

Exploring Holistic Solutions for Type-2 Diabetes for Bottom of Pyramid Population in India

Vinay VENKATRAMAN^a and Prerak MEHTA^b

^aCopenhagen Institute of Interaction Design

^bIndian Institute of Technology

Abstract

Healthcare is a prominent sector where design intervention can make tremendous impact in the way people live and receive treatment. Type-2 diabetes is a huge system condition that involves lifestyle, insulin therapy, oral medication, dietary restrictions and exercise regimen. The underlying socio-economic environment plays a major role in the way patients behave.

The research explores the experience and process of treating diabetes in India for the bottom of the pyramid population. This paper presents the approach and the implications of the approach for identifying patient needs and issues and the key elements relating to design. Emphasis has been laid on a strong research methodology to generate key findings through action research which in turn drive the design conceptualization and development phase. Multiple field visits involving contextual inquiries, shadow-in, volunteering and observation were conducted for this purpose. Pilot user testing for the initial concepts developed has been done. Through a reiterative process, the challenge is to create holistic solutions that span service, communication and product design.

Keywords: *action research, emerging markets, healthcare, bottom of pyramid, diabetes*

Introduction

India has one of the largest number of Type-2 diabetic patients in the world with a current standing of 31.7 million+ and set to reach 79.4 million by 2030 (Wild, 2004). Government healthcare structure covers villages as well as metro cities, whereas private healthcare structure is limited to towns and cities. Bottom of the pyramid population covers people who live in the city suburbs, small towns and villages. They usually don't have a fixed source of income, face difficulty in procuring basic facilities, have low awareness, can afford only the government healthcare facilities and are often disadvantaged section of the society. The government healthcare structure is three tiered: 1. Primary Health Centre (PHC) at village level, 2. Community Health Centre (CHC) at town level and 3. Government hospital at city/district level. Full time Doctors are available for twice a week at PHCs and always at CHCs or government hospitals. PHCs are operated by a network of locally trained primary healthcare workers. Currently, the government is funding and pushing reforms in the sectors of Tuberculosis, maternal healthcare, infant mortality and Malaria through the PHCs. No major funding or reforms have been taken up for diabetes. No blood sugar test happens at a PHC or a CHC; only Government hospitals do blood sugar tests. No medication (insulin or tablets) related to diabetes is available at a PHC (which otherwise gives free medication for Tuberculosis, Malaria, maternal healthcare and common illness). There are almost no awareness programs for diabetes by the government in the rural sectors. The research concentrates around understanding the underlying socio-economic and cultural scenario and arriving at service, communication and product solutions that can bridge this gap for diabetes treatment for the bottom of the pyramid population.

Research Methodology

The methodology listed below was carried out in an iterative manner.

Literature and web study | Identify stakeholders | Chunk information headers | Form questionnaire | Pilot interview | Field visits (contextual inquiries, shadow-in, volunteering and observation) | Generate key findings (insights, observations and user statements)

Literature and Web Study

To gain a thorough understanding of diabetes in general and type-2 diabetes in specific; multiple websites, research papers and books were referred. The major topics studied have been presented as research questions:

What is the concept model of diabetes and its treatment?, What are the existing forms of treatment available?, Who gets diabetes?, How can diabetes be prevented?, What are the current initiatives to spread awareness and prevent diabetes?, What is the number of people affected by diabetes?, What are the associated complications?, What are the symptoms of diabetes?, What are the issues faced in treatment?, Is diabetes a life threatening disease?, Can diabetes be cured?, What research is going on in diabetes healthcare?

