

SOCIAL INNOVATION IN HEALTH INITIATIVE



MOSQUITIA MED

CONTINENT

Central America

COUNTRY

Honduras

HEALTH FOCUS

Primary Health

AREAS OF INTEREST

Telehealth, intercultural health

HEALTH SYSTEM FOCUS

Community service delivery

MOSQUITIAMED, HONDURAS

Initiative based on volunteerism and focused on telehealth to improve access to primary and specialized health services and community care. In addition to lowering barriers to health access for the majority indigenous population of the department of Gracias a Dios, MosquitiaMed seeks to reduce the impact of health service costs on the family and community economy.

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ABBREVIATIONS

PHC	Primary Health Care
CONADEH	National Human Rights Commissioner - Honduras
FOSDEH	Social Forum on External Debt and Development of Honduras
INE	National Statistics Institute
NGO	Non-Governmental Organisation
PAO	Pan American Health Organization

1. CASE INTRODUCTION

The Mosquitia is a cross-border coastal region that includes territories of both Honduras and Nicaragua. On the Honduran side, La Mosquitia is located in the department of Gracias a Dios, an area where the state has not been able to guarantee the minimum required for people to lead a healthy life. Consequently, it encompasses a population whose basic rights are violated. To help change this situation, MosquitiaMed was created as an initiative that seeks to improve access to health services for the inhabitants of Gracias a Dios, the capital of which is Puerto Lempira.

This project has its origin in the commitment and social sensitivity of Manuel Espinoza, a 29 years old Honduran doctor who graduated in 2016 from the Catholic University of Honduras, and who, in his last year of his medical training, volunteered to provide health services in La Mosquitia. Like other young doctors who come to this region, Manuel was attracted by the area's particularities and the lessons that could be learned from working with a population with so many neglected needs. However, not many doctors in training look for this type of experience and the Hospital of Puerto Lempira—the only hospital in all of Gracias a Dios—is usually considered an undesirable place to spend time undertaking required social service.

More than 60 percent of the Honduran population lives in poverty. In rural areas this situation is more serious and extreme poverty is common among its inhabitants (FOSDEH, 2018; CONADEH, 2014). In addition, more than 95 percent of the people on the Honduran side of La Mosquitia belong to the Miskito or Misquita ethnic group (INE, 2013), who have continuously experienced discrimination by the minority that controls the country's economic power, making visible the conditions of inequality in which they live.

Contrasting the conditions of poverty and the natural beauty and abundance of natural resources that characterize Gracias a Dios - the second largest department in the country, with seven percent of the national territory - a young Honduran described its people as "a rich population living as poor." In an ecology of rivers,

savannah, mangrove and rainforest, the Misquitos coexist with smaller ethnic communities of Garifuna, Tawahkas and Pech (Lagos, 2017).

Puerto Lempira is home to nearly 50 percent of the department's 100,000 inhabitants, according to the national census projection for 2018 (INE, 2013). For those who do not live in the capital city, access to the department's only hospital is a challenge because the distance between villages is considerable, transport and access routes are scarce, and many communities can only be reached by water transport. To travel to Puerto Lempira, rural inhabitants use pipantes or canoes propelled by wooden shovels. "The department of Gracias a Dios is quite isolated from the rest of the national territory, so they [the inhabitants] don't have such an easy time getting around, they go in pipantes [for] long hours (....) People often walk for three to four days to go to the Hospital [in Puerto Lempira]," Zuny Mejía and Eimy Barahona, members of the MosquitiaMed team, explained. In addition, the hospital lacks medical specialists, many laboratory services, and various other diagnostic technologies, and the only option for many patients is to travel to Tegucigalpa, the capital city of Honduras. Travel to Tegucigalpa from Puerto Lempira is expensive and only possible by air.

A group of doctors who undertook their required social service at the Hospital de Puerto Lempira, led by Dr. Manuel Espinoza, decided, in their free time and even after their period of social service ended, to implement actions to help improve the region's health problems by: 1) improving access to health care for the population; and 2) guiding and educating families and communities in the early identification of illnesses that do not necessarily require the intervention of health personnel and, therefore, can be treated at home. Both goals allow the possible reduction of costs of seeking healthcare for illnesses on the family economy.

