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SPECIAL SECTION

GLOBAL HEALTH

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A. Levine, MD, MPH



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Rwandan emergency medicine residents and international faculty outside of the ambulance entrance at the Kigali University Teaching Hospital.

16 Little Rhody Goes Global

ADAM C. LEVINE, MD, MPH; ALISON S. HAYWARD, MD, MPH
GUEST EDITORS

17 Addressing Global Human Rights Violations in Rhode Island: The Brown Human Rights Asylum Clinic

ODETTE ZERO, BA, MD-ScM '22; MARGA KEMPNER, BA, MD '22;
SARAH HSU, BA, MD-ScM '22; HEBA HALEEM, BA, MD '22;
ELIZABETH TOLL, MD; ELIZABETH TOBIN-TYLER, JD, MA

21 Obstetric Fistula Repair in Sub-Saharan Africa:

Partnering to Create Sustainable Impact for Patients and Trainees

AMITA KULKARNI, MD; ANNETTA MADSEN, MD; SARAH ANDIMAN, MD;
ARLENE NISHIMWE, MD; B. STAR HAMPTON, MD

25 A Collaborative Family Planning Program in Rural Uganda Utilizing Community Health Workers

ALISON S. HAYWARD, MD, MPH; KELSEY BROWN, MD'22

28 Tele-ECHO for Point-of-Care Ultrasound in Rural Kenya: A Feasibility Study

LINDSAY DREIZLER, MD'21; GRACE W. WANJIKU, MD, MPH

32 Building and Sustaining Partnerships in Health Workforce and Research Capacity in Rwanda

STEPHANIE C. GARBERN, MD, MPH; KYLE D. MARTIN, MD; CATALINA GONZALEZ-MARQUES, MD; OLIVIER FÉLIX UMUHIRE, MD; DORIS LORETTE UWAMAHORO, MD;
ADAM R. ALUISIO, MD, MSc; ADAM C. LEVINE, MD, MPH

36 Developing a Novel Mobile Health (mHealth) Tool to Improve Dehydration Assessment and Management in Patients with Acute Diarrhea in Resource-Limited Settings

MONIQUE GAINEY, MS, MPH; MEAGAN BARRY, MD, PhD;
ADAM C. LEVINE, MD, MPH; SABIHA NASRIN, MBBS, MPH

40 From Rhode Island to Colombia: Brown University Emergency Physicians Lead a Collaborative Consortium in a Post-Conflict Colombia

KATELYN MORETTI, MD; ANDRÉS PATIÑO, MD; LEONAR AGUIAR, MD; ADRIENNE FRICKE, JD; MELANIE LIPPMANN, MD; JACLYN CAFFREY, MD; ASHLEY GRAY, MD;
MARIA NAVEDO; CHRISTIAN ARBELAEZ, MD, MPH

44 An Overview of the Rhode Island Hospital-Cabral y Baez Medical Exchange Program

NEESHA NAMA, MD; MEGHAN McCARTHY, BS; AMANDA NOSKA, MD;
AMOS CHARLES, MD; MARTHA SANCHEZ, MD

47 Tuberculosis: An Epidemic Perpetuated by Health Inequalities

DARIA SZKWARKO, DO, MPH; TARA C. BOUTON, MD, MPH;
NATASHA R. RYBAK, MD; E. JANE CARTER, MD; SILVIA S. CHIANG, MD

Little Rhody Goes Global

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GUEST EDITORS

Rhode Island may be small in size, but it continues to have a major impact on the health of people around the world. In this special Global Health issue of the *Rhode Island Medical Journal* (RIMJ), we present nine articles on innovative research, training, and advocacy projects led by Rhode Island physicians and students that span five continents.

In the spirit of “think globally, act locally,” **ODETTE ZERO**, et al. describe the ongoing work of the Brown Human Rights Asylum Clinic to provide pro bono medical affidavits for asylum seekers in Rhode Island, supporting their claims of torture or violence in their home countries.

Africa

A series of articles focus on projects in sub-Saharan Africa. **AMITA KULKARNI**, et al. describe a unique collaboration between Women and Infants Hospital at Brown University and Kibagabaga Hospital in Rwanda to improve management of obstetric fistula, a common and debilitating diagnosis for tens of thousands of women who lack access to emergency obstetric care. **ALISON HAYWARD**, et al. report on a survey conducted by Brown faculty in collaboration with the local Uganda Village Project in rural eastern Uganda to determine the unmet need for modern contraception. **LINDSAY DREIZLER**, et al. report the preliminary results of Project ECHO, a novel tele-mentoring program training health care providers in rural Kenya in point-of-care ultrasound techniques. And **STEPHANIE C. GARBERN**, et al. describe efforts to build emergency care research capacity at Rwanda’s main government referral hospital.

Asia

In South Asia, **MONIQUE GAINEY**, et al. report on novel research conducted by Brown faculty with local colleagues at the International Centre for Diarrhoeal Disease Research, Bangladesh, on the development of new mobile health decision support tools for managing dehydration from cholera and other severe diarrheal diseases.

Latin America

In Latin America, **KATELYN MORETTI**, et al. describe the rollout of the World Health Organization’s Basic Emergency Care training in rural Colombia, as well as their new projects related to the care of recently arriving Venezuelan refugees and Colombian citizens internally displaced by decades of conflict. And **NEESHA NAMA**, et al. report on a bilateral, trainee-driven medical exchange program between Rhode Island Hospital and Hospital Regional Universitario José María Cabral y Báez in the Dominican Republic.

Global

Members of the Brown faculty are also fighting multi-drug resistant TB all around the globe. The article by **DARIA SZKWARKO**, et al. relates the details of efforts to confront the threat in Peru, Kenya, and Ukraine. These physicians are working on efforts to improve case detection rates and reduce drug resistance through broadened access to diagnostics and treatment.

The articles included in this Global Health special issue present just a few of the multitude of ongoing collaborations between Rhode Island physicians and colleagues based around the world to improve the care of some of the world’s most vulnerable populations. Little Rhody certainly has much to be proud of on the global stage.

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Addressing Global Human Rights Violations in Rhode Island: The Brown Human Rights Asylum Clinic

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ABSTRACT

The Brown Human Rights Asylum Clinic (BHRAC) is a medical student-led organization affiliated with Physicians for Human Rights that collaborates with medical and mental health clinicians, lawyers, and community organizations to provide pro bono medical affidavits to undocumented individuals seeking legal status in the United States. Affidavits can document and corroborate the physical and psychological evidence of trauma alleged by asylum seekers, leading to better legal outcomes. This article describes our innovative program, partnerships, and workflow, as well as demographics and statistics from our past seven years of operation. Since its founding in 2013, BHRAC has conducted 55 medical evaluations, the majority involving Spanish-speaking female-identifying individuals from Guatemala, El Salvador, and the Dominican Republic. Thirteen individuals have been granted legal status, one individual was denied status, and the rest of the cases are pending. BHRAC has experienced a marked increase in affidavit requests. This paper serves as a call to action for medical professionals to become involved in this work.

KEYWORDS: asylum, human rights, immigration, medical affidavits

INTRODUCTION

In 2017, 68.5 million people globally were forcibly displaced from their homes by violence, conflict, and persecution, with the United States (U.S.) receiving 331,700 asylum applications from 168 countries.¹ Although the number of asylum seekers arriving in the U.S. has risen since 2013, paths toward legal resettlement have diminished as application approval rates have dropped.² Asylum seekers are those who have left their country of habitual residence because of a “well-founded fear of persecution on account of race, religion, nationality, membership in a particular social group, or political opinion.”³ In the U.S., granting of asylum authorizes an individual to live and work in the country, sponsor immediate family members for asylum, apply for a green card after one year, and eventually apply for citizenship.³ Alternative forms of relief exist for victims of human trafficking, domestic violence, and other crimes.

Physicians for Human Rights (PHR) coordinates a network of clinicians and medical student-run clinics to provide pro bono medical affidavits supporting asylum seekers' claims of torture or violence in their home countries. Clinician-evaluators play a critical role in establishing the applicant's credibility by conducting examinations to document and corroborate the physical and psychological evidence of trauma alleged by asylum seekers. While the average U.S. asylum approval rate was 37.5% in the early 2000s, it rose to 89% when professional evaluations accompanied the cases.⁴ For these reasons, immigration attorneys value medical affidavits, often encouraging clients to spend money on this service. In many cases, however, undocumented immigrant clients do not have the means to pay for an evaluation, and their case may suffer for it.

Twenty-two non-governmental organizations, academic hospitals, and medical schools across the country, including the Brown Human Rights Asylum Clinic (BHRAC), train clinicians to conduct medical evaluations and write affidavits. Student-run clinics offer the advantage of shifting the burden of time, correspondence, and affidavit drafting to medical students, freeing clinicians to perform evaluations more frequently.⁵ Asylum medicine offers a space for interdisciplinary collaboration and partnership, experiential learning between clinicians and medical students, and the opportunity for international and local impact at the intersection of global health and human rights.

HISTORY OF BHRAC

BHRAC was created in 2013 by five Warren Alpert Medical School (AMS) students in partnership with PHR to respond to the growing number of undocumented immigrants in Rhode Island and southern Massachusetts who were seeking asylum in the U.S. due to experiences or threats of persecution, torture, and violence in their home countries. BHRAC has since conducted an annual PHR training for evaluators and medical students to learn how to perform evaluations and write affidavits for asylum seekers. Currently, 42 health professionals and 87 medical students have been trained to conduct this work.

In the first years of operation, BHRAC received asylum cases exclusively from PHR. Attorneys from all over the U.S. submit applications to PHR, which processes them

and forwards affidavit requests to medical school-affiliated asylum clinics. An increasing number of dedicated Rhode Island clinicians and AMS medical students has allowed BHRAC to increase its capacity to accept cases from local community partners such as Sojourner House, a domestic and sexual violence prevention organization; the Roger Williams University Law School Immigration Clinic, a pro bono legal clinic for immigrants who need assistance obtaining lawful permanent residence; Clínica Esperanza, a free clinic for uninsured adults living in RI; the Alliance to Mobilize Our Resistance (AMOR), an alliance of several community organizations dedicated to providing community support to victims of hate crimes and state-sponsored violence, and local immigration law offices. In response to local need, BHRAC now provides affidavits to undocumented individuals seeking legal status through other avenues besides asylum.

BHRAC WORKFLOW

After receiving a client referral from PHR or a local partner, BHRAC assigns the case to one of four Case Coordinators (CC) at AMS, who then communicate with Rhode Island's network of 42 PHR-trained clinicians, including attending and resident physicians from Internal Medicine, Family Medicine, Emergency Medicine, Psychiatry, Medicine-Pediatrics, Nephrology, Triple Board (Pediatrics, Child and Adult Psychiatry) and mental health professionals such as licensed social workers and psychologists. Clinicians who are able to collaborate on the case respond with their availability. CCs contact specific evaluators if, for example, the client has a gender preference for the evaluator or is younger than age 18.

Case description example

Client is a 32-year-old Guatemalan woman seeking a psychological evaluation for her asylum case. Female evaluator preferred. The client speaks Spanish, is not in detention, and is not requesting oral testimony at this time. The client is from an indigenous group and fears returning to her home country. She is a survivor of childhood sexual abuse and as an adult, was a victim of physical abuse and repeated death threats by her partner. She continues to suffer from insomnia, nightmares, and severe anxiety in daily interactions. The attorney is requesting a completed affidavit in two months.

The CC provides the evaluator's availability to the legal team, who then communicates with the client and secures a non-family member interpreter, if needed. Once the clinician, legal team, and client confirm a date and time, the CC emails the pool of 75 PHR-trained medical students to identify two scribes who will attend the evaluation and help write the medical affidavit.

The CC communicates with designated staff at Clínica Esperanza or Sojourner House to schedule a private room for the evaluation, with an examination table if needed. Then, the CC emails all parties with a description of the case, the

date, time, and location of the evaluation, and resources for conducting the evaluation and writing the medical or psychological affidavit. If available, the evaluator reviews medical health records, previous statements, and other documents provided by the legal team.

Prior to the evaluation, the evaluator reviews confidentiality, informed consent, and the purpose of the evaluation with the client, as well as addresses the sensitive nature of the information to be gathered. Often, evaluators start with questions about the client's demographic information, family, childhood, medical, and social history. After these introductory questions, the evaluator reviews why the client came to the U.S. and assesses any trauma sustained before or after migration that would influence the client's ability to return to their home country. The evaluator then performs an extensive psychological evaluation, which includes a mental status exam and standard mental health screens (e.g. PHQ-9, GAD-7, PCL-C, PHQ-15). In addition, a physical exam may also be performed to document any evidence of torture or abuse.

The recorded trauma history should be as precise and detailed as possible in order to assess consistency with physical and mental symptoms. Some clients, however, may not be able to provide complete or detailed accounts due to emotional distress, language barriers, and memory problems related to physical or mental trauma.^{6,7} In order to minimize re-traumatization, clinicians strive to conduct the evaluation in an empathetic, trauma-informed manner while maintaining objectivity. Evaluations typically last two to four hours. Medical care is not offered during or after the evaluation, as the evaluator's role is to gather the client's evidence for future legal proceedings. Evaluators can, however, include recommendations about the need for further medical or psychological care in the final affidavit. BHRAC has also created a community resource guide and case navigation program to aid clients in need of follow-up services.

In keeping with the Istanbul Protocol, the international guidelines for investigating and documenting torture adopted by the United Nations in 1999, the affidavit documents evidence of torture or abuse, provides expert opinion on the degree to which clinical findings corroborate allegations of abuse, and informs adjudicators on the behavioral, physical, and psychological sequelae of trauma through clinical observations and diagnostic tests.⁸ After the evaluation, the medical students write the narrative portion of the affidavit and send a draft to the evaluator to complete. The evaluator then sends a signed copy of the completed affidavit to the legal team before the requested deadline. Evaluators may be asked to testify in person or by telephone or videoconferencing at future judicial hearings.

BHRAC recognizes that clinicians and medical students exposed to difficult narratives of trauma and violence are at greater risk of vicarious trauma from the emotional burdens of listening and responding to these stories.⁹ Through debriefing opportunities, case discussions, and community

events, BHRAC hopes to create a space for “vicarious resilience” thereby building insight, empathy, and strength among medical students and clinicians to continue this important work.⁵

BHRAC CLIENT DEMOGRAPHICS

As of May 2019, BHRAC has completed 55 total medical evaluations: 26 in the preceding year, with 13 new cases currently in progress. Of the past 55 evaluations, 49 evaluations were conducted in Spanish, 4 in English, and one evaluation each in Arabic and Cantonese. The client base was 69.6% female and 30.4% male. Clients have ranged from 13 to 80 years in age, with the average age being 30.7 years. Clients’ primary reasons for seeking asylum include domestic violence (60%, n=33), gang violence (27%; n=15), ethnic discrimination (4%; n=2), and other (9%, n=5) (Figure 2).

DISCUSSION

The impact and reach of our program has grown each year. The majority of our clients are seeking asylum, but since partnering with Sojourner House, Clínica Esperanza, AMOR, and Roger Williams University Immigration Clinic, we have also conducted evaluations for non-asylum applications.

