

Barriers to Reconstructive Surgery in Low- and Middle-Income Countries: A Cross-Sectional Study of 453 Cleft Lip and Cleft Palate Patients in Vietnam

Caroline A. Yao, M.D., M.S.
 Jordan Swanson, M.D.
 Dayana Chanson, M.P.H.
 Trisa B. Taro, M.S., M.P.H.
 Barrie Gura, M.P.H.
 Jane C. Figueiredo, Ph.D.
 Heather Wipfli, Ph.D.
 Kristin Hatcher, M.P.H.
 Richard Vanderburg,
 R.N., B.S.N.
 William P. Magee III,
 M.D., D.D.S.

Los Angeles, Calif.;
 and Virginia Beach, Va.



Background: Despite health system advances, residents of low- and middle-income countries continue to experience substantial barriers in accessing health care, particularly for specialized care such as plastic and reconstructive surgery. **Methods:** A cross-sectional household survey of patients seeking surgical care for cleft lip and/or cleft palate was completed at five Operation Smile International mission sites throughout Vietnam (Hanoi, Nghe An, Hue, Ho Chi Minh City, An Giang, and Bac Lieu) in November of 2014.

Results: Four hundred fifty-three households were surveyed. Cost, mistrust of medical providers, and lack of supplies and trained physicians were cited as the most significant barriers to obtaining surgery from local hospitals. There was no significant difference in household income or hospital access between those who had and had not obtained cleft surgery in the past. Fewer households that had obtained cleft surgery in the past were enrolled in health insurance ($p < 0.001$). Of those households/patients who had surgery previously, 83 percent had their surgery performed by a charity. Forty-three percent of participants did not have access to any other surgical cleft care and 41 percent did not have any other access to nonsurgical cleft care.

Conclusions: The authors highlight barriers specific to surgery in low- and middle-income countries that have not been previously addressed. Patients rely on charitable care outside the centralized health care system; as a result, surgical treatment of cleft lip and palate is delayed beyond the standard optimal window compared with more developed countries. Using these data, the authors developed a more evidence-based framework designed to understand health behaviors and perceptions regarding reconstructive surgical care. (*Plast. Reconstr. Surg.* 138: 887e, 2016.)

Despite recent advances in health systems, people in low- and middle-income countries continue to face substantial barriers in accessing health care, particularly for specialized care such as surgery.¹ Access to surgical care was declared a global health priority by the United

Nations Millennium Development Goals in 2008 and the World Health Organization Global Initiative for Emergency and Essential Surgical Care in 2005; both organizations identified the need to increase access to and improve standards for district-level surgical care in low- and middle-income

From the Division of Plastic and Reconstructive Surgery, the University of Southern California Institute of Global Health, and the Department of Preventive Medicine, Keck School of Medicine of the University of Southern California; the Department of Plastic and Reconstructive Surgery, Shriners Hospital for Children; the Division of Plastic and Reconstructive Surgery, Children Hospital Los Angeles; and Operation Smile International.

Received for publication February 25, 2016; accepted June 13, 2016.

Copyright © 2016 by the American Society of Plastic Surgeons

DOI: 10.1097/PRS.0000000000002656

Disclosure: The authors have no financial interest to declare in relation to the content of this article.

A “Hot Topic Video” by Editor-in-Chief Rod J. Rohrich, M.D., accompanies this article. Go to PRSJJournal.com and click on “Plastic Surgery Hot Topics” in the “Videos” tab to watch. On the iPad, tap on the Hot Topics icon.

countries.² Years later, frameworks for understanding barriers to surgical care in low- and middle-income countries are still in development, as the Lancet Global Surgery 2030 Commission, spearheaded by plastic and reconstructive surgeons, launched a series of articles that investigated the growing need for surgical care in lower and middle income countries, along with successes and challenges of strategies to scale-up surgical services.³ A common theme in these articles is a frustration with the dearth of rigorous data addressing access to surgical care in low- and middle-income countries. In this article, we present key findings of a large-scale initiative to understand barriers to plastic and reconstructive surgical care in Vietnam, a representative low- and middle-income country in Southeast Asia.

Existing models for barriers to health care often combine primary care (including preventative services) and surgical care, and fail to recognize the unique requisites of the latter (e.g., the need for specially equipped facilities, the demand for specialized physicians, and the high level of follow-up care for certain diseases). Surgical care must also be understood in relation to socioeconomic, cultural, and psychosocial elements. For these reasons, surgical care, and barriers to accessing it, must be analyzed and understood within a unique context. Unfortunately, few evidence-based studies have been conducted on barriers to surgical care in low- and middle-income countries; of those that have, the majority are specific to single-intervention procedures.