After identifying community needs, the doctors took advantage of good cell phone coverage in some sectors of the region, especially in Puerto Lempira, and alliances with institutions and

colleagues, to visit different communities. MosquitiaMed, the name a portmanteau of the region where the initiative operates and “medical work,” began its work through two main lines of action:

a) Health brigades and native language telehealth programs

A team of volunteers offers general health care activities through the work of the Goal Foundation, among others. The main objective is to educate the community in first aid and in family and community care for illnesses that do not require medical intervention. These educational activities, which are carried out in misquito language with the support of volunteer bilingual guides, led to a series of videos that MosquitiaMed plans to show in medical centre waiting rooms and in other community meeting spaces in the Mosquitia.

b) Telemedicine:

For complex medical cases, MosquitiaMed carries out telemedicine consultations with colleagues, specialists, and professors of medical schools primarily located in Tegucigalpa. When doctors who were performing their social service in the Mosquitia were faced with cases that they found difficult to resolve on their own, they consulted with their colleagues via messaging apps to resolve clinical questions. This strategy proved to be effective most of the time and is thought to have prevented many patients from travelling

unnecessarily to Tegucigalpa for care. As airfares to Tegucigalpa cost more than a trip to the United States, this travel often has catastrophic consequences for the family economy. Through telemedicine and crowdsourcing strategies, the members of MosquitiaMed have managed to speed up referral procedures for the diagnosis and treatment of patients in critical situations, and to obtain donations for the movement of patients, medicines, diagnostic tests, and prostheses.

The good clinical results, including the prevention of patient deaths, motivated Manuel, his colleagues in Puerto Lempira, and new doctors arriving to perform their social service in the hospital, to make use of their professional and personal networks, mobile technology, and their abilities to better attend to the population of La Mosquitia. Knowing the community’s needs and identifying opportunities for health intervention have been critical for MosquitiaMed’s activities development, as Manuel explains, *“in the communities there is no drinking water, no road or electricity service, but there is a mobile phone signal, so far from seeing this as a problem we saw an opportunity[to] save many lives by guiding the communities on what to do in various health situations”* (Manuel Espinoza, Innovator, 29 years, Puerto Lempira, 2018).

2. INNOVATION AT A GLANCE

Project Details

Project name	MosquitiaMed: shortening distances through telemedicine
Founding year	2016
Founder's name	Manuel Espinoza, Morgan Hayden, Heidy Galindo, Suny Mejía, Eimy Barahona, Johsuar Barahona, Jimmy Kury, Valeska Matanoros, Dany Diaz
Nationality of funders	Honduras, United States
Organisations involved	NGOs: Goal Foundation; Root Ministries; Public Health Centres: Hospital de Puerto Lempira, Hospital María; Private Sector: Novartis, Químicas Dinan, AstraZeneca
Organisational structure	Volunteering
Size	12 people, on average

Innovation Value

Value proposition	Reducing unnecessary patient transfers and the impact of the cost of seeking health care on family and community economies through the use of telemedicine and community health education in the Miskito language
Beneficiaries	Communities from Gracias a Dios, Honduras
Key components	Community health education, Communication in the Miskito language, Telemedicine and TelehealthCrowdsourcing

Operational Details

Main income streams	Volunteerism, donations, and institutional support from companies, state institutions, non-governmental organisations, and other medical specialist networks and individuals
Annual expenditure	\$40,000 US dollars. However, these costs vary as donations are mainly in kind and depend on the specific needs of the consultants.

Scale and Transferability

Scope of operations	Department of Gracias a Dios (Honduras), with an approximate population of 100,000 inhabitants, according to the 2018 projection of the 2013 national census.
Local engagement	Local authorities, hospital personnel, and the national army in the area have joined efforts in conjunction with laboratories and medical care centres in Tegucigalpa.
Scalability	<p>MosquitiaMed demonstrates the potential for scalability:</p> <ul style="list-style-type: none"> - The implementation of the telemedicine programme even in the most remote communities of the department. - The agreement of public and private health institutions to use the developed health videos and to support community health education. - The creation of a low-cost care centre for the communities and a technological platform to promote the telemedicine program.
Sustainability	<p>To ensure the sustainability of MosquitiaMed, innovators plan to:</p> <ul style="list-style-type: none"> - Legally constitute the programme with an organisational structure that includes a favorable financial analysis for the implementation of the actions and the definition of a basic work team that does not only depend on volunteerism. - Formalize inter-institutional relations with academia, public entities, and the private sector to plan systematic actions with communities.