Most of our clients are Spanish-speakers, over half of whom are female-identifying and hail from Guatemala, El Salvador, and the Dominican Republic (Figure 1). This is different from the national average, where the leading nationality for asylum applications is Venezuelan. While Guatemalan applicants make up 61% of BRAC’s client base, the national application rate for Guatemalan applicants is only 9%.¹⁰

It is of note that more than half of our case results are still pending, reflecting the slow nature of immigration legal proceedings (Figure 3). In the U.S., as of July 2018, there were over 700,000 pending immigration cases and the wait time on average for an immigration hearing was over 2 years. Patience is essential to asylum work, and slow turnaround can be discouraging to evaluators and students. However, the first 12 BHRAC clients were all granted asylum. Of all the cases with a court decision, only 1 BHRAC case has ever been denied asylum. Compared to the national asylum acceptance rate of between 28–46% per year between 2009 and 2018, this provides testament to the importance of our clinic’s work.¹⁰

Figure 1. Client Country of Origin (N=55)

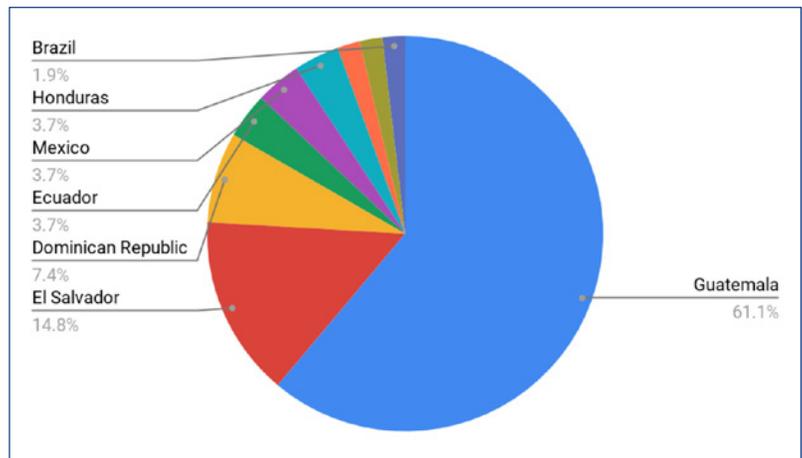


Figure 2. Reasons for Seeking Asylum

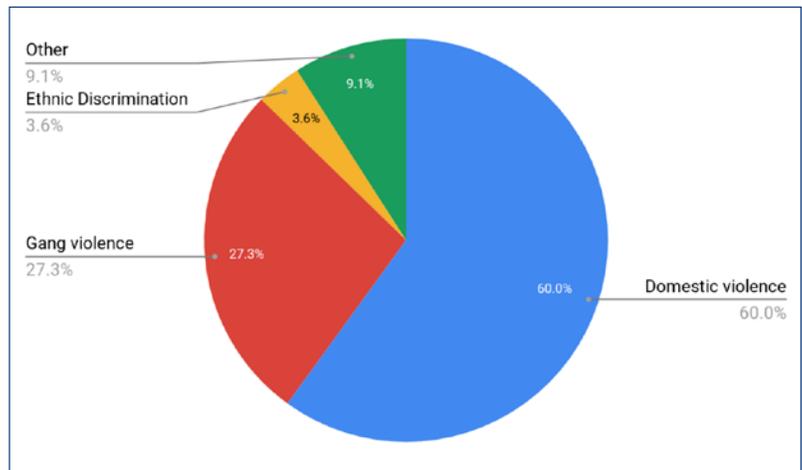
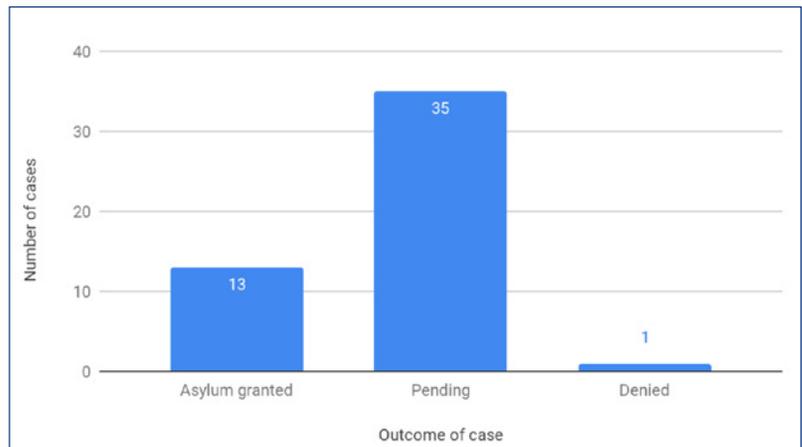


Figure 3. Outcome of Cases (N=55)



A current challenge is the number of evaluation requests received. While we have a large network of evaluators, a smaller pool ends up conducting the bulk of cases. Many evaluators have busy clinical schedules and can only take on one or two cases per year. Others do not feel comfortable conducting evaluations on their own and request to shadow an experienced evaluator; however, coordinating two different clinician schedules can be difficult. To improve engagement with our network, we have expanded communication efforts via email, community events, and trainings, increased transparency on our impact results and workflow, and are building resources and a mentorship system for new evaluators. Another challenge is coordinating between multiple parties to organize the evaluation, a time-intensive task that requires rapid problem solving and consistent monitoring of email by busy medical students and clinicians. Every spring, BHRAC leadership is transferred to rising second-year medical students. Strain is placed on the outgoing board during transition periods to maintain clinic operations while training the next board. The current board has made efforts to solidify and document institutional knowledge to minimize transitional issues.

CONCLUSION

Since 2013, The Brown Human Rights Asylum Clinic (BHRAC), a medical student-led organization affiliated with Physicians for Human Rights, has collaborated with RI medical and mental health clinicians, lawyers, social service organizations, and immigrant communities to provide pro bono medical affidavits for undocumented individuals seeking legal status in the U.S. Affidavits can document and corroborate the physical and psychological evidence of trauma alleged by asylum seekers, leading to better legal outcomes. The clinic also offers a unique opportunity for medical students to learn by observing culturally competent and trauma-informed clinicians conduct skilled evaluations, while offering clinicians and students a setting to practice global health and human rights work in RI.

Our local work takes on the critical global health imperative to address the human rights violations around the world that spur migration to communities like RI. We hope this paper will serve as a call to action for interested medical and mental health clinicians to join our clinic as evaluators, mentors, and human rights advocates. To learn more and participate in our annual Physician for Human Rights training, email Brown.asylum.clinic@gmail.com.

References

1. United Nations High Commissioner for Refugees. Global trends: Forced displacement in 2017 [Report]. 2018. Retrieved from <https://www.unhcr.org/5b27be547.pdf>.
2. Ferdowsian H, McKenzie K, Zeidan A (in press). Asylum medicine: Standard and best practices. *Health and Human Rights J*.

Retrieved from <https://www.hhrjournal.org/2019/05/asylum-medicine-standard-and-best-practices/>.

3. Physicians for Human Rights. Asylum and other relief for immigrant victims of violence and persecution [Fact sheet]. 2015. Retrieved from <https://static1.squarespace.com/static/54c1a793e4b0b73c478253dc/t/551aa12ae4b05e8ec0b867c7/1427808554765/asylum-and-other-relief.pdf>.
4. Lustig S, Kureshi S, Delucchi K, Iacopino V, Morse S. Asylum grant rates following medical evaluations of maltreatment among political asylum applicants. *J Immigrant & Minority Health*. 2007;10(1):7-15.
5. Praschan N, Stukel N, Mishori R. A student-run asylum clinic to promote human rights education and the assessment and care of asylum seekers. *J Student-Run Clinics*. 2016;2(2):1-7.
6. McKenzie K, Bauer J, Preston Reynolds P. Asylum seekers in a time of record forced global displacement: The role of physicians. *J Gen Intern Med*. 2019;34(1):137-143.
7. Herlihy J, Scragg P, Turner S. Discrepancies in autobiographical memories—implications for the assessment of asylum seekers: repeated interviews study. *BMJ*. 2002;324(7333):324-327.
8. Mishori R, Mujawar I, Ravi N. Self-reported vicarious trauma in asylum evaluators: A preliminary survey. *J Immigr Minor Health*. 2014;16(6):1232-1237.
9. U.S. Citizenship and Immigration Services. Affirmative Asylum Applications Decided by Fiscal Year FY2009-FY2018 Q2. 2018. Retrieved from https://www.uscis.gov/sites/default/files/Affirmative_Asylum_Decisions_FY09-FY18_Q2.pdf.
10. Cepla Z. U.S. Asylum Process [Fact sheet]. National Immigration Forum. 2019. Retrieved from <https://immigrationforum.org/article/fact-sheet-u-s-asylum-process/>.

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Disclaimer

The views expressed herein are those of the authors and do not necessarily reflect the views of the Alpert Medical School or Physicians for Human Rights.

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Obstetric Fistula Repair in Sub-Saharan Africa: Partnering to Create Sustainable Impact for Patients and Trainees

AMITA KULKARNI, MD; ANNETTA MADSEN, MD; SARAH ANDIMAN, MD; ARLENE NISHIMWE, MD; B. STAR HAMPTON, MD

ABSTRACT

Obstetric fistula, an abnormal connection between a woman's genital tract and urinary tract or rectum, can be physically and psychosocially debilitating. We describe a sustainable obstetric fistula surgical trip model that includes providers from Women and Infants Hospital at Brown University. These surgical trips provide pre-operative, surgical, and post-operative care to patients with fistulae at Kibagabaga Hospital in Kigali, Rwanda.

To ensure patients are prepared for the recovery process after fistula surgery, the team created a post-operative education curriculum that includes illustrative visual aids and teaching guides translated into Kinyarwanda, focusing on topics including urinary catheter care, wound care, and pain management. Through this program, the team is committed to restoring women's dignity through fistula repair as well as providing a model for delivery of sustainable surgical care in low-resource settings. Involvement of trainees into a global health team like this can benefit both the trainee and the patients served.

KEYWORDS: global health, obstetric fistula, women's health

BACKGROUND

Obstetric fistula, an abnormal connection between a woman's genital tract and urinary tract or rectum, affects between 50,000 to 100,000 women worldwide each year.¹ The most common cause of obstetric fistula globally is protracted, obstructed labor which can often be prevented, in part by timely access to obstetric services. Women experiencing obstructed labor may labor for multiple days, causing tissue necrosis due to fetal head compression within the pelvis, and a subsequent vesicovaginal fistula (connection between the bladder and vagina) or rectovaginal fistula (connection between the rectum and vagina). Women who suffer from obstetric fistula experience constant incontinence of urine, feces, or both, that causes physical complications as well as social isolation, including rejection from their husbands, families, and communities at large. Acknowledging this devastating yet preventable condition, the World Health Organization (WHO) has prioritized the prevention and management of obstetric fistula in its Sustainable Development

Goals as a means of improving global maternal health. The surgical repair of a vesicovaginal or rectovaginal fistula can alter the course of a woman's life; however, the lack of training of local physicians and inadequate resources for evaluation and repair are some of the many reasons the majority of these women are unable to be treated for their condition.

SUMMARY OF IOWD FISTULA SURGERY PROGRAM HISTORY AND ACCOMPLISHMENTS

Benefits of global health experiences for trainees are well-recognized. Global health experiences broaden medical knowledge, foster an improvement in diagnostic, examination and procedural skills, and develop a deeper appreciation for public health issues, professionalism, and cultural sensitivity. In addition, trainees who have global health experiences are more likely to practice medicine among underserved and multicultural populations, and/or work internationally in the future.² Recognizing this, the Division of Urogynecology and Reconstructive Pelvic Surgery within the Department of Obstetrics and Gynecology at Women and Infants Hospital has sponsored Dr. B. Star Hampton, Professor of Obstetrics and Gynecology at the Warren Alpert Medical School of Brown University, and a Fellow in Female Pelvic Medicine and Reconstructive Surgery (FPMRS) to travel to Sub-Saharan Africa as part of an obstetric fistula repair team organized by the International Organization for Women and Development (IOWD) since 2008.³ As part of their training, the FPMRS fellows have a unique opportunity to take part in the evaluation and management of complicated surgical patients, giving them insight into the care of obstetric fistula as well as global health efforts. The Division of Urogynecology at Women and Infants is one of the few FPMRS Fellowships in the nation to sponsor a fellow on a yearly basis. The design and curriculum of this program has served as a national model. Many graduated FPMRS fellows now include global health work in their careers, attributing this experience as life-changing. Dr. Hampton has extended the opportunity to be part of this surgical team to medical students at Alpert Medical School and Obstetrics and Gynecology residents at Women and Infants who have demonstrated a unique interest in obstetric fistula and global health, as well as a level of maturity and cultural competency to integrate into a challenging work environment.

Initially Dr. Hampton traveled with IOWD to Niger, but since 2010, the organization has moved their team to Kibagabaga Hospital in Kigali, Rwanda. Dr. Hampton serves as the team leader and lead surgeon for an annual two-week surgical mission, one of three per year organized by IOWD. During this mission, an average of over 150 women are triaged, many of whom have traveled hours to days for help, and usually more than 50 women undergo fistula repair surgery. Over the last eight years in Rwanda, the program has evaluated approximately 3,500 patients and operated on close to 1,200 women suffering from fistulae. The team works directly with Rwandan care providers, and educates these providers on evaluation and treatment of obstetric fistula, as well as post-operative care, with an aim to be a sustainable program.

POST-OPERATIVE PATIENT EDUCATION

Ensuring that patients understand the care they receive is at the core of “patient-centered care,” but in practice, it is not always easy. Here in the United States, challenges related to patient education including providers’ lack of time, varying levels of health literacy among patients, and cultural barriers are common. During their global health experience with IOWD at Kibagabaga Hospital, trainees on the surgical team have the unique opportunity of having ample time to spend with patients, many of whom have traveled hours to seek care for their fistulae and stay on hospital grounds for two to four weeks after surgery. It is essential, however, for team members to be cognizant of cultural differences between foreign care providers and Rwandan patients, as well as patients’ limited formal education and health literacy.

The idea for a post-operative educational curriculum for the obstetric fistula patients at Kibagabaga Hospital came about after a need was expressed by multiple stakeholders: Dr. Hampton and the team of visiting surgeons who had been performing fistula repair surgeries for over five years at the hospital, Rwandan care providers, and most importantly the patients. Previous literature has noted the limited understanding among patients undergoing fistula repair about the surgery itself and the subsequent post-operative healing.⁴ In addition to the expected post-operative risks associated with any surgery, fistula repair surgeries are often time-intensive and complex. They require prolonged post-operative bladder drainage with an indwelling Foley catheter for one to two weeks, sometimes longer, in order for the tissue to remain tension-free and heal. Recovering from surgery with a urinary catheter

is inconvenient and uncomfortable at baseline. This can be further challenging for women in a low-resource setting like Rwanda. For the patients who presented for fistula surgery to Kibagabaga Hospital, many of them lived hours or days away and had limited access to qualified health care providers if surgical or catheter complications arose. Additionally, many had not openly shared their plan for surgery with their husbands and families so felt a sense of pressure to return back to their homes quickly to resume their responsibilities and also were concerned about how to avoid sexual intercourse without disclosing their condition. To address these potential complications, patients had accommodations on the hospital grounds in order to recover following surgery and allow the Fistula team to follow them post-operatively.

Dr. Hampton and trainees that traveled with her to Rwanda in February 2017 (AK, AM) undertook the task of creating a formalized curriculum to standardize, and make accessible to patients, information regarding post-operative expectations. The curriculum focused on common issues patients would experience post-operatively including urinary catheter care, wound care, pain management, and worrisome signs or symptoms that warranted prompt medical attention. Aware that a majority of our patient population was illiterate, large visual aids provided the basis for the patient education modules with supplemental teaching guides translated into Kinyarwanda to aid the Rwandan providers in group and individual discussions.

It was imperative that the project was a collaboration, from development to implementation, between the US-based team and the Rwandan colleagues in order to be successful. The initial project concept was discussed with both IOWD’s Executive Director and the lead nurse who

oversees the fistula program at Kibagabaga hospital. Having long-term, personal relationships with these partners and their buy-in was vital in moving the project forward. A proposed outline of curriculum content was shared electronically with Rwandan partners, who provided critical feedback that was both constructive and enlightening. For example, during a unit discussing perineal hygiene, the US team suggested use of perineal bottles to keep the area clean. Rwandan partners reminded the team that something as simple as a perineal bottle was not readily available or affordable for most patients. Rwandan partners also encouraged clarification and simplification of instructions and language. Did perineal baths require soap? Many patients didn’t have daily access to soap but a simple bucket with clean water and a wash cloth would suffice.



Figure 1. Simple instructional drawings for visual teaching.



Women waiting for their fistula repair surgeries attend a group educational session about post-operative expectations. **Amita Kulkarni, MD, OB/GYN** resident at Brown, and **Leah Moynihan, NP**, a nurse practitioner at Women and Infants, helped lead the session with Rwandan colleagues.

Once content was finalized, an illustrator (SA), who had traveled with the surgical team on prior missions and was familiar with setting and patients, created simple instructional drawings for visual teaching (**Figure 1**). Rwandan partners helped ensure illustrations were clear and appropriate. Feedback regarding details such as the color of clothing the woman was wearing and the position she was sitting in was essential for illustrations to be accurate and useful. This iterative process was not only helpful in ensuring the US team brought the best educational materials to the patients, but also allowed for connection and idea sharing, creating a team dynamic between Rwandan and US colleagues that everyone felt a part of even before meeting on the ground in Kigali.

Once in Kigali, the curriculum was used to lead a large-group workshop with over 80 women about post-operative care and what they might expect (**Photo above**). Careful consideration was taken regarding workshop structure and leadership, with the fistula program's lead nurse and physician (AN) running the workshop as they not only spoke the language fluently but were known and well-respected by the patients. They had a deep understanding of the emotional, physical, and social impacts fistula had on individual women in the group. With this leadership, the workshop became an interactive safe space, where women felt comfortable talking about the most intimate parts of their bodies and asking questions they may not have otherwise asked. After the large workshop, the US team

worked closely with a group of Rwandan medical students to reinforce educational topics with individual patients after their surgeries. Patients were informally surveyed about perspectives on the educational modules and overall found the illustrations and group sessions helpful, with many stating that it answered questions they may have had but were too afraid to ask. One patient, a 43-year-old woman who lived with a rectovaginal fistula for 15 years after a vaginal delivery underwent surgery with the IOWD team. She recounted the shame she experienced surrounding her fecal incontinence, not telling anyone about it, including her husband who she continued to have intercourse with despite pain because she was afraid he would leave her. She was feeling desperate after she asked a midwife who told her there was nothing that could be done for her due to the lack of skilled doctors. After her fistula repair, she remarked that the curriculum and illustrations were very helpful, stating "you cannot heal if you do not follow them" and that they "give clear instructions, they help when you forget, they show you clear pictures as examples of how to behave."

