Designing Sustainable Revenue Models for CHW-Centric Entrepreneurial Ventures

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Abstract **– Developing countries around the world have implemented Community Health Worker (CHW) programs to improve community health through education, advocacy and direct assistance. CHWs have repeatedly proven their ability to mitigate the growing double disease burden of infectious and chronic illnesses. At the same time, a lack of tangible incentives for CHWs leads to high attrition rates, poor efficiency and lack of coordination and accountability. In the quest for transforming CHWs from volunteers to entrepreneurs, a typology of eight business models where CHWs function as the channels and champions for global health projects has been articulated. In parallel, the literature on the failure modes of telemedicine, eHealth and mHealth ventures is gradually growing and providing new insights and practical design lessons. This article synthesizes the business models and failure modes, i.e. it discusses the primary failure modes for each of the eight business models for sustainable CHW projects and programs. This knowledge is pivotal for innovators and entrepreneurs seeking to engage local entrepreneurs and CHWs to operationalize interventions that tackle last mile health care challenges while creating jobs or providing frameworks for income generation and entrepreneurship.**

Keywords—failure modes; community health workers; business models; mHealth

INTRODUCTION

The increased prevalence of non-communicable diseases coupled with decreased accessibility of medical personnel has led many developing countries to create Community Health Worker (CHW) programs. These programs have the objective of promoting community health through education, advocacy and direct assistance. Community health workers are local volunteers who are trained to provide services such as health education, basic illness treatment, hygiene and sanitation, and data collection [1]. While many governments are turning to CHW programs, they are also working with private organizations and nonprofits to implement e-health and mHealth systems that improve community health. However, both mHealth ventures and CHW programs in these resource-poor areas face a series of challenges when creating a sustainable business model.

Currently, CHWs in many countries are volunteers whose only compensation is the pride and intrinsic gratification that comes with assisting friends and neighbors in their communities [2]. Without any financial compensation, CHW turnover in resource-poor settings is often very high. Some CHW programs allow, or even encourage, workers to augment their daily income by selling health products in addition to providing their regular services. However, this additional income is typically not adequate to cover the cost of living [3]. In order to create sustainable CHW programs there needs to be reliable revenue streams to incentivize CHWs without straining the scarce financial resources of their governments. Similar to CHW programs, many e-health and mHealth systems face difficulties in scaling beyond their pilot phase: a phenomenon that has been dubbed as pilotitis. In Uganda alone, 23 mHealth ventures were unable to grow beyond an initial pilot phase between 2008 and 2009 [4]. A variety of failure modes plague the growth of mHealth pilots in the developing world including financial challenges, business structures, technological limitations, and cultural misalignments.

To overcome these endemic failures that inhibit the sustainability and scalability of mHealth ventures, innovators can partner with CHW programs. This partnership has the potential to bolster the effectiveness of the CHWs and give the mHealth systems a qualified and trusted workforce. When mHealth ventures use CHWs as local employees, they provide these volunteers with a channel of generating income for themselves. By doing so, they can concurrently address the problems of sustaining CHW programs and scaling mHealth ventures. Further, the sustainability and reliability of CHW programs are reliant on adequate incentivization to ensure that health workers are maintaining a high standard for the services they provide. Therefore, mHealth and CHW program successes are intertwined – both are dependent on each other in order to deliver scalable and sustainable solutions to global health issues.

Eight categories of mHealth ventures have previously been presented that utilize CHWs as the primary resource for employee recruitment [5]. Even though all eight of these business models use CHWs, each of them has different barriers to implementation that must be overcome in order to develop a sustainable venture. Furthermore, other research has been conducted examining the potential areas of failure, or failure modes, for all mHealth and telemedicine ventures that focus on the use of CHWs [6]. In this article, these failure modes were considered and applied to the specific CHW business models to find which failure modes are the most important to the development of a particular business model. The purpose of this typology is to provide a list of failure modes for a variety of CHW-mHealth business models. While every mHealth business model may face similar overarching issues such as

financing and supply chain, the failure modes identified in this paper are specific to each individual business model.