Identifying Stakeholders

It was crucial to identify the stakeholders involved in diabetes healthcare and treatment as it would determine the service line involved and lay foundations for the field visits. The following stakeholders were identified:

1. Type-2 diabetic patients

2. Doctors (Endocrinologist, General physician, Ayurvedic physician) and support staff
3. Family members (Partners, Parents, Children, In-laws) and friends
4. Community healthcare workers

Chunking Major Information Headers

Before making a questionnaire for contextual inquiries, chunking of major headers was done to cover all important sections on a macro level:

Lifestyle | Dietary habits | Physical exercise | Stress factor | Availability, accessibility and affordability of medical facilities | Aspirations | Associated ailments | Family history of diabetes and major diseases | Discomforts faced | Outlook of the society and family towards diabetes | Social stigma associated with diabetes | Myths related to diabetes

Field Visits

The field visits were conducted in a naturalistic environment. Contextual inquiries were conducted in casual conversation mode. Environmental study and documentation of the visit as audio/video/photographs/notes was done. Doctor interviews were conducted in their clinics/hospitals. The patient interviews were conducted by visiting them at their homes so that the input of the family members could be captured. Considerable time was spent at each clinic/hospital/home to get a sense of the environment and to understand how it operates. Few diabetes health camps and project sites were visited and volunteered for where work is already in progress by other associations/NGO/individuals. Detailed talks with community healthcare workers were also held during this period. Summary of field visits is given below.

- 2 diabetes project sites visited: 1. 'Sevak' Project, Karakhadi Village, Padra, Gujarat, India, 2.
 - KADAM (Knowledge based Actions for Diabetes Awareness Movement) headquarters, Ahmedabad, Gujarat, India
- 21 contextual inquiries were conducted with the following stakeholders:
 - 7 Doctors (3 General physicians, 2 Ayurvedic physicians, 2 Endocrinologists)
 - 6 Family members and friends
 - 6 Type-2 diabetic patients
 - 2 Community healthcare workers (also conducted shadow-in for daily activities for 2 days in the village)
- 12 Type-2 diabetic patients were observed for treatment and diagnosis at an endocrinologist's clinic
- 2 diabetes health camps visited at:
 - New Golden Nest, Bhayender, Thane, Maharashtra, India
 - Karakhadi Village, Padra, Gujarat, India

Generating Key Findings

Out of numerous key findings the ones which helped form the foundations of the design concepts have been presented below. User statements and observations have been

presented specific to a stakeholder group whereas insights across all the stakeholders have been clubbed together and presented at the end of this section.

Doctor (Endocrinologist): Two endocrinologists were visited with 2 hours being spent at one and 6 hours at another clinic. Environmental study of the clinics and contextual inquiries with the doctors were conducted. At one clinic the doctor was observed treating 12 diabetic patients. Material related to diabetes, treatment and awareness in the form of brochures, presentations and books (in local Gujarati language as well as English) was collected from these two clinics.

User statements:

- Concept model of diabetes and its treatment is unclear to family physicians
- Patients deny initial diagnosis
- Family is worried about associated complications from diabetes in future
- Medical insurance doesn't cover consultation charges
- Diabetes is a taboo in the work place and society
- Difficult to declare it to the society that unmarried girl child has diabetes
- Some Ayurvedic treatments do work

Observations:

- Patients are afraid of syringes
- People have myth that eating/not eating sugary food changes onset of diabetes

Doctor (General Physician): They are family doctors, community doctors or general practitioners. They encounter most of the initial diabetes cases. Contextual inquiries were conducted with three general physicians. Environmental study was conducted at all the places. Two general physicians were based out of Government hospital premises and one was located at Primary Health Centre (PHC) in Karakhadi village.

User statements:

- Patients are misguided by Ayurvedic and homeopathic babas
- Patients don't follow up on a regular basis
- Most of the patients in urban areas are educated
- Unmarried daughter poses issue in diabetic parents declaring their illness to the community

Observation:

- Urban area patients don't have much financial constraints

Doctor (Ayurvedic Physician): These doctors have received formal training in medicine under 'Ayurveda'. Most patients visit them through peer recommendation after suffering for a few years with diabetes. Buying of Ayurvedic medicines directly off the counter of an ayurvedic pharmacy is heavily prevalent. Contextual inquiries were conducted with two Ayurvedic physicians at their clinics.