3. THE CHALLENGE

Although Gracias a Dios is the second largest department in Honduras, it can only be reached by air, river or sea. Even then, the airstrip is unpaved, the dock where boats arrive is precarious, and transportation costs are extremely high (Lagos, 2017; Suazo, 2015). The department, one of the poorest in Honduras, is home to more than 100,000 inhabitants (INE, 2013) and has the lowest population density in the country, with 5.35 inhabitants per km². Gracias a Dios has some of the worst health disparities in Honduras for diseases such as pneumonia, diarrhea, malaria, syphilis, AIDS, hypertension, and diabetes mellitus (Honduran Ministry of Health and PAHO, 2011). The Honduran Mosquitia, a cross-border, indigenous region located principally within Gracias a Dios, is inhabited mainly by Misquitos, Tawahkas, Pech and Garífunas (Lagos, 2017). In this setting, "indigenous peoples' diseases are invisible because the information system does not capture these differences and diseases are the expression of inequities" (PAHO, n.d.).

In Puerto Lempira, capital of the department, only one hospital covers the health needs of the entire population of Gracias a Dios. This hospital lacks adequate infrastructure and available specialists—there are only specialists in internal medicine, gynecology, pediatrics and general surgery—so there are multiple deficiencies in health care delivery. Drugs, basic supplies and technological equipment to address complex health problems are also scarce. In addition, the hospital must deal with multiple decompression sickness accidents in young people who dive without any training or adequate equipment to hunt lobsters, sea cucumbers and snails at the bottom of the sea, an informal job that barely meets their need to survive, and often results in disabling or deadly consequences for which no one is held responsible (Agencia EFE, 2017; Bonilla and Box, 2012; El Heraldo, 2014). The hospital's electricity supply, like that of the entire municipality, is unreliable and, as a result, intra-hospital infections are a serious problem (La Tribuna, 2015).

In the hope that the provision of health services would improve, the hospital of Puerto Lempira, along with four other Honduran hospitals, was decentralised by transferring its administration from the Honduran Department of Health to the Honduran Armed Forces. This strategy was conceived of as a way to improve the region's ability to transport patients by sea or air from Puerto Lempira to better equipped health centres, generally located in the capital city (El Heraldo, 2015, 2016).

Eimy Barahona, a member of the MosquitiaMed team, says that in Tegucigalpa *"nothing is known about La Mosquitia, only rumors; it is the place where the doctors in their year of social service do not want to go because it is a place of very difficult access, which is totally remote, we know absolutely nothing, except that there is a lot of drug trafficking, that has a very tropical climate and where there is a lot of malaria"*. When they arrived in La Mosquitia, she and her fellow doctors were shocked not only by the striking beauty of the place and the richness of Miskito culture, but also by the existence of health problems that could be easily solved or prevented. *"I was impressed to see that there is only one hospital for all Gracias a Dios (...) So what happens to remote communities, what happens if a person cannot mobilize? There are high rates of infectious contagious diseases because people may not know that you don't have to drink unboiled or unchlorinated well water, that you don't have to drink rainwater, that animals don't have to eat or be there, that they don't have a way to treat excreta...simple things caused enough morbidity and mortality mostly in children"* (Eimy Barahona, a member of the MosquitiaMed).

The region of La Mosquitia within Gracias a Dios encompasses a population in which social determinants of health and violations of human rights in health converge. The region lacks road infrastructure and adequate forms of transport between communities in all six of its municipalities. The lack of electricity and clean drinking water, despite the region's natural

resources, and food insecurity due to the low rate of agricultural production and the consequences of a period when drug trafficking was the main source of family income, are important factors that negatively impact the health conditions of the entire population.

Honduras is characterised by high rates of maternal and infant morbidity and mortality, mainly due to preventable infections. Among the main causes of infant death are diarrhea, acute respiratory diseases and malnutrition (National Centre for Medical Sciences Information, 2017). In agreement, Manuel says: *"Here I have seen many children die from diarrhea, from malnutrition, people who have died from infections that are easy to treat [...] it is incredible that no one in the community would have given an antibiotic or a serum to a child for oral rehydration, does anyone know or is not aware what they can do?"* This demonstrates what CONADEH (2014) sees as the urgent need to implement Primary Health Care

(PHC) strategies to ensure that basic health conditions are met, to prevent infectious diseases and promote healthy lifestyles, and to facilitate coverage and access to health services for all inhabitants.

MosquitiaMed arose in response to the accumulated community needs that a group of doctors identified and to which they responded in a committed and innovative way. To this end, they used a series of existing strategies and resources that, by linking them to the socio-economic and cultural realities of the region's inhabitants, gave rise to other ways of solving health problems. Combining community health education (through telehealth), the use of mobile technologies for telemedicine, and crowdsourcing have been important elements in MosquitiaMed. In this way, MosquitiaMed has been able to solve health problems of low and medium complexity, as well as other more complex cases that put people's lives at risk.

