American Cleft Palate–Craniofacial Association

Original Article

The Cleft Palate-Craniofacial Journal
1-9

DOI: 10.1177/1055665620944781
journals.sagepub.com/home/cpc
SAGE

Simulation-Based Comprehensive Cleft Care Workshops: A Reproducible Model for Sustainable Education

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Abstract

Objective: Evaluate simulation-based comprehensive cleft care workshops as a reproducible model for education with sustained impact.

Design: Cross-sectional survey-based evaluation.

Setting: Simulation-based comprehensive cleft care workshop.

Participants: Total of 180 participants.

Interventions: Three-day simulation-based comprehensive cleft care workshop.

Main Outcome Measures: Number of workshop participants stratified by specialty, satisfaction with the workshop, satisfaction with simulation-based workshops as educational tools, impact on cleft surgery procedural confidence, short-term impact on clinical practice, medium-term impact on clinical practice.

Results: The workshop included 180 participants from 5 continents. The response rate was 54.5%, with participants reporting high satisfaction with all aspects of the workshop and with simulation-based workshops as educational tools. Participants reported a significant improvement in cleft lip (33.3 ± 5.7 vs 25.7 ± 7.6; $P < .001$) and palate (32.4 ± 7.1 vs 23.7 ± 6.6; $P < .001$) surgery procedural confidence following the simulation sessions. Participants also reported a positive short-term and medium-term impact on their clinical practices.

Conclusion: Simulation-based comprehensive cleft care workshops are well received by participants, lead to improved cleft surgery procedural confidence, and have a sustained positive impact on participants' clinical practices. Future efforts should focus on evaluating and quantifying this perceived positive impact, as well reproducing these efforts in other areas of need.

Keywords

ethics/health policies, oral health, palatoplasty, lip form, lip function

Introduction

It is estimated that the incidence of congenital cleft lip and/or palate in developing countries exceeds 100 000 per year (Mars and Alex, 2008). Nearly one in 500 to 700 births are affected with cleft lip and/or palate, with significant fluctuations in disease epidemiology around the globe (Shkoukani et al., 2013). If patients with cleft lip and/or palate are not treated in a timely fashion, they are at an increased risk of morbidity as a result of significant functional deficits, malnutrition, aspiration, and respiratory tract infections (Shkoukani et al., 2013). Consequently, it is recommended that affected patients have the cleft lip repaired within the first year of life, and if present, the cleft palate repaired before 18 months of age (American Cleft Palate-Craniofacial Association, 1993).

There are numerous barriers to equitable access for comprehensive cleft care around the world. These barriers can broadly be attributed to lack of appropriate expertise or financial resources and are more profound in developing regions of Latin America, Africa, and Asia (Kantar, 2019a). Foundation-driven surgical initiatives targeting these regions have attempted to alleviate the significant burden of cleft lip and/or palate care by addressing the significant backlog of untreated patients in these societies (Kantar, 2019a). While these initiatives have provided considerable surgical expertise and resources to areas that are devoid of them, their ability to promote long-term sustainable cleft care and contribute to building surgical capacity have been called into question (Kantar, 2019a).

Simulation-based training has emerged as an essential component of medical and surgical education over the last decade in developed countries in light of growing work hour limitations, increasing trainee supervision, and the ever-growing trend toward subspecialization, all of which have limited trainee hands-on clinical exposure (Selzer and Dunnington, 2013). Similar trends have been observed within the field of cleft surgery, where a significant number of simulators have been described (Kantar, 2019b). Nevertheless, financial and logistical constraints have limited the application of cleft surgery simulation in developing countries. However, we have previously described the first simulation-based comprehensive cleft care workshop in the Middle East-North Africa region, and demonstrated that it was well received by participants (Kantar, 2019c). In the current study, we sought to validate our previous findings, demonstrate their reproducibility in Latin America, and evaluate educational simulation-based comprehensive cleft care workshops as a model for sustainable care in regions where significant barriers to comprehensive cleft care exist.

