

Rapid Cycle Implementation and Retrospective Evaluation of a SARS-CoV-2 Checklist in Labor and Delivery

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Research

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Abstract

Background

Preparedness efforts for a COVID-19 outbreak required redesign and implementation of a perioperative workflow for the management of obstetric patients. In this report we describe the rapid cycle implementation of a comprehensive perioperative checklist for care of the COVID-19 parturient and a retrospective analysis of the factors which influenced implementation success.

Methods

A newly designed workflow for COVID-19 parturients requiring perioperative care was produced as a checklist, intended for use as a cognitive aid. Implementation and refinement of the workflow was accomplished through rapid-cycling, debriefing and on-site walkthroughs. Retrospective evaluation of the implementation experience was performed using a group deliberation approach, mapped against the Consolidated Framework for Implementation Research (CFIR).

Results

Post-implementation, consistent use of the workflow was reported for all obstetric COVID-19 perioperative cases (100% compliance). Evaluation of our implementation using CFIR revealed domains of process implementation and innovation characteristics as overwhelming facilitators for success. Constructs within the outer setting, inner setting and characteristic of individuals (external pressures, baseline culture, and personal attributes) were felt to act as barriers. Constructs such as communication, shifted in influence over time.

Conclusion

We describe the implementation of a comprehensive obstetric workflow checklist for care of the COVID-19 perioperative patient. A retrospective evaluation of our implementation experience was possible using CFIR, which enabled identification of barriers and facilitators for change within our unit. Furthermore, we observed that implementation success was possible, despite facilitation being perceived within only two domains at baseline. Emerging themes from this study highlight the importance of thoughtful innovation design, careful implementation planning and the establishment of a long-standing culture of improvement, in order to facilitate implementation of change during a time of crisis.

Contributions To The Literature

- In this study, we describe the experience of rapidly implementing a comprehensive perioperative checklist for the COVID-19 parturient and performed a retrospective analysis of the factors which

influenced implementation success.

- In the setting of the COVID-19 pandemic, implementation success relied more on the importance of thoughtful innovation design and implementation planning, rather than the learning climate and organizational culture. Factors initially perceived to be barriers transitioned into facilitators, once a perceived benefit was acknowledged amongst healthcare teams.
- These findings demonstrate that strategies to promote implementation success, in the setting of a pandemic, may require a different approach.

Background

Obstetrics & COVID-19

The Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), which causes the disease COVID-19, was first detected in Massachusetts, USA on 1 February 2020. Spread of the virus within our area was only appreciated in early March and coincided with the declaration of SARS-CoV-2 pandemic by the World Health Organization on 11 March, 2020 (1). At this time, as exponential community transmission in other areas was being reported, we began to anticipate the imminent presentation of COVID-19 parturients to our hospital.

Preparedness efforts for the COVID-19 outbreak within our labor and delivery (L&D) unit required redesign of perioperative workflow processes, alignment and training of multiple collaborative care teams, while simultaneously delivering high-level care to patients, COVID-19 and non-COVID-19 alike. The rapid spread of SARS-CoV-2 added additional time-constrained challenges to these efforts.

While clinical guidelines and checklists are core components of patient safety efforts within L&D units (2), the implementation of new guidelines or workflow processes within healthcare is challenging and often hampered by several expected and unexpected barriers (3–5). The identification of barriers and facilitators is vital in establishing an efficient strategy for change (6), as described in established frameworks such as the Consolidated Framework for Implementation Research (CFIR) (7–9) and Expert Recommendations for Implementing Change (ERIC) (10, 11). In this report we describe the rapid cycle implementation of a comprehensive perioperative checklist for care of the COVID-19 parturient, along with a retrospective analysis of the factors which influenced implementation success in the setting of the COVID-19 pandemic.