4. INNOVATION IN INTERVENTION AND IMPLEMENTATION

"We do what the hospital [in Puerto Lempira] can't do, we assume from the point that they can't do it (...). The cases we are passionate about are the ones that are beyond what can be done there". With these words, Morgan Hayden, co-founder of MosquitiaMed, describes the initiative and its important role in filling gaps in the delivery of health services in La Mosquitia. In order to reach a solution that shortens distances, reduces costs, and improves quality and time in health care, the MosquitiaMed team identified different actions as follow:

4.1. COMMUNITY EDUCATION TO SOLVE SIMPLE HEALTH PROBLEMS WITHOUT DISPLACEMENT

The MosquitiaMed team decided to travel on weekends and during their free days to remote

places in Gracias a Dios to educate residents about simple and low complexity health problems. Given that these ailments were initially treated in communities, they sought to prevent complications in the patients and so avoid unnecessary trips to the hospital.

People from the communities - nursing assistants, church leaders, teachers, and villagers who wanted to support the initiative - helped to schedule visits and summon community members. Two young volunteers took on the role of bilingual guides in order to achieve communication to reduce the barrier to access to health related to the lack of knowledge of native languages, and of various local practices related to health-disease processes.

MosquitiaMed's main teaching aid was *Dónde no hay doctor: Una guía para los campesinos que*

viven lejos de los centros médicos (Where there is no doctor, Werner et al., 2010), a book on popular health education developed by the Hesperian Foundation. With this methodological guide, the MosquitiaMed team offered guidelines for managing symptoms that can be treated by community members themselves. They also taught *"simple things, like what to do when someone breaks a bone, if someone is not conscious, how and why to boil water, how to prepare homemade rehydration salts, what are the signs of dehydration seen with diarrhea, and in what situations you have to go to the hospital, yes or no,"* says Eimy Barahona.

After carrying out these visits, in teams referred to as health brigades, the doctors began to receive at the hospital of Puerto Lempira people who had already applied what they had been taught, and cases of illness that could be easily treated: *"Patients already come to us without serious dehydration, for example; then, the patient can be treated better and we can achieve a better evolution of his illness, that it resolves faster",* continues Eimy, who was very satisfied to see that the team's efforts had paid off.

4.2. NATIVE LANGUAGE VIDEOS, A STRATEGY FOR THE SOCIAL APPROPRIATION OF KNOWLEDGE

During visits to the most remote communities in Puerto Lempira, the team of volunteers realized that having bilingual, native and interested guides with knowledge of community health was difficult, that the support of someone who could act as a translator was not enough, and sometimes increased the communication barrier between residents and health personnel. The experience showed that communication with the translator was not very fluid and that people lost interest and were bored with the activity.

As a result, MosquitiaMed created another way of educating by keeping the bilingual guide, but in a fluid and clear way, making use of previously constructed scripts and the technological support that facilitated the process. They devoted time and effort to making videos in Misquito that would transmit the same knowledge to communities as a way to prevent long, costly and sometimes unnecessary trips to the hospital. They promoted

community health practices that could reach the inhabitants of Gracias a Dios, in the waiting rooms of medical centres, and in educational centres where the basic technology for sharing videos could be found. This is how Zuny Mejía sums it up: *"We want to promote tele-health through videos in misquito or with translation so that they can begin to empower themselves.... so that they know how to take care of themselves, how to treat the water they drink, how to use excreta, what pregnant women need to know and everything related to basic first aid".*

4.3. TELEMEDICINE TO REDUCE THE NEGATIVE IMPACT OF THE HIGH COST OF HEALTH CARE ON THE FAMILY AND COMMUNITY ECONOMY

Although popular health education proved to be a useful and efficient strategy, MosquitiaMed members felt they were falling short with this approach. Motivated to facilitate and improve access to health care for people who need to consult health personnel, they decided to develop a system of online medical consultation using basic but efficient technological resources.