Methods

Simulation-Based Comprehensive Cleft Care Workshop Organization and Design

Global Smile Foundation is a nongovernmental, nonprofit foundation based in Norwood, Massachusetts. The mission of the foundation is to provide high quality, free, comprehensive cleft care to individuals born with cleft lip and/or palate. The vision of the foundation is a world where all children and individuals born with these craniofacial differences can thrive and realize their full potential. Volunteers with Global Smile

Foundation have been providing comprehensive cleft care for over 33 years in Latin America, Africa, Asia, and the Middle East. Services provided encompass the entire spectrum of cleft care, including surgical, dental, speech, nursing, psychosocial, and nutritional services among others. In line with our commitment to providing sustainable cleft care and building health care capacity in areas of need, we recently strengthened our educational efforts and organized the first simulation-based comprehensive cleft care workshop in the Middle East-North Africa region in April 2018 (Kantar, 2019c).

The workshop was well attended and well received by participants who unanimously reported that they would recommend it to others and participate again in a similar activity (Kantar, 2019c). With these points in mind, we sought to reproduce this effort in Latin America, where significant unmet cleft care needs exist (Kantar, 2019a). Relying on strong collaborations between Global Smile Foundation, other cleft care nonprofit foundations, stakeholders from the biomedical industry sector, and international academic leaders in cleft care, we were able to hold our second simulation-based comprehensive cleft care workshop in Lima, Peru, from October 16 to 18, 2019. As previously described, the workshop included multidisciplinary didactic lectures of relevance to all cleft practitioners, covering surgical, speech, nursing, anesthetic, pediatric, psychosocial, as well as dental considerations and team-based approaches in cleft care (www.cleftworkshop.org; Figure 1) (Kantar, 2019c). Additionally, breakout sessions included hands-on simulations of cleft lip and cleft palate repairs using high-fidelity cleft lip and palate simulators (*Simulare Medical*), with one experienced surgical faculty member per 4 simulation session participants (Figure 1). The 1 to 4 faculty to simulation session participant ratio allowed personalized feedback to participants based on their performance on the simulators, with repetition when necessary. Participants in the cleft lip (N = 50) and cleft palate (N = 43) surgery simulation sessions were provided with standardized instruments and headlights.

Figure 1. Workshop didactic lecture (*top*) and simulation session (*bottom*).

Data Collection

Participants were encouraged to complete satisfaction forms at the conclusion of the workshop as previously described (Kantar, 2019c). Data collected included participants' age, gender, country of origin, specialty, professional position, years in current position, as well as whether participants work with a cleft team in their country. Participants were also asked if they would recommend the 2019 Lima comprehensive cleft care workshop to colleagues and whether they would participate again in a similar activity. Participant satisfaction with the 2019 Lima workshop was evaluated based on 5 parameters: content, design, instructors, results, and delivery, as previously described (Kantar, 2019c). Each parameter had a maximum Likert scale score of 10. Additionally, participants were asked what they considered the most significant obstacle facing cleft care in their countries to be, and what they considered the most important intervention to overcome obstacles facing cleft care in their countries.

Participant satisfaction with simulation-based comprehensive cleft care workshops as an educational method for learning about cleft care was also evaluated using a modified version of the Student Evaluation of Educational Quality (SEEQ) survey, a validated tool for measuring higher education student satisfaction (Supplementary Content 1) (Marsh, 1982; Kantar et al., 2020). The SEEQ survey evaluates whether an educational tool is stimulating, increases participant interest, allows the participant to learn the subject matter, is clear, is an effective means of teaching, and whether participants would recommend it to others. Each of the parameters in the SEEQ survey has a maximum score of 5.

We also evaluated participants' perceptions of the impact of the workshop on their clinical practices. Participants were asked if the workshop improved their competence, performance, outcomes, and clinical care, and whether it changed their practice (Supplementary Content 2). Each of these parameters was graded over a maximum score of 5. Overall impact on practice was graded as a total over 25 by combining all of these parameters. Short-term impact on clinical practice as perceived by the participants was assessed at the end of the