Methods

The study was approved by our Institutional Review Board (IRB) at the Beth Israel Deaconess Medical Center. As this was a qualitative study, describing the implementation of a novel workflow into clinical practice and a retrospective evaluation of the experience, and did not constitute human subject research, the requirement for written informed consent was waved by the IRB. This manuscript conforms to the

Standards for Quality Improvement Reporting Excellence (SQUIRE) guidelines and the Template for Intervention Description and Replication (TIDieR) checklist (12,13).

i. Description of Workflow Checklist Implementation (obstetric workflow redesign)

Initial reviews of COVID-19 pandemic preparedness in our hospital identified the need for the redesign of a L&D site-specific perioperative workflow for managing a COVID-19 parturient. Our L&D unit serves as a regional referral center serving an urban, metropolitan area of approximately 4.6 million people, and is the academic teaching hospital for Beth Israel Lahey Health, a state-wide hospital network representing more than 15,000 births annually. We reviewed the available literature on both SARS-CoV-2 and other related viruses (14), including recommendations on the standards of care from government and professional bodies such as the American College of Obstetrics and Gynecology (ACOG), the Society for Obstetric Anesthesia and Perinatology (SOAP) and the Anesthesia Patient Safety Foundation (APSF) (15–17). We combined these recommendations with our own organization's newly designed perioperative workflows for COVID-19 patients to create the L&D workflow for the COVID-19 parturient requiring perioperative care. It was produced as a single page document, formatted as a sequential checklist with the intention to be used in real time as a cognitive aid. The checklist was an intentional design decision, as it was felt to be a more effective means of detailing sequential steps in care (18); it also fit in with existing practice of pre-operative briefings for all patients going to the operating room on L&D.

Implementation of this innovation took place through a process of rapid cycling over a period of 2 weeks (19–21). Following inter-professional input, virtual event debriefings and on-site walkthroughs, several iterations of workflow re-design resulted in our final refined product (Figure 1). Post-case debriefings were performed routinely after-hours and led by the division chiefs of obstetrics, maternal-fetal-medicine, anesthesia, neonatology, and quality. Details on the individual cycles for change are listed (Supplemental Table 1). Successful implementation of this new workflow was defined by confirmation of its use during the care of successive COVID-19 parturients over the subsequent weeks. Our finalised workflow materials may be readily accessed online (22).

ii. Evaluation of our implementation

To evaluate the implementation of the perioperative workflow redesign on L&D we conducted a detailed retrospective evaluation using the CFIR (7,23,24). CFIR classifies operationally defined domains that have been shown to influence implementation success (7), namely, intervention characteristics (e.g.; adaptability, design quality and cost), the outer setting (e.g., external policy, peer pressure), the inner setting (e.g., culture, climate and readiness for implementation), the characteristics of individuals (e.g., knowledge and beliefs about the intervention) and the process of implementation (e.g., planning, engaging, executing and reflecting). Assessment of our implementation experience was mapped against the CFIR constructs and ranked by a panel of 6 experts within our organization, including obstetricians, anesthesiologists and our quality and safety faculty.

Using a group deliberation approach, with knowledge of local context, each construct was evaluated with respect to its likely influence on implementation and ranked as a facilitator or barrier, having no effect or not applicable to implementation. We transformed these results into a quantitative assessment by allocating a numerical score of 1 to a construct if it acted as a facilitator and 0 if it was considered a barrier or not influencing implementation success, in order to compare the relative contribution of each equally weighted construct within each domain at baseline. The denominator included all constructs within each domain, apart from those deemed not applicable to the study.

Results

i. Outcome of implementation

Over two weeks, a redesigned perioperative workflow for the obstetric COVID-19 patient was successfully implemented within our L&D unit. The initial workflow draft was disseminated among clinical leaders and stakeholders and underwent one cycle of cognitive redesign. Prior to further refinement, planned testing or wide-scale dissemination amongst providers, its use was urgently requested by clinical leaders to assist in the management of our first live COVID-19 obstetric case. At this time, staff members involved in the case had no formal input into the design of the checklist or training in its use but were coached in real-time to work through the checklist elements. By following the sequence of the checklist, staff were able to safely perform the standard operating procedures, as indicated. Following our first live case, a formal debriefing with all members of the obstetric, anesthesia and perinatal team was conducted using video-conferencing, and specific steps were identified for checklist optimization. Subsequent checklist use, post-case debriefing and workflow redesign continued through a process of rapid cycling as described above. Following implementation, we report successful and consistent use of this new workflow for all obstetric COVID-19 perioperative cases (100% compliance) over the subsequent weeks to date. Feedback from frontline clinicians was that the checklist helped with ensuring proper use of PPE, created an environment of safety, and improved coordination and communication among the teams.

ii. Evaluation of checklist implementation

Evaluation of the implementation experience using CFIR demonstrated the significance of the following domains, when ranked in order of influence as facilitators of implementation success (expressed as a percentage of constructs within each domain): process (89%), innovation characteristics (88%), inner setting (64%), characteristic of individuals (40%) and the outer setting (0%). Constructs not applicable to this study included cosmopolitanism, organizational incentives and rewards, and external change agents.

