

# The Public Health Impact of Surgical Interventions in Patzún, Guatemala

The Healing Hands Foundation's 2012 Guatemala Mission



*Patzún, Chimaltenango*

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## Executive Summary

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In November of 2012, The Healing Hands Foundation (THHF) returned to Guatemala for the 4th time since 2009 to provide dental and surgical care for those in Patzún, a town of approximately 18,000 in the central region of Guatemala. Families often traveled long hours by bus to access the free services provided by THHF. During the week-long surgical mission, the medical team performed 71 procedures on 69 patients ranging in age from 3 months to 75 years. The impacts were great; 502 years of quality life were saved over the entire patient population. This was estimated by calculating Disability-Adjusted Life Years, or DALYs, for each patient, based on their age, gender and procedure received.

## Acknowledgements

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We would like to thank all the diligent volunteers from THHF and the THHF Guatemala Branch, who professionally and collaboratively worked to provide support and mentorship to the Guatemalan people.

*"It was a tremendously successful mission. It was an honor working with you all, and I cannot thank you enough for your hard work, dedication, and commitment."*

– Dr. Dylan Stewart, Vice President

Many organizations graciously supported this mission, including Direct Relief International, American Airlines, RTS Family Foundation, MAP/Ethicon and the THHF-Guatemala Board of Directors (Steven Gandara, Carlos Caballeros, Beira de Caballeros, Antonio Bonifasi, Rosario de Bonifasi, Michael Spencer, Giovanna de Spencer and Mark Melidosian). We thank Marco Ávila and Steven Gandara for their leadership and logistics skills that make the mission possible. Also thanks to volunteers Kathleen Spadaro, Erika Waldrop, Jazmin Kazravan and Veronica Rosales for providing personal reflections that add their unique perspectives to the mission's story. Thanks to Marco Avila and Kathleen Spadaro for providing photographs used in this report. We also deeply appreciate the hospitality and collaboration from the caring staff at Corpus Christi hospital.

This report, including the impact analyses performed for this mission, was provided by STC<sup>1</sup>.

*"The partnership between The Healing Hands Foundation and STC is priceless. STC has provided expertise and a quality product that is extremely useful. The information/reporting that STC is providing is an amazing way to tell our story with supporting data to our followers, our donors, volunteers, the public, media and the world. The product that STC is preparing after each mission will help us plan for improved performance on future missions. In addition, the reports will help us acquire grants that we are planning to pursue."*

– Marco V. Ávila, Executive Director/Co-Founder of THHF

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<sup>1</sup> Scientific Technologies Corporation, Tucson, Arizona [www.stchome.com](http://www.stchome.com)

## Introduction

### Picture of Health in Guatemala

The health status of Guatemala is the tale of two countries – one of the urban, non-indigenous and the rural, indigenous. Despite Guatemala's middle income status, health outcomes here compare unfavorably with those of other much poorer countries. Child mortality (43 per 1,000 live births) and maternal mortality (136 per 100,000 live births) are the highest in Central America (1).



Guatemala is Central America's most populous country with 14.3 million people, and 40% are of indigenous descent. It is a multiethnic, multicultural nation with 23 linguistic groups. Guatemala experiences extreme inequalities that reflect the exclusion and disparity affecting the indigenous and rural populations. According to the World Health Organization, 20% of Guatemala's people lack regular access to health services (2), and these people represent the poor, rural, young and indigenous. Chronic malnutrition and inadequate health education remain major problems among the rural indigenous communities. These communities face a series of barriers to health care including transport time and cost, language barriers, low or no literacy and the time and cost of consult and treatment.

Despite the lack of access to healthcare and medical resources, Guatemala has made strides to improve vaccination coverage throughout the entire country. There have been no cases of polio since 1990 or measles since 1997, and over 92 percent of infants are covered by the immunization program, which includes 10 vaccines (2). Progress has been made in controlling malaria, Chagas' disease and onchocerciasis. Access to community health workers has expanded in some rural areas, but Guatemala has been unable to meet the surgical needs of many patients. Patients must travel to Guatemala City to receive surgical care which requires transportation and high fees. Because of this disparity the rural communities largely rely on outside health professionals such as doctors, nurses, and midwives to fill this gap.



### The Foundation

**The Healing Hands Foundation** (THHF) is a non-profit organization founded in 2007 that provides medical services to children and adults around the world. The THHF mission is to **provide high quality surgical care to children with complex congenital malformations in areas lacking resources and expertise.** The medical staff of THHF has decades of combined experience, and its doctors, dentists and nurses have practiced medicine in countries around the world, including Ecuador, Colombia, Guatemala,



Panama, Dominican Republic, Laos and Sierra Leone. The mission not only involves surgical and dental services, but also education and mentorship of local surgeons and other health care providers to improve the quality of people's lives in these areas.