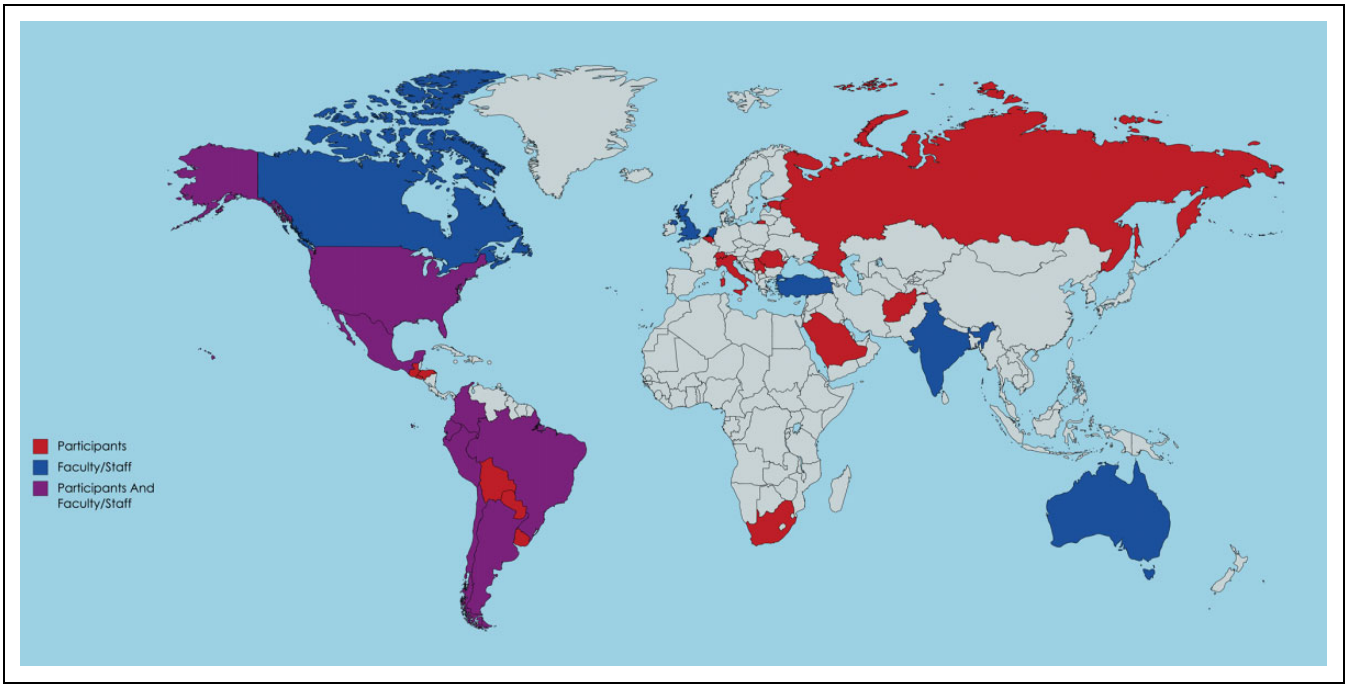

Figure 2. Workshop participants, faculty, and staff countries of origin.

workshop, whereas medium-term impact on practice was evaluated by collecting data from participants up to 6 months following the workshop.

Procedural confidence was evaluated using a modified version of the psychometrically validated tool for measuring self-confidence during surgical learning developed by Geoffrion et al (Geoffrion et al., 2013; Kantar et al., 2020). This included 8 items, each graded on a 5-point Likert scale, for a total maximum score of 40, which was calculated by combining all individual item scores (Supplementary Content 3). Procedural confidence with cleft lip and cleft palate surgery was evaluated prior to, as well as following the cleft lip and palate simulation sessions.

Data Analysis

Descriptive statistics were generated for all collected data. We used parametric testing including the paired sample *t* test based on the central limit theorem and assumption of normal distribution for analyses involving a sample size of more than 30. Data analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 23.0, IBM Corp).

Results

The total number of participants in the workshop was 180 including 98 (54.4%) surgeons, 34 (18.9%) dentists, 33 (18.3%) speech and language pathologists, and 15 (8.4%) other cleft practitioners. Twenty-nine countries of origin were represented by workshop participants and faculty/staff. These included Afghanistan, Argentina, Australia, Belgium, Bolivia, Brazil, Canada, Chile, Colombia, Ecuador, El Salvador, Estonia, Guatemala, Honduras, India, Italy, Mexico, Paraguay, Peru, Romania, Russia, Saudi Arabia, Serbia, South Africa, Switzerland, Turkey, the United Kingdom, Uruguay, and the United States of America (Figure 2).