METHODS AND METHODOLOGY

The goal of this article is to create a list of poignant failure modes and explanations for each CHW-based business model. The real-world ventures found in Appendix A were first analyzed using Osterwalder's Business Model Canvas to understand their operational and business models [7]. Once this analysis was completed, a listing of eight CHW-based business models was developed [5]. The failure modes described in this article are based on a systemic study of 35 entrepreneurial mHealth ventures and 17 additional publications [6]. This analysis supplemented by over 20 years of combined personal experience has yielded the designation of poignant failure modes for each business model. To determine what constitutes a failure mode, a systematic process was used to analyze factors that contributed to mHealth pilot stagnation or failure. An aspect of any of the health ventures was considered to be a failure mode if it significantly hindered the development of the venture or it had the potential to do so.

One of the most significant barriers to conducting this study was the relatively limited amount of data concerning commercialized mHealth systems in the developing world. Many articles exist concerning the potential for such systems, but these articles do not effectively document the challenges facing sustainability. Due to this lack of information, some of the organizations analyzed in this study do not necessarily fit the precise definition of mHealth. Instead, the scope of the research was broadened to entrepreneurial health ventures to gain a better perspective of issues affecting health ventures around the world.

1. ADDITIONAL PRODUCTS BUSINESS MODEL

In this business model, CHWs sell health products in addition to the basic services they already provide.

1.1 Specific Products and Pricing

mHealth ventures looking to follow this model need to determine what products to sell and set specific prices for these products. While there is no set formula for determining the price of any health product in the developing world, ventures can use several validation methods to find an acceptable price. Both product and price validation can come from surveys, community interviews, and using local champions to determine where there are needs and where there may be areas that are already being served. For example, DKT is a venture that focuses on the sale of family planning product such as male contraceptives [8]. They sell these family planning products at affordable prices in resource-constrained environments all over the world, including Africa, Asia, and the Middle East. However, DKT simply could not compete in areas where family planning products were given out for free by the government or NGOs. DKT lost money, resources, and time trying to fulfill a need that was already met in those areas. Appropriate data gathering regarding existing programs could have steered DKT to instead deliver products to communities that already didn't have access to these products. Product validation is not only important for assessing demand, but also for determining an appropriate yet financially sustainable price. Pricing must be validated in a similar fashion as production selection. Surveys, interviews, trial and error, and effective champion leveraging must be used in order to determine a price that is affordable yet profitable. It may be appropriate to trial a product for free in the short-term to determine the demand for it. If the product is determined to have market viability in the long-run, then ventures can slowly implement a market price to begin making a profit on that product.

1.2 Access to Initial Financial Capital

Initial financial capital can come from a variety of sources, including private investors, government or NGO grants, and personal funds. With the exception of personal funds, initial capital is often tied with a promise to deliver returns (in the investor's instance) or a certain social impact (in the case of grants, government subsidies, and NGO funds). When money is tied to a particular outcome, there should be validation that the venture's products will not only be financially sustainable but will also make a positive social impact as well. If a venture can effectively demonstrate the feasibility and social impact of their products, then acquiring start-up capital should be easier. The measurement of such metrics should be an integral part of the operations of the venture. These metrics will allow for proper reporting to existing investors as well as attract new ones.

1.3 Reinvestment Strategy

Once a venture has established itself in communities and begins to turn a profit, it must appropriately utilize this money. Reinvestment of venture profits must be balanced with properly compensating CHWs for the products they sell. Once employees have been compensated and supply costs have been paid, financial reinvestment is influenced by several factors specific to mHealth ventures. First, ventures may be limited by the constraints of their investors. For example, suppose a venture in Kenya has CHWs track the blood sugar readings of diabetics while simultaneously selling sugar-free sweeteners to determine their effectiveness for controlling blood sugar readings. Eventually, the government offers money to this venture for existing data with the stipulation that their money must be spent on the collection of more extensive data. The venture could spend this excess money on training and updating the electronic tools available to their employee. However, this venture must also ensure that CHWs are being properly compensated for training and the new workload accompanying the extra data collection. A proper balance based on entrenched accountability mechanisms and mutual trust would allow for the efficient uptake of accurate data and thus the best use of the reinvestment.