Facilitators of implementation:

Constructs which **positively** influenced the implementation of this workflow redesign spanned all domains, except the outer setting. The domains of implementation process (Table 1) and innovation characteristics (Table 2) demonstrated the greatest proportion of facilitating constructs. Constructs within the inner setting which had a strong influence in facilitating implementation included the structural

characteristics of the unit, the implementation climate (tension for change, compatibility, relative priority, goals and feedback) and the readiness for implementation (leadership engagement, available resources) (Table 3).

Barriers to implementation:

Several constructs were felt to **negatively** influence implementation in this study, in particular those from within the outer setting (Table 4). Additional barriers to implementation included the complexity of the innovation (innovation characteristics, Table 2), baseline culture, climate and communication (inner setting, Table 3) and personal attributes (characteristics of individuals, Table 5).

External pressures created by peer pressure, both locally and internationally, were evident as an early barrier to implementation. Local peer pressure created by a departmental policy within anesthesia on the appropriate personal protective equipment (PPE) resulted in general anxiety, disagreement and inconsistencies in inter-departmental guidance that impacted behaviors within the L&D unit and overall readiness for alignment. Furthermore, external influences from international peer groups, in particular communications from colleagues in China, Italy and other centers across the USA including the Center for Disease Control (CDC), demonstrated a considerable disconnect between the recommendations for care and clinical practice. This affected expectations and resulted in a delay of the shared mental model.

Constructs which demonstrated a change over time:

Evaluation of our implementation revealed some constructs which demonstrated a temporal change over time, the majority of which were within the inner setting (Table 3). At baseline, constructs such as communication, culture and learning climate initially acted as a barrier to implementation, but then progressed to become facilitators within the space of a few weeks.

With respect to this innovation, clear lines of communication and knowledge of where to access the most up to date information were not evident initially within the organization, which resulted in frustration. This was rectified over the course of implementation and communicated through the hospital's COVID intranet. Further communication improvements at the local departmental levels, via intranet, email and teleconferencing permitted inter-professional collaborative work.

While the culture within the L&D unit was accustomed to the use of checklists, standard operating procedures, and iterative cycle improvement, additional internal forces such as recent staffing changes along with external pressures, fears and anxiety, were present that may have influenced the cohesion of the unit. Pre-existing egotism and individualism may have impacted the learning climate and further impacted implementation negatively. However, in view of the urgency of COVID-19, assistance outside of the L&D unit was sought and welcomed over the course of the implementation. Leaders within L&D valued the input of all inter-professional team members during the implementation period. Additionally, through the debrief mechanism, involved staff members felt like a valued partner in the change process.

Finally, within the outer setting, the patient's needs and resources also shifted in influence over time (Table 4).

Discussion:

This paper describes our experience of implementing a new obstetric workflow checklist specific for COVID-19 patients in the perioperative setting. We demonstrate the plausibility of implementation of urgently needed tools by rapid cycling and, furthermore, we identify several factors that impacted implementation through retrospective evaluation using the CFIR established framework.

In our study, constructs within the domains of process implementation and innovation characteristics were overwhelming facilitators for success. We believe that transparency in the development and implementation plan along with the design and content of the tool itself were significant influencers. Innovation characteristics found within the tool included the sequential steps of the checklist which ensured that front-line clinicians were able to perform standard operating procedures. Despite the initial impression that our tool was complex, the ability of staff to successfully use the checklist without prior, and extensive, training demonstrates construct validity of the innovation (25). The immediate and regular testing of our workflow checklist during real COVID-19 obstetric cases by front line staff, enabled us to adapt the tool to meet local requirements (25–27). In general, cognitive aids should be as concise and clear as possible, and their implementation in other units or environments must include local testing and adaptation for success.