The response rate was 54.4% with 98 participants completing our workshop satisfaction survey. The majority of respondents were aged 30 years or older (83.7%) and were surgeons (66.3%), followed by dentists (14.3%), speech and language pathologists (11.2%), and other cleft care practitioners (5.1%). Most respondents were independent cleft care practitioners (64.3%) followed by trainees or students (7.1%), and the majority reported having been in their current positions for 5 years or more (43.9%) and working within a cleft team in their countries (70.4%; Table 1).

The majority of respondents reported that they would recommend the 2019 Lima workshop to their colleagues (91.0%), and that they would participate in similar activities again (90.0%). Respondents also reported a high degree of satisfaction with the 2019 Lima workshop content (9.11 $\pm$ 1.30), design (8.84 $\pm$ 1.41), instructors (9.32 $\pm$ 1.22), results (8.91 $\pm$ 1.43), and delivery (8.73 $\pm$ 1.42; Table 1).

When asked about the biggest obstacle facing cleft care in their countries, the most frequent answer was financial challenges (24.5%), followed by the absence of multidisciplinary cleft teams (20.4%), poor training (9.2%), absence of cleft centers (5.1%), patient travel distance (4.1%), and the lack of awareness about cleft lip and/or palate (4.1%; Figure 3). When asked about the most important intervention to improve cleft care in their countries, the most frequent answer was establishing multidisciplinary cleft teams (23.5%), followed by

Table 1. Workshop Participants Demographic Characteristics and Satisfaction With the 2019 Lima Comprehensive Cleft Care Workshop.[a]

Participant data (N = 98)		
Age, n (%)	< 30	7 (7.1)
	≥ 30	82 (83.7)
Gender, n (%)	Male	44 (44.9)
	Female	49 (50.0)
Specialty, n (%)	Speech and language pathologist	11 (11.2)
	Surgeon	65 (66.3)
	Dentist	14 (14.3)
	Other	5 (5.1)
Position, n (%)	Independent practitioner	63 (64.3)
	Trainee/student	7 (7.1)
	Other	12 (12.2)
Years in position, n (%)	< 5	32 (32.7)
	≥ 5	43 (43.9)
Work with cleft team, n (%)	Yes	69 (70.4)
	No	7 (7.1)
Recommend workshop, n (%)	Yes	89 (91.0)
	No	2 (2.0)
Participate again, n (%)	Yes	88 (90.0)
	No	3 (3.1)
Satisfaction with content (mean ± SD, Max: 10)		9.1 ± 1.3
Satisfaction with design (mean ± SD; Max: 10)		8.8 ± 1.4
Satisfaction with instructors (mean ± SD; Max: 10)		9.3 ± 1.2
Satisfaction with results (mean ± SD; Max: 10)		8.9 ± 1.4
Satisfaction with delivery (mean ± SD; Max: 10)		8.7 ± 1.4

Abbreviations: CCCW, comprehensive cleft care workshop; Max, maximum; SD, standard deviation.
[a]Missing data were not excluded when calculating percentages for each variable.

financial support (16.3%), better training (10.2%), establishing cleft centers (9.2%), and raising awareness about cleft lip and/or palate (5.1%; Figure 3).

Participants demonstrated a high level of satisfaction with simulation-based comprehensive cleft care workshops as an educational method for learning about cleft care, and reported that they were stimulating (4.47 ± 0.73), increased interest in the subject matter (4.57 ± 0.63), allowed for better learning (4.45 ± 0.73), were clear (4.41 ± 0.74), were effective in teaching (4.42 ± 0.75), and they were likely to recommend them to others (4.58 ± 0.67; Figure 4).