2. ADDITIONAL SERVICES BUSINESS MODEL

In an additional services model, a CHW provides supplementary health services for an additional fee, with

necessary materials provided by the venture. The operation of an additional service model venture is not unlike the operation of an additional product service model, making the failure modes mentioned in the additional products business model relevant to additional services. An additional service venture needs to ensure they answer the following questions: What services are the CHWs going to provide and how will they be priced? How is the venture getting initial profits? And how much money is allocated to reinvestment versus going into the pocket of employees? After these questions are answered, some additional failure modes that must be observed for the highest probability of success.

2.1 Supply Chain Considerations

Supply chain issues can be complex and contextually specific. In many resource-constrained environments, infrastructure is underdeveloped and the customer base is spread out. These factors can make it difficult for a CHW to generate profit without access to effective transportation, coordination, and communication. World Health Partners (WHP) specializes in providing rural communities with greater access to primary care through reproductive health services. They have had difficulties delivering their services to the rural areas of Uttar Pradesh and Bihar, India because of underdeveloped supply chains and a diffuse customer base [9]. The venture had difficulty properly understanding the infrastructure, people, and geography to deliver their family planning services. They needed to consider their community health workers' locations in comparison to the geographic distribution of potential customers. Without effective tools for reaching geographically separated customers, WHP struggled to gauge where they could be most effective. Further, WHP had a difficult time determining a competitive price for their service.

2.2 Free Service Model Considerations

When attempting to introduce new services to a community, ventures may fail if they do not prove their worth quickly. A popular tactic to raise awareness and develop credibility for the service being offered is to offer it for free for first time customers or for a limited period of time. This tactic is popular in social health ventures; however, without an appropriate method of switching to a paid model, potential customers will not purchase the service. How and when does the venture evolve into a pay model? There may be no set time frame but there are set symptoms that need to be observed before deciding to end a free service phase. The goal of a free service model is to educate customers on the value of the health service provided. A venture needs to be certain that they have accomplished this goal and that the customers understand why such a service is worth their money. Further, a slow transition to a full price is more effective than a rapid increase in price. By raising a price sharply, mHealth ventures may cause immediate alienation of certain groups of customers who do not want to pay a full price for a service that their family or friends did not pay for at all. It is important to slowly raise the price of the additional services being offered in an attempt to keep the customer engaged with the health service for as long as possible so they develop a strong understanding of why the service is important. Free service models are a means to an end: educating customers to understand the value in the health service that is provided. While a free service model can provide this education, there are other methods for demonstrating the value of additional health services.

2.3 Venture/CHW Trust-building

Trust must be built with the CHW as much as it is built with customers. At first, a venture may need to pay the CHW as demand develops for the new service. As time goes on and the CHW sees value in the service, they will be the best champions at explaining this value to the community. The most effective way to educate a population on the importance of health service is to get CHWs to educate the community on the issues surrounding the service. For example, a CHW is beginning to offer blood glucose readings for diabetics. The CHW needs to make sure that potential customers understand diabetes and the benefits of monitoring blood glucose levels. Once a CHW provides a clear explanation a customer will be much more likely to partake in the service.

It is important that CHWs are properly trained on when the service may be deemed appropriate. For example, children would not need their blood sugar checked on a weekly basis. Further, CHWs should be provided with a reporting mechanism for the services they provide. This will allow for greater accountability as well as an opportunity for data analysis by the venture.

Further, ventures will surely fail if they do not treat CHWs as partners when deciding pricing and the specific daily operations. It is important for the venture to understand that the CHW will be integrating this venture into *their* community, and are therefore much more vulnerable to the fallout of offensive pricing schemes or inappropriate operations.

3. DATA COLLECTION BUSINESS MODEL

CHWs can also collect health information to sell.