## Volunteers

In November of 2012, THHF returned to Guatemala for the 4<sup>th</sup> time since 2009 to provide dental and surgical care for those in the town of Patzún, a town of approximately 18,000 in the central region of Guatemala. The 2012 mission was truly a national effort, with 40



volunteers coming from all over the U.S., including Florida, Maryland, Virginia, Washington, D.C., Arizona and California. These volunteers consisted of trained surgeons, fellows, nurses, cardiologists, dentists, nurses, psychologists, anesthesiologists, epidemiologists and medical technicians (see Table 1).



Table 1 – 2012 Guatemala Mission Expertise.

| Specialty                                 | No. Volunteers |
|---|----------------|
| Cardiologist                              | 1              |
| CRNA                                      | 4              |
| DDS & Dentist                             | 2              |
| Dental Assistant                          | 2              |
| Director/Operations                       | 1              |
| Epidemiologist                            | 1              |
| General Surgeon/ M.D.                     | 2              |
| OR Nurse                                  | 5              |
| OR Technician                             | 1              |
| Pediatric surgeon                         | 1              |
| Pediatric surgery fellow                  | 1              |
| Plastic Surgeon                           | 3              |
| Cranio-Maxillofacial Surgery Fellow       | 1              |
| Ocular/Craniofacial/Ophthalmology Surgeon | 1              |
| RN  | 5              |
| RN/BSN Pediatrics                         | 3              |
| Clinical Psychologist                     | 1              |
| Anesthesiologist                          | 1              |
| Additional support                        | 4              |
| <b>TOTAL:</b>                             | <b>40</b>      |

*"I was honored to be part of this outstanding team and looking forward for future missions."*

— Jazmin Kazravan  
MBA, BSN, RN, RNFA

*"...The team that went to provide care was stellar and I am sure they all know what a difference they made."*

— Veronica Rosales, RN

## Goals and Objectives of the Mission

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The goals of THHF are to *provide high quality surgical procedures, medical treatment, dental care, and educational support in Guatemala*. Through established in-country partnerships, THHF engages with communities to identify and treat patients, improve health care infrastructure, and provide needed medical training to surgeons, doctors, and community health care workers.

The Foundation's objectives are to create a long-term impact by empowering impoverished communities to improve the health and quality of life of their own people through sustainable partnerships to meet these goals.

For this mission, the impact on health was determined by estimating the number of years of healthy life that were saved due to performing medical procedures and surgeries. Documenting patient health status and the resources available also provide a comprehensive picture of the value that THHF brings to the communities in this region of Guatemala.

## Great Needs in the Region

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The need for health services in this region of Guatemala is great, as evidenced by the health status of referred patients, the distances they were willing to travel in order to receive services, and the type and conditions of the patients requiring surgery. The Healing Hands Foundation has the challenge of meeting great needs under challenging conditions with few, but valuable, resources.

## Resources

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The mission was based at the Corpus Christi Hospital in Patzún, Chimaltenango, Guatemala. Patients were either referred to THHF by other medical doctors working in the region, or added to the list during a pre-mission trip October 11-14, 2012, where THHF medical staff examined and identified candidate patients for surgery.

Corpus Christi Hospital is a "mission hospital" used during volunteer medical missions to the region. While working at Corpus Christi, THHF volunteers have many of the existing hospital resources available to them, which is a major benefit to working at this hospital. The kinds and amount of resources at Corpus Christi are listed below in Table 2.

The Foundation was able to furnish a new operating room for the hospital in early 2012, providing a total of 3 fully functioning operating rooms plus an additional procedure room used for minor surgical procedures, such as lipoma removals and cyst excisions. A large amount of equipment and supplies must be provided by THHF and these are brought on-site from the U.S. for every mission. Surgeries are only performed using appropriate supplies and resources to ensure the safest possible environment for the patient; if supplies run out, services cannot be provided.



