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A practical tool for managing change: cross-sectional psychometric assessment of the safe surgery organizational readiness tool

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Background: Strengthening health systems through planned safety and quality improvement initiatives is an imperative to achieve more equitable, resilient, and effective care. And yet, years of organizational behavior research demonstrate that change initiatives often fall short because managers fail to account for organizational readiness for change. This finding remains true especially among surgical safety and quality improvement initiatives in low-income countries and middle-income countries. In this study, our aim was to psychometrically assess the construct validity and internal consistency of the Safe Surgery Organizational Readiness Tool (SSORT), a short survey tool designed to provide change leaders with insight into facility infrastructure that supports learning and readiness to undertake change.

Materials and methods: To demonstrate generalizability and achieve a large sample size ($n = 1706$) to conduct exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), a collaboration between seven surgical and anesthesia safety and quality improvement initiatives was formed. Collected survey data from health care workers were divided into pilot, exploration, and confirmation samples. The pilot sample was used to assess feasibility. The exploration sample was used to conduct EFA, while the confirmation sample was used to conduct CFA. Factor internal consistency was assessed using Cronbach's alpha coefficient.

Results: Results of the EFA retained 9 of the 16 proposed factors associated with readiness to change. CFA results of the identified 9 factor model, measured by 28 survey items, demonstrated excellent fit to data. These factors (appropriateness, resistance to change, team efficacy, team learning orientation, team valence, communication about change, learning environment, vision for sustainability, and facility capacity) were also found to be internally consistent.

Conclusion: Our findings suggest that communication, team learning, and supportive environment are components of change readiness that can be reliably measured prior to implementation of projects that promote surgical safety and quality improvement in low-income countries and middle-income countries. Future research can link performance on identified factors to outcomes that matter most to patients.

Keywords: global surgery, organizational learning, organizational readiness, quality improvement, surgical safety, teamwork

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Introduction

Strengthening health systems through planned safety and quality improvement initiatives is an imperative to achieve more equitable, resilient, and effective care[1]. And yet, years of organizational behavior research demonstrate that change initiatives often fall short because managers fail to account for organizational readiness for change[2,3]. This finding remains true especially among safety and quality improvement initiatives in low-income countries and middle-income countries (LMICs)[4]. Because good management is fundamentally linked to healthcare performance[5], assessing organizational readiness prior to implementation of change initiatives can assist managers anticipate challenges to avoid project failure.

Organizational readiness for change is a multilevel and multidimensional concept that has to do with organizational members' 'beliefs, attitudes, and intentions regarding the extent to which changes are needed and the organization's capacity to successfully undertake those changes'[6]. As a shared psychological state, readiness is predictive of implementation success[7]. Presently, existing preintervention assessment tools are not specifically tailored for surgical and anesthesia related interventions implemented in LMICs[8].

While there is no doubt that policy interventions related to resources and infrastructure play a crucial role as determinants of surgical and anesthesia quality and safety, achieving successful change at the sharp end of patient care is ultimately about managing processes of learning[9] in organizations. Moreover, there is no one size fits all solution to managing change successfully[7,10]. For instance, an important finding from the Safe Surgery 2020 (SS2020) collaborative initiative aimed to strengthen health systems and surgical services in LMICs was that there was heterogeneity in successful program implementation, and that this heterogeneity could be explained by preintervention organizational characteristics related to teamwork, communication, and learning[11].

The Safe Surgery Organizational Readiness Tool (SSORT) – initially developed through a theoretical integration of SS2020 findings and literature on organizational readiness – provides change leaders with insight into the cultural infrastructure that supports learning[8]. It is designed to be a pragmatic tool for managers in LMICs seeking to assess their facility's readiness to undertake change. While the content validity of SSORT has been assessed, further psychometric validity and internal consistency assessments of the underlying constructs are necessary. In this paper, our aim was to psychometrically assess the construct validity and internal consistency of the SSORT.

HIGHLIGHTS

- The Safe Surgery Organizational Readiness Tool (SSORT) is a feasible and psychometrically valid tool designed to provide change leaders in low-income countries and middle-income countries with insight into their facility infrastructure for organizational learning and readiness to undertake change.
- Effective communication, team learning, and a supportive environment for learning remain crucial factors that can be reliably measured prior to implementation of projects that promote safety and quality improvement in low-income countries and middle-income countries.
- Providing health care staff an opportunity to speak up and provide feedback about planned safety and quality improvement projects can help them feel heard and empowered to make change work.