User statements:

- Patients have allopathic drug dependence

- Patients have a myth that popping pills will improve diabetes

Patients: Contextual inquiries were conducted with six Type-2 diabetic patients at their home. Three patients were insulin dependent. All of them were on allopathic medication and five of them were also taking ayurvedic medicines in parallel. One patient had stopped taking ayurvedic medicines after trying them.

User Statements:

- Other diabetic patients' recommendations to do exercise work well
- Insulin pens and pumps are convenient to use but very expensive

Observations:

- Most of the patients don't know which medicine they are taking and why
- Poor knowledge of how and where to store insulin amongst patients
- Low income group patients use the same syringe to take insulin for 2 to 4 days to save money
- Due to constant indulgence in household work, females ignore exercise
- Usually diabetes is detected when blood sugar level count is 300 to 400
- Patients choose to remain ignorant even after blood sugar levels are detected to be 160 to 200
- Some patients use ice packs to store insulin vials while they travel
- Insulin pens are not available at pharmacy stores in rural areas
- Few patients keep a notebook about articles on diabetes, its treatment, Ayurvedic medication and their blood sugar test records
- Most patients get Ayurvedic treatment done in parallel to allopathic treatment
- Low income group patients don't maintain proper record of medical prescriptions and test reports and face difficulty interpreting them

Family members and Friends: They are an integral part of a diabetic patient's life and treatment. Many times they state the actual facts rather than the diabetic patients themselves. Contextual inquiries were conducted with 6 family members and friends.

User Statements:

- Allopathic doctors don't like patients who ask questions
- Patients treat taking insulin as the last stage of diabetes
- Wheat costs INR 45 per kg. Doctor suggests having 'chapati' (wheat bread) daily but we can't afford it (low income group patients)
- We can't afford a syringe which costs INR 10 and hence use the same syringe multiple times (low income group patients)
- Initial diagnosis of diabetes leads to shock and nervousness in patients

Observation:

- Patients use polythene bags or plastic boxes to keep insulin, syringes and tablets

Community Health Camp: Two diabetes health camps were attended and one was volunteered for. It gave a new perspective on people's behavior during blood sugar tests.

Observations:

- People encourage their family members to get their blood sugar test done at the health camp
- Patients are scared to know their blood sugar level
- Usually there is no doctor or qualified professional at the health camp to explain the treatment and related tests, patients have to go separately with the report and the test results to a doctor
- Health camps rely on funding by pharmaceutical company, individual or an association and offer free blood sugar test
- Primary Health Centres (PHCs) in rural areas don't detect or treat diabetes

Community healthcare workers: They are volunteers who are trained by medical professionals and are usually affiliated to an NGO. They work closely with the Primary Health Centre (PHC) in a village. Contextual inquiries and shadow-in were conducted for two days with 2 community healthcare workers in Karakhadi village in Gujarat, India.

User Statement:

- There is a high prevalence of illiteracy in the village

Observations:

- Each community healthcare worker visits a fixed number of rural households to collect data, distribute medication for illness/disease and counsel the villagers on health matters
- Many village households have a color television but no electricity supply for most part of the day
- When a community healthcare worker visits a village household, the neighbors gather to listen to the healthcare worker
- Many villagers have a mobile phone and some mobiles support video playback
- Villagers are used to receive postcards and inland letters and listen to the radio

Insights from across all the stakeholder groups

- People have low awareness and a wrong concept model or no concept model of diabetes and its treatment
- Most of the patients have no idea which type of diabetes they have and are not clear on how to proceed ahead with the treatment
- Doctors at government and private hospitals don't explain the concept model of diabetes, its treatment and the associated complications
- Private Doctors suggest morning walk and diet restrictions
- Clear concept model of diabetes and its treatment helps in adherence
- Ayurvedic physician explains the concept model of diabetes and how medicine works in the body to the patients