Respondents also reported that they thought the 2019 Lima workshop will positively impact their clinical practices at the end of the workshop, including competence (4.28 ± 0.79), performance (4.25 ± 0.90), outcomes (4.27 ± 0.77), and clinical care (4.30 ± 0.86), as well as that it will change their practice (4.00 ± 0.98; Figure 4). This impression among participants was positive and sustained over medium-term follow-up, with no significant difference in overall impact on practice reported by participants at the end of the workshop versus up to 6 months following the workshop (21.1 ± 3.7 vs 20.7 ± 3.8; $P = .1$; Figure 4).

Importantly, participants reported that their procedural confidence significantly improved following the hands-on simulation-based sessions. This was applicable for both participants in the cleft lip surgery (33.27 ± 5.67 postsimulation vs 25.72 ± 7.60 presimulation; $P < .001$; N = 50; Figure 5) and cleft palate surgery (32.42 ± 7.07 postsimulation vs 23.72 ± 6.63 presimulation; $P < .001$; N = 43; Figure 5) simulation sessions.

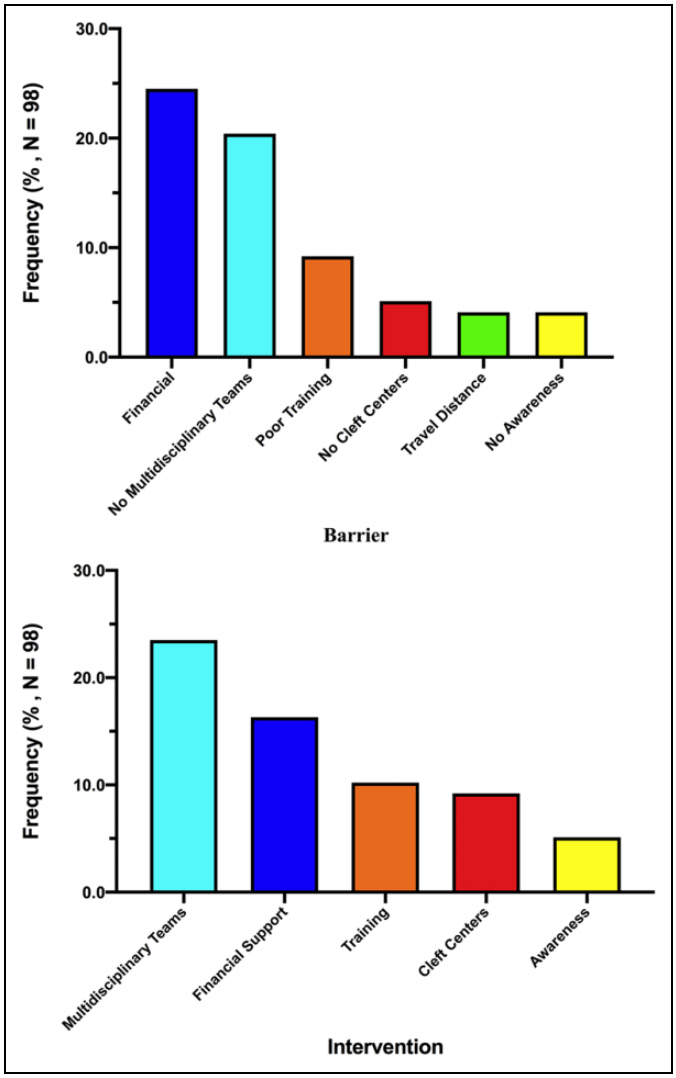

Figure 3. Greatest barrier to cleft care in workshop participants' countries (*top*) and intervention to improve cleft care in workshop participants' countries (*bottom*) as perceived by workshop participants.

Discussion

When patients affected with cleft lip and/or palate are not treated in a timely fashion, they are at a significantly increased risk of morbidity including malnutrition, speech and functional deficits, aspiration, recurrent respiratory tract infections, as well as mortality (Michael Mars and Alex, 2008). Nevertheless, significant disparities in access to cleft care persist around the globe, and are more pronounced in developing countries in Asia, Latin America, Africa, and the Middle East (Massenburg