Telemedicine is a useful and viable alternative in a context where people, despite many basic unmet needs and a lack of electricity and piped drinking water, generally have access to telephone and mobile data networks, that operate through solar panels or fuel-based generators. The MosquitiaMed team saw this as an opportunity to: a) carry out consultations with general medicine and first and second level specialists, b) provide solutions to health problems without having to transport patients to the capital and, on other occasions, c) transfer patients in an organised manner and in agreement with professionals and health entities in the capital. According to Manuel, this strategy *"was born in the hospital when we received a case that required consultation with a specialist but we did not have access to one physically. But all of us were students of some specialist in the faculty, so we had the contact of a lot of specialists, so every time we had a problem or a case that came out of our hands, we consulted by whatsapp or by phone".* These young doctors followed the instructions given by their teachers to diagnose and treat many of the cases, so moving from mHealth to telemedicine.

Thanks to this effort, MosquitiaMed was able to significantly reduce the costs of solving certain health problems in La Mosquitia. In many cases, they were able to avoid patient transportation to Tegucigalpa by air, and the expenses associated with the patient's and his/her companion's stay in the capital. Before MosquitiaMed made this possible, families had to borrow money, or even sold their pipantes or other objects necessary for their daily life and subsistence.

4.4. CROWDSOURCING

Given the precarious conditions of inhabitants of La Mosquitia and even the doctors who work at the Hospital of Puerto Lempira, the MosquitiaMed team understood that the objectives could not be achieved if they worked alone and that cooperating and collaborating with others enhanced the effectiveness and scope of their actions. For this reason, they created a network of friends, colleagues and health personnel willing to contribute to the people of Gracias a Dios with their knowledge, suggestions, recommendations and even *"with financial contributions if necessary,"* as Manuel says.

Crowdsourcing is an English term that refers to the generation of mass collaboration to provide solutions to concrete problems. In the case of MosquitiaMed, crowdsourcing allowed them to have expertise and resources not available in Puerto Lempira, but which was able to be mobilized through a cell phone, making use of free instant messaging applications such as WhatsApp. Currently, professionals in Business Administration and Systems Engineering supported MosquitiaMed to move towards the development of a platform that, in a simple but safe way, can facilitate the interaction between doctors and specialists from different parts of the country.

MosquitiaMed's collaborative strategy has also allowed the group to receive in-kind donations such as medicines, laboratory tests and, in one specific case, a prosthesis for a man whose right arm had been devoured by a crocodile. In describing this collaboration, Manuel shared Melanie's case: *"She was 9 years old with the height of a three or four-year-old girl, nobody wondered what was wrong with her height, so we contacted endocrinology and were given instructions to do a hand x-ray to see bone age, it was identified that she had the bones of a two-year-old girl and we proceeded to take a sample for thyroid testing. The blood sample was airlifted to Tegucigalpa to an allied laboratory, where it was processed*

and a severe thyroid problem was diagnosed, so treatment was continued without having to displace the girl. This saved us time and money with the support of the network of friends and colleagues".

5. ORGANISATION AND PEOPLE

The group of young doctors who started MosquitiaMed provided their year of social service

in Puerto Lempira in 2016. Throughout this period, they lived together and established close

relationships of friendship and partnership. *"We are truly united by the desire to want to change the way things are done in the health system, especially in this region where we lived together for a year and saw that there was so much need,"* says Manuel Espinoza (Puerto Lempira, 2017).

Under the leadership of Manuel Espinoza, colleagues such as Zuny Mejía, Eimy Barahona and Morgan Hayden (language therapist) dedicated their free time to bring health to communities and bringing this initiative to life. However, their stay in La Mosquitia was limited and they were forced to return to the capital or other cities of the country to practice their profession. As a result, they began a process of recruiting volunteers from the hospital's permanent staff, residents of the region and new doctors who came to provide their social services to the hospital. Most recently, Juan Diego Escalante, who has experience and training in administrative and technological areas rather than in the health area joined the team to strengthen the multidisciplinary condition of the initiative.

The set-up of the working group and the relocation of most of them to the capital city, within public and private hospitals and health programs, has allowed those who remain linked to MosquitiaMed to move from providing assistance in Puerto Lempira to being resource managers. In this way, they have managed to attract new specialists to support the telemedicine strategy and to generate agreements with institutions to facilitate the care of patients who must necessarily travel to the capital. MosquitiaMed takes advantage of its

location and relationships of each of its members to deploy its aid from several fronts, and to manage to carry out each of the cases, with their particularities.

After two years of operation – guided by intuition, heart and the conviction of being able to contribute socially to the construction of better health conditions in the population of Gracias a Dios – MosquitiaMed is now advancing in terms of organisational constitution with a view to strengthening its goals and objectives. Its purpose is to be legally constituted as an NGO to operate permanently from Puerto Lempira.