We investigated barriers to surgical care at medical missions in Vietnam sponsored by Operation Smile, a nonprofit organization dedicated to the repair of cleft lip and cleft palate for children around the world. Cleft lip and cleft palate represents the most common craniofacial congenital defect, with a birth prevalence of one in 500 to one in 2500 worldwide.⁴ Not only does the defect result in physical obstacles to feeding and language development, but patients are often subjected to significant social stigma.

We present data from Vietnam for both single- and multiple-intervention cleft repair to introduce a comprehensive analysis of barriers to surgical care. Based on our evidence, in conjunction with the existing literature, we recommend a modified model to describe barriers to health care that addresses the particular needs of surgical patients and accounts for the complexities of surgical and postoperative care. This type of evidence-based framework for the structural and behavioral determinants of surgical care access is necessary to allow

policymakers, donors, and other key stakeholders to develop policies and programs that effectively address barriers to obtaining surgical care.

In recent years, the academic community, and specifically the plastic surgery community, has raised its commitment to global surgery, reflected in recent publications that highlight international partnerships and well-designed evaluations of surgical delivery systems as key components to sustainable solutions.^{3,5,6} Our study represents this growing commitment to higher level investigations in global surgery that can be used as a springboard for further study.

PATIENTS AND METHODS

In this cross-sectional study, surveys were administered to members of households who attended the Operation Smile International 25th Anniversary multisite missions in Vietnam in November of 2014. Eligibility criteria were individuals of any age currently residing in Vietnam with a cleft lip and/or cleft palate with or without previous surgical repair. Missions were completed in the cities of Hanoi, Nghe An, Hue, Ho Chi Minh City, An Giang, and Bac Lieu. Among 884 eligible patient households, 51 percent (453 households) were randomly surveyed. Depending on the number of households/patients at each site, every other or every third household/patient was approached for participation.

Through collaboration with the Vietnamese Fund for Children, local bilingual (English-Vietnamese) medical and dental students verbally administered the survey. All volunteers underwent an 8-hour training course led by study investigators to ensure consistent data collection, professionalism, and cultural sensitivity when surveying patients and families about their social/medical history and cleft disease. At each mission site, a study investigator oversaw surveyors and reviewed each survey for consistency and completeness.

As most orofacial cleft patients were children, surveys were administered in a confidential setting to a member of the household aged 17 years or older who was deemed an authority in the household and able to answer medical history and questions regarding familial decision processes (e.g., a parent, grandparent, aunt/uncle, or other family member/close friend).

A portion of households/patients had undergone cleft surgery previously and attended the current mission with the hope of undergoing surgery for a related defect or revision operation to improve their results. As such, the survey was

adapted into two versions: one for individuals who had had prior surgical repair of the cleft lip and/or palate and one for those who had no previous surgery.

Demographic and access/barriers to care questions were taken from the validated World Health Organization Survey of Health and Health System Responsiveness. Questions specific to medical and surgical history were adapted from a validated survey created for the International Family Study, an epigenetic cleft study designed by the University of Southern California during similar Operation Smile International missions.⁷ Data analysis included descriptive statistics and comparisons between those who had undergone past cleft surgery versus those who had not (Stata 12.0; StataCorp, College Station, Texas).

RESULTS

A total of 884 households presented to the cleft missions sites and 453 were randomly surveyed. One hundred percent of approached households chose to participate in the survey. Table 1 shows demographic characteristics of household participants and stratified access to care data. The proportion of patients with cleft lip, cleft palate, or cleft lip and palate differed significantly by households who had received cleft surgery in the past compared with those that had not (23, 28, and 49 percent, respectively; $p < 0.001$). Overall, the mean age at the time of first cleft surgery was 3.24 years. Current patient age, patient age at the time of first surgery, and health insurance status differed significantly by surgical status. The mean age of patients who were undergoing surgery for the first time at the current mission was 2.61 years; for those who had undergone cleft surgery before the current mission, the mean age at the time of first surgery was 3.78 years ($p = 0.004$).

Median and mean annual income of each household at the mission was \$1700 and \$2390, respectively. Mean annual income per household member was \$530. Most household adults were farmers by trade (53 percent of fathers and 52 percent of mothers), followed by unskilled labor workers and those who were self-employed. A majority of mothers and fathers had finished secondary (middle) school or higher (55 percent and 54 percent, respectively) (Table 2). Mothers and fathers were more likely to have finished secondary school for patients who were able to obtain previous surgery ($p = 0.05$ and $p = 0.0020$, respectively), and the mother's occupation was

correlated with whether or not the child received cleft surgery in the past ($p = 0.02$).