Methods

Study design

Initial SSORT development following the mixed-methods assessment of SS2020 implementation[11] and theoretical review of the literature on organizational readiness for change produced 54 questions related to 16 factors at 3 levels[8]. These questions are asked in a 1-5 Likert scale fashion. Following content validation, the goal was to reduce the number of items and assess the underlying psychometric structure of the questions. Thus, this factor analysis study included multiple components designed to assess the feasibility of administering the SSORT in LMICs, determine latent variables using exploratory factor analysis (EFA) and their fit to the data using confirmatory factor analysis (CFA), and estimate the internal consistency of constructed variables using Cronbach's alpha coefficient.

In order to demonstrate generalizability and achieve a large enough sample size to conduct these analyses, a collaboration between seven surgical and anesthesia safety and quality improvement initiatives was formed. Table 1 provides a description of each of these surgical and anesthesia related interventions. Data collection and analysis was designed with three stages in mind. The first stage included pilot testing of the SSORT in SS2020 sites in Tanzania. The second stage included gathering survey data from three other change initiatives in Tanzania, as well as four initiatives implemented in Haiti, Nigeria, and Rwanda. The third stage, statistical analysis, proceeded after all data were collected. Prior to data collection, we received ethical approval from the local institutional review boards at each research site. We report our work in line with the strengthening the reporting of cohort, cross-sectional and case–control studies in surgery (STROCSS) criteria (Supplemental Digital Content 1, http://links.lww.com/JS9/B456)[12].

Sample and data collection

Study samples included all surgical and anesthesia care givers and trainees along with quality improvement and leadership staff across facilities. Those who would not be affected by the proposed interventions were excluded from the samples. Prior to survey administration, the SSORT was translated both forward and backward across respective local languages to ensure accuracy. For all administrations of the SSORT, participants were described the goals of this study and asked to provide verbal consent after guarantee of privacy and anonymity.

Pilot testing of the SSORT took place between November and December, 2020. The SSORT was disseminated in 10 facilities in the Lake Zone of Tanzania to a convenience sample of professionals working in those 10 facilities during the day of data collection. These facilities had served as control sites for the SS2020 project. Therefore, they had not yet received the package of interventions associated with SS2020. Although limiting generalizability, this setting provided us the ability to quickly test how feasible it would be to administer the SSORT after facility

Table 1

Project descriptions.

Project name	Short description	SSORT use case	Country of implementation
Safe Surgery 2020 - Pilot	A multicomponent program aimed at strengthening surgical services, improving systems and changing the way care is delivered	Assess readiness to engage training on leadership, teamwork, and communication, and learn evidence-based practices in safe surgery and anesthesia, equipment sterilization and data quality	Tanzania
ImPACT AFRICA	Improve the safety of anesthesia and perioperative care by enhancing education and training for both physician and nurse anesthesia providers. Elements of the program include virtual learning modules, training of trainers, and the establishment and use of simulation centers	Assess readiness with respect to the development and use of virtual and simulation anesthesia training	Tanzania
Data use for decision making in Primary health care in Tanzania	A program that aimed to promote and institutionalize a culture of data use for decision making in primary health care settings in Tanzania	Assess readiness of primary care facilities to implement a data use intervention including agreeing on indicators for monitoring, analyzing and visualizing data to support quality improvement	Tanzania
A primary health care system strengthening program to improve emergency services	A primary health care strengthening component of the Tanzania COVID-19 socio-economic Response and Recovery plan supporting emergency and intensive care	Assess readiness for establishment of emergency departments and ICUs	Tanzania
PROTRA	An implementation and quality improvement project focused on implementing education and trauma registry use	Assess readiness to implement trauma systems strengthening intervention	Haiti
Plateau State Safe Surgery Checklist Implementation	Surgical safety improvement through implementation of the surgical safety checklist	Assess readiness to implement the surgical safety checklist	Nigeria
Non-Technical Skills for Surgeons, for Variable Resource Context (NOTSS-VRC)	Integrate NOTSS-VRC into new employee onboarding training programs	Assess readiness of surgical team members' and hospital leadership's to teach and learn non-technical skills during new employee onboarding training programs	Rwanda

members were aware that there were going to be changes made but had not yet encountered them. The SSORT was administered in-person in a structured interview format by a trained data collector (please see supplementary appendix for data collectors' manual, Supplemental Digital Content 2, http://links.lww.com/JS9/B457) in each facility. This data collector also surveyed participants following SSORT administration regarding participants' perceptions of survey length, question clarity, and question valuableness alongside their preferences for administration method, ideal survey participants, and other suggestions.