MosquitiaMed's dream is to have a health care centre which can provide consultation with specialists at very low cost through telemedicine, specialized diagnostic tests in partnership with laboratories, specialized centres in Tegucigalpa and other cities of the country, health education through videos in the Misquito language, and health brigades to the most distant communities of the region implemented within the framework of a formal national and international volunteer program. Constituted as the MosquitiaMed Foundation, its members hope to reduce the difficulties they currently face when it comes to receiving donations in money and in kind. Zunny Mejia says: *"We are looking for medicines to send them [from the capital], this has happened three or four times, but not being legally constituted means that the aid is reduced"*.

6. RESULTS AND IMPACT

6.1. IMPACT ON ACCESS TO HEALTH SERVICES

Despite the fact that MosquitiaMed is an initiative with only two years of experience and that it does not yet have a systematic process of evaluating results and impact, through the testimony and experience of volunteers, institutional representatives and inhabitants of Gracias a Dios, it is possible to identify the value of the initiative for the people and the communities of La

Mosquitia in Honduras. An example of this is the testimony of Duval Alvarado: *"La Mosquitia has many needs, we have few doctors [...] but we want to take this town forward [...] MosquitiaMed has helped us with the needs that we doctors have: to have a specialized consultation, to have a support with the logistics, with the inputs [...], they have supported us with medicines that the regional level*

does not supply us with, they get medicines and they send them to us free of charge, such as prenatal care for pregnant women and some antibiotics" (doctor of the municipality Ramón Villeda Morales).

According to Manuel Espinoza, MosquitiaMed has managed to reduce the need for transfers by approximately 80 percent. In addition, it has facilitated the procurement of basic inputs for the work of volunteer doctors at the Hospital de Puerto Lempira and for health personnel who work permanently in community care centres. By 2017, MosquitiaMed had directly benefited nearly 2,800 children through a nutritional support programme and 2,500 patients in health brigades in communities, villages and hamlets. They have trained more than 600 people in the course, based on the book *Donde No Hay Doctor*. Of the 350 cases that have had access to consults through telemedicine, approximately 20 patients were transferred with the support and resource management of MosquitiaMed. A significant number of these beneficiaries received medication supervised by volunteer doctors and nurses.

The main result for members of the initiative is that they have contributed to the empowerment of indigenous communities to attend to and evaluate their own needs in terms of prevention and treatment of diseases of low complexity, without distorting the cultural sense of traditional medicine. At the same time, MosquitiaMed has contributed significantly to preventing the family and community economy from unnecessary displacement and, in other cases, by displacements in search of services and specialized doctors in Tegucigalpa without the adequate assistance of health professionals. As will be seen in the two cases below, planning and coordinating travel with institutions and professionals in cities makes it easier to access services and so reduces costs and time spent outside people's own communities.

6.2. EXPERIENCE OF PATIENTS WHO MARKED THE HISTORY OF MOSQUITIAMED

Although MosquitiaMed has provided support to a large number of people in Gracias a Dios, two cases have been reported that, due to the critical

condition of the patients, were a cornerstone in the origin and development of this initiative.

Arturo, the man whose arm was snatched away by a crocodile

Arturo is a 33 years old man of the Miskito ethnic group, father of seven children. Like many men in the region, he worked in lobster fishing through artisanal diving, a highly dangerous practice that has left "negative consequences on both marine ecosystems and the health of Miskito divers" (Bonilla & Box, 2012). On the morning of May 7, when he was diving in the Mocoron River looking for turtles to provide food for his family, he suddenly found a crocodile. *"He came to me and grabbed my hand, I saw him coming with the intention of eating me and my first reaction was to put my arm on him"*, Arturo explained (Tansin community). A man passing by on a boat picked Arturo up and took him to his community. Several hours later, people were able to find a vehicle to transport him to the hospital where his arm was inevitably amputated.

MosquitiaMed helped Arturo to obtain the arm prosthesis and took care of the air transfers, with the support of private organisations, to the department of Copán, in the far western part of the country. Crossing the country from east to west by plane, staying for days in another city and covering the costs of feeding him and his companion – as well as the costs associated with the prosthesis, medicines and specialists – would not have been possible for Arturo without the logistical and financial support of MosquitiaMed. Besides, he would have had to leave his family without support. *"The first time I traveled, they evaluated me and took my measurements out of my arm, but the second time they already put the prosthesis on me...]* When I didn't have a prosthesis I couldn't even tie my shoes, then it was good for everything, I can now brush my teeth and I can even work for a living, the prosthesis has helped me a lot", says Arturo.