Eighty-five percent of households who had not received surgery in the past reported having insurance, whereas only 63 percent of households who had surgery in the past reported having insurance ($p < 0.001$). Of those households/patients who had surgery previously, 83 percent had their surgery performed by a charity. Most households reported having a local hospital with surgical facilities that was more accessible than the mission site, but stated that they could not obtain surgical cleft treatment at these facilities largely because of the cost of care (Table 1).

Each household had an average of 4.8 members, with an average of one person per household able to see a primary care physician in the past 3 months. On average, one of four people per household needed to see a physician but did not or could not; one in five people per household saw a surgeon in the past 3 months, and one in seven persons who needed to see a surgeon did not or could not. If not given surgical care during the current mission, 43 percent reported that they did not have access to any other form of surgical cleft care. If not provided nonsurgical care for their cleft (e.g., general pediatric, dental, or speech therapy) at the current mission, 41 percent reported they did not have any other access to such care.

The impact of structural, financial, and cultural barriers is summarized in Figure 1. Structural barriers, such as the lack of trained medical personnel (66 percent) and lack of equipment/medicine (67 percent), were the most commonly reported obstacles to obtaining surgical cleft care for households/patients. Significant financial barriers to care included treatment costs (54 percent), lack of savings (57 percent), travel costs (60 percent), and food/living expenses necessary to travel for care (64 to 66 percent). With respect to cultural barriers, most households cited family opinion/permission (68 percent), lack of trust in the medical system/personnel (54 percent), and poor quality of available treatment (43 percent) as obstacles to obtaining surgical cleft care.

DISCUSSION

Several important findings emerged from this patient-centric study of access to plastic and reconstructive surgery. First, the total proportion of insurance coverage is high (73 percent) among these communities in Vietnam. Second, despite high rates of insurance coverage, households have considerable difficulty accessing surgical care, and the

Table 1. Demographic Characteristics and Barriers to Surgery for Households/Patients Surveyed

	No Previous Surgery (%)	Previous Surgery (%)	Total (%)	<i>p</i>
Diagnosis				
Cleft lip	69 (34)	31 (13)	100 (23)	<0.001*
Cleft palate	79 (39)	45 (18)	124 (28)	
Cleft lip and cleft palate	55 (27)	166 (69)	221 (49)	
Sex				
Male	124 (60)	107 (44)	260 (57)	0.197*
Female	83 (40)	136 (56)	190 (43)	
Age				
Patient age, yr	2.58	6.71	4.82	<0.001†
Patient age at time of first surgery, yr	2.61	3.78	3.24	0.004†
Annual income‡				
Household income	\$2461	\$2328	\$2390	0.586†
Household income per person	\$543	\$518	\$530	0.645†
Hospital access				
Closest hospital, hr	0.79	0.79	0.74	0.379†
Closest hospital, km	15.89	15.89	20.90	0.130†
Travel cost to closest hospital‡	\$13.84	\$15.73	\$14.94	0.610†
Insurance				
No	24 (15)	72 (37)	96 (27)	<0.001*
Yes	132 (85)	124 (63)	256 (73)	
Reasons for not seeing a doctor				
Cost	30 (61)	35 (49)	65 (54)	0.156*
Too far	7 (14)	15 (21)	22 (18)	
No time	8 (16)	10 (14)	18 (15)	
Fear	2 (4)	4 (6)	6 (5)	
Other	2 (4)	8 (11)	10 (8)	
Reasons for not seeing a surgeon				
Cost	16 (39)	19 (56)	35 (47)	0.310*
Too far	8 (20)	8 (24)	16 (21)	
No time	7 (17)	6 (18)	13 (17)	
Fear	4 (10)	0 (0)	4 (5)	
Poor health	3 (7)	0 (0)	3 (4)	
Lacked information	2 (5)	0 (0)	2 (3)	
Family disagreed	1 (2)	1 (3)	2 (3)	
Travel cost to nearest facility				
0–99,999 VND (\$0–\$4.49 USD)	70 (49)	95 (48)	165 (48)	0.610†
100,000–199,999 VND (\$4.50–\$8.99 USD)	26 (18)	33 (17)	59 (17)	
200,000–299,999 VND (\$9.00–\$13.49 USD)	11 (8)	23 (12)	34 (10)	
300,000–399,999 VND (\$13.50–\$17.99 USD)	12 (8)	11 (6)	23 (7)	
400,000–499,999 VND (\$18.00–\$22.49)	4 (3)	2 (1)	6 (2)	
>500,000 VND (≥\$22.50)	19 (13)	35 (18)	54 (16)	

* χ^2 test.†*t* test.