Following pilot testing, the SSORT was administered across the other six change initiatives throughout 2022. Selected projects in Tanzania offered greater generalizability extending beyond the SS2020 setting, but the quality assurance of collecting data in a similar context. Projects in Haiti, Nigeria, and Rwanda provided greater generalizability because of differences in linguistic, political, and cultural context. All survey data were collected in person by trained data collectors. Immediately after SSORT completion, data were stored in Excel files in a deidentified format and safely shared with the data manager and analyst who monitored data quality.

Statistical analyses

Statistical analyses were conducted using the 'psych' and 'lavaan' packages in R (version 2022.02.3). The data were divided into three samples: pilot, exploration, and confirmation. The postpilot exploration sample consisted of the three Tanzanian projects, while the confirmation sample consisted of the projects in Haiti, Nigeria, and Rwanda. Descriptive statistics were produced to review the results of each sample.

The exploration sample was used to conduct EFA. EFA is a complex statistical procedure used to examine the underlying structure of the data[13–16]. The Kaiser–Meyer–Olkin sampling adequacy test and Bartlett's test of sphericity were conducted to verify the appropriateness of factor analytic methods. As recommended in the literature, multiple analytic strategies including the scree plot, Kaiser rule, and Horn's parallel analysis were conducted to generate the number of factors to extract. Data were rotated in an orthagonal varimax fashion to group items in a manner driven by theory on organizational readiness for change. Items with a loading greater than 0.40 without appreciable cross-loadings were kept. For robustness, data were also rotated in an oblique promax fashion, which rendered the results unaltered.

The confirmatory sample was used to conduct CFA. CFA is a structural equation modeling based technique that allows analysts to assess the fit of items to theoretically determined factors resultant from the EFA[17]. A novel sample was used to provide evidence of generalizability. For robustness, we also combined the exploratory and confirmatory factors and randomly split half the data and found that the CFA results were not meaningfully altered. Guidelines promote acceptable CFA fit indices as follows: SRMR <0.08, RMSEA <0.06, and TFI and CFI >0.95[18]. To assess internal consistency, each factor's Cronbach's alpha was measured.

Results

Pilot results

Eighty-one individuals participated in the pilot survey. Between eight and nine individuals responded to the survey from each of the 10 facilities. Thirty-five percent of the sample identified as

female. A majority of the sample at 54% aged between 26 and 35, while 5% aged 55 +, 21% aged 46–54, 17% aged 36–45, and 2% were aged 18–25.

Completion of the unaltered SSORT, along with structured interview questions, took roughly 15 min on average. Of the 81 respondents, 74% indicated that the survey length was just about right, and only 7.4% found it to be too long. Seventy-nine percent of respondents agreed that all questions asked were valuable; however, 23% found team level questions and 51% found facility level questions to be most valuable. All responded that the questions were clear and not confusing. When asked what additional types of questions should be asked to learn more about organizational readiness, respondents suggested that more objective data could be gathered from facility administrators and leaders regarding facility infrastructure and capacity (e.g. count of staff, supplies, equipment, and beds).

Exploratory results

The exploratory sample included 705 individuals. Of those individuals, 53% identified as female. A majority of the sample at 53% aged between 26 and 35, while 4% aged 55 +, 12% aged 46–54, 21% aged 36–45, and 10% were aged 18–25.

Results of the Kaiser–Meyer–Olkin sampling adequacy test (0.92) and Bartlett's test of sphericity (ð ²(1326) = 18493.68, $P < 0.001$) deemed this sample appropriate for EFA. Factor extraction strategies suggested between 7 and 11 underlying factors. After including only items with loadings greater than 0.40 without appreciable cross-loadings, and theoretically correlating item groupings based on face validity, 9 of the 16 factors remained (Table 2). Appropriateness and resistance to change remained as the individual level factors. Team efficacy, team learning orientation, and team valence remained as the team level factors. Communication about change, learning environment, vision for sustainability, and facility capacity remained as the facility level factors. These nine factors, consisting of 28 questions, explained 62% of the cumulative variance in the dataset.