Constructs within the inner setting, such as implementation climate and readiness for implementation, likely acted to support the time pressure. Our institution's L&D unit is a world-leading center for teamwork and excellence in obstetrics and anesthesia and is a well-established division within the medical center. The unit has a history of clear processes in place to facilitate multidisciplinary quality improvement. Therefore, clarity in the prioritization of implementing this innovation along with a readiness demonstrated by senior leaders and stakeholders within the L&D unit and organization facilitated implementation success. A culture of inclusion and teamwork promotes alignment during rapid change, as leaders actively reach out to each other for input. Crisis is a challenging time to develop trust, inclusion and teamwork; a pre-existing culture that includes these characteristics makes it easier to incorporate change. The effectiveness of implementation in our unit demonstrates that developing a culture of quality improvement, multidisciplinary alignment, and trust has true long-term value.

Given the context of the pandemic, the influence of some usual barriers to implementation, including peer pressures and individual personal attributes may have been lessened. Generally, guidance from regulatory bodies and peer groups often convey a consistent and unified set of recommendations, with little room for interpretation by most providers. However, early publications from international centers and anecdotal reports surrounding COVID-19 left significant room for interpretation, which may have led to a greater sense of anxiety amongst providers and delays in strategic alignment. One significant observation was that the use of the checklist shortened the preparatory time needed for clinical care, as it

provided clarity and unified thinking amongst staff with regards to implementation of clinical recommendations.

Reflecting on how the pandemic affected our implementation success, it is worth noting that even in the context of an originally perceived barrier, the urgency and time pressure applied by threat of an outbreak enabled a rapid transition of impact to facilitate change. The finding of implementation success, despite the presence of perceived barriers within the outer setting, inner setting and amongst the characteristics of Individuals, was unexpected. This may be a reflection of the urgency brought about by the COVID-19 pandemic, or perhaps an indication that in the time of crisis, the influence imparted by constructs within these domains are minimal. Furthermore, we noted that drivers for change during the COVID-19 pandemic within our organization are different than during times of routine care. For instance, anxiety around healthcare worker infection rates, the associated stress of rapidly changing local policies and the unknown value of the innovation may negatively impact adherence to guidelines (4). In contrast, our agile team-centered implementation approach resulted in greater engagement and acceptance of the checklist as a central cohesive factor in enhancing care of these patients.

Limitations

In this study we did not perform a comparative pre-post analysis, our evaluation is therefore limited to the post-implementation period. Retrospective evaluations of implementation are often performed to help explain success or failures; they are done at the end of the project and rely on key stakeholder experiences.(28–30) Rankings of individual constructs was performed through a group deliberation approach, however, agreement between raters about the influence of each construct on implementation success was consistent, likely reflecting a high level of shared mental model and leadership engagement in the implementation process. Due to the rapid nature of the study, we report mainly on our qualitative findings. In this context, however, qualitative analyses may provide a deeper understanding of the barriers and facilitators for implementation.(6)

Conclusions

This study describes the successful implementation of a comprehensive obstetric workflow checklist for care of the COVID-19 perioperative patient. We also demonstrated the benefit of retrospective evaluation of implementation experience using the CFIR framework in order to identify the barriers and facilitators for change within our setting. Emerging themes from this implementation may provide the basis for future recommendations and implementation strategies, specifically during a time of crisis.

Abbreviations

SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus-2
COVID-19	Coronavirus disease 2019
L&D	Labor and delivery
PPE	Personal protective equipment
CFIR	Consolidated Framework for Implementation Research
ERIC	Expert Recommendations for Implementing Change
IRB	Institutional review board
ACOG	American College of Obstetrics and Gynecology
SOAP	Society for Obstetric Anesthesia and Perinatology
APSF	Anesthesia Patient Safety Foundation
CDC	Centers for Disease Control
SQUIRE	Standards for Quality Improvement Reporting Excellence
TIDieR	Template for Intervention Description and Replication

Declarations

Ethics approval and consent to participate:

As stated in the methods, this study was approved by our IRB at the Beth Israel Deaconess Medical Center and did not constitute human subject research, therefore the requirement for written informed consent was waived (Protocol number: 2020D000469).

Consent for publication:

not applicable

Availability of data and materials:

not applicable

Competing interests:

The authors declare that they have no competing interests.