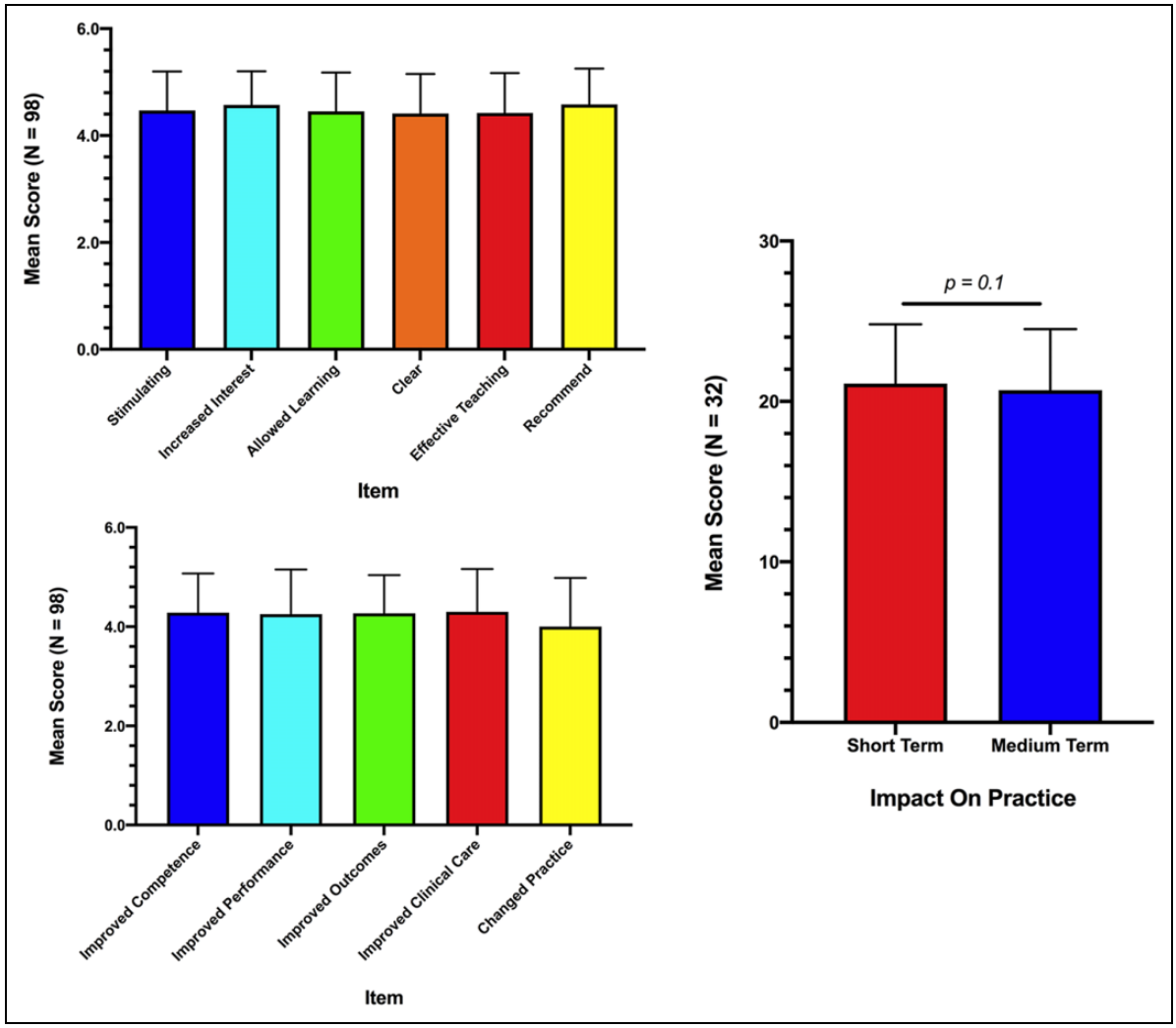

Figure 4. Participants' SEEQ survey results regarding simulation-based comprehensive cleft care workshops as an educational method to learn about cleft care (top left), short-term workshop impact on practice as perceived by participants (bottom left), and comparison of short-term and medium-term overall workshop impact on practice as perceived by participants (right). SEEQ indicates Student Evaluation of Educational Quality.