Confirmatory results

The confirmatory sample included 974 individuals. For this sample, 2% of the respondents were from Haiti, 49% from Nigeria, and 49% from Rwanda. The difference in sample size from each country was related to the difference in size of the projects. In this sample, 56% identified as female. Again, a majority of the sample at 45% aged between 26 and 35, while 4% aged 55 +, 10% aged 46–54, 26% aged 36–45, and 15% were aged 18–25.

CFA results of the identified nine factor model demonstrated excellent fit to data (CFI = 0.95; TLI = 0.94; RMSEA = 0.05, $P < 0.98$; SRMR = 0.04). Factors were also found to be internally consistent, with Cronbach's alpha for each factor ranging between 0.71 and 0.85 (Table 3). Descriptive statistics indicated that, for this sample, the facility capacity factor ranked the lowest (mean = 3.4; SD = 1.1) while the appropriateness of proposed change factor ranked the highest (mean = 4.5, SD = 0.74) among nine factors (Table 3).

Discussion

This study aimed to test the feasibility and psychometric validity of the SSORT in a broad sample across surgical and anesthesia settings in LMICs. The main results of this study provide evidence of the psychometric validity of this practical change management tool (Supplemental Digital Content 3, http://links.lww.com/JS9/B458). As demonstrated in the pilot study, its administration is expected to take far less than 15 min per person, providing high value insights for change managers and leaders with respect to the readiness of facilities to implement change. EFA and CFA results, guided by theory on organizational readiness, demonstrated the validity and internal consistency of measuring readiness though 28 questions covering nine factors.

Although other readiness tools exist, the SSORT was designed with surgical, obstetric, and anesthesia care in LMICs facing resource constraints in mind. That is because the SS2020 studies[11] – which serves as the foundation of this tool – provided inductive insights from surgical systems strengthening initiatives in less-resourced contexts within LMICs. Questions in the SSORT, especially those having to do with facility capacity, were included with such contexts in mind. Morevoer, the results of this study confirm the previously established SS2020 findings[11] that communication, team learning, and supportive environment are factors that can be measured in the journey to promote safety and quality improvement. Specifically, the SSORT provides individual, team, and facility level insights, because readiness is a multilevel construct[19,20]. These are the levels at which a change leader could intervene.

At the individual level, cognitive beliefs and emotions about change are known to explain variation in change readiness[21]. Thus, whether organizational members believe the proposed change is appropriate[22,23] and whether they are resistant to change[24] is critical for change leaders to know.

Early conceptualizations of planned organizational change treat organizations as social systems with homeostatic properties[25]. Although some interpret the popular 3-step model (unfreeze, change, and refreeze) as a linear process, reality is quite the contrary as organizations are at a constant flux[26]. Instead, change is a nonlinear process requiring cycles of experimenting, failing, updating, and learning. Teams are the fundamental unit through which these organizational processes manifest[27,28]. Thus, at the team level, the SSORT measures learning orientation[29], alongside efficacy and valence which are critical ingredients of sustained motivation[30,31].

Continuing the focus on learning, the SSORT measures learning environment at the facility level, providing insight into the broader climate felt by organizational members[32]. Learning habits and climate; however, need direction. How organizational members perceive organizational communication about the proposed change[23] and whether they perceive a vision for sustainability[22] are long recognized pieces of effective change management[2]. But so is structural capacity, which is why the SSORT includes questions regarding capacity. Responses from the pilot suggest, for instance, that combining the SSORT and the Surgical Assessment Tool (SAT) could provide broader and deeper insight into the general and cultural infrastructure of health care delivery facilities[33].

This study has several limitations. Responses collected during this study may have been influenced by social desirability bias, but we tried strategies to minimize this concern (e.g. survey

Table 2

EFA results.