‡U.S. dollars.

vast majority (>80 percent) still rely on charitable care outside of the centralized health care system. This discrepancy leads to creating a more surgically centered public health model for understanding barriers to surgical care, to better serve patients in low- and middle-income countries. Finally, as a result, surgical treatment of congenital conditions, such as cleft lip and palate, is delayed beyond the standard optimal window compared to more developed countries. Although reconstructive surgery experts agree that surgical repair of cleft lip and cleft palate should be performed between 3 and 18 months of age to optimize surgical results and ability to feed and phonate,⁸ cleft individuals in our study underwent their first cleft repair operation at an average age of 3.24 years.

Several public health models have been developed to categorize and evaluate access to health care (summarized in Table 3). The most cited nonsurgical health care model is Andersen's Behavioral Model of Utilization. Several models are derived from Anderson's paradigm, but few specifically address surgical intervention.⁹ Irfan et al. combined Phillips' adaptation of Andersen's model¹⁰ with the World Health Organization health systems concept to create the Healthcare Barrier Model for both surgical and nonsurgical care.⁹ This model deconstructs patient-level barriers into several variables (i.e., predisposing, enabling, and need-based) but does not clearly identify which factors are specific to surgical versus nonsurgical care. In a systematic review, Grimes et al. present the most commonly

Table 2. Socioeconomic Demographics of Household Parents

	Father			Mother		
	No Previous Surgery (%)	Previous Surgery (%)	<i>p</i>	No Previous Surgery (%)	Previous Surgery (%)	<i>p</i>
Occupation						
Farming	108 (52)	135 (54)		103 (49)	137 (55)	
Government/public employee	7 (3)	5 (2)		12 (5)	10 (4)	
Housewife/unemployed	3 (1)	1 (0)		31 (14)	25 (10)	
Labor worker (unskilled)	20 (9)	24 (9)		23 (11)	25 (10)	
Professional employee	8 (3)	7 (2)		9 (4)	3 (1)	
Self-employed	25 (12)	23 (9)	0.181*	18 (8)	27 (10)	0.018*
Service	19 (9)	14 (5)		6 (2)	1 (0)	
Labor worker (skilled)	3 (1)	7 (2)		2 (0)	4 (1)	
Military	2 (0)	1 (0)		0 (0)	0 (0)	
Other	5 (2)	19 (7)		1 (0)	9 (3)	
Omitted	7 (3)	10 (4)		2 (0)	5 (2)	
Education						
None	13 (6)	26 (10)		15 (7)	12 (4)	
Some primary school	16 (7)	17 (6)		16 (7)	21 (8)	
Completed primary school	44 (21)	78 (31)		53 (25)	86 (35)	
Completed secondary school	55 (26)	63 (25)	0.110*	55 (26)	66 (27)	0.102*
Completed high school	47 (22)	36 (14)		42 (20)	36 (14)	
Completed university	24 (11)	13 (5)		23 (11)	13 (5)	
Omitted	8 (3)	12 (4)		3 (1)	10 (4)	

*Chi-squared test.

cited model for barriers to surgical care using three broad categories: structural aspects, cultural beliefs and attitudes, and financial barriers.¹¹ The model proposed by Grimes et al., although compelling, was created based on short-term, single-intervention operations such as cataracts/glaucoma (ophthalmologic) and antenatal/delivery (obstetric). Although certain barriers apply to all types of surgery (e.g., anesthesia, fear), specific classes of surgical disease present different barriers at each level, both perceived and real.

Past models do not stratify medical or surgical care by the level of continuing care required. Although surgical repair for cleft lip may be a singular intervention, many cleft lip patients require several additional operations, such as scar revision, rhinoplasty, cleft palate repair, alveolar cleft repair, fistula repair, and others. Cleft palate patients require multiple revisions to improve speech over years of care and extensive postoperative rehabilitation through speech therapy. To this point, the majority (54 percent) of households in our random sample were returning to the mission for revision surgery and follow-up medical treatment or speech therapy. In addition, cleft patients are in need of comprehensive, long-term care that includes maxillofacial, dental, speech, hearing, and psychosocial aspects. Given the magnitude of care needed for cleft patients, cleft treatment needs and barriers may be best examined in the context of a “chronic” disease. Clefts and other surgical conditions that require multistage reconstruction or longer term follow-up must be addressed differently when