3.1 Partnerships

While sometimes it may be difficult to find organizations looking to buy health data, properly implemented data collection models can have a high level of social impact and a high profit potential. One of the most prominent issues facing this business model is finding entities willing to pay for data collection. A venture cannot simply begin to collect data and expect another entity to purchase the data. The organizations that would potentially buy data have specific requirements to meet their needs. Once a venture is certain that they have a reliable, transparent buyer of their proposed dataset, it can then move forward with the operational issues of their venture.

3.2 Operating Costs

Once this partnership is established, the venture must ensure that the costs of collecting and managing data are properly handled. A data collection service needs Internet access, wireless communication, and technologies to record,

store, and send information. Cell phones, tablets, and laptops need to have quality cellular reception and decent device storage in order to collect and send data. These expenses must be incorporated into designing a business model because they are vital to the business.

3.3 Employee Training and Turnover

Even with a data buyer and proper infrastructure, a venture will still fail if it does not ensure the hiring of quality, driven, and reliable individuals. These employees are an investment because learning how to collect data in a secure and efficient manner can be difficult. Oftentimes in the data collection model, workers will be digitizing data through the use of cell phones, laptops, tablets, or some other type of device. They need to be taught how to use these devices both efficiently and reliably. A venture cannot spend a significant amount of time and resources to have employees accustomed to the technology within the venture. While resorting back to more basic technologies can be a potential solution for technology barriers, "gamifying" the data entry process can be a solution as well. "Gamifying" the process is done by making data collection interfaces it more like a game to provide some entertainment in the potentially monotonous task of data collection. This can be done by making a piece of equipment with interesting buttons and sliders that allow for a fun and easy interactive experience for the customer and the CHW using the equipment.

3.4 Technology Appropriateness

Perhaps an even more fundamental question a venture needs to ask is: Is this technology appropriate for this environment and this infrastructure? Data collection businesses can operate in many locations, but some technologies may not be culturally appropriate. For example, the Mashavu Telemedicine in Kenya started collecting and tracking simple health metrics, such as height, weight, and blood pressure, of community members. The venture originally used cyber cafes in the town center to enter data, but over time, employees switched to cell phones in order to be more mobile. In certain cases, technology may not be the solution at all. The Mashavu system eventually transitioned away from mobile devices in favor of simple receipt books and pens. The switch was made due to a distrust of digital data gathering. This distrust stemmed from a common practice during the presidential elections, where there were widespread issues with individuals being signed up to political parties without their knowledge. Further, the additional amount of time necessary for entering data into the phone was prohibitive to maximizing the people seen, and thus the income generated, by the CHWs.

3.5 Incentivizing Methods

It is advised that ventures appropriately incentivize their work to keep employees in the business for as long as possible. The incentivization scheme is dictated by the level of trust with the employees. Direct compensation for each collected data point can potentially lead to improper or false data. Proper training and accountability measures are necessary to ensure quality datasets. Furthermore, the community is trusting CHWs with their private health records. A venture can fail if there is an accidental disclosure of this information. This disclosure could mean negative stigmas surrounding the venture, which could result in irreparable reputation damage. A venture needs to have clear rules with their CHWs, managers, and partnering organizations about ensuring the security and privacy of all data acquired. Punishments and incentive schemes should accompany these privacy regulations to ensure the safety and security of patient health information.

4. Advertising Business Model

CHWs can also advertise products and services of other companies in exchange for compensation.

4.1 Partnerships

It is typically easier to find potential partners for advertising than those for data collection. However, finding the right partner for a venture can be difficult and cause a venture to fail. A venture must find advertisers whose products will benefit the health of the community, and furthermore are deemed appropriate by the CHWs. Any advertisement partnership is an endorsement of the product or service offered by the CHW. This fact can cause a conflict because the highest bidder is not always the most ideal partner. For example, a venture in Kenya attempting to take advantage of an opportunity to facilitate advertising through a CHW network could consult many businesses about their interest in advertising with the company. A company may wish to partner with the CHWs in order to advertise a newly developed birth control product. While this product may lead to positive health outcomes, CHWs may not feel comfortable associating themselves with this product in a more conservative rural area. CHWs would need to educate their communities regarding reproductive health until they feel comfortable advertising this product. Not only should the CHW be comfortable but the community should feel comfortable hearing the advertisement from the CHW. CHWs who are working in this business model are inherently giving a recommendation and the community should feel comfortable with the CHW and be able to put their trust in them.