Table 2 – Resources at Corpus Christi Hospital.

|   |  |  |                               |
|---|--|--|-------------------------------|
| No. of Hospital Beds                                      | 14 beds<br>2 Cribs   | No. of Permanent Nursing Staff           | 4                             |
| Isolation Ward  | No   | No. of Itinerant Medical & Nursing Staff | 1 doctor and 2 nurses on call |
| Outpatient Facility                                       | Yes  |  |                               |
| Emergency Room  | Yes  |  |                               |
| No. of Operation Rooms                                    | 3  | Midwife                                  | 1                             |
| Delivery Room   | Yes  | Anesthesia                               | No                            |
| No. of Recovery Rooms                                     | 4  | Residents and Staff                      | 1 resident                    |
| No. of Intensive Care Units                               | 0  | OB/GYN                                   | No                            |
| Blood Bank  | No   | General Surgeons                         | 2 (outside vendors)           |
| Pharmacy  | Yes  | Pharmacy technicians                     | 1                             |
| Clinical Laboratory                                       | Yes  | Pharmacist                               | No                            |
| Radiology   | No   | X-ray technician                         | No                            |
| Ultrasound  | Yes  | Radiologist                              | No                            |
|   |  | Physical Therapist                       | No                            |
| Equipment and Supplies                                    |  | Otolaryngologist                         | No                            |
| No. of Devices Anesthetics                                | 3  | Dentist                                  | 1                             |
| Pulse Oximeter  | 2  | Ophthalmologist                          | No                            |
| Blood pressure monitors                                   | 3  |  |                               |
| Respirators/Oxygen Supply                                 | Oxygen Supply  |  |                               |
| Blood Products  | No   |  |                               |
| Microbiology equipment                                    | No   |  |                               |
| Drugs   | Yes  |  |                               |
| Surgical Supplies - gloves, consumer goods, linens, robes | Linens and robes are available, but disposable items required for each group must be brought in. |  |                               |

## Distances Traveled by Patients

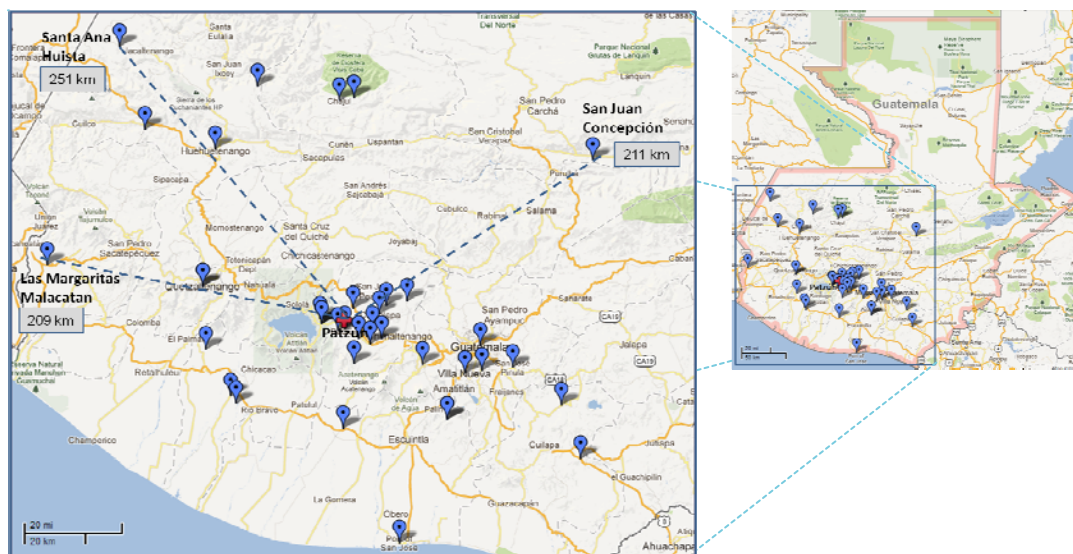
Hometowns for 62 of 69 patients were identified during the mission. Patients came from 38 different towns and municipalities, and represented 12 of Guatemala's 22 geographic regions: Alta Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Quiche, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez and Villa Nueva. At least half of the towns were over 75 km from Corpus Christi Hospital and usually very remote. Roads are often in poor condition and most patients had to travel by bus and were at mercy to unreliable bus schedules. While 75-250 km is not far by U.S. standards, these distances represent enormous challenges for patients without access to a car or even bus money. The furthest patients traveled as far as 250 km, distances that took many hours by bus and often required overnight travel.

*"Some of our patients lived in such remote areas that they were never exposed to the Spanish language." — Erika Waldrop, C.R.N.A., B.S.N., M.S.*

The distances that people traveled to reach Corpus Christi Hospital in order to receive treatment from THHF is a testament to the need in Guatemala for quality healthcare and surgical interventions, and the value that THHF provides. Many of THHF's patients came from very remote villages, are of poor socioeconomic status and of indigenous descent, reaffirming the disparities in healthcare that exist in Guatemala.

*"Many patients traveled 10+ hours for their surgeries, and some didn't even own shoes, yet their patience and graciousness were unwavering."*  
— Kathleen Spadaro, R.N., B.S.N.