The initial implementation of the post-operative education modules was successful and through ongoing collaboration with and feedback from Rwandan colleagues and patients, content has continued to be updated (**Photo below**). The project has also been a lesson in the challenges of



From left, **Nicole Kanyana**, a Rwandan medical student, **Amita Kulkarni, MD, OB/GYN** Resident at Brown, **Annetta Madsen, MD**, previous Urogynecology Fellow at Women and Infants and **Arlene Nishimwe, MD**, a Rwandan physician.

sustainability. While the core US and Rwandan members of the program have been involved for a number of years, there is often turnover each year among visiting team members, Rwandan medical students, and hospital staff. Further, with a long-standing program like this, there are multiple priorities each mission that need to be balanced. This can make it difficult to maintain continuity and excitement around any single initiative. In order to address this, the team's goal is to have the education modules revisited during each surgical mission by appointing a champion within both the US and Rwandan care teams each trip to ensure close follow-up and follow-through.

CONCLUSION

Obstetric fistula is both physically and psychologically debilitating. IOWD and its surgical teams continue to work to help restore women's dignity, allowing them to reintegrate into their families and communities. Through integration into this experience, trainees can better understand how to deliver sustainable surgical care to patients in low-resource settings, as well as dedicate time to projects such as the patient education initiative described here. Involvement of trainees into a global health team thus not only benefits the trainee, but can positively impact the patients served.

References

1. "10 facts on obstetric fistula." World Health Organization. WHO.org.
2. Drain PK, Holmes KK, Skeff KM, Hall TL, Gardner P. Global health training and international clinical rotations during residency: current status, needs, and opportunities. *Academic Medicine: Journal of the Association of American Medical Colleges*. 2009; 84(3), 320.
3. International Organization for Women and Development. IOWD.org.
4. Nathan LM, Rochat CH, Grigorescu B, Banks E. Obstetric fistulae in West Africa: patient perspectives. *American Journal of Obstetrics and Gynecology*. 2009; 200(5), e40-e42.

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A Collaborative Family Planning Program in Rural Uganda Utilizing Community Health Workers

ALISON SCHROTH HAYWARD, MD, MPH; KELSEY BROWN, MD'22

ABSTRACT

In 2015, a household survey was conducted in rural eastern Ugandan villages to determine fertility rate, prevalence of childbirth in the hospital setting, use of and unmet need for modern contraception. There remains a high fertility rate as well as high unmet need for contraception in the surveyed villages. However, Uganda Village Project's community health worker-based family planning program has shown promise to address these concerns.

KEYWORDS: Uganda, family planning, reproductive health, community health workers

BACKGROUND

In rural Uganda, there are many barriers to accessing reproductive healthcare, family planning counseling and contraception. According to the most recent Uganda Demographic and Health Survey (DHS), women in Uganda experience a large gap between wanted fertility rate and actual fertility rate. Wanted fertility rate is the average number of children a woman wants to have by the end of her childbearing years. Actual fertility rate is the total number of children a woman has by the end of her childbearing years. For Ugandan women in rural areas, such as the region served by Uganda Village Project, actual fertility rate was 1.3 children higher than the wanted fertility rate. The large gap among women in rural area suggests that there is a need for more family planning counseling and contraception. The DHS suggests that 32% of sexually active unmarried women have an unmet need for family planning.¹

In rural Uganda, lack of access to health centers and pervasive misinformation about contraception pose as large barriers to women and girls accessing contraception. These barriers, among others, help to explain why 1 out of every 4 women living in rural areas become pregnant or have their first child between ages 15 and 19.¹ Pregnancy and childbirth-related complications are the leading cause of death for girls aged 15 to 19.^{2,3} Pregnant adolescents also experience a significantly higher rate of severe neonatal conditions such as preterm delivery, low birthweight infants, and stillbirth. They also face a higher risk of perinatal systemic infections, eclampsia and endometritis.⁴

Uganda Village Project (UVP), a grassroots nonprofit based in eastern Uganda, has partnered with community health workers (CHW) and local health center staff to assess the family planning needs of the community and to provide necessary and desired access to family planning programs to women and adolescent girls living in rural Uganda.

RESEARCH SETTING AND PARTNERSHIP

Uganda Village Project was co-founded by Alison Hayward, MD, MPH, a member of the faculty of the Department of Emergency Medicine of the Warren Alpert Medical School of Brown University. Since 2003, UVP has partnered with villages to improve community health through implementation of the Healthy Villages Initiative. The objective of this initiative is to provide a set of programs addressing community health needs prioritized by residents of target villages, including malaria prevention, HIV/AIDS testing and counseling, safe water, sanitation and hygiene, obstetric fistula awareness and support, and family planning/reproductive health services. In order to achieve this objective, UVP partners with community leaders, community health workers on Village Health Teams (VHTs) and local health center staff to promote community health and to perform household-based needs assessments throughout target villages. Through conducting a series of surveys in the region, Uganda Village Project has obtained a detailed combination of demographic information and health indicators from a large randomized sample of our target population in order to provide the most needed health interventions to rural Ugandan villages.

PROGRAM DESCRIPTION

The UVP family planning program is integrated into the Healthy Villages Initiative. Family planning outreaches are run by UVP staff, Village Health Team family planning representatives and family planning nurses from local health centers (HCs). Before the scheduled outreach, a family planning representative from the Village Health Team helps mobilize women from the village to attend the event. On the day of the outreach, the family planning nurse and a UVP staff member travel to the target village, conduct an educational session, and provide one-on-one contraception

counseling to the women in the village. After counseling, the nurse provides each woman the contraception method of her choice. Outreaches occur every 12 weeks to ensure clients are able to receive timely contraceptive injections or pill refills for continuous use.

Men are typically not recruited to attend these events. In the past, female attendees have refused birth control if a man in the village was present at the outreach, as they fear he might disclose her birth control use to her husband. Based on anecdotal evidence and observation, it has become clear that family planning is not widely accepted among men in the villages. This creates additional barriers to women achieving family planning goals and ensuring healthy, desired pregnancies. To help break down this barrier, Uganda Village Project has taken steps to ensure that men are also receiving necessary family planning education. UVP conducts male specific outreaches at the local trading center or other places where men frequent. The conversations at these outreaches typically include information surrounding planning for desired family size and addressing misconceptions about contraceptives.

Adolescents also do not frequently attend family planning outreaches. Based on internal data, only 2% of attendees at UVP's outreaches in 2015 were younger than 19. In order to engage adolescents in family planning discussions, UVP also conducts reproductive health outreaches specifically for adolescents that include games or competitions. Young people who attend are specifically invited to the next HIV or family planning outreach. By making these connections and providing education, UVP intends to lower the rate of unmet contraceptive need, reduce pregnancy rates amongst adolescents, increase HIV testing and knowledge, and lower the prevalence of pediatric HIV cases.

METHODS

In 2015, community leaders from Bukakaire, Kitukiro and Nabirere villages provided the study team with a list of households in their village. The study team assigned each household a number and then used a random number generator to choose which houses to survey. By the end of the data collection period, a total of 351 households, from across the three villages, had completed the household-level needs assessment survey as a part of the Healthy Village Initiative.

The household-level needs assessment was a quantitative survey that included modules on household demographics, malaria, family planning, obstetric fistula, water, sanitation, hygiene, and HIV, as well as including child anthropometry with measurements of the height, weight, and mid upper arm circumference of household children. The family planning module was completed by the female head of the household. Descriptive statistical analysis was performed on all collected data using StataSE. The study protocol was approved by both the Uganda National Council of Science and Technology and the Brown University Institutional Review Board.

RESULTS

Out of the 351 households interviewed, 323 females completed the family planning module of the survey. The age of the women completing the survey ranged from 17 years old to 100 years old, with the average age being 37 years old. The self-reported total fertility rate was 6.29, which was slightly higher than Uganda's total fertility rate, which is 5.4, as well as higher than the 5.9 rate reported for Uganda's rural areas. 121 (49.8%) of the women interviewed had given birth in that past 12 months and the overwhelming majority (87.7%) of those births occurred in a hospital setting.

Of the 323 women interviewed, 71% were not currently using a form of modern contraception. Out of those women, 52% reported that they would like to be. The most commonly cited reasons for not using modern contraception included fear of after effects (43%), advanced maternal age/infertility (19.5%), and desire to become pregnant (10.7%).

DISCUSSION

There is currently a significant unmet need for contraception and family planning programs in rural villages in eastern Uganda, as elucidated by UVP's household survey results. The limitations of this survey included the format of household surveying being less likely to reach certain populations, such as women who work outside the home in the town or trading center, or adolescent females who would be attending secondary school. Our survey was only completed by female heads of the household, whereas the Uganda DHS has continually shown a greater need for family planning services amongst unmarried, sexually active women. Thus, the need amongst the population overall, including adolescent females and unmarried young adults, is likely even higher than these figures reflect.

Illustrating the barriers faced by women in the village in seeking family planning services, a large majority of the women surveyed were not using any modern method of birth control, and more than half those women stated they would like to be. Concerns about the safety of modern birth control methods are high in this population, since rumors of embarrassing or dangerous side effects are prevalent. Future efforts by Uganda Village Project will be aimed at further assessment of the specific needs of adolescent and young, unmarried females in our target communities and how they can better be served, as well as trying to improve accessibility of discreet family planning services for those who do not wish to attend public educational events.

CONCLUSION

By surveying villages at the household level, assessing the specific needs of village residents, and providing educational and interventional outreaches focused on reproductive health and the provision of family planning services in conjunction with local public health centers, Uganda Village Project hopes to continue to work to address the needs of people living in rural eastern Uganda.

References

1. Uganda Bureau of Statistics (UBOS) and ICF. Uganda Demographic and Health Survey 2016: Key Indicators Report. 2016.
2. WHO. Global health estimates 2015: deaths by cause, age, sex, by country and by region, 2000–2015. Geneva: WHO; 2016.
3. WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Trends in maternal mortality: 1990 to 2015: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: WHO; 2015. Filippi V, Chou D, Ronsmans C, et al. Levels and Causes of Maternal Mortality and Morbidity. In: Black RE, Laxminarayan R, Temmerman M, et al., editors. Reproductive, Maternal, Newborn, and Child Health: Disease Control Priorities, Third Edition (Volume 2). Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2016 Apr 5. Chapter 3.
4. Ganchimeg T, et al. Pregnancy and childbirth outcomes among adolescent mothers: a World Health Organization multicountry study. *Bjog*. 2014;121(Suppl 1):40-8.

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Disclaimer

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Tele-ECHO for Point-of-Care Ultrasound in Rural Kenya: A Feasibility Study

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ABSTRACT

BACKGROUND: Geographical isolation limits continuous point-of-care ultrasound (PoCUS) education for healthcare providers in rural Kenya. This study evaluates the use of the Project ECHO (Extension for Community Healthcare Outcomes) videoconference platform to connect health care providers in rural Kenya with PoCUS trainers at Brown University.

METHODS: Twelve PoCUS trainees from 11 clinics were included in the study. Every week, trainees participated in a 2-hour Tele-ECHO session via Zoom. Attendance was logged onto iECHO. A Qualtrics survey was used to collect participant feedback.

RESULTS: Trainees faced difficulty with computer-based Wi-Fi connection and mostly used smartphone-based Internet. Whatsapp messaging was preferable to email for Tele-ECHO notifications. Work obligations kept some trainees from participating. The majority of participating trainees felt that the didactic material was relevant to their practice.

CONCLUSION: Telementoring through Project ECHO was found to be an acceptable adjunct to PoCUS training for rural trainees. Internet access was primarily smartphone-based.

KEYWORDS: ultrasound, Tele-ECHO, training, rural, Kenya

BACKGROUND

The use of point-of-care ultrasound (PoCUS) benefits patient screening, accuracy of diagnosis and management for a wide range of indications in low- and middle-income countries (LMICs).^{1,2} Several studies examining patient outcomes in low- resource settings revealed ultrasound findings made significant contributions to treatment plans in medical, surgical and obstetric care specialties.^{2,3,4} Evidence of the advantages of PoCUS as well as improvements in cost and ease of use has contributed to growing interest in applications for ultrasound services in LMICs. However, challenges in training and poor access to ultrasound machines persist around the world. In a survey of health care professionals in

LMICs in 2015, providers identified lack of training, insufficient access to equipment and inadequate maintenance as the most significant barriers to ultrasound use.⁵ Additional issues include the lack of robust frameworks for image review and feedback largely due to poor infrastructure and limited Internet connectivity.

Different telemedicine and teleradiology platforms have been employed to bridge the gap between providers in remote areas and specialists at teaching institutions.⁶ International telehealth services reveal significant improvements to quality of patient care, patient diagnosis, and cost.^{7,8}

While telemedicine programs provide direct patient care, telementoring services train health care providers who can then provide these services locally with the benefit of building local capacity. Education-oriented telementoring programs contribute to improved access to specialty care. For example, telementoring programs were shown to be a feasible and effective option for training health care providers in low-resource settings in Guatemala.⁹

For ultrasound instruction specifically, several studies have demonstrated that remote training programs offer a viable option.^{10,11,12} Telementoring services that expand ultrasound training have been shown to improve provider knowledge and specificity of differential diagnoses.⁸ A pilot study revealed beginner ultrasound users were able to identify an ejection fraction after telementoring training through Google Glass technology.¹³ Telementoring is a useful supplement to PoCUS training programs in resource poor areas because it enables specialists to provide remote support, education and feedback to their trainees. It also allows for continued training without requiring trainees to leave their already under-resourced facilities for extended training in an academic center.

In 2013, a point-of-care ultrasound (PoCUS) training program was developed to train rural Kenyan providers on point of care ultrasound applications, including the Extended Focused Assessment with Sonography for Trauma (E-FAST), thoracic ultrasound, basic ECHOCardiography and focused obstetric ultrasonography.¹⁴ This program was coupled with ultrasound machine donation. Based on feedback from trainees, the main barriers that impede routine use of PoCUS include lack of guidance while scanning at their facilities, lack of frequent feedback on their scans and limited interaction with trainers outside of the scheduled sessions 3 times

a year.¹⁵ Therefore, the goal of this pilot study was to explore the utility and acceptability of Project ECHO as a teleremoting platform to connect PoCUS trainees in rural Kenya with trainers from Brown University for the purpose of continued education and feedback.

PROJECT ECHO

Project ECHO (Extension for Community Healthcare Outcomes) is a teleremoting platform developed with the primary aim of providing continuous medical education, guided practice and capacity building by connecting specialists to health care providers working in remote low resource areas.¹⁶ It is distinct from telemedicine in that the focus is not on virtual patient care, but on developing local experts who can then provide high quality care at their own institutions. The platform uses a 'Hub' and 'Spoke' model whereby specialists or experts at the Hub and community-based health care providers at several spoke sites schedule regular Tele-ECHO clinics through video conferencing. Providers present patient cases and ask questions about best practices. Experts provide advice and mentorship, supplemented with didactics and demonstration of skills and modeling. Project ECHO has inbuilt tools that allow for program evaluation at every stage of implementation, making it particularly well suited for this project.

METHODS

We assessed the utility and acceptability of the Tele-ECHO clinic sessions among POCUS trainees in rural Kenya. Twelve trainees from 11 clinics (Figure 1) were included in

the study. Trainees were medical officers (medical school graduates who have also finished 1 year of internship), clinical officers (graduates from a 3-year clinical medicine diploma program), nurses, and radiographers. These trainees were among a cohort that had received prior PoCUS training, and had a donated ultrasound machine for use at their health care facility. The study participants received funds to purchase 3G-network access through their smartphones. Training sessions took place once a week from June 22 through August 18, 2018. Every week, participants received a link to log on for a 2-hour Tele-ECHO session via Zoom. (Figure 2) Topics covered included: E-FAST for trauma, establishing intra-uterine pregnancy, diagnosing ectopic pregnancy, 2nd and 3rd trimester dating, establishing presentation, placental location, and fetal heart rate. Attendance was logged onto iECHO (an in-built tracking feature within the project ECHO platform).

A Qualtrics survey was sent to participants via Whatsapp on July 31, 2018 after 6 weeks of training sessions to collect participant feedback. The survey included 7 multiple-choice questions regarding their perception of the training sessions, with the option to fill in additional comments. Participants were asked about quality of the teaching sessions, Internet quality, relevance of training content, and barriers to participation.