- Health camps provide a good platform to spread awareness, explain concept model of diabetes and tap people to check blood sugar levels
- Low income group patients are heavily ill-informed and largely ignorant. They don't allocate money for medicines and treatment
- Financial unaffordability prevents low income group patients to go for doctor follow ups, do regular blood tests (cheapest test INR 40 to 50), follow diet restrictions and regularly buy insulin vials (around INR 150)
- Patients are irregular in the pattern/timing of taking pills and have an irregular exercise/diet control regimen
- Family is worried about associated complications from diabetes in future
- Female patients have a rigid mindset regarding not doing regular exercise
- Major complications in health and/or awareness of future complications lead to adherence in treatment
- Young patients find it difficult to declare being diabetic to the society due to fear of gossip and being looked down upon in the community
- There is no precise way to measure the effect of Ayurvedic medicine but it has no recorded side effects with the patients encountered
- Low income group patients treat doctor's word as GOD's word and don't question
- Mostly, associated complications lead to detection of diabetes
- Regular tab on body's blood sugar helps define a personalized and clear concept model for diabetes treatment
- Difficult to ascertain whether people will follow up with a doctor after getting their blood sugar levels tested at a health camp
- Health camps are trustworthy and easy to inform people as the community organizes them in the neighborhood
- Currently not much initiative involving healthcare workers is being taken in the rural areas for diabetes healthcare

Personas

By taking cues from the key findings and patients visited, four personas were drawn to facilitate formation of design concepts and to concise the knowledge bank that the key findings offered. The four personas tend to represent the typical patients that were encountered and are a representative of that segment of population. The personas were supported by illustrations to make them rich. For ease of understanding they have been represented in a narrative form below.

Persona 1: Insulin dependent Type 2 diabetic patient with associated complications

Budha Lal (Male) is 36 years old, illiterate and works as a daily laborer (lifts heavy weights) in a village in Gujarat, India. He earns a meager INR 3000 per month and falls in bottom of pyramid population. He is the sole bread winner in his family comprising of a wife, 2 daughters and his father. His goal in life is to get a labor job every day. He has a color television and a goat in his 1 room-kitchen house.

He is adherent to medication prescribed, but financial constraints obstruct follow up with Doctor. It has resulted in him being Insulin dependent since 9 years but never having changed dosage. He manages to buy insulin vial worth INR 170 every two weeks.

His last blood sugar test (random) was done 3 years ago at a health camp in the village where his blood sugar count was 300. His average blood sugar level since past 5 years is 250. He has partially maintained test reports and can't interpret them. He is suffering protein loss since past 5 years, has no control over motions and is on the verge of a kidney failure. He stores insulin and syringes in a polythene bag near an earthen pot ('matka') used to store drinking water.

Persona 2: Insulin dependent Type 2 diabetic patient

Prajesh Kumar (Male) is 29 years old, has secondary school education and owns a local grocery store in a village in Gujarat, India. He has been bed ridden since 1 year due to a severe blister infection on his right thigh. Meanwhile, his elder brother is taking care of the family (father, mother, his wife and two children who go to school) by managing the store. Family's monthly income is INR 8000 to 10000. His goal is to lead a comfortable life with diabetes. He has a refrigerator and a color television in his 2 bedroom-hall-kitchen house.

He was non adherent with pills for 3 years and with insulin for 6 months, but serious blister infection and bed rest for 6 months made him adherent. He has been doing regular exercise for 15 to 20 minutes and goes for morning walk since past 6 months.

Due to fear of being looked down he hasn't declared being diabetic to the community. His average blood sugar test count has stabilized to 150 to 180. Family members get insulin from local chemist in the nearby town which is 15 minutes away (they buy 1 bottle at a time). He stores insulin/syringes in a plastic box and keeps it in the side door of the refrigerator. He carries insulin vial in an ice pack wrapped in polythene while travelling.