4.2 Evaluating Impact

Once a quality partnership is found, a venture can still fail if they do not determine how to tie the value of their work to the financial success of their partner. A venture can organize vouchers, coupons, or referral cards as a way to tie the new customer's patronage of the partner company to the CHW's referral. Without some method of referral ownership, there is no way for the partner to know whether an increase in purchasing activity was due to the CHWs. A rule of thumb for all advertising ventures is to make sure the process is as transparent as possible. The partner should offer specific facts and conversation points in order for the CHWs to pitch the product in a uniform manner that appropriately represents their brand.

5. Referral Business Model

In certain business models, CHWs make recommendations for individuals to engage with external organizations providing health services. Often, these organizations have unique partnerships with a hospital, clinic, or other health care provider. The health care providers pay the CHWs to recommend community members to their facilities. The CHWs make recommendations through simple evaluations based on a community member's symptoms.

5.1 CHW Referral Training

The first obstacle with these types of ventures is making sure CHWs have the training to refer community members. While it is unnecessary for CHWs to have extensive medical knowledge, they need to be trained to make basic assessments as to whether it is appropriate for a community member to see a health professional. CHWs should be familiar with common diseases and their symptoms, such as yellow eyes or skin for jaundice, or insatiable thirst for diabetes. This education can be a very expensive and the costs need to be taken into account when designing this business model.

5.2 Organizational Mapping

Once disease education has been established, CHWs in the referral business model may still fail without a clear, organized map of where they should refer their patients. The partner organization should be able to provide the referral venture with a clear hierarchy and division of services so CHWs know where to refer the community member. Without an effective framework for patient referral, this business model is doomed to suffer from poor reputation and miscommunication. This failure mode can be overcome by establishing which diseases or aliments should be directed where before creating the business model. Once these diseases are identified, a CHW can easily understand the several referral options before they begin to see people.

5.3 Community Involvement

Community involvement enables the referral businesses to have wider access to indigenous information concerning health issues. For example, a CHW in Tanzania realizes has not seen one of her constituents, Salome, lately and was wondering where they have gone she goes to some of the neighbors of the person to find out more. The community tells the CHW that the Salome has been feeling very tired lately and has not left her house much. This way the CHW can investigate more and inform Salome that she should go to a pharmacist in the neighboring town because of her symptoms of sleeping sickness caused by the Tsetse fly. Previously, the CHW had forged a relationship with this pharmacy that has agreed to pay the CHW to direct those in need of sleeping sickness treatment to their location. Without the help of the community, however, the CHW would have had no idea that Salome needed help and referral. To incentivize this process you can offer commission for community members to bring CHWs sick people who are in need of help. This could increase the probability of catching issues before they turn into major issues.

6. Labor Business Model

CHWs can participate in additional labor services that do not necessarily tie directly to health. Some examples of such services are farming, cleaning, and laundry. While not necessarily providing health benefits to their patients, these types of ventures provide help to those who may not be able to do these things themselves due to disease, age, or other health related concerns. Consider a man in Zambia suffering from HIV. He is constantly feeling tired due to affects of his disease and cannot use his plot of land to farm crops because he is too sickly. If he does not find some way to farm crops he may not be able to effectively feed himself or his family. This man can hire his CHW to farm for him in exchange for a combination of money and an opportunity to farm a portion of his land. In the developing world, arable land is at a premium, making this a very attractive solution to both parties.