creating a public health model to understand barriers to care. Although some elements of comprehensive care can be provided in a mission setting, cleft patients need comprehensive therapies long term, and these change with an aging child. This study primarily addressed access to initial cleft care; further work will need to examine whether different barriers affect later stages of comprehensive cleft care. Finally, certain disease states, such as cleft lip, are easily recognized by laypersons, which leads to stigmatization and community pressure for treatment. Patients requiring plastic surgical reconstruction often suffer from similar stigmatization (e.g., individuals with burns, craniofacial defects, limb defects, and large wounds). The perception or reality of external pressures to obtain treatment is separate from what Grimes et al.¹¹ and Irfan et al.⁹ refer to as “acceptability,” which is the cultural or social resistance to obtaining treatment.

A majority of past models are also limited in their capacity to address barriers specific to surgical care. In this study, the lack of qualified surgeons and lack of surgical equipment were the most frequently cited barriers to obtaining needed surgery. The most commonly cited cultural barrier to care was distrust of the medical system because of both corruption and suspicion of medical providers, which was heightened by the perceived invasiveness of surgery. In addition, barriers for multistage operations may exacerbate existing perceived provider-level limitations and patient factors.

The financial barriers identified in our population have been described in past models (i.e.,

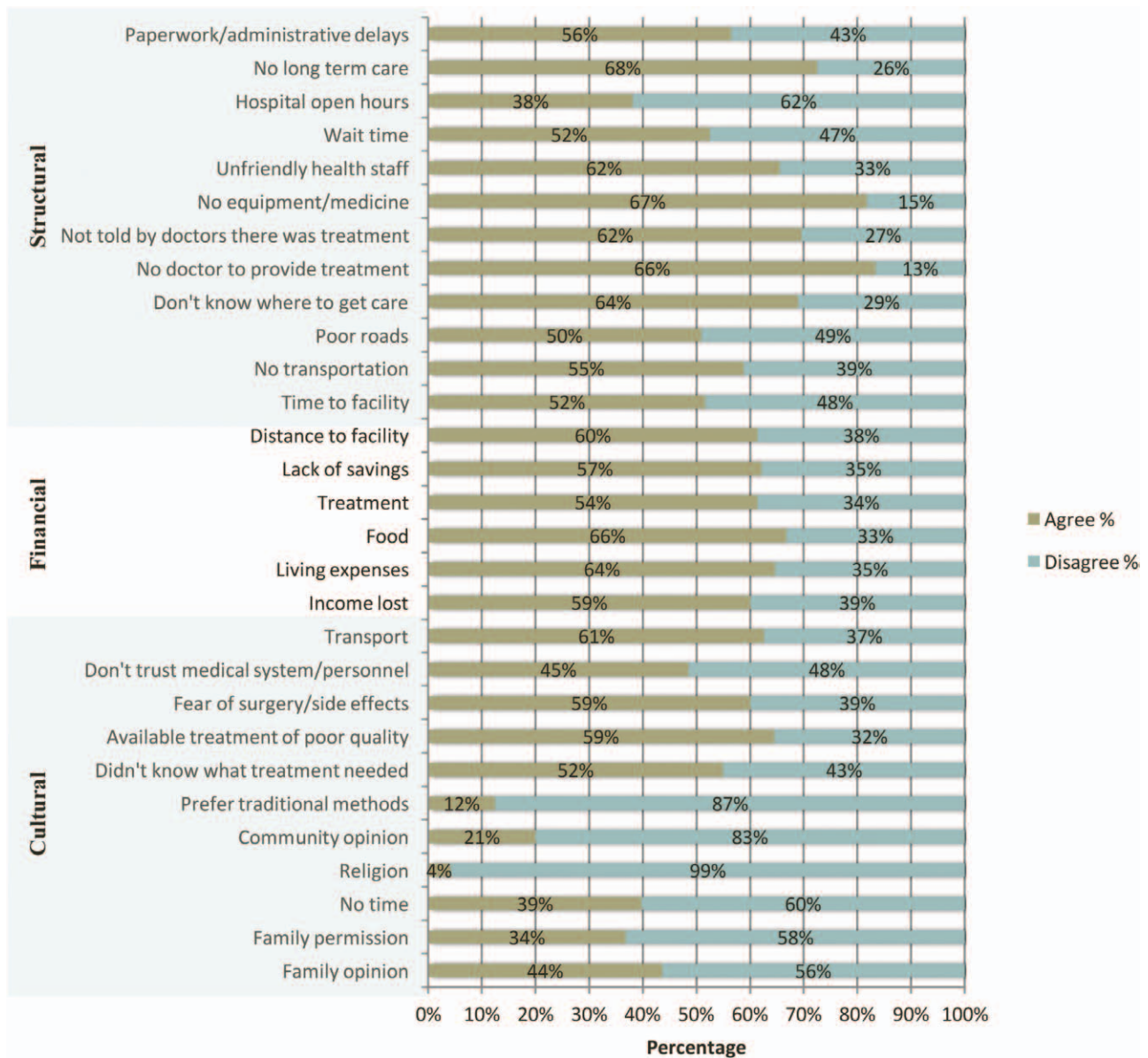


Fig. 1. Barriers to surgical cleft care as percentages of respondents/households.

treatment costs, lack of savings, and travel/living expenses). However, qualitative data from our study showed that the lack of accurate information and education in this population may have led to inflated perceptions of costs and a diminished perception of the benefits of surgical intervention. Although the model proposed by Grimes et al. subjugates “no perceived need” and “lack of understanding of severity of condition” as barriers related to cultural beliefs and attitudes,¹¹ it does not specifically address how a patient’s perception of a health care problem and the corresponding solution pervasively affect care-seeking behavior. Similarly, Irfan et al.’s Healthcare Barrier Model mentions how perceptions, knowledge, and beliefs are barriers within

