

Exploring Digital Systems for Tuberculosis (TB) Patients to Improve Adherence to TB Pills

Introduction

Globally, tuberculosis (TB) is one of the top ten diseases leading to death [1]. According to World Health Organization (WHO) report 2017, TB caused 1.3 million deaths among HIV negative and additional 300000 deaths among HIV positive people. Around 10.0 million people became victim of TB in 2017 among which 5.8 million were men, 3.2 million were women and 1.0 million were children [1]. Pakistan is sixth amongst twenty two high burden countries [2]. Annually around 430,000 people including 15,000 children contract TB and every year no less than 70,000 deaths can be attributed to the disease in country [2].

TB Treatment

TB is caused by bacteria called mycobacterium tuberculosis and is spread by aspiratory droplets. TB is of two types i) Active TB ii) Latent TB. In latent TB bacteria is not active and its treatment is 6 months. While in Active TB bacteria is spread to different parts of body and its treatment is 8 months or depends on the severity level of disease. The severity level of disease leads to Multi Drug Resistance (MDR) or Extensive Drug Resistance (XDR) TB. In MDR/TB there is resistance of two basic oral first line drugs and for its treatment both oral and injectable drugs are used. While XDR/TB is severe form of MDR/TB and patient develop resistance to three of the oral drugs and one of the three injectable second line drug (drugs that are using for treatment of MDR/TB), it is rare and hard to cure [3]. Directly Observed Treatment Short course (DOTS) is recommended by WHO, which means that a trained health care worker or other designated individual (excluding a family member) provides the prescribed drugs and watch the patient swallow every dose [4].

Background

As Pakistan is among twenty two high-burden nations, it has restricted assets to execute DOTS as suggested. Number of patients are too high to even think about managing in medical clinics. Spots is work escalated, transportation subordinate and as due to destitution patients can't visit health centers on regular routine. Patients being conceded in clinics are generally relies upon their seriousness level.

In Pakistan's context DOTS is not implemented as recommended, only a card is provided to patients on which visits and follow-up dates are mentioned. Patients more often forget to take their drug. They

don't visit emergency clinics for their tests. Also, there is nobody to remind them or to request that they visit emergency clinic as it is beneficial for them and their relatives.

Study Design

We did exploratory research to know Pakistan's point of view towards TB and its treatment. We needed to know the fundamental driver of TB among individuals, high TB rate in Pakistan, primary driver of MDR/TB, behavior of patients towards medicine, people's access to cell phone and accessibility of cell phone.

We led semi-structured meetings from 50 patients to know their perspectives towards TB, essential factor causing TB, symptoms, prudent steps they are following and their conduct towards prescription. We directed 6 specialists meeting to find out about TB, its prescription and to know their viewpoint that how innovation can be utilized to enhance current TB circumstance. Each meeting comprises of 40-45 minutes.

Major Findings

From our meetings from specialists we find a few discoveries I) Patients once in a while not finish their six to eight months course and subsequently this prompts extreme type of TB. As indicated by specialist:

“People usually suffer from TB second time because they stop using their medicine. They come to us and lie that they took their medicine properly.”

From experts we also came to know TB medicine should be take on regular basis if a patient missed his medicine more than five day then there are chance of treatment failure and drug Resistance.

From our meetings from patients our real discoveries are moral worries that individuals some of the time don't pursue prudent steps since they don't feel it morally great or their job doesn't enable them to tail them. Individuals are uninformed of the indications and careful steps they ought to pursue to abstain from spreading TB. Even a child experiencing TB can't pursue measures since he dread from being harassed from companions. Some of the sayings of patients are

“My mother is suffering from TB. It is unethical to give them separate food. And cover our face while talking to her.”

“I am studying in class 7. I fear that when I cover my face my friends will make fun of me.”

*“I was taking medicine one year before and then I stopped taking medicine because I got pregnant.
Now I am taking medicine again.”*

We also inferred that medicine adherence is serious issue in tuberculosis. Inability to take the medicine accurately prompts following impacts: Patient Again moves toward becoming casualty of TB, Drug-resistance, Treatment failure and TB transmission which compromise general wellbeing.

We also inferred that there is no appropriate method for following drug. The best way to follow is DOT card yet just beginning and following visit date can be found on DOT card. There is need to follow patient's medication and to remind them to take prescription, remind individuals for their test date and follow-up date. What's more, there is additionally need to instruct individuals legitimately about symptoms and precautionary measures.

Proposed Solution

Text and Call Based Tracking System

We proposed a low cost solution for low-income and low-literate people. A following and update framework that will remind patients for drugs, tests and subsequent meet-ups and monitor their medication, tests and subsequent meet-ups. Working of this framework is as per the following:

Patients' data will be entered including his breakfast time. As patient have to take his medicine in morning before his breakfast so reminder message will be sent to him 1.5 hour prior to his breakfast, another reminder message will be sent to him 1 hour prior to his breakfast and similarly half hour prior to breakfast. Then a call will be made after 1 hour of breakfast time to know if patient has taken his medicine, if he already took his medicine he will be asked to press 1 otherwise 2 and he will record his reason of not taking his medicine. System will be user-adaptive as if patient didn't take his medicine for one day a message will be sent to him next day saying “you didn't take your medicine yesterday. Kindly take your medicine as missing medicine may lead to treatment failure.” For follow ups and test tracking a reminder message will be sent to patient 2 weeks before, then 1 week before then 2 days before and a final reminder call will be made to remind patient about his follow-up or test date. Behavior of our system will be same so that patients will feel comfortable with our system. Moreover educational messages for precautionary measures and symptoms will be sent once a week and once in fortnight.

Digital Medicine Box for Medicine Adherence

We proposed a real time medication monitoring in such a resource restricted nation. This drug box gives sound and visual (Light Emitting Diode (LED) based) reminder when there is a time of medication. While opening the case a magnet sensor activates, patient takes his drug out. On shutting the case weight sensor actuates. Weight sensor calculate weight difference in the event which is contrast, framework records it as medicine is taken. Else it is considered as drug isn't taken. This gadget has Global System for Mobiles (GSM) module. It transmit measurement history to our server through General Packet Radio Service (GPRS). At the point when the gadget isn't open on time. This gadget reminds patient about his drug. It likewise remind patient about refill when there is no drug in the box. This gadget has battery rechargeable.



Limitations

There are a few limitation of our proposed arrangement. One is cost effective. Our framework is quite costly because of GSM module and it isn't feasible for patients to buy it. If we evacuate GSM module, its cost will be essentially limited. But for Real Time Monitoring it is required. In addition if a child open this container and takes medicine out, it will be considered as medication is taken. Pakistan is low income country and GSM module is high so there are chances that somebody sell GSM module to satisfy their diverse needs.

HCI Across Border

We concluded that it is moral worry to cover face from relatives. It is additionally identified with business conduct this thing considered against working attitudes while managing clients. Dread of being tormented that is an enthusiastic concern so patients (specially kids or adolescents) don't impart disease history to their companions or relatives. So our study is suitable for HCI Across border as it is intersection of ethical (social and work ethics) and Emotional concern.

Experts Reviews

we want to know expert reviews about provided solutions that how can we improve our solutions to improve its impact in society and that it will be cost-effective as well as need less user input as illiteracy and poverty rate is high in TB patients.

References

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