Figure 1 – Locations of Patients' Home Towns and the Corpus Christi Hospital (with driving distances to furthest 3 towns).



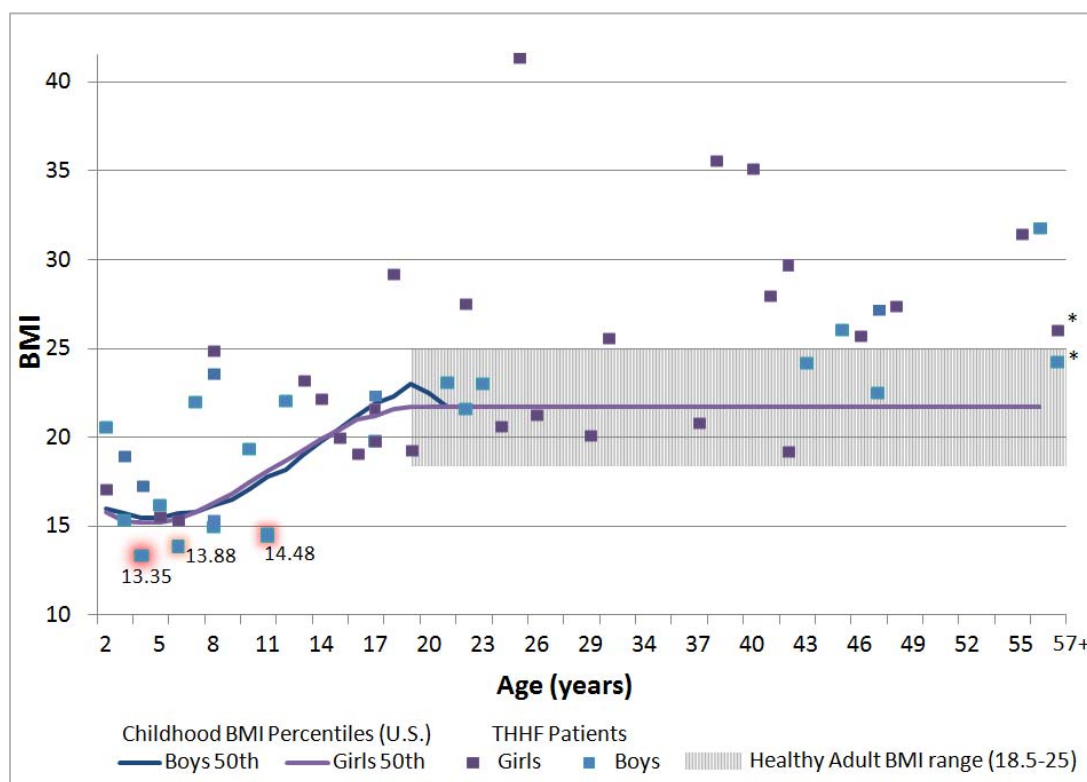
## Health Status of Patients

Body Mass Index (BMI) was calculated for 59 patients aged 2 to 75 years. The values and trends in BMI among these THHF patients show evidence of long-term malnutrition and/or poor diet, and underlying health issues may contribute to unhealthy weights observed in children with lower than normal BMI.

Among the youngest THHF patients, aged 2 to 7 years, there were no overweight children but three children were underweight based on their age-adjusted BMIs. Two of these children fell well below the 50th percentile range for their ages, putting them squarely in the 'under-weight' category, and one was at the threshold (See Figure 2). These three children were all boys ages 4, 6 and 11 years, and all presented with right inguinal hernias, which were repaired by THHF surgeons without complications. Two additional children (boys) were also slightly below the 50th percentile for healthy BMI based on age, but were not low enough to be considered underweight.

School-aged children 7 to 19 years were either within the 50th percentile range for healthy weights or were overweight and their BMIs ranged from 15.0 to 29.3. This trend continued among adults 20 years and older: just 14 of 31 adults (45%) were a healthy weight (BMI 18.5 to 25), and 17 were overweight (BMI 25 to 30). Five of the overweight patients were “obese” (BMI >30); one was “severely obese” (BMI >40).

Figure 2 – Body Mass Indices (BMI) for THHF Patients by Age and Gender, Compared to Expected Healthy BMI Ranges.



*\*represents BMI average for 5 men ages 57-75 (range: 20.4-31.8), and for 1 woman age 63 years. Underweight children (n=3) are highlighted in red.*

In Guatemala, the food groups that sustain the population - especially in low-income population groups - are cereals (mainly maize), sugars and beans. These foods meet nearly 90% of energy requirements and are deficient in total fats, proteins of animal origin and micronutrients (3). While more robust observations are needed to make concrete conclusions, the trends observed among the THHF patients suggest that weight issues due to poor diets begin to manifest at school-age and continue to exacerbate into adulthood. This trend is reminiscent of trends in the U.S. regarding obesity, but is more alarming in Guatemala, since underlying health conditions that go untreated further impair growth and development in these at-risk children.