Roy, the boy who came back to life

Morgan, a member of MosquitiaMed, ran a children's canteen as a way to alleviate hunger and malnutrition among children in the Mosquitia region. One day, a six-month-old boy, Roy, with injuries to his scalp and face was taken to the

canteen, and Morgan suggested that his mother to take him to the hospital. A week later, when he visited Roy at home, Morgan found that that problem had progressed and the child had an open lesion with skull exposure.

At that moment, MosquitiaMed's assistance began. Roy was taken to the hospital and then, with inter-institutional support and donations from colleagues and friends, he was taken to Tegucigalpa for scalp grafting and recovery from undernutrition. Weeks after his return to the community, Roy had returned to a critical state of undernutrition, in addition to his diagnosis of cerebral palsy and epilepsy. He was again taken to Tegucigalpa for a neurological check-up and initiation of treatment to control the seizures and high fever. Morgan says: *"I only had to see a neurologist and medicate for the seizures, and that's something I see that MosquitiaMed could help with, it was an easy solution, but if he stayed here [in Puerto Lempira] he was going to die"* (Puerto Lempira, 2018).

In this case, it was necessary to add to the resource management a translator to act as a bilingual guide, since Roy's mother could only communicate in Miskito language. After this, Roy remained, in the company of his mother, in an institution for single mothers located in the city of Tegucigalpa. There they both were offered the necessary attention and in this way, it was possible to guarantee care and adherence to Roy's treatment.

7. SUSTAINABILITY AND SCALABILITY

As an initiative that arises from the specific needs of a society in which social inequity, the negligence of the state and the lack of resources and infrastructure prevail, MosquitiaMed became a strategy with possibilities of replicability and scalability within the department of Gracias a Dios, other communities in Honduras, and in neighbouring countries facing similar situations.

The approach, based on telehealth and telemedicine, drew on on simple and open access technology to offer some health services, especially online medical consultation and prevention education, to various communities in Puerto Lempira. It gradually broadened its spectrum of care to cover other municipalities of Gracias a Dios, through a strategy that has the potential to expand to other regions as young doctors who complete their social service settle in different cities to practice their profession.

The scalability in this case is possible through two ways:

A commitment to technological development

MosquitiaMed looks forward to develop a web app, designed specifically for the population of Gracias a Dios. This tool would take advantage of the growing Internet access in the region, which works stably for most of the day. It would function as a networking platform for doctors and specialists. At the same time, it would make it possible to attend to cases in Gracias a Dios through telemedicine and coordinate appointments with specialists in other cities, so reducing costs and the impact of this on families and communities.

An accessible medical centre

The support offered to patients like Arturo and Roy has demonstrated to MosquitiaMed that telemedicine is extremely valuable when dealing with low and medium complexity cases. However, highly complex cases require economic, technical and professional resources to achieve the objectives of diagnosis and treatment. For this reason, MosquitiaMed is currently working on an

organisational structure that includes three pillars: tele-health, telemedicine and a medical centre.

The goal is to create a medical centre that offers specialized services through telemedicine, health education, training of doctors and other professionals who do academic internships in the region, and specialized diagnostic services, among others. The aim is to continue to focus on reducing the number of trips to the capital for medical reasons. *"The idea is to open a clinic so that there can be some return in which the costs are lower for the communities and that here they can have access to consultation with specialists through telemedicine and highly complex examinations. It's much better to have it here so you don't have to travel, pay for airfare, pay for lodging, lose work time. All of that, comparatively, is a value proposition",* says Manuel Spinoza (Puerto Lempira, 2018).

Sustainability, articulated with scalability, should break the dependence pattern that MosquitiaMed, during these two years of existence, has had with people and donor institutions. While it is difficult for the state to support and appropriate such initiatives, it does not seem feasible for MosquitiaMed to achieve sustained public sector support. This jeopardizes the continuity of MosquitiaMed and its health care capabilities for the population of Gracias a Dios.

Despite the above, MosquitiaMed is currently committed to medium-term sustainability strategies such as:

- **Involving the academic sector** in the initiative as a way to support the consolidation of the

organisational structure, and to design intervention and research projects to identify other forms of work and funding.

- **Recruitment of health personnel as volunteers**, especially those who arrive in Puerto Lempira for their year of social service. So far this has been a strategy with positive results.