Persona 3: Non-insulin dependent Type 2 diabetic patient

Smita Ben (Female) is 45 years old, a college graduate and currently a house wife in a semi-urban area in Maharashtra, India. Her husband runs a small business unit and earns INR 15000 to 20000 per month falling in middle income group. She has been married since 25 years and has 2 children (Male: 20 years, Female: 23 years). She never misses to do 'Puja' (religious ceremony to please God) for 2 hours every morning. Her goal in life is to get her son and daughter married and she is constantly tensed about their future. They have a refrigerator, washing machine, sofa and a color television in their two bedroom-hall-kitchen house.

She is irregular with taking 'Metformin' pills. After suffering for 4 years with diabetes she met an Ayurvedic Doctor who explained the concept model of diabetes to her. Her husband goes for a morning walk everyday but she doesn't go due to household chores. She has low physical activity and stays at home most of the time.

Due to fear of her unmarried daughter not getting a good groom, she has not declared being diabetic to her community. Now she believes that with coming of age she needs to be careful of her health and keeps a regular tab on newspaper articles, books and doctor's advice/instructions on diabetes and writes them down in a notebook.

Persona 4: Pre-diabetic Type 2 patient

Bharat Bhai (Male) is 35 years old, has primary school education and owns a local store in a village in Gujarat, India. He earns INR 8000 to 10000 per month. He is married and has two children who go to the local primary school. He has a family history of diabetes with her mother being an insulin dependent Type 2 diabetic since two decades. She is

adherent to medication in bursts and doesn't follow dietary restrictions. She has visited USA for 2 years where her daughter is living post marriage. His goal is to live a relaxed life. He has a refrigerator, sofa and color television in his 1 bedroom-hall-kitchen house.

His recent blood sugar count in a village health camp was 180. He feels that currently there are no visible symptoms of diabetes and he is not facing any difficulty. Hence, he doesn't want to act on preventing onset of diabetes. He feels visiting a Doctor will make his life more difficult with constraints and it is nonetheless expensive.

Compiled Findings and Conclusions

After making the personas, key findings were sorted and grouped into smaller chunks. Post that affinity mapping of the grouped findings was carried out. From sorting, grouping and affinity mapping, pointers to develop holistic solutions spanning service, communication and product design were evolved. They are as follows:

1. Concept Model

- Suggested medium: Audio-visual to convey concept model to the rural audience.
- Reason: Poor/wrong concept model of diabetes and treatment root cause of all major problems.
- Clear concept model will lead to: Better adherence, early detection, less suffering, more confidence and better life for the diabetes patient.

2. Service Channel

- Direction: Form a strong service channel.
- Reasons:
 - Sedentary and stressful lifestyle along with very little/no exercise, especially females, makes them very susceptible to diabetes.
 - Associated complications are a big headache especially for insulin dependent patients. Early detection and proper treatment can avoid their onset.
 - No initiative for follow-up sessions. Primary Health Centre's (PHCs) don't play any role in detection and treatment of diabetes (existing infrastructure not utilized for diabetes).

3. Socio-economic factors

- Where: To be considered very eminently while designing solutions.
- Reasons:
 - Financial affordability a major hindrance (low-income group) to: Follow up with doctor, Regular blood and sugar test, Safety/hygiene for insulin storage, Follow diet restrictions and Use of better medication.
 - Difficult for unmarried females and young patients to declare diabetes to society.

4. Tools/Methods

- Direction: Develop a methodology and product (kit).
- Reasons:

- A regular tab on blood sugar levels and their interpretation necessary to keep diabetes under check.
- Insulin storage a major hindrance due to: Poor/wrong information; No ambient place to store it; Carrying it while traveling an issue.
- Disposal of used syringes not done properly.
- Insulin dosage skipped on a regular basis by patients.

Concepts and Prototype Development Phase 1

Aim of the first phase of concepts and prototype development was to create awareness and communicate a clear concept model of diabetes and its treatment to the bottom of pyramid population as a majorly pre-emptive measure. Also, identify service chains across the rural scenario and make interventions using communication tools and low high tech products. The personas and pointers developed above played a major role in forming the concepts.