et al., 2016; Kantar, 2019a). One of the significant barriers to comprehensive cleft care in these regions is the lack of qualified cleft practitioners and expertise, which is further compounded by the lack of financial resources (Massenburg et al., 2016). Over the last decade, simulation-based training has emerged as an essential component of surgical education in light of increasing trainee supervision, growing work hour limitations, and the evolving trend toward subspecialization, all of which have limited trainee hands-on operative exposure (Selzer and Dunnington, 2013). This has also been the trend within the field of cleft surgery, where a significant number of simulators have been described (Kantar, 2019b). However, logistical and financial limitations have prevented the application of simulation-based cleft surgery training in developing countries. We have previously described the first simulation-based comprehensive cleft care workshop in the Middle East-North Africa region, and demonstrated that it was well received by participants (Kantar, 2019c). In this manuscript, we sought to demonstrate the reproducibility of our previous workshop and findings in Latin America, with the purpose of highlighting the potential role of simulation-based comprehensive cleft care workshops as a reproducible model for education with sustained impact in regions where significant barriers to comprehensive cleft care exist. In an attempt to do so, we evaluated participant satisfaction with the workshop, participant satisfaction with simulation-based workshops as a teaching tool for learning about comprehensive cleft care, workshop short-term and medium-term impact on participant practice, as well as workshop impact on participant cleft lip and palate procedural confidence.

Simulation-based training in cleft surgery has gained significant momentum over the last decade, with the development and widespread dissemination of a significant number of digital and haptic educational simulators (Kantar, 2019b). This momentum was catapulted by the significant logistical challenges facing surgical education that were previously

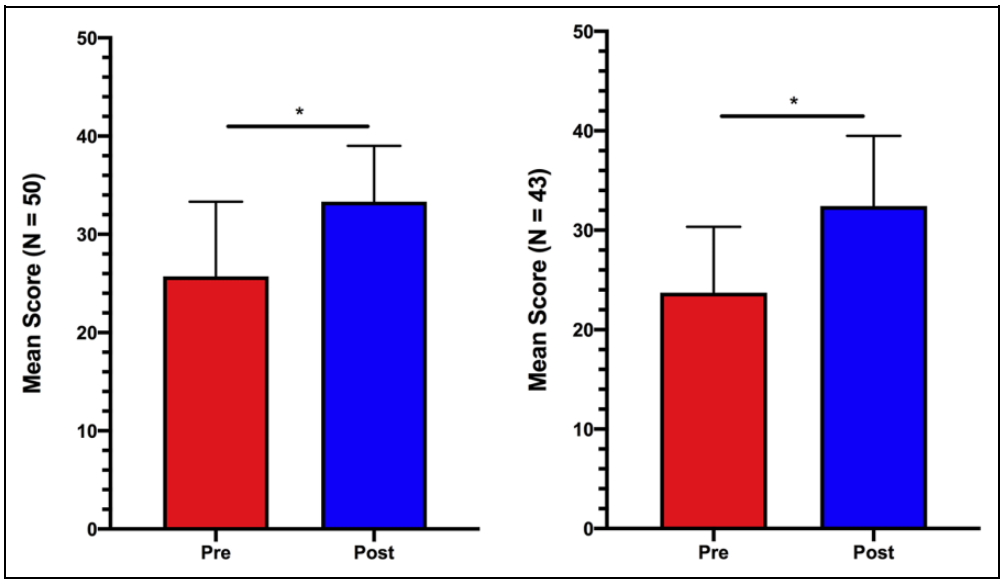

Figure 5. Cleft lip (*left*) and palate (*right*) simulation sessions impact on procedural confidence.