Patients presented with a myriad of medical conditions requiring surgical intervention. Conditions of the head, eye, ear, nose, throat, groin, core, mouth, foot, wrist and hand were



observed among 69 patients (See Table 3). The majority of primary conditions affected the groin (n=26) and these were usually due to inguinal and/or umbilical hernias. The second most afflicted areas were the mouth (n=10) followed by the ear (n=9), due largely to congenital deformities including cleft palates, cleft lips and microtia, a deformity where the ear is undeveloped.

Table 3 – Cases by Body Area.

| Area Affected | No. Cases |
|---------------|-----------|
| Groin         | 26        |
| Mouth         | 10        |
| Ear           | 9         |
| Core          | 6         |
| Foot          | 5         |
| Wrist         | 4         |
| Hand          | 3         |
| Head          | 3         |
| Eye           | 2         |
| Nose          | 1         |
| <b>TOTAL</b>  | <b>69</b> |

Cleft lip and palate is one of the most common congenital deformities, occurring at a rate of 1 per 500 to 700 births (4). These children face problems with feeding, speech, hearing, teeth, and developing psychosocial skills. Ideally a multidisciplinary team would treat the condition by offering primary surgery to close the defect, orthodontic and speech therapy, and further surgery to refine the initial surgical result. Unfortunately for many impoverished people in Guatemala, cleft palate and lip treatments are lacking and children often go years before receiving treatment, if they receive any at all. This exacerbates malnutrition, growth retardation, social ostracization, and economic prosperity for these people, creating ongoing disparities that continue to the next generation. Among the poor and indigenous communities, families rely on outside help and free services in order to get treatment and repair these deformities.

*“Being able to take my skills, passion, and knowledge outside our country’s limits to provide much needed healthcare to underserved citizens, who possess the most humbling patience and appreciation, all while being accompanied by an amazing team of professionals, was by far a life changing experience. I felt that I personally made an impact, was useful, and was most importantly trusted.”*

— Kathleen Spadaro R.N., B.S.N.

## Providing Quality Patient Care

*The Guatemala mission was one the best missions I've been part of in 19 years. The team was extremely efficient, caring compassionate and above all performed surgeries were very safe with phenomenal results. It's what every medical surgical mission should strive for. I'm blessed to have a part of it and hope that every mission can be equally successful."*

*– Dr. Jaime Flores, THHF President/Co-Founder*

## Dental Team Activities

The THHF dental team consisted of two dentists and two dental assistants. There were two dental operatories at Corpus Christi, which were partially operable. Portable dental equipment for one of the rooms was provided by the THHF-Guatemala branch, and repairs were made in the second room that provided a basic level of functionality. All supplies, materials and instruments were brought on-site by THHF for the mission.

Dental treatments were performed at Corpus Christi during November 2-6, and at Las Margaritas Farm (LMF) during Nov 5-6, 2012, which is located in the town of San Francisco de Zapotlitan, Suchitepéquez, in southwestern Guatemala. The farm was also visited by THHF last year and houses approximately 45 families, with 4-6 members per family, who are in need of dental care but have little or no money.

Overall, the dental team treated 149 people (Patzún = 99, LMF = 50; 47 males and 102 females) who ranged in age from 1 year to over 61 years (See Table 4). The most often performed procedure was restoration (n=87), which was followed by extractions (57), examinations (57) and fluoride treatment (36).

Table 5a – Dental Procedures Performed on 69 Patients.

| Procedures           | No. Completed |
|----------------------|---------------|
| Examination          | 57            |
| Restorations         | 87            |
| Extractions          | 57            |
| Dental Cleaning      | 30            |
| Fluoride Treatment   | 36            |
| Root Canal Treatment | 2             |
| X-rays               | 22            |
| Miscellaneous        | 9             |
| <b>Total</b>         | <b>300</b>    |

Table 5b – Dental Patients by Age.

| Age Group (years) | No. Patients |
|-------------------|--------------|
| 1-5               | 8            |
| 6-10              | 16           |
| 11-15             | 30           |
| 16-20             | 27           |
| 21-25             | 15           |
| 26-30             | 10           |
| 31-40             | 25           |
| 41-50             | 12           |
| 51-60             | 3            |
| 61 and up         | 3            |
| <b>Total</b>      | <b>149</b>   |

## Medical Team Activities

The THHF surgical team performed a total of 71 procedures on 69 patients, ranging in age from 3 months to 75 years. Two patients receiving hernia repairs also received an orchiopexy and a skin tag removal (See Table 5).