Authors' contributions

All authors read and approved the final manuscript. **LZ** helped with study design, data analysis and interpretation, manuscript drafting. **NL** helped with data interpretation and manuscript drafting. **YL** helped with data interpretation and manuscript drafting. **TG** helped with data interpretation and manuscript drafting. **SAS** helped with data interpretation and manuscript drafting. **PEH** helped with study design, data analysis and interpretation, manuscript drafting. **SKR** helped with study conception, study design, data analysis and interpretation, manuscript drafting

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Contributions

to the literature

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not applicable

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Tables

Table 1: CFIR Domain - Process

CFIR Constructs and Definitions	Ranking	Reason for Assigned Ranking	Score
Planning: The degree to which a scheme or method of behaviour and tasks for implementing an innovation are developed in advance, and the quality of those schemes or methods.	F	The innovation was tested in real-time within the organization, assessed and modified, prior to implementation in L&D. There was a role for all stakeholders in the planning process, tracked the implementation process.	1
Engaging: Attracting and involving appropriate individuals in the implementation and use of the innovation through a combined strategy of social marketing, education, role modelling, training, and other similar activities.	F	Staff members were engaged with the innovation, invited to use the checklist during live cases, participated in debriefings and did not require repeated attempts to engage. This engagement encouraged feedback and enabled the rapid improvement of steps within the checklist.	1
Opinion Leaders: Individuals in an organization that have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the innovation.	F	Clinical leaders within L&D were engaged with the innovation and were actively involved in each step of implementation, assessment and improvement.	1
Formally Appointed Internal Implementation Leaders: Individuals from within the organization who have been formally appointed with responsibility for implementing an innovation as coordinator, project manager, team leader or another similar role	F	A formally appointed quality and safety lead (SKR) supported and enabled implementation of this innovation. Clinical leads and local stakeholder buy-in was present.	1
Champions: Individuals who dedicate themselves to supporting, marketing, and 'driving through' an [implementation]", overcoming indifference or resistance that the innovation may provoke in an organization.	F	The innovation was informally championed by our surgical obstetric divisional lead.	1
External Change Agents: Individuals who are affiliated with an outside entity who formally influence or facilitate innovation decisions in a desirable direction.	NA	We did not have an outside organization assisting with implementation, this was internally driven and tested.	NA
Key Stakeholders: Individuals from within the organization that are directly impacted by the innovation, e.g., staff responsible for making referrals to a new program or using a new work process.	F	Key stakeholders, including a designated quality and safety team, were engaged with the innovation and assisted in the development, implementation, assessment and improvement of the innovation.	1
Innovation Participants: Individuals served by the organization that participate in the innovation, e.g.,	NI	The 'participants' in this study were considered the patients with confirmed or under investigation for	0

patients in a prevention program in a hospital.		COVID-19. These participants did not impact implementation.	
Executing: Carrying out or accomplishing the implementation according to plan.	F	The redesigned workflow was implemented rapidly, in a concise manner, according to plan.	1
Reflecting & Evaluating: Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.	F	The implementation team consistently assessed the progress of implementation and the quality of the innovation in order to promote continuous quality improvement.	1

B: barrier, CFIR: Consolidated Framework for Implementation Research, F: facilitator, NA: not applicable, NI: no impact.

Table 2: CFIR Domain - Innovation Characteristics

CFIR Constructs and Definitions	Ranking	Reason for Assigned Ranking	Score
Intervention source: Perception of key stakeholders about whether the innovation is externally or internally developed.	F	The intervention came from within the organization, it was an internally developed workflow checklist, not from outside policy makers or regulatory bodies.	1
Evidence, strength & quality: Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the innovation will have desired outcomes.	F	The intervention came from a trusted internal source and from an expert group with awareness of local needs. Though guided by literature from previous epidemics, there was little peer-reviewed evidence of what exactly was needed to promote effectiveness.	1
Relative advantage: Stakeholders' perception of the advantage of implementing the innovation versus an alternative solution.	F	National guidelines and recommendations for managing obstetric COVID-19 patients were collected, synthesised, and disseminated among the stakeholders; however, there was wide variety of interpretation as to the implementation of these in practice. Implementing a sequential checklist was perceived to be faster at producing alignment.	1
Adaptability: The degree to which an innovation can be adapted, tailored, refined, or reinvented to meet local needs	F	The ability to adapt the innovation to the local obstetric context was clear. Input from multiple disciplines (OB, anesthesia, nursing, NICU) were involved in deciding whether changes were needed to the intervention.	1
Trialability: The ability to test the innovation on a small scale in the organization, and to be able to reverse course (undo implementation) if warranted.	F	Immediate testing was possible. The intervention was used during real cases with the ability to reverse the implementation if required.	1
Complexity: Perceived difficulty of the innovation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement.	B	The workflow was felt to be very complex, involved several aspects of care that were not intuitive and required several iterations to improve performance. It required extra staff members for implementation compared to routine care, which was perceived as a further complication that may have hindered adoption, in particular if staffing levels were low..	0
Design Quality & Packaging: Perceived excellence in how the innovation is bundled, presented, and assembled.	F	The initial reception of the innovation was positive and the quality perceived to be high.	1
Cost: Costs of the innovation and costs associated with implementing the innovation including	F	The cost of implementation was the additional manpower needed to ensure the checklist was being followed as the many steps would be impossible to memorise in a short period of time.	1