6.1 CHW-Client Trust and Work Evaluation

Considering the example above, trust must be established between the health worker and the man before this transaction can occur. Is the CHW trustworthy enough to be in the man's private property and use it wisely? Will the CHW take more crops than they agreed upon? Without a good standing in the community, the venture may have a difficult time answering these questions. Another issue from the CHW's perspective is being able to quantify the work that is done. In the previous example, will the CHW get paid on produce delivered or hours worked? And how much of the land would they be able to use for themselves? Accountability is also difficult to maintain in this scenario. A venture must decide if they will be held accountable for a CHW's work or if the CHW alone will be accountable. Accountability includes the quality and the quantity of work done by the CHW. A CHW could potentially tally up all the viable produce made from the season's harvest and keep a certain percentage or charge a certain wage for how many hours worked in the fields.

6.2 Social Stigmas

In some communities, there are social stigmas against manual labor that would prohibit CHWs from wanting to engage in this work. When a CHW goes to serve their community they receive a certain degree of respect. This position puts them at a higher position in the social hierarchy of the community, which may make it difficult for a CHW to accept doing odd jobs such as farming.

7. Education Business Model

A CHW can also be compensated for providing supplementary educational materials or services to community members. Many times, they will be employed by the government's Ministry of Health or an NGO to educate communities on issues that every citizen should be informed about such as hygiene, diabetes, malaria, HIV, and many others.

7.1 Choosing the Right CHWs

Unlike some of the other models, not every CHW is fit to take on a position as an educator. These CHWs need to be particularly well trusted, comfortable and proficient in speaking to large crowds, and also knowledgeable about the presentation topics. To choose CHWs for an education business model, a venture must be systematic and try out CHWs in more basic educational roles. For example, a venture could first see how a CHW performs in front of a small crowd of three to six people while presenting about something the CHW is already knowledgeable about. From here, a venture could get a good idea if the CHW could be trained to become a quality educator. A venture then must find a way to supply trainers and materials to the CHWs. Often, governments and NGOs will train these CHWs on how to perform their traditional CHW duties, but these large organizations can pose bureaucratic inefficiencies. To overcome large organizational issues, ventures may need to develop their own training mechanisms. This can be expensive and difficult to organize but may be necessary as a trust-building exercise between the venture and the CHWs. CHWs can be trained using preexisting protocols on CHW training which many times can be less specific but are proven. Ventures can also make their own training for CHWs which can be more specific but must ensure that the CHWs understand that this venture is a separate entity from the organization that trains or manages CHWs and the training is not necessarily available to everyone. A certificate of participation that includes the training topic and venture name will help to clarify this important distinction.

7.2 Employee Turnover

With highly specialized training of elite CHWs, losing them would be a failure for any venture. Employee turnover is difficult to deal with because of the large investment involved in searching for the right CHWs and training them well. One of a venture's main priorities should be to keep these employees. To properly incentivize these CHWs, a venture must incentivize both the quantity and quality of education. A good way to do this is by requiring pre and post tests for the people attending these education sessions. The larger the difference between scores and thus the larger amount of comprehension warrants some type of monetary reward for the CHW. These incentives allow a venture to keep CHWs from leaving and also produce a quality service.

7.3 Community Outreach

The largest amount of impact from a CHW comes from being able to educate the largest amount of people effectively. In order to accomplish this task, CHWs must establish these educational sessions as large events in the community and get local authorities behind the cause to attract people to attend. CHWs have a much easier time doing this if they are already well respected in the community. Ideally, CHWs will speak the local language, are adapted to the cultures of the area, and are already engaged in the community. If these CHWs are not well versed with the community, they need to find a local champion and use their assistance to provide these educational sessions.

8. Regulatory Business Model

Certain ventures can utilize CHWs to monitor the health of local organizations on behalf of NGOs or government entities. In this model, CHWs act as health inspectors in charge of evaluating the hygiene of local businesses.

8.1 CHW Training

CHWs must be properly trained in order to objectively evaluate businesses with owners whom they may have a personal relationship with. For example, a CHW must be able to walk into a new business in town and hold them to the same standard that they would a business the CHW has been acquainted with for 20 years. A venture needs to look for qualities such as self-confidence and self-assurance in their CHWs.