Table 5 – Procedures Performed on 69 Patients.

| Procedures  | No. Completed |
|---|---------------|
| Excisions (mass, cyst, lipoma, skin tags, etc)    | 22            |
| Hernia repair (inguinal)                          | 18            |
| Microtia (external ear rebuild)                   | 5             |
| Orchiopexy  | 4             |
| Cleft Palate                                      | 3             |
| Hernia repair (femoral)                           | 3             |
| Polydactyly - removal                             | 3             |
| Contracture release                               | 2             |
| Hernia repair (umbilical)                         | 2             |
| Dacryo-cysto-rhinoplasty                          | 1             |
| Cleft Lip   | 1             |
| Frenulectomy (tongue tie release)                 | 1             |
| Hemifacial microsomia Kaban Type 1                | 1             |
| Repair obstructed lacrimal conduit/ eye infection | 1             |
| Lip release                                       | 1             |
| Lip revision                                      | 1             |
| Palate fistula repair/closure                     | 1             |
| Inferior earlobe repair                           | 1             |
| <b>Total</b>                                      | <b>71</b>     |

## Impact on Quality of Life

A total of 502 DALYs were averted by performing the 71 surgical procedures on 69 patients. The most DALYs were saved through hernia repairs (inguinal, umbilical and femoral). In all, hernia repairs for 23 patients contributed towards a savings of 393.2 life years, an average of 17 years saved per patient!

Cleft palate repairs were also responsible for a large proportion of DALYs averted in comparison to their proportion of cases (these contributed to 8.6% of DALYs saved but only represented 4.2% of total cases; see Figure 3). For cleft lip and/or palates, 1.9 years of quality life (DALYs) to age 5 were saved for the three patients less than 5 years of age. Total years of quality life saved over lifetimes by performing cleft