investment, supply, and
opportunity costs.

B: barrier, CFIR: Consolidated Framework for Implementation Research, F: facilitator, NA: not applicable, NI: no impact.

Table 3: CFIR Domain - Inner Setting

CFIR Constructs & their definitions	Ranking	Reason for Assigned Ranking	Score
Structural Characteristics: The social architecture, age, maturity, and size of an organization.	F	The intervention took place within the L&D unit, which is a world-leading center of excellence in obstetrics and in anesthesia, and well-established division within the medical center. They have clear processes in place to facilitate quality improvement.	1
Networks & Communications: The nature and quality of webs of social networks, and the nature and quality of formal and informal communications within an organization.	Change over time B to F	Clear lines of communication were not initially evident within the organization regarding this innovation; it was an initial source of frustration for where to locate the most up to date resource. This was rectified over the course of implementation and communicated through the hospital's COVID intranet. Further communication improvements at the local departmental levels, via intranet, email and teleconferencing permitted inter-professional collaborative work.	0
Culture: Norms, values, and basic assumptions of a given organization.	Change over time B to F	While the culture within the L&D unit was accustomed to the use of checklists, standard operating procedures, and iterative cycle improvement. Additional internal forces along with external pressures of fears and anxiety, were present that affected the cohesion of the unit. Pre-existing egotism and individuality initially impacted implementation negatively. In view of the urgency of COVID-19, recognition that assistance outside of the L&D unit was required, sought and later welcomed over the course of the implementation.	0
Implementation Climate: The absorptive capacity for change, shared receptivity of involved individuals to an innovation, and the extent to which use of that innovation will be rewarded, supported, and expected within their organization.	F	Within the organization and within the L&D unit, there was clear receptivity to implementing the innovation. It aligned with existing frameworks already in place, including the use of cognitive aids, checklists, team training and iterative process improvement. Although the checklist and processes were developed quickly, limiting stakeholder buy-in, the implementation climate supported the innovation and valued its use.	1
Tension for Change: The degree to which stakeholders perceive the current situation as intolerable or needing change.	F	The innovation was absolutely necessary, as the outbreak revealed gaps in our workflow for the COVID-19 parturient.	1

<p>Compatibility: The degree of tangible fit between meaning and values attached to the innovation by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the innovation fits with existing workflows and systems.</p>	F	<p>The innovation was based upon frameworks already used within the organization (e.g.: cognitive aids, checklists) and therefore demonstrated compatibility with organizational values and work processes</p>	1
<p>Relative Priority: Individuals' shared perception of the importance of the implementation within the organization.</p>	F	<p>There was clarity in the priority and urgency of this innovation. Given the anticipated surge of potential COVID-19 patients on L&D, implementing this workflow was a priority for all staff.</p>	1
<p>Organizational Incentives & Rewards: Extrinsic incentives such as goal-sharing, awards, performance reviews, promotions, and raises in salary, and less tangible incentives such as increased stature or respect.</p>	NA	<p>This innovation was not associated with an external policy or incentive, financial or otherwise.</p>	NA
<p>Goals and Feedback: The degree to which goals are clearly communicated, acted upon, and fed back to staff, and alignment of that feedback with goals.</p>	F	<p>This innovation was aligned with organizational and departmental goals, and feedback was obtained to help understand if any gaps existed between the current organizational status and the perceived goal.</p>	1
<p>Learning Climate: A climate in which: 1. Leaders express their own fallibility and need for team members' assistance and input; 2. Team members feel that they are essential, valued, and knowledgeable partners in the change process; 3. Individuals feel psychologically safe to try new methods; and 4. There is sufficient time and space for reflective thinking and evaluation.</p>	<p>Change over time B to F</p>	<p>The time pressure resulted, initially, in insufficient time to for reflective thinking and evaluation.</p> <p>Leaders within L&D valued the input of all inter-professional team members and, over time, staff members involved in the implementation felt like a valued partner in the change process.</p>	0
<p>Readiness for Implementation: Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.</p>	F	<p>The L&D leadership demonstrated a readiness to change; they sought out assistance and innovation.</p>	1
<p>Leadership Engagement: Commitment, involvement, and accountability of leaders and managers with the implementation of the innovation</p>	F	<p>Organizational leaders demonstrated a dedicated level of engagement and invested adequate time and resource to the innovation. This included the Director of L&D, division director of maternal-fetal-medicine, division direction of OB anesthesia, Anesthesia Executive Vice</p>	1