- **Payment of low cost services** so that patients can contribute to the sustainability of the initiative with their economic contribution when they attend the medical centre or third pillar of MosquitiaMed. The costs will be reckoned in such a way that they do not affect the family economy, as proposed from the beginning. It is also proposed that this payment be made from a differential approach, taking into account the socio-economic conditions of the people, the support of the communities, the time and resources required for travel to Puerto Lempira, and the need to stay or not in the municipality.

- **Crowdsourcing** has been and will continue to be an important source of human, financial and technical resources to allow MosquitiaMed to continue carrying out its activities and to manage alternative solutions to low, medium and high complexity health problems. The main contribution of partners is based on volunteering, both to visit communities and to respond to concerns and provide advice in the process of online medical consultation through telemedicine.

8. KEY LESSONS

After the significant achievements regarding the improvement of the health situation of the inhabitants of the Honduran Mosquitia who had been assisted by a group of innovators, members of MosquitiaMed have learned that when dreams and commitments are shared, barriers that seemed insurmountable can be broken down. Now they are encouraged by their motivation to continue with

the initiative and to make it sustainable. Acting as a group of volunteers, without an organisational structure to support them, has made them flexible and capable of generating diverse solutions to the contingencies that have arisen. However, they have also imposed a challenge in terms of resource management to resolve specific situations.

As a result, MosquitiaMed's innovators have been forced to seek financial help from friends, family and colleagues, who in turn rely on the solidarity of their personal and institutional networks to contribute to the solution of a specific situation or case in La Mosquitia. With this same intention they have obtained support through crowdfunding platforms. Like many other programs of social interest, they face difficulties to find sustainability strategies for the strategic projection of their activities, so they are now working on the generation and strengthening of the organisational structure of MosquitiaMed. They are also dedicated to creating a strategic work plan that will allow them to organize their future goals and activities so that they can continue to exist. In this way, they hope to be able to find sustainable forms of financing and national and international cooperation that will allow them to work without being forced to "use their hat to get money".

MosquitiaMed has left its members with invaluable lessons. It has been an unexpected journey for this group of young doctors. For some who arrived to Puerto Lempira planning only to carry out their year of social service, joining MosquitiaMed provided them with a temporary option to show solidarity with some of the most forgotten Hondurans, with a productive and socially meaningful activity to occupy those free days when there was not much to do in the municipality. But for Manuel, Zuny and Eimy, among others equally committed to the mission, MosquitiaMed became a personal and professional challenge that, after completing social service, persists. *"Health is everyone's right, so it is also a right that the people of Gracias a Dios must have at their fingertips [...]. They are our brothers, they are our people too, and we want to help them with what*

we have within our reach, our perseverance to give what we have and to seek what is necessary" (Jhosua Barahona, Tegucigalpa, 2018).

From their new workplaces, Zuny, Eimy, Jhosua, Jorge and the other members of MosquitiaMed, find a way to continue to be involved and liaise with specialists, laboratories and hospitals of second and third level of care. Manuel decided to settle permanently in La Mosquitia. He recently established a home with Morgan, one of the founders of MosquitiaMed, and their four children, of whom three were adopted in Puerto Lempira. Although Manuel is working on the malaria programme of a US nonprofit organisation with no explicit link to MosquitiaMed, he has been able to remain in the region and continue being committed with the initiative, taking advantage of the help of those who arrive temporarily or permanently in this territory. The challenge is just beginning -- or, this is only the start of MosquitiaMed -- because improving the health conditions of a community and a region implies complex perspectives and multidimensional alternatives in health that go beyond access to medical care. MosquitiaMed needs to work hard to find the chance of consolidating itself until the communities can legitimize their work in benefit of the social transformation of the population.

9. CASE INSIGHTS

1. Communities are able to learn and solve health problems of low complexity, avoiding unnecessary travel and complications arising from not doing so. MosquitiaMed provides leaders, community authorities and residents with basic knowledge of primary health care and health posts with inputs for assistance work. These contributions recognize traditional medicine as an opportunity to promote health empowerment among the communities of Gracias a Dios.
2. MosquitiaMed is a diverse venture based on three elements: health education, primary health care and telemedicine that articulates, through volunteerism, different individual and institutional actors to provide assistance to the inhabitants of La Mosquitia in needs related to health access. Many cases demand a comprehensive and holistic health model to make this innovative approach effective.
3. The willingness of a group of well-meaning and highly motivated young doctors is not enough to address the multiple health needs of the people of Gracias a Dios. The state should take charge by working in partnership with other institutions that already have presence in the area, such as Goal and Norman I Love Foundations among others, but also with initiatives that, like MosquitiaMed, want to contribute to the wellbeing of the communities.

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