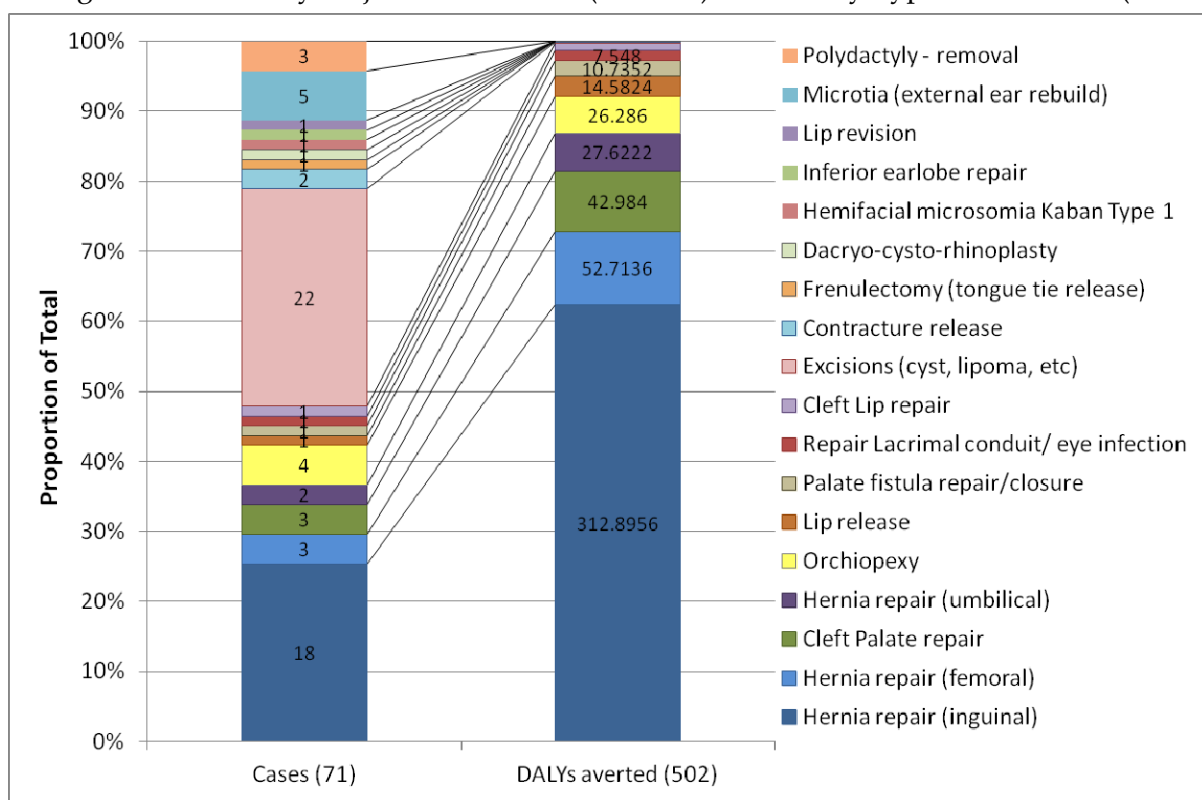


palate repairs were 43 years – that is an average of 14 years saved per patient! Other procedures that averted proportionately more DALYs were palate fistula repair, orchiopexy, lacrimal conduit obstruction repair, and cleft lip repair and - depending on extent of resulting disability - scar contracture releases (See Figure 3).

*“The smiles and hugs from the patients and their families from pure elation and gratitude for changing their lives brought tears to my eyes. We didn't want to leave.”*

— Erika Waldrop, C.R.N.A., B.S.N., M.S.

Figure 3 – Disability-Adjusted Life Years (DALYs<sup>1</sup>) Averted by Type of Procedure (Cases)



<sup>1</sup>Each DALY represents a year of healthy life lost due to disability or death.

## Discussion

Assessing the burden of disease encompasses the prevalence of disease entities, but it is the impact that affects the populace, and optimal intervention evaluations demonstrate impact as opposed to simply enumerating their services (4). In this report we evaluated the impact in terms of years of quality life saved (DALYs averted). We also demonstrated the need for clinical health services based on the patients' health status and the distances families were willing to travel to receive care.

A total of 502 total DALYs were averted due to the intervention of THHF! The majority of these DALYs were averted through surgical treatment of inguinal hernias, and cleft palate and lip repairs. Hernias, cleft lip and cleft palate all have a substantial impact on the economic health of countries in the developing world. The Healing Hands Foundation missions to Patzún provide a cost-effective intervention to treat these conditions and others of major health consequence.

Since certain conditions are not considered life-threatening nor contribute to a quantifiable life-long disability, not all patients' surgical treatments by THHF doctors contributed directly toward the total DALYs averted. Still, these treatments can make an enormous positive impact on those patients' lives in terms of reducing social stigmas associated with deformities and improve self-esteem. These surgical corrections provide the patient, as well as their community, benefits that are not quantified but no less important.

Further studies may evaluate quantifying the economic benefits of surgeries in addition to their health impact. Mission costs and benefits should be evaluated with an economically sound approach (5).

Based on experiences from the 2012 mission, some recommendations may be considered for future missions, including:

- Electronic record keeping. This was THHF's 4<sup>th</sup> mission to Patzún, and some patients received their 2<sup>nd</sup> mission-provided procedure. Electronic record keeping would improve tracking and documenting patient health status and history, particularly for those patients who may be seen again. The benefits would also be shared by Corpus Christi Hospital, and there may even be potential for health information sharing with the local Patzún health clinic.
- Same-Day Surgery Scheduling. A daily procedure scheduling system is needed that tracks patients as they are admitted, receive pre-operation examination, allow viewing of vitals and medical history, OR room number and status, PACU status, recovery room number, and discharge date and time. Such a system could be changed as needed throughout the day/week, and provides a single, central point of up-to-date information.
- Internet service – wireless – to provide THHF volunteers immediate access to the above described schedule via mobile devices such as iPads or monitors located throughout the hospital.
- Include vaccinations as part of mission.
- Continued use of THHFG for logistical support. Having in-country support is tremendous and adds additional local funding to support THHF missions. The in-country support also streamlines all logistical activities, allowing the physicians and surgeons to focus on their medical work and fulfill the purpose of the mission.



*The findings from the 2012 Guatemala mission reveal the importance of bringing surgical expertise and medical supplies to this remote region, as realized by the distances and variety of*



locales from which patients traveled to receive care. The BMI and health status of patients expose the great need for better health and nutritional care among THHF patients.

## Data Analysis

Age, sex, diagnosis, treatment and outcome were documented for each patient. A medical history of each patient was gathered based on self-reports and THHF/Corpus Christi medical charts. Pre-surgery vitals were taken including weight, height, temperature, hemoglobin, blood glucose and white blood count for patients. Additional medical observations were documented during pre-surgery physical exams by THHF staff. Drug treatments were noted when available. Medical charts were translated by the medical and support staff of the THHF.