		Chair, and the Vice Chair for quality and safety	
Available Resources: The level of resources dedicated for implementation and on-going operations including physical space and time.	F	Resources, including time, were allocated specifically to the innovation being implemented. Resources in particular: implementation team released from clinical duties to develop and implement this innovation	1
Access to Knowledge & Information: Ease of access to digestible information and knowledge about the innovation and how to incorporate it into work tasks.	B	Access to information regarding the innovation was difficult initially, due to version updates. All information was eventually made readily available throughout the organization through the intranet	0

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Table 4: CFIR Domain - Outer Setting

CFIR Constructs & Definitions	Ranking	Reason for Assigned Ranking	Score
Patient Needs & Resources: The extent to which the needs of those served by the organization (e.g., patients), as well as barriers and facilitators to meet those needs, are accurately known and prioritised by the organization.	Change over time B to F	Despite the purpose of the intervention being focused on managing the patient, it was designed for use amongst the healthcare force. Initially the perceived purpose of the checklist and usefulness for care of the COVID-19 patient was not clear to some staff, creating a barrier for implementation. After the experience gained from a real case and spread of knowledge from the debriefing process after the case, the perceived benefit of the checklist then acted as a facilitator.	0
Cosmopolitanism: The degree to which an organization is networked with other external organizations.	NA	Networking with external organizations did not apply in this circumstance.	NA
Peer Pressure: Mimetic or competitive pressure to implement an innovation, typically because most or other key peer or competing organizations have already implemented or are in a bid for a competitive edge.	B	Differences in international and regional guidelines for preparedness and practice for the clinical care of patients with COVID-19 on the L&D Unit resulted in interdepartmental conflicts that impacted behaviours and impacted the readiness for alignment.	0
External Policy & Incentives: A broad construct that includes external strategies to spread innovations including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.	B	The leadership was in communication colleagues in China, Italy and other centers in the United States. In the early stages the practices and societal recommendations varied considerably, and this affected expectations and prevented shared mental models. This impacted the readiness for alignment.	0

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Table 5: CFIR Domain - Characteristics of Individuals

CFIR Constructs and Definitions	Ranking	Reason for Assigned Ranking	Score
<p>Knowledge & Beliefs about the Intervention:</p> <p>Individuals' attitudes toward and value placed on the innovation, as well as familiarity with facts, truths, and principles related to the innovation.</p>	NI	Individual stakeholders shared a belief that the intervention was necessary and were seeking an innovation. Obtaining the checklists and processes was challenging initially due to a lack of coordinated communication.	0
<p>Self-efficacy: Individual belief in their own capabilities to execute courses of action to achieve implementation goals.</p>	F	There was confidence in the ability to implement the intervention and that staff members would be able to use the intervention.	1
<p>Individual Stage of Change:</p> <p>Characterization of the phase an individual is in, as s/he progresses toward skilled, enthusiastic, and sustained use of the innovation.</p>	NI	Various roles and responsibilities within the organization of staff members affected how they readiness for adoption in the initial stages of implementation.	0
<p>Individual Identification with Organization: A broad construct related to how individuals perceive the organization, and their relationship and degree of commitment with that organization.</p>	F	There was broad consensus that all staff members were working toward a common organizational goal.	1
<p>Other Personal Attributes: A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.</p>	B	Despite several positive traits among stakeholders in terms of willingness to implement changes, expectations toward standard operating procedures and innovation. We identified negative traits such as tribalism, egotism and individualism which affected implementation.	0