RESULTS

Of the 12 trainees, 50% participated in the survey including 2 clinical officers, 2 radiographers, 1 medical officer and 1 nurse. The majority of participants in the survey felt the didactic material was valuable and well presented. Among

Figure 1. Clinic locations in Kenya.



Figure 2. Tele-ECHO Clinic session.



participants in the survey, 83% selected they *Strongly agree* the material was relevant to their practice. All participants selected *Agree* or *Strongly agree* that the cases were relevant and 83% selected they *Strongly agree* the material was clear and well presented. When asked if the sessions increased their confidence in ultrasound scanning, 66% replied *Strongly agree* or *Agree*. Participants primary concerns were related to their ability to participate in the Tele-ECHO sessions. Three participants endorsed poor Internet connection, and 66% reported their work schedule prevented them from attending the entire session at times.

As most trainees experienced technical difficulties accessing the Internet through their work computers, smartphone-based Internet access was found to be superior. All our trainees had their own smartphones, but they required financial support to purchase Internet bundles that would allow them to participate in 2-hour Tele-ECHO sessions every week. Zoom was selected as the videoconference platform as it performs well in low bandwidth settings. Whatsapp messaging was preferable to email for the purpose of sending Tele-ECHO notifications and for scheduling sessions.

DISCUSSION

The results of the Qualtrics survey suggest telementoring through Project ECHO is an acceptable adjunct to prior PoCUS training for rural health care providers. Our trainees were willing to participate, and felt the material presented was not only relevant to their practice but also helped them improve their confidence in ultrasound scanning. These findings are consistent with various studies that have examined the feasibility and efficacy of Tele-ECHO training programs in health care. A study on a Tele-ECHO training program in India regarding oral cancer screening and smoking cessation revealed significant knowledge gain among health care providers.¹⁷ Telementoring programs in different locations across the United States also revealed enhanced specialty knowledge and ability to care for patients.^{18,19}

These studies support our findings that telementoring is a feasible option to improve specialty knowledge among local providers. However, a study through the University of Washington Medicine Telehealth network showed no improvement in primary care providers' knowledge in treating chronic pain.²⁰

Further research is therefore needed to assess the efficacy of telementoring among our trainees.

The second key finding from this study is that the technology required for telementoring in rural Kenya is available, but financially prohibitive. Internet access is primarily achieved through smartphone use that most health care providers already own due to increasing smartphone presence in African countries. However, Internet connection through the smartphone is costly in Kenya, ranging from \$10 to \$100 per person per month. Therefore, we had to provide funding

for trainees to purchase Internet bundles for their phones. As a result, trainees were able to download the Zoom videoconferencing mobile application and to participate in 2-hour Tele-ECHO sessions. The trainees also had the option to create a hot spot using the Internet services purchased from their cell phone network.

The third key finding was that trainees struggled to attend the Tele-ECHO sessions due to competing clinical obligations. This is an expected finding given the low number of health care workers in rural Kenya. Our trainees work long hours to take care of their patients, and continued medical education is difficult to prioritize in these settings.

This study's primary limitations include small study size and low response rate to the survey. However, our experiences from this small pilot study and the responses we received gave us useful insight into the key feasibility question: "Can Tele-ECHO work as an adjunct to PoCUS training in rural Kenya?" Our findings indicate that it can work if Internet access is subsidized and if health care facilities can provide protected time for trainees to participate.

CONCLUSION

This feasibility study found that telementoring is an acceptable adjunct to established PoCUS training programs in rural Kenya. Participants found the content to be relevant and helpful to their practice. Videoconferencing via Zoom is feasible using smartphones. However, Internet access through these phones can be cost prohibitive, and future telementoring programs should keep this in mind. Health care facilities should be encouraged to release trainees from clinical duties so they can participate in telementoring sessions. Future research is recommended to examine specific areas of knowledge gain to continue to improve training programs for participants.

References

1. Becker D, et al. The Use of Portable Ultrasound Devices in Low- and Middle-income Countries: A Systematic Review of the Literature. *Trop Med Int Health*. 2016; 21(3): 294-311.
2. Sippel S, et al. Review Article: Use of Ultrasound in the Developing World. *Int J Emerg Med*. 2011; 4: 72.
3. Shah S, et al. Impact of the Introduction of Ultrasound Services in a Limited Resource Setting: Rural Rwanda. 2008. *BMC Int Health Hum Rights*. 2009; 9: 4.
4. Groen R, et al. Review: Indications for Ultrasound Use in Low- and Middle- income Countries. *Trop Med Int Health*. 2011; 16(12): 1525-35.
5. Shah S, et al. Perceived Barriers in the Use of Ultrasound in Developing Countries. *Crit Ultrasound J*. 2015; 7: 11.
6. Swanson J, et al. Web-Based Quality Assurance Process Drives Improvements in Obstetric Ultrasound in 5 Low- and Middle-Income Countries. *Glob Health Sci and Pract*. 2016; 4(4):675-83.
7. Qaddoumi J, et al. Impact of Telemedicine on Pediatric Neuro-oncology in a Developing Country: The Jordanian-Canadian Experience. *Pediatr Blood Cancer*. 2006; 48(1): 39-43.

8. Bagayoko C, et al. Medical and Economic Benefits of Telehealth in Low- and Middle-Income Countries: Results of a Study in Four District Hospitals in Mali. *BMC Health Serv Res.* 2014; 14(1): S9.
9. McConnell K, et al. Telehealth to Expand Community Health Nurse Education in Rural Guatemala: A Pilot Feasibility and Acceptability Evaluation. *Front Public Health.* 2017; 5: 60.
10. Smith A, et al. Remote Mentoring of Point-of-Care Ultrasound Skills to Inexperienced Operators Using Multiple Telemedicine Platforms: Is a Cell Phone Good Enough? *J Ultrasound Med.* 2018; 37(11): 2517-2525.
11. Poland S, et al. Telepresent Focused Assessment With Sonography for Trauma Examination Training Versus Traditional Training for Medical Students: A Simulation-Based Pilot Study. *J Ultrasound Med.* 2018; 37(8):1985-1992.
12. Winn S, et al. Remote, Synchronous, Hands-On Ultrasound Education. *Telemed J E Health.* 2015; 21(7): 593-97.
13. Russell PM, et al. First 'Glass' Education: Telementored Cardiac Ultrasonography Using Google Glass—A Pilot Study. *Acad Emerg Med.* 2014; 21 (11): 1297-99.
14. Bell G, et al. A Pilot Training Program for Point-of-Care Ultrasound in Kenya. *Afr J Emerg Med.* 2016; 6(3): 132-37.
15. Wanjiku G, et al. Assessing a point of care ultrasound training program for rural health care practitioners in Kenya. *BMC Health Serv Res.* 2018; 18(1):607.
16. Arora S, et al. Project ECHO (Project Extension for Community Healthcare Outcomes): A National and Global Model for Continuing Professional Development. *J Contin Educ Health Prof.* 2016; 36 Suppl 1: S48-9.
17. Nethan ST, et al. Project ECHO: a Potential Best-Practice Tool for Training Healthcare Providers in Oral Cancer Screening and Tobacco Cessation. *J Cancer Educ.* 2019; Epub ahead of print.
18. Gleason LJ, et al. An innovative model using telementoring to provide geriatrics education for nurses and social workers at skilled nursing facilities. *Geriatr Nurs.* 2019; Epub ahead of print.
19. Wood BR, et al. Project ECHO: telementoring to educate and support prescribing of HIV pre-exposure prophylaxis by community medical providers. *Sex Health.* 2018; 15(6): 601-605.
20. Eaton LH, et al. Telementoring for improving primary care provider knowledge and competence in managing chronic pain: A randomized controlled trial. *J Telemed Telecare.* 2018; Epub ahead of print.

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Building and Sustaining Partnerships in Health Workforce and Research Capacity in Rwanda

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ABSTRACT

Rwanda's ambitious Human Resources for Health (HRH) program comes to an end this year, having made great strides towards achieving its aim to create a large, diverse and competent health workforce, and will have graduated over 4,500 healthcare professionals since its inception in 2012. The HRH program was based on strong collaborative relationships between Rwandan and United States academic institutions and faculty and now stands poised to enter a new phase focused on sustaining the many gains achieved. Fostering career development of new Rwandan faculty and building health research capacity are key components to sustaining the mutually beneficial partnerships that have been forged over the past seven years, with the goal of creating strong Rwandan health researchers that can advance knowledge of best practices for patient care and public health, appropriate to the Rwandan context and other resource-limited settings.

KEYWORDS: human resources for health, medical education, resource-limited, Rwanda, research capacity-building

INTRODUCTION

From 1989–1997, the average life expectancy for citizens of the East African nation of Rwanda was less than 30 years – the lowest of any nation in the world.^{1,2} However, during the past two decades intensive reconstruction in Rwanda's health sector has yielded markedly steep declines in premature mortality for its population of approximately 12 million people.^{3,4} Backed by the Rwandan government's "Vision 2020" initiative launched in 2000 that established health equity as a fundamental priority among other key goals for the country, numerous investments and programs in health-care have been made; as a result, Rwanda's average life expectancy is now over 67 years – substantially higher than its surrounding neighbors – and continues to improve each year.^{3,5} Today, the majority of Rwandans have health insurance, and there is near-universal coverage for childhood vaccinations as well as access to highly active antiretroviral therapy (HAART) for people living with human immunodeficiency virus (HIV).^{1,6,7} The country has been hailed as a



Figure 1. Rwandan emergency medicine residents and international faculty outside of the ambulance entrance at the Kigali University Teaching Hospital.

"beacon of hope" by many, including former Prime Minister of the United Kingdom Tony Blair, for the many advances in health that the country has achieved since the devastation of the 1994 Rwandan genocide which claimed the lives of over 800,000 people.⁸

HUMAN RESOURCES FOR HEALTH IN RWANDA

Prior to 2011, Rwanda had fewer than 0.84 health providers (physician, nurse, or midwife) per 1,000 people.^{1,4} Rwanda was far from meeting the World Health Organization's target minimum number of health providers (4.45/1,000 people) laid out in the Sustainable Development Goals. While the country had greatly expanded access to basic health care through a robust community health worker system, there remained an enormous need for trained health providers as well as specialists.

The creation of a strong health education infrastructure was recognized as a key priority in order to produce a high-quality health workforce and thereby sustain the improvements in health outcomes achieved in Rwanda. In 2012, the Rwandan Ministry of Health's (MOH) Human Resources for Health (HRH) workgroup developed a strategy to "develop and implement long-term plans to increase

the quantity, quality and diversity of healthcare training.”¹¹ Together with the Clinton Health Access Initiative and a consortium of 22 United States academic training institutions, a 7-year (2012–2019) partnership was formed to train the next generation of Rwandan health professionals.¹ Funding for this program was primarily provided by the US Centers for Disease Control and Prevention and the Global Fund for HIV, TB, and Malaria.

Faculty from the Warren Alpert Medical School of Brown University were among the core international faculty that partnered with Rwanda’s HRH program to lead new training programs in emergency medicine, internal medicine as well as pediatrics. Other specialties prioritized for training programs in collaboration with other US academic institutions were in general surgery, obstetrics and gynecology, anesthesiology, psychiatry and neurosurgery as well as training programs in nursing, health management, and oral health. Core visiting faculty typically were deployed for 6–12 months, with visiting faculty paired or “twinned” with a Rwandan faculty member to share academic and teaching responsibilities.¹⁰ The program was designed so that new graduates of HRH training programs would longitudinally replace visiting faculty, with the goal that all teaching and care delivery would be assumed by Rwandan faculty at the conclusion of the program.¹ To ensure retention, graduates are required to sign a mandatory 4–5 year contract in the public sector.¹⁰ Now, nearing the projected end of the HRH program, it will have graduated over 4,500 students.¹⁰

In November 2018, the first class of Rwandan emergency medicine specialists graduated, joining graduates from multiple other specialties, and marking the formal handover of the emergency medicine residency training program to the new Rwandan faculty. However, the partnerships and professional connections forged over the past seven years are planned to continue in the form of intermittent visiting faculty to assist the teaching duties, as well as in growth of research collaborations between Rwandan and US researchers. These partnerships, especially in research, are key to sustaining the growth of Rwanda’s academic medical institutions and for creating strong clinical researchers that will drive evidence-based improvements in patient care and public health appropriate to the sub-Saharan African context.

RESEARCH CAPACITY IN LMICS

Key and complimentary to the development of a sustainable healthcare workforce is the investment in and development of research programming. This requires knowledge-generating infrastructure for research which engages and empowers healthcare providers to be able to address the most important, impactful and appropriate issues existing in these settings. Although research is recognized as necessary for health system development in LMICs, to date, barriers to effective research implementation persist particularly in the African

context. These barriers are multifactorial but driven largely by financial, infrastructure and human resource aspects as well as prioritization of clinical care to research needs. In the financial domain there has been a historic disconnect of priorities among funders from high-income settings in which financial support has not been most efficiently allocated to meet local research needs.¹¹ Furthermore, in most LMICs there is limited infrastructure to support research endeavors. This limitation is demonstrated in the forms of limited availability of accessible research training programs, institutional research agendas and review boards able to provide ethical oversight. In relation to human resources there exist fewer trained researchers per capita in LMICs versus HICs despite the fact that the majority of morbidity and mortality globally occurs in LMICs.¹³ Associated with this deficiency is a resultant lack of guidance and mentorship resources in LMICs, all of which is compounded by frequent migration of trained researchers.^{12,13}

It has been increasingly realized that research conducted primarily in HIC settings cannot be feasibly translated to LMIC settings, and in some cases, simply implementing guidelines designed for HIC to LMIC settings may even be harmful. One of the most notable instances of this phenomenon was the landmark FEAST trial from 2011 that showed that among pediatric patients with sepsis in sub-Saharan Africa intravenous fluid bolus administration actually increased mortality risk, contrary to findings from HICs.¹⁴ Similar findings showing discrepancies in outcomes between HIC and LMIC settings have been shown in a multitude of other studies and urge for research appropriate to LMIC contexts to be significantly scaled up.

RESEARCH CAPACITY IN RWANDA

Health research in Rwanda has historically been neglected due to a lack of sufficient staff, greater prioritization of clinical care, and paucity of mentorship. The HRH program has made significant impact on research, largely through the development of research curriculums integrated in residency programs, and by fostering collaborative research projects, which have resulted in a substantial number of publications to date. Additionally, several teaching hospitals (Kigali University Teaching Hospital, Butare University Teaching Hospital, King Faisal Hospital, Rwanda Military Hospital) have now formalized the position of a Research Division serving as an Institutional Review Board/Ethics Committee in charge of coordinating all research endeavors in the teaching hospitals.

To date, more than 80 studies have been published from partnerships between Rwandan and US researchers including: research on the use of a simplified echocardiogram strategy for heart failure diagnosis, the epidemiology and outcomes of trauma patients, and predicting mortality risks among intensive care unit patients.^{15–17} Notably, the impact



Figure 2. Rwandan resident Dr. Francois Regis Twagirumukiza teaching participants from the Emergency Medicine in the Tropics course held in May 2019.

on clinical care of the HRH training programs has also been shown, most recently with a study that showed a significant decline in ED mortality from 6.3% to 1.2% after the implementation of the EM residency program.¹⁸ Research such as the development of the Kigali modification of the Berlin definition of acute respiratory distress syndrome (ARDS) as well as for the use of the quick sepsis organ failure assessment (qSOFA) score in assessing risk of mortality among ED patients show promise for the creation of context-appropriate clinical tools specific to resource-limited settings.^{18,19}

Efforts to bolster research capacity in Rwanda have focused primarily on research curriculum development and research support. Each resident physician in Rwanda is required to complete a research project as part of their Master of Medicine (the degree received upon completion of residency program) thesis requirement. As an example of the research programs spearheaded by individual specialties, within the emergency medicine training program, research training has been supported by the Tina and Richard V. Carolan Grant for Emergency Care which has facilitated the creation of a module-based research course that has been integrated into the didactic curriculum. The Carolan Grant has also provided funding for a research coordinator fellowship; this dedicated Carolan research fellow teaches the research curriculum and assists Rwandan residents with their research theses. Finally, the Carolan grant provides funding for seed grants that residents can use to support their own research projects or so that they can present their research at regional and international conferences, and also funded a backup medical supply project to help trainees obtain the material supplies needed to provide patient care and reduce stockouts. The results of these projects have been presented by Rwandan EM residents at the Society for Academic Emergency Medicine (SAEM) Annual Meeting and at the International

Conference for Emergency Medicine (ICEM) in Seoul, South Korea this year.