The mission's efficacy in reducing disease burden was determined by estimating disability adjusted life years (DALYs) that were averted due to THHF's medical services and surgeries. According to World Health Organization (WHO) guidelines, the DALY is a measure of disease burden that considers both premature death as well as non-fatal health consequences of disease or injury (disability) (6, 7). Each DALY can be thought of as one year of healthy life lost, and is a commonly used methodology for cost-effectiveness analysis (8). The metric is calculated as  $DALY = YLL + YLD$ , where YLL represents years of life lost due to the condition, and YLD the years lived with disability for non-fatal conditions. To calculate YLL, we used published standard values for discounted YLL due to death at ages.

A scoring system defined severity of disease and efficacy of treatment (for either life or disability) following previously established methods (6, 9). Disability weights for diseases and conditions were taken from average disability weights used by Murray,(6) from values reported in Table 3A.6 of the Global Burden of Disease Project (10) or from other published condition-specific metrics(11).

Life-long DALYs due to disability and/or death were calculated for all conditions; however, for cleft lip and/or palate we calculated DALYs to age 5 years as well as life-long. Since cleft lip and palate require follow-up therapies in addition to surgeries, children in developing countries miss out not only on surgical treatments, but also pre and postsurgical therapies of speech and orthodontics. Because of this, we postulate that the cost incurred for affected persons in terms of premature death, access to treatment, exclusion from education, employment and society in general are significant. Magee et al (12) attempted to measure this by attributing disability weights for untreated cleft palate (0.231) and residual weights following treatment (0.015). We followed their published methods to adjust for residual disability.

## Assumptions

Children in the developing world not only fail to receive surgery, but they also miss important post-treatments and therapy that children in the developed world receive. It is challenging to calculate cleft lip/palate DALYs over a person's life-time, because it depends on how much comprehensive care each patient receives, and how old they are when they receive it.

In addition, the Disease Control Priorities Project (DCP1) life tables suggest that the entire burden of disease from a cleft lip and palate is incurred within the first 4 years of life. The absence of disability weights for untreated cleft lip and palate after the fifth year of life does not fit with the reality of living with an unrepaired cleft lip or palate (12).

Recently, Magee et al (12), attempted to demonstrate the cost-effectiveness of cleft lip and palate operations in the developing world, specifically through international volunteer missions, such as Operation Smile, as a vehicle for delivery. They deduced a residual disability measure to take into account the average amount of disability a patient maintains after surgery, and which we used as well in our DALY calculations.

## References

1. Initiative GH. Global Health Initiative: Guatemala Strategy. [online article]. 2010: <http://www.ghi.gov/country/guatemala/documents/160169.htm>.
2. Organization WH. Country Statistics - Guatemala. 2010.
3. Department AaCP. Nutrition Country Profiles. Food and Agriculture Organization of the UN; 2010 [cited 2012 December]; Available from: [http://www.fao.org/ag/agn/nutrition/gtm\\_en.stm](http://www.fao.org/ag/agn/nutrition/gtm_en.stm).
4. Corlew D. Estimation of Impact of Surgical Disease Through Economic Modeling of Cleft Lip and Palate Care. *World J Surg* 2010;34(3):391-6.
5. Alkire B, Hughes C, Nash K, Vincent J, Meara J. Potential Economic Benefit of Cleft Lip and Palate Repair in Sub-Saharan Africa. *World J Surg* 2011;35(6):1194-201.
6. Murray CJ. Quantifying the burden of disease: the technical basis for disability-adjusted life years. *Bull World Health Organ* 1994;72(3):429-45.
7. Murray CJL, Lopez AD. Global comparative assessments in the health sector : disease burden, expenditures, and intervention packages : collected reprints from the Bulletin of the World Health Organization. Geneva: World Health Organization; 1994.
8. Sassi F. Calculating QALYs, comparing QALY and DALY calculations. *Health Policy and Planning* 2006 September 1, 2006;21(5):402-8.
9. McCord C, Chowdhury Q. A cost effective small hospital in Bangladesh: what it can mean for emergency obstetric care. *Int J Gynaecol Obstet* 2003 Apr;81(1):83-92.
10. Lopez AD, Disease Control Priorities Project. Global burden of disease and risk factors. New York, NY; Washington, DC: Oxford University Press ; World Bank; 2006.
11. Shillcutt SD, Clarke MG, Kingsnorth AN. Cost-effectiveness of groin hernia surgery in the Western Region of Ghana. *Arch Surg. [Comparative Study Multicenter Study Research Support, Non-U.S. Gov't]*. 2010 Oct;145(10):954-61.
12. Magee W, Vander Burg R, Hatcher K. Cleft Lip and Palate as a Cost-effective Health Care Treatment in the Developing World. *World J Surg* 2010;34(3):420-7.