Concept 1

Brief: Developing audio clip snippets to be broadcasted via FM Radio and to be sent as a voice message on mobile phones to villagers in rural areas. They would also be available for the rural audience on a broadcaster fitted at the Primary Health Centre (PHC).

Service chain identified: Primary Health Centre (PHC) – Healthcare worker – Villager

Development and implementation: As an early iteration, a ten minute audio clip was developed based on a script. The major chunks that were covered: Digestion, Metabolism, Diabetes in the body, Adherence to medication, Symptoms of detection, Preventive measures, List of localized healthcare facilities.

The audio clip was dramatized and recorded in Gujarati language as the pilot was in a rural village in Gujarat called Karakhadi. The Gujarati people in villages are loud and dramatized in their daily conversations. A story was weaved around the local village populace encountered during field visits. Their character sketches were drawn to lend authenticity to the audio clip. Subtle and relevant background score was used to generate the village scenario. Finer nuances of the key findings were included in the story. Important facts were repeated in the audio clip and different tones of fear, inquisitiveness, hope and curiosity were played with to achieve the desired effect in communication. Audio was chosen over written content as majority population in the village was illiterate and could recognize a few written words.

Concept 2

Brief: Developing an audio-visual to be shown using a mobile projector which would be carried by a healthcare worker on his regular visits to rural households.

Service chain identified: Healthcare worker – Villager's Home – Neighbors

Development and implementation: Audio-visual snippets depicting the processes of digestion, metabolism and the onset of diabetes were developed in the Gujarati, the local language. The animation and graphic style had elements inspired from the village environment and the local art scene. The audio-visual ended with a short quiz. Two healthcare workers were given a mobile phone with a projector which had pre-loaded audio-visual snippets. During their regular visits to the village households, the healthcare workers were supposed to carry the projector based mobile phone and play the audio-

visual snippets. The assumption was that a group of villagers could watch the audio visual together with the healthcare worker. Few years from now these audio visual snippets can be sent to the villagers as an MMS on their mobile phones. With the advent of 3G spectrum in India, the Internet bandwidth issue will be solved in a few years.

Concept 3

Brief: Developing an audio poster to be carried by the healthcare worker and pasted at various village households. Also, develop audio postcards which will be mailed directly to villagers.

Service chain identified: Healthcare worker – Villager's Home – Neighbors

Development and implementation: Audio is a good medium as literacy levels are low. If a central supporting visual could be provided to an audio clip then explaining concepts like digestion, metabolism and onset of diabetes in the body would become much simpler. So an A3 size audio poster was developed explaining the processes of digestion, metabolism and onset of type-2 diabetes in the body. An electronic circuit with a sound IC, small speaker and a 9 volt battery was integrated and pasted behind the poster. On the front side an instructional info-graphic was made. The graphical style had patterns and elements from the village environment. Words were used sparingly and were in Gujarati, the local language. The healthcare worker was to carry this audio poster along with him on his visits to the village households and leave behind the audio poster by pasting it at a convenient location. The poster has a small red button which when pressed plays the audio content. On his/her next visit, the healthcare worker would bring a new audio poster. The cost of developing a single audio-visual poster was INR 130. Rough estimates put the mass manufacturing cost to be around INR 10 to 20. On similar lines an audio postcard was developed which has an image on one side and on pressing a small button on the postcard it narrates the audio content. In some villages there are no healthcare workers and hence mailing the audio postcards directly to the villagers would work well.

Pilot Testing

Pilot testing for concept 1

Location: Karakhadi village in rural Gujarat, India.

Aim of the testing: To get answers to the following questions - Is the content understood? Is the medium of dramatized storytelling effective? Will the important facts and processes be retained?

Number of users tested: 4 (3 non-diabetic users and 1 diabetic user)

Location of conducting user testing: Primary Health Centre premises (2 users), User homes (2 users)

User testing was split across two locations to get a rough idea of installing an audio broadcaster at the PHC versus playing the audio clip on radio or a user's mobile phone. These were very preliminary thoughts and needed to be developed in detailed.