Residents have displayed great enthusiasm and creativity in their research projects. Recently completed projects designed and implemented by current residents include an evaluation of gender differences in patterns of injury and trauma, an association between tuberculosis diagnosis during Rwanda's dry versus rainy season (a topic previously studied but still poorly understood in many regions of the world), and evaluating mortality outcomes in patients with traumatic intracranial bleeding by operative or non-operative management. The success of the research capacity-building programs has most recently been exemplified by a grant that was obtained by two Rwandan emergency medicine physicians (faculty Dr. Chantal Uwamahoro and resident Dr. Vincent Ndebwanimana)

to study interfacility transfers between district hospitals to Kigali University Teaching Hospital.

FUTURE DIRECTIONS FOR TRAINING AND RESEARCH IN RWANDA

Retention of new graduates is fundamental to maintaining a strong health workforce in Rwanda. In order to retain graduates, continued professional development and leadership programs are needed as well as funding to support increased numbers of faculty and to improve equipment and supplies available in teaching hospitals. With regard to career development, Rwandan faculty have had opportunities to give lectures abroad, and Rwandan trainees have participated in clinical rotations in the United States and also have had the opportunity to engage in regional and international conferences. Furthermore, as an example of reciprocal educational exchange, the Rwandan EM residents recently led the fourth "Emergency Medicine in the Tropics" course – an educational program designed and led by Rwandan clinicians and trainees to teach tropical medicine to their counterparts from high-resource settings. Rwanda has also recently begun to host trainees from other sub-Saharan African countries within their residency programs.²⁰ Other efforts to expand and improve the quality of the healthcare workforce are initiatives to develop Rwanda's pre-hospital emergency care system through dedicated training for pre-hospital providers.

Future goals for research development in Rwanda include leadership training and expanded opportunities for Rwandan resident physicians and faculty to disseminate their research. Leadership training is important for building administrative capacity and producing caring, charismatic and effective individuals. As a part of leadership training efforts, international researchers from academic institutions

work one-on-one with Rwandan faculty and resident physicians to provide guidance, counselling and mentorship. The Carolan grant also provides funding for an annual EM leadership retreat.

CONCLUSIONS

Putting in place measures to sustain Rwanda's achievements in health education and research is a foremost priority of both the Rwandan MOH and the HRH program. A key part of strengthening the capacity of Rwanda's academic medical institutions will be to support career development of Rwandan faculty through continued mentorship and leadership development, as well as to maintain existing partnerships between Rwandan and US institutions in fostering improved research capacity. Research studies designed and led by Rwandan faculty and trainees are especially needed, with continued mentorship from experienced researchers in order to develop strong Rwandan principal investigators who can produce evidence on how to address the most pressing health concerns facing the region. Also crucially needed are the resources to continue to increase access to residency programs, and increased support for Rwandan trainees with interest in academic medicine.

References

- Binagwaho A, Kyamanywa P, Farmer PE, et al. The human resources for health program in Rwanda—a new partnership. *N Engl J Med*. 2013;369(21):2054-2059.
- World Bank. World Development Indicators | DataBank. <https://databank.worldbank.org/>. Accessed June 6, 2019.
- World Bank; Rwanda | Data. <https://data.worldbank.org/country/rwanda>. Accessed June 6, 2019.
- Farmer PE, Nutt CT, Wagner CM, et al. Reduced premature mortality in Rwanda: lessons from success. *Bmj*. 2013;346:f65.
- Thomson DR, Amoroso C, Atwood S, et al. Impact of a health system strengthening intervention on maternal and child health outputs and outcomes in rural Rwanda. *BMJ Glob Heal*. 2018;3:674. doi:10.1136/bmjgh-2017-000674
- World Health Organization, Pierson DJ, Fagan K, et al. Vital sign prediction of adverse maternal outcomes in women with hypovolemic shock: the role of shock index. *Gerontology*. 2016;10(2):7. doi:10.1001/jama.2016.0287
- Ministry of Health Rwanda, PMNCH, WHO, World Bank A and participants in the R multistakeholder policy review. *Success Factors for Women's and Children's Health*; 2015.
- Blair T. 20 Years after the Genocide, Rwanda Is a Beacon of Hope. *The Guardian*. June 2014.
- World Bank; Nurses and midwives (per 1,000 people) | Data. <https://data.worldbank.org/>. Accessed June 10, 2019.
- Cancedda C, Cotton P, Shema J, et al. Health professional training and capacity strengthening through international academic partnerships: The first five years of the Human Resources for Health Program in Rwanda. *Int J Heal Policy Manag*. 2018;7(11):1024.
- Dieleman JL, Schneider MT, Haakenstad A, et al. Development assistance for health: past trends, associations, and the future of international financial flows for health. *Lancet*. 2016;387(10037):2536-2544.
- Duvivier RJ, Burch VC, Boulet JR. A comparison of physician emigration from Africa to the United States of America between 2005 and 2015. *Hum Resour Health*. 2017;15(1):41. doi:10.1186/s12960-017-0217-0
- Sewankambo N, Tumwine JK, Tomson G, et al. Enabling Dynamic Partnerships through Joint Degrees between Low- and High-Income Countries for Capacity Development in Global Health Research: Experience from the Karolinska Institutet/Makerere University Partnership. *PLoS Med*. 2015;12(2):e1001784. doi:10.1371/journal.pmed.1001784
- Maitland K, Kiguli S, Opoka RO, et al. Mortality after fluid bolus in African children with severe infection. *N Engl J Med*. 2011;364(26):2483-2495.
- Mbanjumucyo G, George N, Kearney A, et al. Epidemiology of injuries and outcomes among trauma patients receiving prehospital care at a tertiary teaching hospital in Kigali, Rwanda. *African J Emerg Med*. 2016;6(4):191-197.
- Riviello ED, Kiviri W, Fowler RA, et al. Predicting mortality in low-income country ICUs: the Rwanda Mortality Probability Model (R-MPM). *PLoS One*. 2016;11(5):e0155858.
- Aluisio AR, Barry MA, Martin KD, et al. Impact of emergency medicine training implementation on mortality outcomes in Kigali, Rwanda: An interrupted time-series study. *African J Emerg Med*. 2019;9(1):14-20.
- Riviello ED, Kiviri W, Twagirumugabe T, et al. Hospital incidence and outcomes of the acute respiratory distress syndrome using the Kigali modification of the Berlin definition. *Am J Respir Crit Care Med*. 2016;193(1):52-59.
- Aluisio AR, Garbern S, Wiskel T, et al. Mortality outcomes based on ED qSOFA score and HIV status in a developing low income country. *Am J Emerg Med*. 2018;36(11). doi:10.1016/j.ajem.2018.03.014
- Cancedda C, Binagwaho A. The human resources for health program in Rwanda: a response to recent commentaries. *Int J Heal Policy Manag*. 2019;8(7):459-461.

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Developing a Novel Mobile Health (mHealth) Tool to Improve Dehydration Assessment and Management in Patients with Acute Diarrhea in Resource-Limited Settings

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ABSTRACT

Dehydration due to diarrhea is one of the main causes of death worldwide, yet no clinical tools for accurately assessing and managing dehydration in patients with acute diarrhea have been created for low- and middle-income countries (LMICs). In 2012, Brown University's Department of Emergency Medicine began partnering with the International Centre for Diarrhoeal Disease, Bangladesh in order to address some of these gaps. Out of this partnership, the DHAKA Score, a clinical diagnostic model for assessing dehydration in children under five years of age with acute diarrhea, was developed. Building upon the success of the DHAKA Study, researchers at both institutions have launched the NIRUDAK Study earlier this year to develop and validate similar age-specific clinical diagnostic models yet shifting the patient population to those over five. Improving diagnostic approaches and fluid management may reduce unnecessary utilization of already limited healthcare resources as well as the morbidity and mortality that occurs due to misdiagnosis.

KEYWORDS: dehydration assessment, diarrhea management, mHealth, developing country or LMIC

BACKGROUND

Globally, diarrhea remains one of the most common and deadly acute conditions, second only to upper respiratory infections. According to the Global Burden of Disease Study in 2015, there were nearly 2.4 billion cases of acute diarrheal illness globally.¹ However, there may, in fact, be many more cases as medical care is sought in fewer than 30–50% of cases in resource limited settings.² While the typical course of diarrheal illness is self-limiting and benign, approximately 5% of cases in adults and older children (21.5 million diarrheal episodes annually) result in higher disease severity thus requiring advanced medical management.² Despite recent strides in combating mortality, diarrheal disease is still the 5th leading cause of years of life lost globally, accounting for more than 1.3 million deaths annually, including 813,000 deaths in adults and children over five years of age.³

While a sizeable body of research on diarrheal illness in children under five years of age exists, less is understood about diarrheal illness in older children and adults. In comparison

to the common viral causes of diarrheal illness in children less than five years of age, such as rotavirus and norovirus, bacterial causes predominate in older children, adolescents, adults, and the elderly globally.⁴ Worldwide, *Vibrio cholerae* O1/O139 and Enterotoxigenic *Escherichia coli* (ETEC) are the most common causes of acute diarrhea in hospitalized patients over five years of age, while *Salmonella* and *Shigella* species were the most common etiologies in outpatient settings.⁴ Evidence suggests that the elderly are especially at risk for higher diarrhea morbidity and mortality in both high-income countries as well as in low- and middle-income countries (LMIC). In the United States, 83% of all diarrheal deaths occur in patients over age 65.^{5,6} In Dhaka, Bangladesh, patients over 60 years of age with acute diarrheal illnesses are more likely to require hospital admission and have a more severe course of illness than younger patients.^{5,6} This difference in disease severity could be attributed to various reasons including age-related structural and functional gastrointestinal tract changes, underlying chronic illnesses, concomitant use of medications, impaired sense of thirst, poor baseline nutrition and hydration status or a more subtle clinical presentation of diarrheal illness.⁶

Based on their Integrated Management of Childhood Illness (IMCI) strategy, the World Health Organization (WHO) currently recommends assessing children under five years of age presenting with acute diarrhea for dehydration and classifying their level of dehydration severity into three categories: severe, some, or none based on the presence of four different clinical signs.⁷ For children with severe dehydration, immediate treatment with intravenous fluid is recommended, while those with some dehydration should receive oral rehydration solution (ORS). Those with no dehydration require only expectant management.⁷ The IMCI dehydration algorithm still remains the most common clinical tool for assessing dehydration status. However, several studies have found it to be a poor predictor of dehydration when compared to the gold standard of percentage weight change with rehydration.^{8–10}

Several research institutions and organizations have attempted to develop better tools for assessing dehydration in children. The most commonly used diagnostic dehydration scales include the Clinical Dehydration Scale (CDS; created at the Hospital for Sick Children in Toronto) and the Gorelick Scale (developed at the Children's Hospital of Philadelphia).⁸ While prior studies have found these tools to



Figure 1. Emergency ward at icddr,b's Dhaka Hospital. [PHOTO: DR. SABIHA NASRIN]

be relatively accurate for predicting dehydration in young children in high-income country settings, they have not been well validated in low- and middle-income countries nor have they been tested in older children or adults.^{8,11–15} The Gorelick scale, and the Clinical Dehydration Scale (CDS) Misclassification of dehydration is a significant diagnostic problem as underestimation of a patient's dehydration status could potentially result in further medical complications, such as acute renal failure or even death, while overestimation could result in increased risk of hospital-related adverse events, additional hospital expenses as well as increased burden on the patient's family, especially in low- and middle-income countries.^{8,14,16}

RESEARCH SETTING AND PARTNERSHIP

Initially founded in the early 1960s under the South-East Asia Treaty Organization, Cholera Research Laboratory (now known as the International Centre for Diarrhoeal Disease Research, Bangladesh or more simply icddr,b since 1978) has developed an international reputation as a preeminent research/treatment center for developing and testing interventions specifically designed to meet the needs of Bangladesh and other LMICs.¹⁷ Such areas of research include malnutrition, respiratory disease, vaccine testing, maternal and child health and health systems. Research conducted at icddr,b has produced innovative solutions to some of the most prominent global health concerns and generated evidence that has influenced health policy globally. A few of its most notable achievements include the development of the ORS, providing key evidence underpinning the WHO's decision to recommend zinc as a way to shorten the duration and prevent future cases of diarrhea, providing data that illustrated maternal immunization with tetanus toxoid before pregnancy protects mothers from neonatal tetanus, and detailing treatment guidelines for severe malnutrition that are now standardized protocol endorsed by the WHO.¹⁷

Icddr,b's commitment to developing high-quality research studies has led to its robust network of scientific collaborators and implementing partners worldwide. In 2012, Brown University's Department of Emergency Medicine began partnering with icddr,b in order to address some of the above-mentioned gaps in diagnostic tools to assist clinicians in assessing and managing dehydration in patients with acute diarrhea in LMICs. Through a five-year research grant from the United States National Institutes of Health (NIH) Fogarty International Center (PI Levine, K01TW009208), researchers at Brown University and icddr,b collaborated on the DHAKA Study together to develop and test new clinical prediction models, ultrasound-based tools and mobile health tools for assessing dehydration in young children under five in Bangladesh.

DEHYDRATION ASSESSMENT IN YOUNG CHILDREN

As part of this research, the DHAKA (Dehydration: Assessing Kids Accurately) Score, the first clinical diagnostic model for assessing dehydration in children under five years of age with acute diarrhea in LMIC settings, was developed.¹⁶ The DHAKA Score was empirically derived and externally validated in a low-income country, to avoid the limitations of the other models, like CDS.^{12,13} Using the gold standard of percent weight change with rehydration, the DHAKA Score categorized patients as severe dehydration (>9% weight change), some dehydration (3–9% weight change) or no dehydration (<3% weight change).¹⁸ Of children enrolled in the study, 49% had no dehydration, 37% had some dehydration and 14% had severe dehydration.¹⁶ Each 1-point increase in the DHAKA Score was found to predict an increase of 0.6% in percent dehydration and increase the odds of dehydration by 1.4.¹⁶ When compared to the IMCI algorithm, both the accuracy and reliability of the DHAKA score were superior.¹⁶

The use of mHealth tools can also facilitate the evaluation of dehydration in patients with diarrhea, with a study

showing greater reliability when an mHealth-supported WHO algorithm was used rather than the standard WHO algorithm printed on a laminated card.¹⁹ In conjunction with clinical predictor tools, point-of-care ultrasound can be a useful adjuvant in predicting dehydration in children with diarrhea. By measuring aorta-to-IVC ratio, point-of-care ultrasound has been shown to be a significant predictor of the percent dehydration, with each 1-point increase predicting a 1.1% increase in the percent dehydration.²⁰ However, the sensitivity and specificity were not sufficiently robust for it to be used as an independent screening tool.

DEHYDRATION ASSESSMENT IN OLDER CHILDREN AND ADULTS

Despite the progress in evaluating and developing a clinical diagnostic scale, the patient population for such diagnostic tools has predominantly been children under five years of age. This leaves out a significant portion of patients who are also affected by diarrheal illnesses – those over five. As such, researchers at Brown University and icddr,b have continued their partnership and launched the NIRUDAK Study earlier this year at icddr,b's Dhaka Hospital (Figure 1) to address the above-mentioned limitations. NIRUDAK, which means “dehydrated” in Bangla, stands for Novel Innovative Research for Understanding Dehydration in Adults and Kids. The overall objective of this prospective study is to develop and validate new age-specific clinical diagnostic models to assess dehydration, thereby building upon the success of the DHAKA Study.^{16,18,19} However, the focus of the study will be in patients over five years of age presenting with acute diarrhea. Once these age-specific models are developed, they will be incorporated into a mobile health application so that clinicians will not only be able to more accurately diagnose dehydration severity but will also better determine the optimal management strategy for patients with acute diarrhea.

The aim of the NIRUDAK Study is threefold:

1. To derive and internally validate three age-specific clinical diagnostic models for the assessment of dehydration severity in older children/adolescents, adults and the elderly.
2. To incorporate these models into a mobile health tool to be used by clinicians.
3. To validate this mobile health tool in a new population of patients.

NIRUDAK Study's research aims will be accomplished through two large, prospective observational studies, which will occur in three phases over the next five years. The first phase will focus on achieving Aim 1. During this derivation phase, data on clinical signs and symptoms shown to correlate with dehydration severity will be collected from patients presenting to the rehydration unit of icddr,b. Using advanced machine learning techniques, the best clinical predictors for each individual age group will be selected against the gold

standard of percent weight change with rehydration to develop diagnostic models. The second phase, or formative phase, will use the models from the derivation phase to develop an innovative new mobile health tool to guide clinicians in the management of dehydration. Formative focus groups and in-depth interviews will also be conducted to further improve its usability. Finally, in the validation phase the application's accuracy and reliability will be validated in a new population of patients presenting with acute diarrhea at icddr,b.