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Figures

FIGURES

Figure 1: Rapid cycles of change

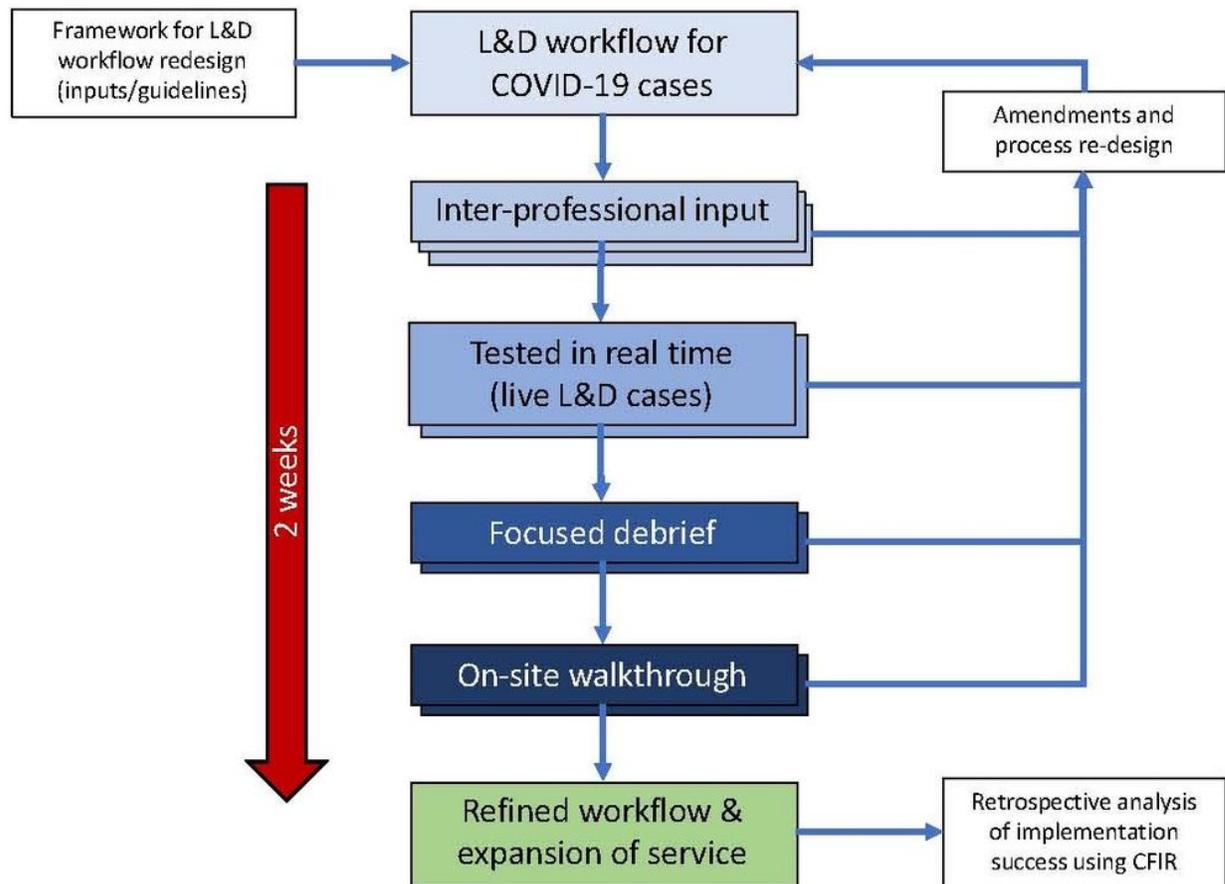


Figure 1

Rapid cycles of change. Schematic representation of rapid-cycle implementation, demonstrating how the individual processes of inter-professional input, testing in real-time, focused debriefing, on-site walkthroughs and iterative re-design contributed to our final refined product. CFIR: Consolidated framework for implementation research, L&D: labor and delivery.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [TIDieRChecklistWordOBCOVID19checklist.docx](#)
- [TIDieRChecklistWordOBCOVID19checklist.docx](#)

- [SupplementalMaterials.docx](#)
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