patient-level factors⁹ but does not describe or define what “perceptions” are; furthermore, they do not propose how and why perceptions impact the decision to obtain surgery. No previous models clearly delineate patient perceptions, which we define as a non-community-, culture- or religion-specific personal modifier that may change over time. As such, public policies aimed at medical information and cost transparency and health education are essential for the improvement of barriers to surgical care discussed in this article.

Our data highlight barriers specific to surgical care within the health systems context of a low-and middle-income country that are not addressed in previous research. Table 3 summarizes which

Table 3. Past and Proposed Barrier/Access to Health Care Frameworks*

	Environment	Structural	Health System	Provider	Culture	Patient Predisposing	Patient Perceptions	Nature of Disease
Nonsurgical disease								
Obrist	+	+	+	+	+	+	-	-
McIntyre	-	-	+	+	+	+	-	-
Anderson	+	+	+	+	-	+	-	-
Surgical disease								
Grimes	-	+	-	-	+	+	+	-
Health care barrier model	+	+	+	+	+	+	-	-
Surgical LMIC model (proposed herein)	+	+	+	+	+	+	+	+

LMIC, low- and middle-income country.

*Irfan FB, Irfan BB, Spiegel DA. Barriers to accessing surgical care in Pakistan: Healthcare barrier model and quantitative systematic review. *J Surg Res.* 2012;176:84–94; Phillips KA, Morrison KR, Andersen R, Aday L. Understanding the context of healthcare utilization: Assessing environmental and provider-related variables in the behavior model of utilization. *Health Serv Res.* 1998;33:571–596; Grimes CE, Bowman KG, Dodgion CM, Lavy CB. Systematic review of barriers to surgical care is to surgical care in low-income and middle-income countries. *World J Surg.* 2011;35:941–950; The World Bank. GDP per capita (current US\$). Available at: <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>. Accessed March 10, 2013; McIntyre D, Thiede M, Birch S. Access as a policy-relevant concept in low- and middle-income countries. *Health Econ Policy Law* 2009;4:179–193.