Since early June 2019, 503 patients have been enrolled in the first phase of the NIRUDAK study with 53% of them being males and 47% females. So far, 97% of patients enrolled in the study have sufficient follow-up information to calculate their percent weight change with rehydration, our gold standard measure for dehydration. Among those enrolled in the study, 83.1% were characterized as being severely dehydrated by triage nurses and received IV fluid, while the rest were characterized as having some dehydration and given ORS. However, according to the study's gold standard of percent weight change, only 11.1% were severely dehydrated and should have received IV fluids while 60.7% had some dehydration and 28.2% of patients had no significant dehydration. (Figures 2,3)

Figure 2. Sex Distribution of Patients Enrolled in NIRUDAK Study as of June 2019

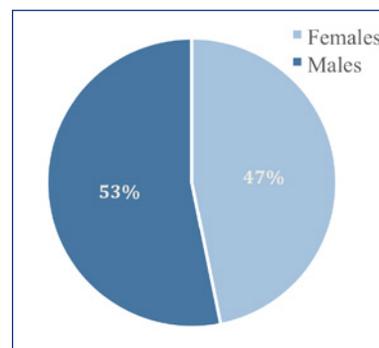
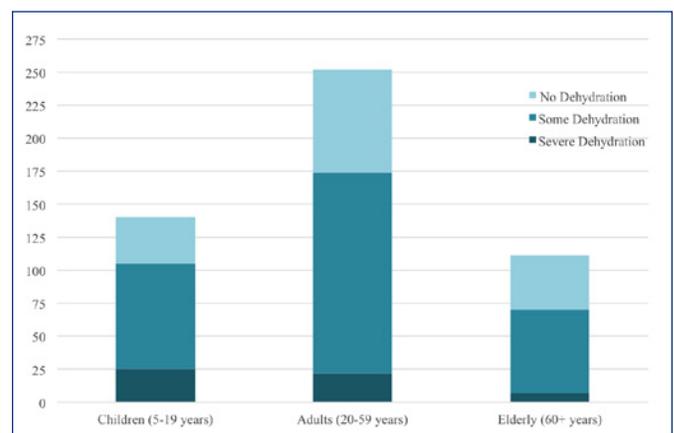


Figure 3. Dehydration Status Distribution within Each Age Group of Patients Enrolled in the NIRUDAK Study



CONCLUSION

Developing such models, like the DHAKA Score and the upcoming NIRUDAK Score, and incorporating them into mobile health applications has the potential to help clinicians rapidly and accurately not only determine the severity of dehydration in patients with acute diarrhea but also choose the optimal rehydration strategy. Those 28.2% of enrolled patients who were admitted with no significant dehydration would have most likely received expectant management at home rather than IV fluids and/or ORS with the help of such diagnostic tools. While the intended use of this tool will be in hospitals or clinics by hospital staff, one of the major uses will be during epidemics of cholera in humanitarian settings, where the numbers of patients can overwhelm available resources. Additionally, this tool can be incorporated into international/local guidelines for dehydration management. Making such distinctions in characterizing dehydration could reduce unnecessary utilization of already limited healthcare resources. More importantly, improved diagnostic approaches and fluid management may in turn be shown to reduce both the morbidity and mortality that occurs as a result of misdiagnosis.

References

1. GBD 2015 Disease and Injury and Prevalence Collaborators. Global, regional and national incidence, prevalence and years lived with disability for 310 diseases and injuries, 1990 - 2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388:1545-1602.
2. Lamberti L, Fischer Walker C, Sack D, Black R. Systematic review of diarrhea duration and severity in children and adults in low- and middle-income countries. *BMC Public Health*. 2012;12(276).
3. Mortality GBD C of DC. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388(1459):544.
4. Fischer Walker CL, Sack D, Black RE. Etiology of diarrhea in older children, adolescents and adults: a systematic review. *PLoS Negl Trop Dis*. 2010;4(768).
5. Hall A, Curns A, McDonald L, Parashar U, Lopman B. The roles of *Clostridium difficile* and norovirus among gastroenteritis-associated deaths in the United States, 1999 - 2007. *Clin Infect Dis*. 2012;55(216):23.
6. Faruque ASG, Malek MA, Khan A, Huq S, Salam M, Sack D. Diarrhoea in elderly people: aetiology, and clinical characteristics. *Scand J Infect Dis*. 2004;36(204):8.
7. WHO. *IMCI: Integrated Management of Childhood Illness*.; 2005.
8. Pringle K, Shah SP, Umulisa I, et al. Comparing the accuracy of the three popular clinical dehydration scales in children with diarrhea. *Int J Emerg Med*. 2011;4(1):58. doi:10.1186/1865-1380-4-58
9. Levine AC, Munyaneza RM, Glavis-Bloom J, et al. Prediction of Severe Disease in Children with Diarrhea in a Resource-Limited Setting. Carlo WA, ed. *PLoS One*. 2013;8(12):e82386. doi:10.1371/journal.pone.0082386
10. Jauregui J, Nelson D, Choo E, et al. External Validation and Comparison of Three Pediatric Clinical Dehydration Scales. Carlo WA, ed. *PLoS One*. 2014;9(5):e95739. doi:10.1371/journal.pone.0095739
11. Kinlin LM, Freedman SB. Evaluation of a Clinical Dehydration Scale in Children Requiring Intravenous Rehydration. *Pediatrics*. 2012;129(5):e1211-e1219. doi:10.1542/peds.2011-2985
12. Falszewska A, Szajewska H, Dziechciarz P. Diagnostic accuracy of three clinical dehydration scales: a systematic review. *Arch Dis Child*. 2018;103(4):383-388. doi:10.1136/archdischild-2017-313762
13. Falszewska A, Dziechciarz P, Szajewska H. The diagnostic accuracy of Clinical Dehydration Scale in identifying dehydration in children with acute gastroenteritis: a systematic review. *Clin Pediatr*. 2014;53(1181):8.
14. Pomorska D, Dziechciarz P, Mduma E, Gidion J, Falszewska A, Szajewska H. Comparison of three dehydration scales showed that they were of limited or no value for assessing small children with acute diarrhoea. *Acta Paediatr*. 2018;107(7):1283-1287. doi:10.1111/apa.14284
15. Falszewska A, Dziechciarz P, Szajewska H. Diagnostic accuracy of clinical dehydration scales in children. *Eur J Pediatr*. 2017;176(8):1021-1026. doi:10.1007/s00431-017-2942-8
16. Levine A, Glavis-Bloom J, Modi P, Al E. External validation of the DHAKA score and comparison with the current IMCI algorithm for the assessment of dehydration in children with diarrhoea: a prospective cohort study. *Lancet Glob Heal*. 2016;4(744):51.
17. icddr,b - About us. <https://www.icddr.org/about-us>. Accessed June 12, 2019.
18. Levine A, Glavis-Bloom J, Modi P, Al E. Empirically Derived Dehydration Scoring and Decision Tree Models for Children With Diarrhea: Assessment and Internal Validation in a Prospective Cohort Study in Dhaka, Bangladesh. *Glob Heal Sci Pr*. 2015;3(405):18.
19. Meisner L, Bilal S, Nelson E, Et al. Evaluation of standard and mobile health (mHealth)-supported clinical diagnostic tools for assessing dehydration in patients with diarrhea in rural Bangladesh. In: *ASTMH 66th Annual Meeting*. ; 2017.
20. Modi P, Glavis-Bloom J, Nasrin S, et al. Accuracy of Inferior Vena Cava Ultrasound for Predicting Dehydration in Children with Acute Diarrhea in Resource-Limited Settings. Simeoni U, ed. *PLoS One*. 2016;11(1):e0146859. doi:10.1371/journal.pone.0146859

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Disclaimer

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From Rhode Island to Colombia: Brown University Emergency Physicians Lead a Collaborative Consortium in a Post-Conflict Colombia

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ABSTRACT

INTRODUCTION: Colombia represents a country in transition, from decades of devastating civil war to a post-conflict era of peace building, to the recent management of the influx of thousands of Venezuelan migrants. Brown University, along with Colombian partners, are leading the way in an international, multi-institutional consortium with the goal of emergency medicine capacitation across Colombia.

PROGRAM IMPLEMENTATIONS: Through these collaborative efforts, exchange programs for residents and faculty alike have been successfully established. A baseline assessment of emergency medicine education for medical students is underway. By the end of 2019, the Harvard Humanitarian Initiative (HHI) will launch an online tool in multiple languages, including Spanish, to help medical and nursing educators conduct systematic needs assessments of the way in which conflict has impacted medical and nursing schools.

CONCLUSIONS: Successful avenues for collaboration and partnership are described between Brown Emergency physicians and Colombian collaborating universities. These programs help to build capacity in Colombia and also provide education and support for residents and faculty at Brown University. Current work will see these programs grow into the future.

KEYWORDS: Colombia, emergency medicine, development

INTRODUCTION

Colombia is a country of both immense progress as well as challenges. Colombia's 5 decades of internal armed conflict between the government, guerrilla groups, paramilitaries and drug cartels has led to the 2nd largest number of internally displaced people (IDP) in the world.^{1,2,3} Currently, Colombia has transitioned into a post-conflict era although challenges remain.^{4,5,6} Most recently, the Colombian government has opened its border, welcoming over 1 million migrants escaping the regime and famine in Venezuela.

In the context of this changing landscape, Brown emergency medicine (EM) providers have partnered with Colombian

EM physicians to create a multi-institutional, international consortium with the goal of improving emergency care delivery and emergency medicine training. The partnerships have been grown since initial collaboration seven years ago. Students and residents participate for 2–6 weeks during an elective time period with funding from the medical school or residency program. Bogotá offers an ideal setting in Latin America with accessible housing near the universities, no extra immunizations required nor extra security procedures needed. Colombia has become a major tourist attraction in South America and travel to the main cities is safe.

To this end, the consortium has focused on the development and support of exchange programs, the implementation of the WHO Basic Emergency Care (BEC) training targeted at low-resource settings, the creation of community-based public health projects for IDP and ex-FARC (*Fuerzas Armadas Revolucionarias de Colombia*/Revolutionary Armed Forces of Colombia) vulnerable populations, and humanitarian disaster relief work for the Venezuelan migrant population.

DEVELOPMENT AND GROWTH OF EMERGENCY MEDICINE THROUGH EXCHANGE PROGRAMS

The team, led by Christian Arbelaez, MD, MPH, Vice Chair for Academic Affairs in the Department of Emergency Medicine at Brown, has been aiding in the development of emergency medicine through clinical exchanges, educational programs, academic collaborations, and leadership development.^{7,8} Recognizing the educational value of understanding care in different settings and cultures, the team has established bi-directional exchanges. Numerous emergency physicians and trainees from Colombia have completed formal US observerships which include tailored training experiences, providing participants with skills to take back and incorporate into home departments.

Recently, the team has established an exchange between EM residents at Brown University and Universidad Javeriana in Bogotá, Colombia. Since coming to Brown University, Dr. Arbelaez has been able to leverage the unique resources in Rhode Island to continue his international work with local support from Brown Emergency Physicians, Lifespan, and Brown University. Thus, two inaugural Brown residents made the trip to Colombia this past March, working in San Ignacio Hospital, one of the busiest institutions in Bogotá.



Team photo on bridge that previously separated the front line of combat between the Colombian government and the FARC guerilla group.

Through this exchange, the residents gained a broader understanding of healthcare in a global environment. Exposed to new patterns of departmental flow and patient management, they were able to witness excellent quality care ongoing at San Ignacio while sharing their own experiences at Brown. They partnered with the simulation center to assist in teaching, and gained from the knowledge of local faculty who taught them innovative procedural techniques such as subclavian-guided central lines.

In recognizing that language is integral to cultural and interpersonal understanding, the residents also focused on cultural immersion and language development by enrolling in the Language Center of Universidad Javeriana. Their experience led to a deeper appreciation for the work of emergency physicians abroad and the value of international collaboration. The team looks forward to welcoming residents from Universidad Javeriana to Rhode Island Hospital in the near future. In addition, potential exchanges for additional specialties are being explored.

Focusing at all levels of education, the team has also created opportunities for faculty development. Several academic projects describing the state of emergency medicine and of the residency programs in Colombia have been published with faculty from Colombian Universities.^{7,8} In October 2019, the team will welcome Dr. Leonar Aguiar Martínez as guest lecturer. Dr. Aguiar learned medicine through the years of conflict in Colombia, with first-hand experience as

a new physician practicing in the Northern city of Cúcuta. As his career progressed, he witnessed the transition of the country into a post-conflict era. Dr. Aguiar became instrumental in the establishment of emergency medicine as a new specialty in Colombia bringing home expertise gained through an advanced fellowship in emergency medicine at the Ronald Reagan Institute of Emergency Medicine at George Washington University in Washington, D.C.

Now, he practices as an attending physician within the Emergency Department at San Ignacio Hospital. During a lecture series for health professionals, students and the community, Dr. Aguiar will share his expertise on both the clinical practice of emergency medicine in the changing landscape of a post-conflict Colombia, as well as the development of emergency medicine as a specialty in Latin America.

IMPROVEMENT OF EMERGENCY CARE DELIVERY IN RURAL AREAS THROUGH WHO BASIC EMERGENCY CARE (BEC) TRAINING

Initial results from WHO BEC rollouts in Africa indicate that providing basic emergency medical training in a low-resource setting results in a significant increase in knowledge of such care.⁹ Currently involved in the course translation, the team is planning to pilot a novel application of the BEC in Bogotá by integrating a training-of-the-trainers course into the medical school curriculum. This will arm new graduates

both with the knowledge and ability to teach acquired emergency skills across rural Colombia. Despite great strides, most emergency care in Colombia is provided by medical graduates with no residency or specialty training. This is especially true in rural, limited-resource settings. Introduced in May, a national longitudinal survey is currently following new physicians during their first six months out of medical school to assess their confidence and knowledge of emergency care. Using this information, the team will assess how to best support emergency medicine education during medical school for these future general practitioners.

CREATION OF COMMUNITY-BASED PUBLIC HEALTH PROJECTS FOR IDP AND EX-FARC VULNERABLE POPULATIONS AFFECTED BY THE CONFLICT

In conjunction with colleagues from the Harvard Humanitarian Initiative and the Open Hands Initiative (OHI), Drs. Arbelaez and Patiño crossed cultural barriers to bring students from the Harvard School of Public Health and the Universidad de Antioquia together. OHI is a non-profit foundation that is based in New York City. Using a public health lens, their innovative course guided students through an examination of the reforms in education, transportation and urban design that led to the transformation of the city of Medellin, Colombia. It also asked students to assess current healthcare hurdles faced by the city's internally displaced population and create solution-driven recommendations and briefings, which they presented to stakeholders in Bogotá. Some of the students became involved in public health projects in an IDP settlement through connections they established during the course. Universidad de Antioquia and Brown University Faculty remain in touch.

In 2017 Universidad de Antioquia hosted the 3rd National Congress of Emergency Medicine in Colombia, with participation of Drs. Arbelaez and Patiño, who also came back in July 2018 to visit Universidad de Antioquia as part of their work as Ambassadors of the American College of Emergency Medicine to Colombia.

The Harvard Humanitarian Initiative, in close collaboration with the team, has conducted a survey to understand the impact of conflict on medical and nursing education in Colombia during the period of 1990–2016. Preliminary findings included the major socioeconomic and mental health impacts on medical and nursing students from rural and conflict-affected areas. Severely restricted access to medical education within these communities exacerbated the lack of local health care providers. The importance of shifting attitudes in the classroom towards students who may have formerly been combatants emerged as a theme, as did the profound need for soft skills such as conflict resolution and patient advocacy training for students of medicine and nursing who participate in a year of governmental social service

(Servicio Social), practicing in resource-limited settings.

Conflict-related social trauma has affected faculty, students, and patient populations, and the struggle to embrace coexistence in disparate parts of Colombian society extends to patient populations. In order to help promote a cadre of healthcare providers for low-resource areas, it will be necessary to improve access to medical and nursing education for a wider range of low-income students; it will also require thoughtful incentives to promote graduates to work in these areas past the 6–12 month of Servicio Social. Most medical and nursing faculty report that graduates participating in the Servicio Social program – especially when they are assigned to conflict-affected areas or “Red Zones” – lack adequate mental and emotional preparedness to succeed at providing healthcare. Possible interventions were suggested, including mental health and security trainings for those interested in the Red Zone or active conflict area work. New cross-disciplinary research related to the growth of post-conflict studies in Colombia may pose multiple opportunities for addressing healthcare needs.

HUMANITARIAN DISASTER RELIEF WORK FOR THE VENEZUELAN MIGRANT POPULATION: FUTURE DIRECTIONS

Looking forward, the team is examining how to best aid in the current Venezuelan crisis.

