

PDSA4 - Test using 1 medical expert with 8 non-medical staff per call shift.

Behavioural Science

All improvement requires individuals and groups to change their behaviour. There are several resources to help to move behaviour in a desired direction.

Improvers are familiar with the concept of "making it easy to do the right thing" and the importance of motivation by winning "hearts and minds. The *Fogg Behavior Model* (fig.2) recognises these elements and highlights the importance of using prompts appropriately to help remind and encourage people to act in the intended way and emphasising that good design (being easy to do) reduces the amount of motivation and prompting required. The combination of these elements is needed to design new systems that ensure critical behaviours such hand washing or Personal Protective Equipment (PPE) use are reliably adopted.

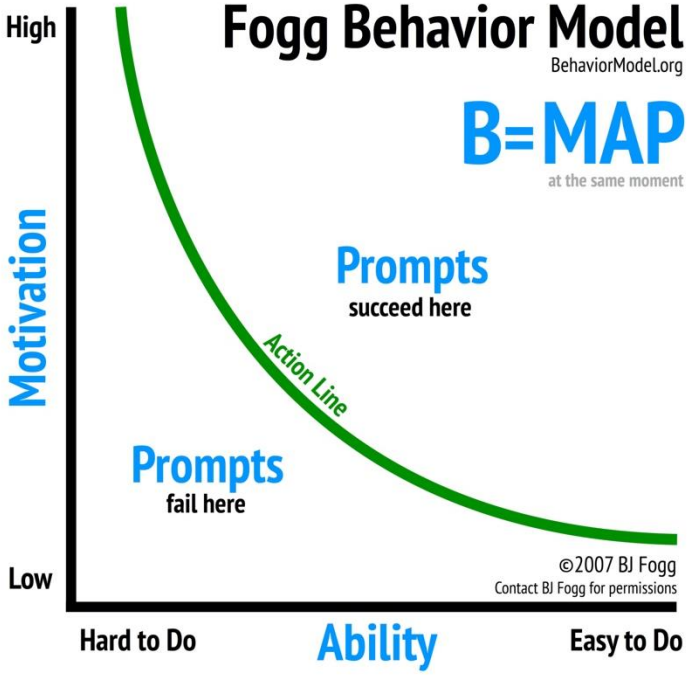

Figure 2: Fogg Behavior Model (Tiny Habits: The Small Changes That Change Everything, BJ Fogg, 2019)

Another excellent behavioural science resource is the *Institute for Healthcare Improvement (IHI) Psychology of Change Framework* white paper[4]. This document recognises that all change requires power (agency) to make behavioural choices and courage to act. It also considers five domains of practice needed to achieve and sustain change including the distribution of power and need for co-design and co-production. In crisis situations these features may need to adapt, however where possible improvement is still more likely to be successful and sustained if it is conceived and delivered in partnership.

Finally, a new document from the Economic and Social Research Institute (ESRI) in Ireland is rich in evidence-based ideas on how to achieve the public and organisational behaviour changes needed to tackle the COVID-19 pandemic[5]. Behavioural topics include hand washing, face touching, social isolation, public spirited behaviour, tackling undesirable behaviours, crisis communication and risk perception.

Crisis Standards of Care (CSC)

QI is built on the clarity of knowing what quality is. In a crisis situation it may not be possible to meet the quality standards of normal times so ethical and operational guidance is required to adapt to new scenarios. The concept of Crisis Standards of Care is an example of

how to apply a set of principles to help create a situational definition of quality[6]. These principles include fairness, duty to care, duty to steward resources, transparency, consistency, proportionality and accountability. Addressing issues such as the stewarding of resources may direct new QI efforts to avoid the rationing of critical care or other scarce interventions through improved preparation, conservation, substitution, adaption or the re-use of existing facilities[7].

Patient Safety Science

Patient safety science is also drawn from a broad base of theories that are increasingly being integrated in approaches such as the Systems Engineering Initiative for Patient Safety (SEIPS) model[8]. The SEIPS model recognises that safety emerges from the multiple interactions between people, tasks and physical environments as well as organisational characteristics and cultures. Below are some specific examples of interventions drawn from safety science which are most effective when part of a system of safety.

Teamwork and Human Factors

Modern healthcare is a team sport and many practitioners have experience of working over long periods in effective teams to deliver complex services. Crisis situations however see new teams being created and having to perform to a high standard in a short time. This asks us to identify the critical and teachable skills needed for healthcare teams to work effectively. Based on work from the military and aviation, Crisis Resource Management (CRM) is proposed as a means of training teams for high performance and there many excellent healthcare specific resources and programmes available[9] [10] [11]. The goals of CRM are, within a team setting, to ensure clarity around role and leadership while focusing on essential non-technical skills such as communication, shared situation awareness and the creation of psychological safety (the confidence and security to speak up).

Huddles

Huddles utilise many of the behaviours highlighted above in the setting of brief (<15min) team meetings. These meetings review performance, create shared situation awareness and anticipate problems in the time period before the next huddle. Essential to the huddle is the idea of a flattened hierarchy where the opinion of everyone present is equally valued, heard and used to problem solve and mitigate potential harm[12]. In crisis situations huddles help teams to stay connected and allow for issues to be shared openly and discussed, so that future challenges can be identified, and interventions planned in anticipation of them happening.

After Action Review (AAR)

Also builds on good team behaviours by providing a structured means to learn from any event. AAR uses a 4-question model[13] to create a shared model of a situation which can be used to draw lessons from. The four questions which should be answered by all team members, again with a flattened hierarchy, are:

1. What did we expect was going to happen?
2. What happened?
3. Why was there a difference?
4. What can we learn or do differently?

AAR can be used for small tasks as well as events with positive outcomes to ensure learning.

Conclusion

"Perfection is the enemy of the good when it comes to emergency management. Speed trumps perfection. And the problem in society we have at the moment is everyone is afraid of making a mistake. Everyone is afraid of the consequence of error, but the greatest error is not to move, the greatest error is to be paralyzed by the fear of failure."

Dr Mike Ryan, Executive Director, WHO Health Emergencies Programme, discussing the need for prompt international action to the COVID-19 Crisis on March 13th 2020.

The above quote highlights the need for action in the current crisis. The COVID-19 pandemic creates a new paradigm where the old rules of engagement are no longer valid. Many healthcare staff have experience of QI and patient safety training which can now be used to respond to new challenges. This selection of ideas shows how QI and patient safety thinking can support good choices and decisions, in a timely way, when designing and implementing new patterns of work, particularly at the team, ward, community service and hospital level.

Finally, there is a real need to look after ourselves and each other at this time, not only physically but also psychologically and emotionally. Quality and safety are characteristics of goodness and highlighting, sharing and celebrating good practice is important to bolster personal and team resilience. Now, more than ever, we must treat each other with kindness and respect so that we can care for many as possible in the time ahead.

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Top Tips

- The mindset, concepts and tools of improvement and safety science can all be used in crisis situations such as the current COVID-19 pandemic.

- Selecting good ideas and learning through small tests of change in real world settings while causing minimal disruption to critical work, can support good decision making when resources are stretched.

- Training healthcare teams in key non-technical skills such as shared situation awareness and communication to learn and adapt to dynamic situations improves safety and effectiveness.