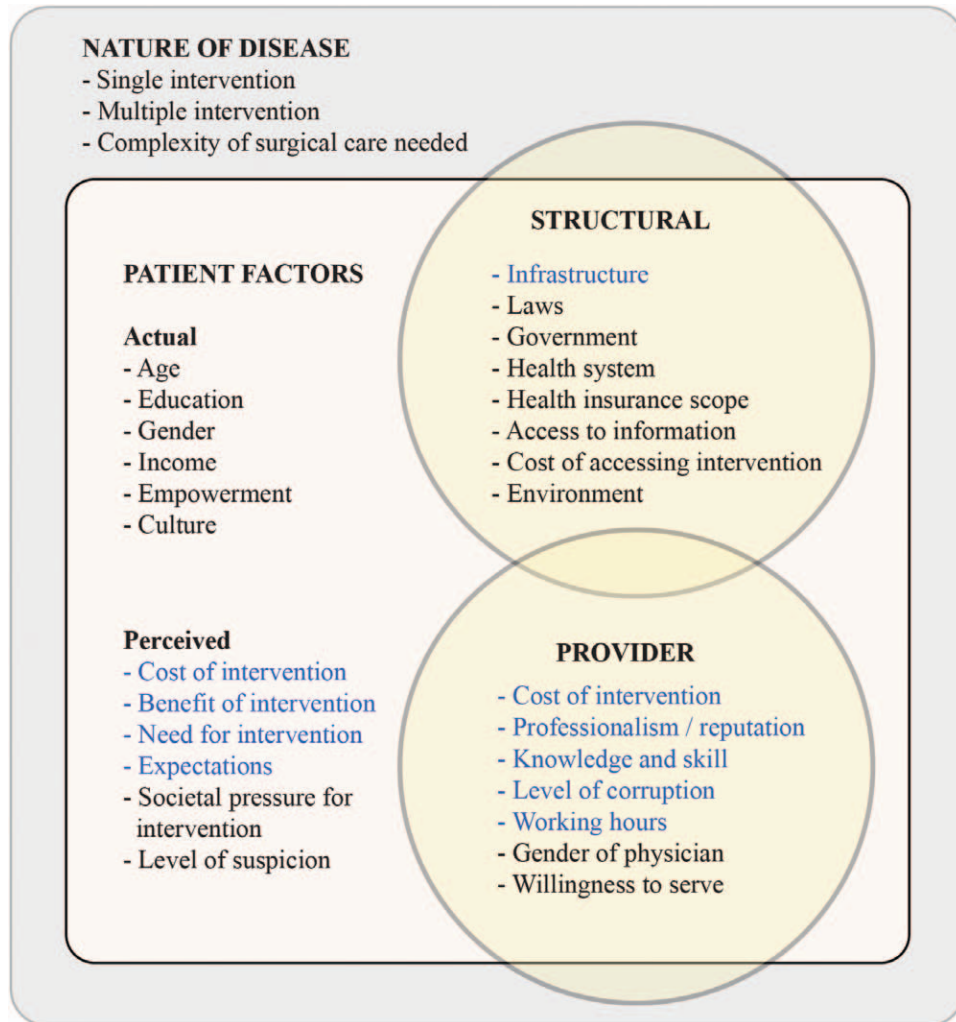


Fig. 2. Proposed barriers-to-care framework using the surgical low- and middle-income country model. Items in blue are factors that are particularly exacerbated by diseases that require multiple or a series of treatments/interventions.

factors are included in past models for barriers to care and highlights the elements that we propose to modify and/or introduce. Our proposed framework to organize barriers to surgical care, the “surgical low- and middle-income country model” (Fig. 2), augments current models by addressing three key elements: barriers specific to surgical care; single- versus multiple-intervention diseases; and specific low- and middle-income country challenges (e.g., perceived versus real barriers on a patient level). In Figure 2, items in blue are factors that are particularly exacerbated by diseases that require multiple or a series of treatments/interventions, which reconstructive surgery often requires.

The conclusions from this study and the proposed model developed as a result can be generalized for other populations in Vietnam and similar low- and middle-income countries. For Vietnam specifically, our study cohort provides a strong representation of the national population: households surveyed were comparable in income, occupation type, and education level to the nation’s lower and middle class population; the reported annual household income for our study population was on par with Vietnam’s gross national income per capita in 2013¹²; and the majority of our study population were farmers, parallel to national statistics that report 51 percent of adults being employed in the agricultural sector.¹³

As with most cross-sectional studies, the primary limitations of this study are the potential for selection bias and limited generalizability. Individuals were recruited from surgical missions where households were proactive in seeking care and had the time/means to spend several days at the mission site. Although Operation Smile reimbursed travel, food, and lodging fees, those at the mission likely represented a more economically secure and/or educated subset. Missions were announced on billboards, on television, on the radio, by community health workers, and by word of mouth; nevertheless, even these varied forms of messaging may not have reached the most marginalized people. In addition, our results may be specific to the local context of Vietnam, which may differ significantly in religious/spiritual, educational, cultural, and economic characteristics compared with other low- and middle-income countries. Although our model may be more generalizable to regional low- and middle-income countries elsewhere in Southeast Asia with similar political and structural infrastructure, it is worth noting that Vietnam’s gross domestic product per capita is higher than that of Cambodia, Myanmar, and Laos but lower than that of Thailand.¹⁴⁻¹⁶