As part of the Ministry of Health, Health Cluster, Brown emergency physicians have been participating in regular meetings with the local Pan American Health Organization office to identify the best way to support ongoing efforts to provide emergency care to Venezuelan immigrants. To this end, the team is working to finalize a concept note for emergency medicine training of providers along the Northern border and secure external funding.

SUMMARY

After a signed peace agreement, Colombia entered into an era of rebuilding and reconciliation. It is now facing new challenges with the arrival of over 1 million migrants due to the humanitarian crisis in Venezuela. Colombia's healthcare sector, considered one of the most advanced and robust in the region,^{5,6} is now faced with the difficult challenge of providing care to a large migrant population settling throughout the country.

Brown Emergency Medicine is currently spearheading a multi-institutional, international collaborative team dedicated to supporting emergency providers across Colombia as they continue face new challenges. However, the benefit is mutual, as students, residents and faculty come together across cultures and institutions to share, learn, and collaborate from Rhode Island to Colombia.

References

1. Shultz JM, Ceballos ÁMG, Espinel Z, Oliveros SR, Fonseca MF, Florez LJH. Internal displacement in Colombia: Fifteen distinguishing features. *Disaster Health* 2014;2(1):13–24.
2. Holmes JS, Mendizabal AP, De LFDS, et al. Identifying Municipal Risk Factors for Leftist Guerrilla Violence in Colombia. *Peace Econ Peace Sci Public Policy* [Internet] 2018 [cited 2019 Apr 18];24(2). Available from: <http://www.degruyter.com/view/j/peps.2018.24.issue-2/peps-2017-0009/peps-2017-0009.xml>
3. Uribe A, Serna L, Guerrero C, Bernal G, Vargas S. Encuesta Nacional de Demografía y Salud. :96 ENDS Colombia, 2015.
4. Economic Survey of Colombia 2017 - OECD [Internet]. [cited 2019 Apr 18]; Available from: <https://www.oecd.org/eco/surveys/economic-survey-colombia.htm>
5. Giedion U, Uribe MV. Colombia's Universal Health Insurance System. *Health Aff (Millwood)* 2009;28(3):853–63.
6. Tandon A, Murray CJ, Lauer JA, Evans DB. Measuring Overall Health System Performance for 191 Countries. 23.
7. Arbelaez C, Patiño A. State of emergency medicine in Colombia. *Int J Emerg Med* [Internet] 2015;8. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4397222/>
8. Patiño A, Alcalde V, Gutierrez C, et al. Characteristics of Emergency Medicine Residency Programs in Colombia. *West J Emerg Med* 2017;18(6):1120–7.
9. WHO | Piloting the WHO Basic Emergency Care course in Uganda, United Republic of Tanzania and Zambia [Internet]. WHO. [cited 2018 Jul 7]; Available from: <http://www.who.int/emergencies/care/dispatches/pilot-bec-course/en/>

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An Overview of the Rhode Island Hospital-Cabral y Baez Medical Exchange Program

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ABSTRACT

In recent years, there has been a surge in the number of global health programs directed by academic institutions. Global health programs take many forms, focusing on different curricular goals such as knowledge attainment of endemic diseases, community service projects, and improved foreign-language skills. This is an expository paper describing the origins and evolution of the medical exchange program between Rhode Island Hospital and Hospital Regional Universitario José María Cabral y Báez. The exchange program is unique because it is trainee-driven and has strived to maintain a bilateral educational exchange over the past 15 years. Future goals for the program include further developing a research curriculum for both institutions and creating a longitudinal relationship with a community-based state-funded clinic in Santiago, Dominican Republic.

KEYWORDS: global health, international medical exchange program, bilateral exchange, international medical elective

“What is true in the US may not be true in the Dominican Republic...This rotation offers students a chance to both teach skills that might be useful to folks in the Dominican Republic, but also to learn and hone a unique skill set required for the practice of international medicine that allows for education to be reciprocal, mutually respectful, and ideally equally beneficial to all involved.” — Amanda Noska, MD, Infectious Disease physician who participated in the Dominican Republic exchange program in 2017

International medical exchange (IME) programs are becoming increasingly more common in academic medical training in the United States (US). According to a survey by the Association of American Medical Colleges, as many as 30% of medical students report participating in a global health program during their time in medical school and an estimated 20% of US-based residency programs offer global health training.^{1,2} These IME programs typically offer short-term, service-learning electives at a host institution located in a resource-constrained setting, and often feature opportunities for medical trainees to observe the provision of care and engage with clinical research projects at the international site.¹ A growing body of literature suggests that IME experiences have a strong positive impact on medical

trainees by increasing their awareness about a wider range of diseases, improving their language skills, and exercising their cultural competency.^{3,4} Few IME programs, however, develop sustainable and bidirectional collaboration between the sites, like that between Rhode Island Hospital (RIH) and Hospital Regional Universitario José María Cabral y Báez (HRUJMCB).⁵

In 2004, the RIH Department of Medicine entered into an educational exchange agreement with the Department of Internal Medicine (IM) at HRUJMCB in Santiago, Dominican Republic (DR). HRUJMCB is a public, regional hospital that serves as the safety-net, tertiary care center for the northern half of the DR and as the main teaching hospital for three medical schools located in Santiago. The partnership was primarily spearheaded by Edward Wing, MD, an Infectious Disease (ID) physician who was Chief of Medicine at RIH and the Miriam Hospital (TMH) from 1998 to 2008 and the Dean of Alpert Medical School from 2008 to 2013. The partnership grew under the leadership of Mark Fagan, MD, Joseph Diaz, MD, Michael Stein, MD, Amos Charles, MD, and Jael Rodriguez, MD. The current director of the exchange program is Martha Sanchez, MD, an ID physician at RIH and TMH. In the DR, the program is led by Claudia Rodriguez, MD, and Francisco Mejia, MD, both IM physicians at HRUJMCB.

After considering other locations in Central America and the Caribbean, the RIH Department of Medicine chose HRUJMCB as the site for the educational exchange program primarily because of the interest of HRUJMCB faculty in participating in an academic collaboration. Additionally, the sizeable population of Dominicans in Rhode Island (RI), the ease of travel to Santiago, and the desire of many Brown University IM residents and medical students to gain international experience in a Spanish-speaking country made Santiago an advantageous location to put down roots. According to 2017 Census estimates, around 52,070 Dominicans live in Rhode Island, representing 5.1% of the total population of Rhode Island and the highest concentration of Dominicans in the US.⁶ Time spent in Santiago allows RI medical providers to have a better understanding of the culture, language, and social issues of their Dominican patients.

The program was established to be a mutually-beneficial partnership and bilateral educational exchange program in which IM residents from RIH would rotate at HRUJMCB, and IM residents from HRUJMCB would rotate at RIH and TMH in RI annually. The curriculum for participants in the DR evolves yearly with the leadership of the medical student coordinator and program director. The curriculum in

the DR includes rounding with inpatient teams at HRUJMCB, participating in morning report, social activities with HRUJMCB residents, and an outpatient experience. In the past, the Brown University students, residents and attendings participated in health outreach efforts at an outpatient clinic called “Pequeños Pasitos” located in the mountains serving an impoverished area of Santiago. They also worked in *bateys*, which are settlements around sugarcane mills primarily occupied by Haitians. Over time these experiences evolved and occasionally dissolved depending upon the sustainability of the rotation and the needs of the individual programs. More recently the exchange program has collaborated with a Primary Attention Unit, which is a state-funded clinic, that serves the community of Palo Amarillo in Santiago. Primary Attention Units are clinics that provide first-level care to a specific community. In this clinic, Brown University medical teams work together with the local general practitioners providing outpatient care and home visits. During this time, qualified Brown University medical providers have the opportunity to give educational talks on preventive medicine topics to the community.

The curriculum for Dominican residents from HRUJMCB in RI is comprised of IM and subspecialty inpatient rotations at RIH and TMH, simulation laboratory training, case discussions, and journal clubs. The visiting residents are also integrated in the different academic activities of the IM residency program, such as grand rounds and morbidity and mortality conferences. IM residents from HRUJMCB who have participated in the program have expressed how the experiences from their time working in Providence hospitals have led to systematic changes in their practice of medicine in Santiago, including improvements in patient-centered care and the practice of evidence-based medicine. In addition, with the support of faculty leadership, they have shifted the hierarchical residency training structure to one that is more inclusive of participation from medical students and interns in academic activities. A recent HRUJMCB resident who participated in the exchange stated, “We leave Providence with a broader knowledge base and feel empowered to bring changes to our institution.”

Every year, a third-year Brown University medical student is selected to work as the coordinator of the exchange program. The coordinator is given the task of recruiting and guiding the team of students, residents and attendings that will participate in the elective, as well as developing and executing a four-week curriculum that aligns with the program’s goals and philosophies (Table 1). Academic tools that coordinators have used include reading materials on cultural competency, case discussions on the challenges in the diagnosis and management of diseases in a resource limited setting, case presentations of patients seen at HRUJMCB, and weekly “Brown Rounds,” which are hospital rounds led by Brown University faculty in HRUJMCB.

A new and developing facet of the exchange program is

Table 1. Goals of the Rhode Island Hospital - Cabral y Baez Exchange Program

Primary Goals
(1) Ensure that participants’ goals and values align with those of the community in which they are working by recognizing the active process of developing a sensitivity to the suffering of others and working to prevent their marginalization.
(2) Further develop participants’ cultural competency by actively practicing the values of humility, introspection, solidarity, and social justice while rotating at Cabral y Baez.
(3) Understand the clinical presentation and management of common serious illnesses in the DR, including stroke (ischemic and hemorrhagic), complications of uncontrolled HTN, complications of uncontrolled HIV (CNS manifestations, opportunistic infections, malignancies), complications of uncontrolled DM, pneumonia and pulmonary effusions, COPD, ulcers (venous and arterial), anemia secondary to GI losses, soft tissue infections (cellulitis, fasciitis, abscesses), complicated UTI, PE, TB, and tropical diseases such as leptospirosis and dengue.
(4) Understand the structure of the Dominican healthcare system, the major causes of morbidity and mortality in the DR and the ways in which they differ from morbidity and mortality in the US.
(5) Increase understanding of Dominican culture.
(6) Assist the Cabral y Baez residents that rotate at Brown University.
Secondary Goals
(1) Understand preventive health measures for travelers to the DR.
(2) Understand the structure of medical education in the DR.
(3) Develop skill in working within the medical education system at Cabral y Baez.
(4) Develop skill in the cost-effective evaluation of illness in a resource-scarce environment.
(5) Develop increased competence in Spanish.

an experience of medical provision in Haiti. The Dominican Republic and Haiti share the Island of Hispaniola, and the migration of people and culture is very common. As many as 1 million Haitians live and work in the Dominican Republic, and a substantial number of patients at HRUJMCB are of Haitian descent.⁷ To better understand the history, culture, and medical infrastructure of Haiti, a one-week elective in Haiti has recently been developed under the leadership of Amos Charles, MD, who is the Chief of the Hospitalist section of the Department of Medicine at the Providence VA Medical Center and Neesha Nama, MD, who was the student coordinator at the time. The first iteration of the Haiti elective took place in February 2018 where participants observed and rounded at Fort Liberté Hospital and the public hospital in Cap-Haïtien. More recently, the exchange program has partnered with Henry Paul, MD, and the nonprofit organization named NOAH, which aims to provide lasting healthcare and medical resources to the community of Fort Liberté. There have been many challenges to setting up a rotation in Haiti including finding a hospital to partner with, medical interpreters to translate between Haitian Creole and English, safe housing, food, and transportation for the participants. In order to assess any potential barriers, Dr. Charles and the coordinator travel to Haiti prior to the start of the elective to assure the safety and feasibility of the trip. We hope to continue this component of the elective as it provides valuable

insight on the healthcare challenges that Haitians face, but unfortunately local political uprisings limited our ability to travel safely to this location in 2019.

The formalized cultural competency training is a new addition to the exchange program's curriculum. *Cultural competency* for medical practitioners can be defined as the ability to demonstrate compassion, respect, and responsiveness to patient needs, regardless of their gender, age, culture, race, religion, disability, and sexual orientation.⁸ A 2005 *JAMA* article shows that resident self-reported preparedness to deliver cross-cultural care lags well behind other clinical and technical areas.⁹ Although cross-cultural care was perceived to be important among residency program and medical school directors, there was little clinical time, training, formal evaluation, or role modeling in cultural competency issues. The exchange program in Santiago provides the perfect opportunity to practice and improve both American and Dominican students' cultural competency. The curriculum has integrated a series of readings and introspective exercises with an attempt to expand and assess participants' knowledge, skills, and attitudes relating to the provision of healthcare for diverse patient populations. To assess the impact of this curriculum we have implemented pre-and post-departure surveys for the participants. Feedback from participants revealed that students want to know more about the medical system in the DR and the state of medical educational trips in the US in order to better appreciate their experience.

The program has faced various challenges over the years: identifying the personal and professional trainee factors that ensure a successful cohort of participants, developing travel requirements that create a safe experience for participants, and recruiting attending physicians and residents to the program. Program leadership has addressed this issue by conducting annual information sessions about logistics, curriculum, and goals of the elective early in the year.

In the future, we would like to increase opportunities for Brown University students and residents to rotate and pursue research in collaboration with the local residents at HRUJMCB. This would strengthen the alliance between RIH and HRUJMCB by increasing the amount of time members from the two institutions interact, and would benefit Cabral y Baez by bringing in resources and scientific attention to key issues that this under-resourced hospital faces such as antimicrobial stewardship efforts, multidrug resistant tuberculosis, and hepatitis C diagnosis and treatment.

In summary, the exchange program between RIH and HRUJMCB takes on a new form guided by each year's coordinator, program director, and cohort of participants. However, the central principles and goals of the program have remained constant since its inception. By emphasizing the importance of an annual, long-term commitment, rather than being a "drop-in and drop-out" experience, a mutually-beneficial educational exchange program has been sustained over the last 15 years. To ensure a truly bidirectional and reciprocal educational exchange, ongoing intentional efforts and invitations continue to be made by Brown University participants: (1) teachers accompany learners to the Dominican Republic to ensure that the education systems at HRUJMCB are not overburdened by the presence of Brown

learners, and (2) when the residents from HRUJMCB arrive in Providence, efforts are made to pair them with Brown attendings and residents who have previously participated in the exchange program in the Dominican Republic. Adhering to these principles allows the program to meet its original goal while adapting to the innovations and initiatives of each new cohort of participants.

References

1. Medical School Graduation Questionnaire: 2017 All Schools Summary Report. *Association of American Medical Colleges*. 2017: p19. https://www.aamc.org/download/481784/data/2017_gqallschoolsummaryreport.pdf
2. Kerry V, Walensky R, Tsai A, Bergmark R, Bergmark B, Rouse C, Bangsberg D. US medical specialty global health training and the global burden of disease. *Journal of Global Health*. 2013; 3(2).
3. Jacobs F, Stegmann K, Siebeck M. Promoting medical competencies through international exchange programs: benefits on communication and effective doctor-patient relationships. *BMC medical education*. 2014; 14(1):43.
4. Bodnar B, Claassen C, Solomon J, Mayanja-Kizza H, Rastegar A. The Effect of a Bidirectional Exchange on Faculty and Institutional Development in a Global Health Collaboration. *PLoS ONE*. 2015; 10(3).
5. Dowell J, Merrylees N. Electives: isn't it time for a change? *Medical education*. 2009; 43(2):121-6.
6. Ennis S, Rios-Vargas M, Albert N. The Hispanic Population: 2010. *2010 Census Briefs*. 2011.
7. World Directory of Minorities and Indigenous Peoples - Dominican Republic: Haitians. Minority Rights Group International. 2018. <https://www.refworld.org/docid/49749d2e21.html>
8. Chun M, Yamada N, Huh J, Hew C, Tasaka S. Using the Cross-Cultural Care Survey to Assess Cultural Competency in Graduate Medical Education. *Journal of Graduate Medical Education*. 2010; 2(1): 96-101.
9. Weissman J. Resident Physicians' Preparedness to Provide Cross-Cultural Care. *JAMA*. 2005; 294(9).

Disclaimer

The views expressed herein are those of the authors and do not necessarily reflect the views of other academic institutions.

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Tuberculosis: An Epidemic Perpetuated by Health Inequalities

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ABSTRACT

Tuberculosis (TB) is the leading single-agent infectious disease killer worldwide. The World Health Organization (WHO)'s End TB Strategy aims to achieve tuberculosis (TB) elimination by 2030, and in September 2018, the United Nations General Assembly held a High-Level Meeting on TB to address the urgency of the TB epidemic and the health inequalities that continue to propel it. The meeting endorsed an ambitious, comprehensive approach to the TB epidemic that incorporates universal health coverage and tackles the social determinants of this disease. In this article, we provide an overview of the key strategies promoted in this meeting and introduce work by five Rhode Island-based physicians that align with these goals.