	Facility capacity	Vision for sustainability	Appropriateness	Team efficacy	Team learning orientation	Learning environment	Resistance to change	Team valence	Communication about change
This facility has enough funds to make this change work	0.61								
We have the right staff in this facility to make this change work	0.57								
This facility has the infrastructure to implement this change	0.78								
This facility has the right equipment and supplies to implement this change	0.85								
The majority of my respected peers are dedicated to making this change work		0.7							
Our leaders have a long-term vision beyond this change to strengthen our facility		0.76							
Our leaders and staff are committed to ensure the success of this change moving forward		0.71							
I believe that this change will improve the performance of our facility			0.7						
This change is correct for our situation			0.68						
I believe that this change is appropriate for our facility			0.79						
Achieving this change as a team is well within our reach				0.68					
This team can support its members as they adjust to change				0.85					
This team can handle the challenges that might arise in implementing this change				0.57					
This team looks for opportunities to develop new skills and knowledge					0.54				
This team likes challenging and difficult assignments that teach new things					0.72				
This team is willing to take risks on new ideas in order to find out what works					0.7				
In this facility, people are open to alternative ways of getting work done						0.59			
In this facility, people value new ideas						0.74			
This facility frequently seeks new information that leads us to make important changes						0.6			
I generally consider change to be a negative thing							0.58		
I feel more comfortable when things stay the same							0.8		
I would rather not change the way I do things at work							0.75		
This team believes this change will be beneficial for our facility								0.62	
This team wants to implement this change								0.72	
This team values this change								0.66	
Information provided to us about the change is clear									0.57
We are sufficiently informed of the progress of change									0.8
Our leaders are able to address concerns and provide clarity about the change process									0.54
Proportional variance explained	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.06

Table 3

Results of internal consistency and descriptive statistics.

Domain	Mean	SD	Cronbach's alpha
Appropriateness	4.5	0.74	0.82
Resistance to change*	4.3	1.1	0.82
Team efficacy	4.3	0.8	0.72
Team learning orientation	3.9	0.9	0.71
Team valence	4.4	0.8	0.81
Communication about change	3.9	1.1	0.85
Learning environment	4.2	0.9	0.81
Vision for sustainability	4	1	0.85
Facility capacity	3.4	1.1	0.81

*Reverse scale.

responses were confidential and remained anonymous). Factors identified here are yet to be correlated with outcomes that matter most to patients, which is the next step of research needed. More work is also needed on how managers can help teams and facilities improve performance on these domains. The sensitivity of the tool to measure change over time has not yet been assessed. As this tool was developed with the intention of being used prior to implementation, additional considerations would be needed to consider whether it could be used to track progress through change. Similarly, this tool does not reveal insights into the quality of the change initiative itself. Lastly, the SSORT is not designed to provide a simple go/no go decision. Instead, results demonstrate strengths and weaknesses unique to each facility.

Conclusion

Indeed, there is no one best way to improve readiness[7]. However, knowing preimplementation strengths and weaknesses can help leaders decide where to invest resources. The SSORT, when used in combination with the SAT, prior to implementation can assist change managers assess components of readiness to change, ensuring an evidence-based path forward on the journey to improved surgical safety and quality in LMICs. It can also provide motived staff an opportunity to speak up and provide feedback about planned safety and quality improvement projects, an opportunity that can help them feel heard and empowered to make change work[34]. As conducted in this study, making the anonymous questionnaire available in respondents' native language may improve accuracy and reduce confusion. Future research can link performance on identified factors to outcomes, specifically studying how organizations can improve on weaker factors.

Ethical approval

Prior to data collection, we received ethical approval from the local institutional review boards at each research site. Harvard University oversaw the review process.

Consent

Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

T.C.H.: conceptualized and designed the study, collected, analyzed, and interpreted the data, and drafted the manuscript; J.G.M.: conceptualized and designed the study, interpreted that data, and drafted the manuscript; E.A.: collected and interpreted the data, and substantively revised the manuscript; B.A.: collected and interpreted the data, and substantively revised the manuscript; S.A.: collected and interpreted the data, and substantively revised the manuscript; D.B.: substantively revised the manuscript; collected and interpreted the data, and substantively revised the manuscript; A.A.B.: collected and interpreted the data, and substantively revised the manuscript; A.K.: collected and interpreted the data, and substantively revised the manuscript; J.K.: collected and interpreted the data, and substantively revised the manuscript; P.K.: collected and interpreted the data, and substantively revised the manuscript; I.K.: collected, interpreted, and analyzed the data, and substantively revised the manuscript; E.R.L.: collected and interpreted the data, and substantively revised the manuscript; C.M.: collected and interpreted the data, and substantively revised the manuscript; J.N.: collected and interpreted the data, and substantively revised the manuscript; A.N.: collected and interpreted the data, and substantively revised the manuscript; V.L.S.: collected and interpreted the data, and substantively revised the manuscript; N.K.: collected and interpreted the data, conceptualized the study, and substantively revised the manuscript; S.A.: conceptualized and designed the study, interpreted that data, and drafted the manuscript.

Conflicts of interest disclosure

The authors declare that they have no financial conflict of interest with regard to the content of this report.

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