Our data help validate existing health care barrier models through quantitative methods and support the development of a more evidence- and needs-based public health framework designed to modify health behaviors and perceptions regarding surgical care. Our surgical low- and middle-income country model accounts for barriers specific to surgical care, plastic surgical care, and low- and middle-income countries that are not addressed in previous models, including disease type/nature (single- versus multiple-intervention surgical disease) and patient perceptions. Although our barriers-to-care model was created using a cleft lip and palate population, we believe this model may be useful to understand barriers for a variety of reconstructive surgical needs such as for hand, burn, and trauma injuries, among others. It also highlights the challenges and successes for mission-based care and the need to better understand surgical barriers to design more effective programs for both mission-based and locally sustainable surgical care. Plastic surgeons are uniquely positioned to lead the surgical community in addressing the need for improvements in global surgical access and care, given our history of mission-based work, access to multicultural patients, and dedication to education systems within global surgery. Better understanding patient barriers to reconstructive surgical care can guide plastic surgeons in being more attuned clinicians and more informed directors of surgical outreach initiatives.

William P. Magee III, M.D., D.D.S.

Division of Plastic and Reconstructive Surgery
Keck School of Medicine of the University of Southern
California
1510 San Pablo Street, Suite 415
Los Angeles, Calif. 90033
wmagee@chla.usc.edu

ACKNOWLEDGMENTS

The authors thank Allyn Auslander, M.P.H., for contributions and leadership in statistical analytics; and William Magee, Jr., D.D.S., M.D., and Kathy Magee for helping them partner with Operation Smile International and supporting research in sustainable outreach for surgical care in lower- and middle-income countries.

REFERENCES

1. Ologunde R, Maruthappu M, Shanmugarajah K, Shalhoub J. Surgical care in low and middle-income countries: Burden and barriers. *Int J Surg*. 2014;12:858–863.
2. PLoS Medicine Editors. A crucial role for surgery in reaching the UN millennium development goals. *PLoS Med*. 2008;5:e182.

3. Meara JG, Leather AJ, Hagander L, et al. Global Surgery 2030: Evidence and solutions for achieving health, welfare, and economic development. *Surgery* 2015;158:3–6.
4. Parker SE, Mai CT, Canfield MA, et al.; National Birth Defects Prevention Network. Updated national birth prevalence estimates for selected birth defects in the United States, 2004–2006. *Birth Defects Res A Clin Mol Teratol.* 2010;88:1008–1016.
5. Schechter WP. Academic global surgery: A moral imperative. *JAMA Surg.* 2015;150:605–606.
6. Kotagal M, Horvath K. Surgical delivery in under-resourced settings: Building systems and capacity around the corner and far away. *JAMA Surg.* 2015;150:100–102.
7. Figueiredo JC, Ly S, Raimondi H, et al. Genetic risk factors for orofacial clefts in Central Africans and Southeast Asians. *Am J Med Genet A* 2014;164:2572–2580.
8. Hopper RA, Cutting C, Grayson B. Cleft lip and palate. In: *Grabb & Smith's Plastic Surgery*. Thorne CH, Bartlett SP, Beasley RW, Aston SJ, Gurtner GC, Spear SL, eds. Philadelphia: Wolters Kluwer Health; 2006:201–215.
9. Irfan FB, Irfan BB, Spiegel DA. Barriers to accessing surgical care in Pakistan: Healthcare barrier model and quantitative systematic review. *J Surg Res.* 2012;176:84–94.
10. Phillips KA, Morrison KR, Andersen R, Aday L. Understanding the context of healthcare utilization: Assessing environmental and provider-related variables in the behavior model of utilization. *Health Serv Res.* 1998;33:571–596.
11. Grimes CE, Bowman KG, Dodgion CM, Lavy CB. Systematic review of barriers to surgical care in low-income and middle-income countries. *World J Surg.* 2011;35:941–950.
12. The World Bank. GNI per capita, Atlas method (current US\$). Available at: <http://data.worldbank.org/indicator/NY.GNP.PCAP.CD>. Accessed April 25, 2013.
13. The World Bank. *Vietnam Development Report 2014: Skilling up Vietnam. Preparing the Workforce for a Modern Market Economy*. Washington, DC: The World Bank; 2014.
14. The World Bank. GDP per capita (current US\$). Available at: <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>. Accessed March 10, 2013.
15. McIntyre D, Thiede M, Birch S. Access as a policy-relevant concept in low- and middle-income countries. *Health Econ Policy Law* 2009;4:179–193.
16. Obrist M, Osei-Bonsu E, Awuah B, et al. Factors related to incomplete treatment of breast cancer in Kumasi, Ghana. *Breast* 2014;6:821–828.