User's initial knowledge about diabetes and its associated processes was noted. A short quiz was conducted with every user after they had listened to the audio clip to verify the aim. The interview/quiz post the testing was recorded for documentation.

Findings from the user testing of the audio clip:

1. The audio snippets need to be of 2 to 3 minutes each to help retention of facts.
2. Medical processes that were engraved in the story with localized examples were understood and retained easily.
3. Medical terminologies like 'Pancreas', 'Koshanu (Cell)' and others were not retained completely, though their functionalities were registered in the mind.
4. Re-emphasis of a terminology with local connotations like 'Inshulin-Finshulin (Insulin)', 'Rog thai che Rog (Disease)', 'Nanha-Nanha tukda (Small pieces)', etc. made retention easier.
5. Dramatization of the story with localized examples helped in retention of the facts.
6. A supporting central visual along with the audio would aid in making certain concepts and processes clearer to the villagers.

Pilot testing for concepts 2 and 3

Location: Karakhadi village in rural Gujarat, India.

The content considered for this pilot revolved around the process of digestion, metabolism and the onset of diabetes. Two community healthcare workers took the mobile projector and audio poster to various village homes on their regular visits.

Aim of the testing: To get a sense whether or not the concept and prototype development was going in the right direction.

Total number of users tested: 26 (spanning across 4 households).

First house belonged to a family of non-diabetics. 3 house members and 8 neighbors turned up to watch the audio visual which was followed by a quiz.

Second house belonged to a pre-diabetic patient. The wife of the pre-diabetic patient and her neighbor attended the audio visual and the following quiz.

Third house belonged to a severely diabetic (insulin dependent) patient. 4 house members and 7 neighbors turned up to watch the audio visual on the mobile projector and the following quiz.

Fourth household belonged to non-diabetics. 1 house member and 1 neighbor turned up to watch the audio visual on the mobile projector and the following quiz.

In the second, third and fourth households, post the quiz one person was asked to play the audio poster.

Findings from the user testing of the audio poster and audio-visual using mobile projector:

1. Post the quiz an informal discussion erupted where the gathered people started asking their doubts about diabetes to each other. They started sharing their experiences and myths around diabetes with other villagers and the healthcare workers.
2. The healthcare workers present at the location clarified the villagers' doubts and myths. Usually such an open discussion about diabetes would not have been possible otherwise.

The concepts and prototypes are under reiteration. Few other concepts are being looked upon in the second phase of development. Post that phase two of user testing will begin.