mentioned, which have led surgical educators to pursue alternatives to intraoperative exposure for training surgical residents (Rosen et al., 2009; Selzer and Dunnington, 2013; Diaz-Siso et al., 2016; Kantar, 2019b). Importantly, data suggest that trainees prefer using simulation-based educational tools more than traditional textbooks (Beaubien and Baker, 2004). Similarly, early data evaluating simulation-based educational resources in cleft surgery seem to be favorable (Kantar, 2019b). High-fidelity haptic as well as digital cleft surgery simulators created in developed countries have been shown to provide trainees with realistic surgical experiences leading to improved procedural knowledge, confidence, skills, and overall performance (Podolsky et al., 2017; Podolsky et al., 2018; Plana et al., 2019; Kantar et al., 2020). However, financial and logistical restraints have prevented the widespread use, availability, or adoption of these educational resources in developing countries. Nevertheless, previous experience suggests that these resources carry significant potential in addressing global disparities in cleft surgery education when made freely available, as recently demonstrated by an online cleft surgery simulator reaching surgeons and trainees in more than 130 countries, for a total screen time of nearly 1700 hours (Kantar et al., 2018). With these factors in mind, we have previously organized the first simulation-based comprehensive cleft care workshop in the Middle-East/North Africa region in 2018, with participants reporting an overall positive experience. All participants reported that they would participate again in a similar workshop and recommend it to colleagues. This highlights the potential of these workshops in promoting sustainable cleft care in areas of need through capacity building and education (Kantar, 2019c). The results reported in this manuscript reinforce the potential role of our simulation-based comprehensive cleft care workshop as reproducible model for comprehensive cleft surgery education, with participants continuing to report an overwhelming satisfaction with the workshop.

The Lancet Commission on Global Surgery has significantly improved our understanding of current global surgical deficits and enlightened the international surgical community on potential avenues to alleviate them (Meara et al., 2015). Among these, surgical education is vital to strengthening and revitalizing the surgical workforce in low to middle income countries, where disparities in care are most pronounced (Meara et al., 2015). Key stakeholders in this effort are numerous, including nongovernmental organizations which, "outside of acute crisis situations, should have a training component hardwired into their programs to ensure the durability of their effect" (Meara et al., 2015). Importantly, nongovernmental organizations, including cleft surgery nonprofit foundations, should provide "responsible training" whereby their educational efforts are tailored to the context in which they are delivered (Meara et al., 2015). The Commission on Global Surgery has also emphasized the importance of competency-based training, which focuses more on the acquisition of context-appropriate skills and knowledge rather than on the passage of time. In this setting, the use of simulation-based training is a method to develop and ensure competency is not at the expense of quality of patient care (Meara et al., 2015).

Relying on these guiding principles and our substantial experience in providing comprehensive cleft care to underserved patients around the world, we launched our simulation-based workshops in 2018 (Kantar, 2019c). While our participants' positive feedback following our first workshop was reassuring, we wanted to confirm that we were indeed delivering a transformative education to our participants. With this issue in mind, we collected data in our second workshop about its impact on participant cleft surgery procedural confidence, as well as short-term and medium-term impact on clinical practice. To our knowledge, this study is the first in the literature to provide evidence that implementation of a simulation-based comprehensive cleft care workshop leads to

significantly improved procedural confidence as well as a sustained positive impact on clinical practice, reinforcing its role as a cleft care capacity-building tool in areas of need.

Our study provides significant insight into the potential role of simulation-based education in building sustainable cleft care in developing countries and areas of need. However, many questions remain unanswered and are at the forefront of our future research and educational endeavors. While we demonstrate that simulation-based exercises lead to significant improvement in participant cleft surgery procedural confidence, we need to determine how this is translating at the clinical level in terms of patient outcomes. Similarly, while participants reported a positive impact on their clinical practices, including clinical performance and patient outcomes, we need to better quantify and delineate these benefits. Most importantly, financial challenges remain significant barriers to widespread implementation of simulation-based educational initiatives in developing countries, and the importance of strong collaborations among key stakeholders in cleft surgery education can't be emphasized enough in order to disseminate this educational model in developing countries. With these issues in mind, we hope to keep refining and making our workshops more accessible to meet the needs of our trainees, help alleviate disparities in cleft care around the world, and contribute effectively to sustainable cleft care in developing countries.

Conclusion

Simulation-based comprehensive cleft care workshops offer a reproducible model for building sustainable cleft care capacity in areas of need. Such educational initiatives are well received by trainees, lead to a significant improvement in cleft surgery procedural confidence, and have a sustained positive impact on clinical practice. Key players in global cleft surgery should continue to collaborate to make these initiatives more widely available in order to alleviate disparities that exist in cleft care around the world through education.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Supplemental Material

Supplemental material for this article is available online.

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