8.2 Community Appreciation for Service

The success of this model hinges upon a level of demand by the community for maintaining high health standards. Advocacy programs can be used to inform community members of the benefits of having health standards for businesses. The ideal situation would be for CHWs to couple with educational ventures in order to explain the importance of hygiene both at home and in food services before implementing any sort of strict health codes.

8.3 CHW Accountability

Even with a community appreciation for regulatory ventures there needs to be CHW accountability. Corruption is an unfortunate aspect of humans in power. CHWs, in their position of power, could easily take bribes in return for good ratings on regulatory evaluations. Corruption at any level of the venture would defeat the purpose of having this type of service. To prevent this issue there needs to be some sort of CHW accountability program. Quality of the evaluations can be understood by looking at patterns in a CHW's records. Any type of suspicious behavior could prompt an investigation or some type of shadowing experience to make sure that regulatory service is conducted in an honest and professional manner.

Conclusion

The purpose of this paper is to provide both current and aspiring entrepreneurs with a guide to common business models and the potential areas in which they fail. The failure modes and business models detailed in this article indicate that many of the problems facing CHW-oriented ventures derive from social and economic issues. Entrepreneurs and NGOs looking to use CHWs as a leverage point for tackling global health issues should have a thorough understanding of the cultural and social barriers that could hinder the development of any of the business models described in this article. Most of the business models outlined in this paper, with the exception of data collection, do not fail due to the technological solutions imposed by developed nations. Instead, these business models fail to scale beyond a pilot stage due to cultural and social

barriers. These barriers are more difficult to overcome than simply designing technological solutions.

Further study is being done on CHW-oriented business models in specific countries, including Sierra Leone and Kenya. While having a broad understanding of these business models is important, it is vital to begin to apply these concepts to real-world applications in the developing world. With extensive knowledge of these business models, it is hoped that entrepreneurs and other health entities in the developing world can begin to create scalable, sustainable solutions for addressing the world's health needs.

REFERENCES

[1] Z. Bhutta, Z. Lassi, G. Pariyo and L. Huicho, "Global Experience of Community Health Workers for Delivery of Health Related Millennium Development," 14 October 2010. [Online]. [Accessed 30 December 2013].

[2] U. Lehmann and D. Sanders, "Community health workers: What do we know about them?," University of the Western Cape, School of Public Health, 2007.

[3] H. Perry, R. Zulliger, K. Scott, D. Javadi and J. Gergen, "Case Studies of Large-Scale Community Health Worker Programs: Examples from Bangladesh, Brazil,Ethiopia, India, Iran, Nepal, and Pakistan," 28 October 2013. [Online]. Available: http://www.mchip.net/sites/default/files/mchipfiles/17_AppB_CHW_CaseStudies.pdf. [Accessed 2 December 2013].

[4] Text to Change, "Pilotitis, the biggest disease in mHealth," Amsterdam, 2010.

[5] S. Suffian, R. Zang, M. Robinson, S. Jeong and K. Mehta, "A Typology of Revenue Models for Community Health Worker Programs," *Journal of Telemedicine and eHealth,* p. Pending., 2014.

[6] P. Sundin, J. Callan and K. Mehta, "Why do Telemedicine Ventures in the Developing World Fail to Scale?," *Journal of Telemedicine and eHealth,* In Press.

[7] A. Osterwalder and Y. Pigneur, "Business model generation," John Wiley & Sons, 2010, 2010.

[8] DKT International, "Social Franchising," 2012. [Online]. Available: http://www.dktinternational.org/wp-content/uploads/2011/04/DKT-Social-Franchising-White-Paper-Final.pdf. [Accessed 19 January 2014].

[9] World Health Partners, "The WHP Model," July 2012. [Online]. Available: http://worldhealthpartners.org/Resources/report_19.pdf.

[10] M. Camann, "Global Persepctives on Mental Health," Jones & Bartlett Publishers Inc., Sudbury, 2008.