KEYWORDS: Tuberculosis, End TB Strategy

INTRODUCTION

The World Health Organization (WHO)'s End TB Strategy aims to achieve tuberculosis (TB) elimination by 2030 – a formidable goal given that *Mycobacterium tuberculosis* is the leading single-agent infectious disease killer worldwide.¹ In 2017, approximately 10 million people fell sick with TB, and 1.6 million people died from the disease.² Multidrug-resistant TB (MDR-TB), which accounted for 558,000 incident TB cases in 2017, further complicates the fight against TB. MDR-TB treatment requires a longer regimen with more toxic drugs. Globally, the treatment success rate for MDR-TB is only 55% compared to 83% for drug-susceptible TB.^{2,3}

Drug-susceptible TB treatment was developed >50 years ago and costs less than 10 USD/course. Why, then, has so little progress been made in the fight against a curable, preventable disease, when significant reductions in mortality have been achieved against more difficult-to-treat conditions? In the past century, high-income countries (HICs) have achieved drastic reductions in TB incidence through a combination of improved living standards and dedicated public health infrastructure/resources. Yet, the disease continues to devastate impoverished, marginalized populations in low- and middle-income countries (LMICs), for whom optimal TB care is often deemed “impractical” and not “cost-effective.” Although progress has been made towards

improving TB care in LMICs, technologies and interventions considered essential for combating TB in HICs – such as universal drug susceptibility testing (DST) and treatment of latent TB infection (LTBI) – have only been recently recommended for widespread implementation.

In September 2018, the United Nations (U.N.) General Assembly held a High-Level Meeting on TB (HLM-TB) to address the urgency of the TB epidemic and the health inequalities that continue to propel it. This meeting marked the third time in history that the U.N. has convened to discuss a specific disease. The priority actions for Heads of State and Governments adopted by the 1000 HLM-TB delegates reflected five key points: (1) reach all people by closing the gaps on TB diagnosis and prevention; (2) transform the TB response to be equitable, rights-based, and people-centric; (3) accelerate development of new diagnostic and treatment tools; (4) invest the necessary funds to fight the epidemic; and (5) commit to decisive and accountable global leadership, including regular reporting and programmatic review.⁴ These goals convey that an effective, comprehensive response to the TB epidemic must incorporate universal health coverage and tackle the social determinants of this disease.⁵ In this article, we provide an overview of the key strategies promoted in this meeting and introduce work by five Rhode Island-based physicians that align with these goals.

REACHING ALL PEOPLE: FINALLY PRIORITIZING CHILDREN

For decades, pediatric TB has been ignored as health officials prioritized contagious adult cases as the drivers of the epidemic. Therefore, children represent a higher proportion among estimated missing, unregistered TB cases. Children, particularly those < two years of age, are at highest risk for rapid progression to severe TB disease.⁶ Additionally, diagnosing TB in children is challenging due to its paucibacillary nature and the inability for most children to produce sputum.⁷ Rapid, prompt diagnosis is required in young children, but our current testing strategies are limited. Dr. Silvia Chiang and her colleagues at Partners In Health-Peru and Harvard Medical School have conducted studies in Peru to identify the barriers to childhood TB diagnosis and to develop strategies to improve this process.⁸

Detecting childhood TB is further complicated by its non-specific clinical presentation; the signs and symptoms usually are much more subtle than those of adult TB. Kenya's National TB Program recommends that healthcare workers in all pediatric outpatient settings screen children for TB symptoms, but the high patient-to-healthcare worker ratio is a formidable barrier to this goal. Dr. Daria Szkwarko is leading a study on how to increase screening for childhood TB through the use of a mobile health intervention, which is being piloted in waiting areas at a large county hospital in western Kenya. A community health volunteer (CHV) uses a tablet-based screening application to conduct a symptom screen with parents/caregivers. If the application notifies the CHV that the child has presumptive TB based on two or more symptoms, the CHV gives the parent/caregiver a notification card, which informs healthcare workers that this child is at risk and requires further evaluation. This novel intervention also aligns with the emphasis placed at the HLM-TB on developing digital technologies for TB prevention, treatment, and care.

INCREASING CASE DETECTION: FIND THE MISSING

Globally, only 64% of estimated drug-susceptible TB cases and 25% of MDR-TB cases were registered and reported in 2017.² Finding and treating missing TB cases is key to TB elimination. Every global TB treatment site has a method of reporting TB cases to its national Ministry of Health. These data have been used for tracking the epidemic, but not for evaluating the quality of care. Dr. E. Jane Carter is working with her colleagues at The International Union Against TB and Lung Disease to institute TBData4Action, a new method to examine locally derived TB data to improve finding missing cases and the quality of care. After eighteen months, the project has retrained all county and sub-country TB coordinators in Kenya and increased case detection.

Work by Dr. Chiang and Dr. Natasha Rybak found that the number of children receiving treatment for MDR-TB in Kyiv City, Ukraine, was much lower than the projected number of pediatric MDR-TB cases.⁹ This finding is unsurprising since Ukraine is among ten countries with the largest gaps between the number of patients started on MDR-TB therapy and estimates of MDR-TB incidence.¹⁰ To find missing childhood TB cases (both drug-susceptible and MDR) in Ukraine, Dr. Rybak is leading a pilot study to estimate the number of missed pediatric TB cases that end in death. Ukraine's Ministry of Health mandates autopsies in all individuals who die before age eighteen. Dr. Rybak, Dr. Chiang, and their collaborators at Boston University are reviewing pediatric autopsy data to identify possible TB-related deaths. The medical records of these children will then be reviewed to further evaluate the possibility that their deaths were caused by TB. This work will generate preliminary data that

will lead to a more comprehensive effort to identify missed TB cases in Ukraine.

CLOSING THE GAP ON PREVENTION

LTBI represents the time period between initial infection with *M. tuberculosis* and development of symptomatic disease. LTBI can last for years or decades in immunocompetent individuals, or may be as short as weeks in people living with HIV (PLWHIV) or young children. Highly effective preventive therapy that significantly reduces the risk of progression from LTBI to TB disease has been available since the 1960s; however, its use has been limited to HICs. More recently, preventive therapy has been extended globally to PLWHIV and to children <5 years of age who have been in contact with contagious TB patients. As previously mentioned, young children are particularly vulnerable to TB: compared to non-household contacts, child contacts have a 70% increased risk of TB infection,¹¹ and a 66% increased risk of mortality.¹² Yet, implementation of preventive therapy for young children has been slow - the rate of preventive therapy initiation in child contacts < 5 years was estimated to be 23% of those eligible in 2017 globally.² Drs. Carter and Szkwarko have been working to improve the child contact management care cascade (identification, screening, treatment initiation, treatment completion) since 2011.^{13,14} Most recently, Drs. Carter and Szkwarko collaborated with colleagues at Center for Health Solutions to implement a clinic-based child contact management strategy across 100 facilities in Kenya. Of 2022 child contacts < 5 years exposed to contagious TB identified, 149 (7%) were diagnosed with TB disease, and 1613 (80%) initiated preventive therapy.

ADOPTING A PATIENT-CENTERED APPROACH

Adolescents – defined by the WHO as persons aged between 10–19 years – make up a large proportion of LMICs populations. They have an increased risk of progression from TB infection to disease, have poor adherence to TB therapy, and tend to congregate in group settings – all factors that lead to adolescents comprising a significant proportion of the global TB burden.^{6,15-17} Adolescence is a critical time for physical, psychosocial, and cognitive development – all of which may be jeopardized by TB disease and treatment. However, adolescents have been neglected in TB research and policy, mostly because standard TB reporting practices group 10- to 14-year-olds with children and 15- to 19-year-olds with adults.² Many knowledge gaps remain with respect to adolescent TB, such as risk factors for poor treatment outcomes, and the impact of adolescent TB disease and treatment on long-term health and wellbeing.

To address these gaps, Drs. Chiang and Rybak are conducting two studies in Ukraine. The first is an analysis of >5000 cases of adolescent TB disease to identify risk factors

for loss to follow-up, death, and drug resistance. The second is a qualitative study to characterize the impact of TB disease and treatment on quality of life in adolescent TB survivors. In Peru, Dr. Chiang and her collaborators at Partners In Health-Peru are interviewing >100 adolescent TB survivors, parents/guardians of these adolescents, and healthcare providers to evaluate TB treatment adherence facilitators and barriers. Informed by these interviews, Dr. Chiang and her collaborators will then enroll 400 adolescents at the start of TB treatment and develop a clinical prediction tool of poor treatment adherence for adolescent TB. Through this study, the investigators will also be able to answer other questions, such as the prevalence of depression among adolescents with TB disease.

COMBATING DRUG RESISTANCE THROUGH ACCESS TO DIAGNOSTICS AND TREATMENT

In the 1990s, many LMICs relied on loans from international financial institutions to support public health programs; as a result, these programs prioritized interventions that provided high return on investment.¹⁸ Therefore, TB control guidelines focused on diagnosis by sputum microscopy instead of the more expensive culture, and empirical use of first-line drugs for drug-susceptible TB rather than conducting DST to construct regimens based on these results. In the United States and other HICs, combating MDR-TB outbreaks by tailoring individualized regimens based on DST results became the standard of care. However, in most LMICs, the management of MDR-TB remained the same. As TB treatment policy diverged between HICs and LMICs, the MDR-TB epidemic in LMICs worsened and became the most common form of antimicrobial resistance globally.⁵

Today, the creation of rapid molecular TB diagnostics that require less laboratory expertise have facilitated the diagnosis and prompt treatment of MDR-TB worldwide. The roll-out of Xpert MTB/RIF (Cepheid, California) in 122 high TB-burden countries led to an eight-fold increase in MDR-TB case detection by the end of 2015.¹⁹ However, major disparities continue, and only 39% of patients who are diagnosed with MDR-TB receive the recommended panel of DST for second-line drugs.¹⁰ Dr. Tara Bouton and colleagues, with support from the Brown University Global Health Initiative, have shown in Ghana that even at international academic centers, meeting DST guidelines remains a challenge.

Traditional MDR-TB regimens include ≥ 5 drugs administered for 18-24 months. Toxicity for second-line regimens is high, with up to 62% of patients developing hearing loss with second-line injectable therapy.²⁰ In most TB-prevalent settings, patients are infrequently monitored for adverse events. Approval of the first new MDR-TB drugs in 50 years has made possible all-oral and shorter therapies. Dr. Bouton, through collaborations at Boston University and in South Africa, is examining the roll-out of new drugs and the impact of their empirical use on drug resistance.

CONCLUSIONS

The HLM-TB has focused the world's attention – and more importantly garnered political commitment at government levels – on ending TB by 2030. The attendees' commitment to address TB by focusing on the health inequalities that propel the epidemic is a major step forward. By reaching vulnerable populations, increasing case detection, adopting a patient-centered approach, and combatting drug resistance through improved access to diagnostics and treatment, local Rhode Island physicians are helping to lead the way to ensure that ending TB is no longer a dream but a possible reality.

References

1. World Health Organization. Implementing the end TB strategy: the essentials. WHO/HTM/TB/2015.31. Accessed May 10, 2019. http://www.who.int/tb/publications/2015/end_tb_essential.pdf?ua=1. Geneva, Switzerland: WHO; 2015.
2. World Health Organization. Global Tuberculosis Report 2018. Geneva, Switzerland: WHO; 2018. Available at: <http://apps.who.int/iris/bitstream/handle/10665/274453/9789241565646-eng.pdf?ua=1>. Accessed December 1, 2018.
3. World Health Organization. Multidrug-Resistant Tuberculosis 2018 Update. https://www.who.int/tb/areas-of-work/drug-resistant-tb/MDR-RR_TB_factsheet_2018_Apr2019.pdf?ua=1. Accessed May 14, 2019. 2019.
4. Stop TB Partnership. United to End Tuberculosis: An Urgent Global Response to a Global Epidemic 2018 [cited 2019 May 15]. Available from: <http://www.stoptb.org/global/advocacy/un-hlm.asp>.
5. United Nations. Political Declaration of the UN General Assembly High-Level Meeting. 2018.
6. Marais BJ, Gie RP, Schaaf HS, Hesselring AC, Obihara CC, Starke JJ, et al. The natural history of childhood intra-thoracic tuberculosis: a critical review of literature from the pre-chemotherapy era. The international journal of tuberculosis and lung disease: the official journal of the International Union against Tuberculosis and Lung Disease. 2004;8(4):392-402. Epub 2004/05/15. PubMed PMID: 15141729.
7. Chiang SS, Swanson DS, Starke JR. New Diagnostics for Childhood Tuberculosis. Infectious disease clinics of North America. 2015;29(3):477-502. Epub 2015/07/21. doi: 10.1016/j.idc.2015.05.011. PubMed PMID: 26188605.
8. Chiang SS, Roche S, Contreras C, Alarcon V, Del Castillo H, Becerra MC, et al. Barriers to the diagnosis of childhood tuberculosis: a qualitative study. The international journal of tuberculosis and lung disease : the official journal of the International Union against Tuberculosis and Lung Disease. 2015;19(10):1144-52. Epub 2015/10/16. doi: 10.5588/ijtld.15.0178. PubMed PMID: 26459524.
9. Chiang SS, Sheremeta Y, Padilla RS, Jenkins HE, Horsburgh Jr CR, Petrenko V, et al. Pediatric Multidrug-resistant Tuberculosis in Kyiv City, Ukraine. Journal of Epidemiology and Global Health. 2019;9(1):56-61.
10. World Health Organization. Global Tuberculosis Report 2017. Geneva, Switzerland: WHO; 2017. Available at: <http://apps.who.int/iris/bitstream/10665/259366/1/9789241565516-eng.pdf?ua=1>. Accessed December 26, 2017.
11. Mandalakas AM, Kirchner HL, Lombard C, Walzl G, Grewal HM, Gie RP, et al. Well-quantified tuberculosis exposure is a reliable surrogate measure of tuberculosis infection. The international journal of tuberculosis and lung disease : the official journal of the International Union against Tuberculosis and Lung Disease. 2012;16(8):1033-9. Epub 2012/06/14. doi: 10.5588/ijtld.12.0027. PubMed PMID: 22692027.

12. Gomes VF, Andersen A, Wejse C, Oliveira I, Vieira FJ, Joaquim LC, et al. Impact of tuberculosis exposure at home on mortality in children under 5 years of age in Guinea-Bissau. *Thorax*. 2011;66(2):163-7. Epub 2010/12/15. doi: 10.1136/thx.2010.141309. PubMed PMID: 21148136.
13. Szkwarko D, Ogaro F, Owiti P, Carter EJ. Implementing a tuberculosis child contact register to quantify children at risk for tuberculosis and HIV in Eldoret, Kenya. *Public Health Action*. 2013;3(3):209-13. Epub 2013/09/21. doi: 10.5588/pha.13.0018. PubMed PMID: 26393031; PubMed Central PMCID: PMCPCMC4463135.
14. Szkwarko D, Owiti P, Buziba N, Bigelow C, Eaton CB, Carter EJ. Implementation of an active, clinic-based child tuberculosis contact management strategy in western, Kenya. *Public Health Action*. 2018;Forthcoming.
15. Snow KJ, Sismanidis C, Denholm J, Sawyer SM, Graham SM. The incidence of tuberculosis among adolescents and young adults: a global estimate. *European Respiratory Journal*. 2018;51(2):1702352.
16. Seddon JA, Chiang SS, Esmail H, Coussens AK. The Wonder Years: What Can Primary School Children Teach Us About Immunity to Mycobacterium tuberculosis? *Frontiers in immunology*. 2018;9:2946. Epub 2019/01/09. doi: 10.3389/fimmu.2018.02946. PubMed PMID: 30619306; PubMed Central PMCID: PMCPCMC6300506.
17. Johnstone-Robertson SP, Mark D, Morrow C, Middelkoop K, Chiswell M, Aquino LD, et al. Social mixing patterns within a South African township community: implications for respiratory disease transmission and control. *American journal of epidemiology*. 2011;174(11):1246-55.
18. Keshavjee S, Farmer PE. Tuberculosis, drug resistance, and the history of modern medicine. *New England Journal of Medicine*. 2012;367(10):931-6.
19. Albert H, Nathavitharana RR, Isaacs C, Pai M, Denkinger CM, Boehme CC. Development, roll-out and impact of Xpert MTB/RIF for tuberculosis: what lessons have we learnt and how can we do better? *European Respiratory Journal*. 2016;48(2):516-25.
20. Seddon JA, Thee S, Jacobs K, Ebrahim A, Hesseling AC, Schaaf HS. Hearing loss in children treated for multidrug-resistant tuberculosis. *The Journal of infection*. 2013;66(4):320-9. Epub 2012/09/11. doi: 10.1016/j.jinf.2012.09.002. PubMed PMID: 22960077.

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