References

- Government Of India, The Ministry of Overseas Indian Affairs. *Sevak project: A pilot project for access to care for the villages in India*. Retrieved 15 February, 2011, from <http://www.moia.gov.in/services.aspx?id1=342&idp=342&mainid=196>
- KidsHealth. *Diabetes facts and myths*. Retrieved 27 January, 2011, from http://kidshealth.org/parent/diabetes_center/diabetes_basics/diabetes_facts_myths.html?tracking=P_RelatedArticle
- KidsHealth. *How your body gets energy*. [Interactive Web Video]. Retrieved 27 January, 2011, from <http://kidshealth.org/misc/movie/cc/diabetes/index.html>
- Klein, D., Wustrack, G., & Schwartz, A. (2006). Medication adherence: Many conditions, a common problem. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 50(10), 1088-1092. Retrieved from http://www.ideo.com/images/uploads/news/pdfs/HFES_IDEO-adherence_2006.pdf
- Lehmann, U., & Sanders, D. World Health Organization, Evidence and Information for Policy, Department of Human Resources for Health, Geneva. (2007). *Community health workers: What do we know about them? The state of the evidence on programmes, activities, costs an impact on health outcomes of using community health workers*. Retrieved from World Health Organization website: http://www.who.int/hrh/documents/community_health_workers.pdf
- Life With Diabetes. *Insulin storage*. Retrieved 20 February, 2011, from <http://www.lifewithdiabetes.org/insulin-storage.shtml>
- Medindia. *Type 2 diabetes - slideshow*. [Web Sideshow]. Retrieved 25 January, 2011, from <http://www.medindia.net/slideshow/type2-diabetes.asp>
- Nazario, B. (Reviewer). (2011). *Slideshow pictures: Type 2 diabetes - learn the warning signs*. [Web Sideshow]. Retrieved from http://www.emedicinehealth.com/slideshow_pictures_type_2_diabetes/article_em.htm
- Polonsky, W., Fisher, L., Guzman, S., Villa-Caballero, L., & Edelman, S. (2005). Psychological insulin resistance in patients with type 2 diabetes. *Diabetes Care*, 28(10), 2543-2545. doi: 10.2337/diacare.28.10.2543
- Polonsky, W., & Jackson, R. (2004). What's so tough about taking insulin? Addressing the problem of psychological insulin resistance in type 2 diabetes. *Clinical Diabetes*, 22(3), 147-150. doi: 10.2337/diaclin.22.3.147
- Project KADAM (knowledge based action for diabetes awareness movement)*. Retrieved 17 February, 2011, from <http://www.diabetescareindia.org/Kadam/Default.aspx>
- Ramachandran, A., Snehalatha, C., & Viswanathan, V. (2002). Burden of type 2 diabetes and its complications – the Indian scenario. *Current Science*, 83(12), 1471-1476. Retrieved from <http://www.iisc.ernet.in/currsci/dec252002/1471.pdf>
- The SEVAK Project. *The Sevak project: Videos*. [Web Video]. Retrieved 15 February, 2011, from http://wn.com/the_sevak_project
- Times News Network. Project KADAM to spread awareness about diabetes. (2009, October 7). *The Times Of India*. Retrieved from http://articles.timesofindia.indiatimes.com/2009-10-07/ahmedabad/28077064_1_diabetes-awareness-movement-rssdi-spread-awareness
- Waters, R. (2011, January 20). Mankind's inhaled insulin fails to win U.S. approval. *Bloomberg*. Retrieved from <http://www.bloomberg.com/news/2011-01-19/mankind-fails-to-win-u-s-marketing-approval-for-afrezza-inhaled-insulin.html>
- WebMD. *Slideshow pictures: Type 2 diabetes - learn the warning signs*. [Web Sideshow]. Retrieved 14 February, 2011, from http://www.emedicinehealth.com/slideshow_pictures_type_2_diabetes/article_em.htm
- Wild, S., Roglic, G., Green, A., Sicree, R., & King, H. (2004). Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*, 27(5), 1047-1053. doi: 10.2337/diacare.27.5.1047

Author Bio

Vinay Venkatraman is one of the founding partners of CIID (Copenhagen Institute of Interaction Design). He studied product design from the National Institute of Design (NID) in India and also graduated with honors in Masters from the Interaction Design Institute Ivrea, in Italy. He has in the past worked on emerging technologies as a product designer at Microsoft, Redmond. As part of his current work he consults to global companies like Nokia, Intel, Philips, Maersk etc. on various innovation projects for new product & service development. He also enjoys teaching design & technology crossover courses at various universities like IUAV Venice, IT University Copenhagen, Denmark's Design School etc. In the past he has been invited to give talks at various innovation events at Danish Design Center, Icelandic Design Center, NCKU Taiwan, UNICEF and such similar gatherings. His works have been written about in leading design magazines like wallpaper, blueprint and exhibited during the Salone Del Mobile in Milan.

Prerak Mehta holds a Masters of Design degree from Indian Institute of Technology, Bombay and a Bachelors of Technology in Computer Engineering. He has been working with entrepreneurial as well as established ventures like Embrace, Quetzal, CIID and Oracle and the work experience ranges from business management to user centric design. His work has been published and exhibited in Design Society's ICED'11 conference at Denmark, MobilePlus at Chennai and International Conference of Research into Design (ICORD'11), Bangalore. His current interests include service design, design research and developing user interfaces for complex and large systems in education, healthcare and information technology.