

## Human API as a research source in health care

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*This paper illustrates how the concept of “Human API” can help cancer post-treatment cancer patients with challenges they face once they are released from the hospital. The results and implications of this semester long graduate project will help illuminate how the Human API through its various data collection methods could potentially play a larger role in extended cancer care. The research will also attempt to determine if hyper-connected networks of individual patients could become effective sources of information for health institutions to engage and connect with patients after treatment or surgery.*

### INTRODUCTION

From the initial suspicion of cancer, through the subsequent journey of diagnosis, treatment, and recovery, a cancer patient experiences extreme physical and emotional challenges. During this period of active treatment, the patient is highly engaged with a care team through many examinations, consults, treatments, follow-ups, and phone conversations that ensue over the course of several months or years. He or she may have dozens—or even hundreds—of regular interactions with hospital staff: doctors, nurses, therapists, administrative staff, security guards, doormen, and cafeteria staff. However, after being released from active care, a patient may be instructed to follow up with his or her oncologist in several months, or even a year. Opportunities to interact with hospital staff drastically plummet and post-treatment patients may feel lost, abandoned, and disconnected. (Trump and MSKCC 2012) Even with access to new technologies, cancer survivors often feel uncertain about how to address various questions and concerns that arise after cancer. The lack of effective channels of communication and trusted counseling from institutions can lead to poor communication between clinical teams, patients, and their families. (Trump and MSKCC 2012) To address this challenge, Memorial Sloan-Kettering Cancer Center (MSKCC) sought to find new ways to engage and connect with these patients after the completion of critical treatment, and to extend the high quality of care that patients have come to expect from the hospital.

The use of information technology and self-quantification through always-on digital devices presents an opportunity for such organizations to better engage cancer survivors in self-monitoring and adoption of healthy behaviors. While number of researchers (e.g. Bentley and Tollmar 2013) have attempted to support such proactive recovery, existing

solutions (e.g. Berkowitz 2012, Hammond 2012) have yet been widely utilized and more work is needed to fully understand the behavior of cancer survivors around such communication tools. In this paper, we explore a proof-of-concept aimed at motivating cancer patients to keep a healthy, social life. The research also looks to explore the use of Human API and the potential that networks of individual patients could become direct sources of information for health institutions like MSKCC. The research question this paper addresses sits in a network of other related questions regarding how such a concept might be implemented. How might we provide intrinsic motivators for stronger, lasting engagement? How might health institutions store and manage vast amount of data collected? What future policies must govern the use and application of such data? Of course, one of the primary questions is regarding privacy. How can sensitive health data be used for an application like this? While we acknowledge the importance of these questions, we chose not to address them in this paper to reduce the scope of the project and be manageable in the timeframe we had.

This project was the outcome of a graduate level course at the Illinois Institute of Technology (IIT) Institute of Design in Chicago, Illinois. The proof-of-concept was presented to the Innovation Team at MSKCC; many of the key findings and design principles were considered highly applicable to the design and implementation of future post-treatment cancer care.

## **WHAT IS HUMAN API?**

Human API is an emerging concept of a modern day technology where the consumer or user is seen as a source of relevant, always-on human health data. In software development the term API stands for “Application Programming Interface”, essentially the interface through which outside programmers can develop upon a common platform for their software to communicate with existing software and devices. APIs are commonly used by software companies as a way for other programs to interface with their product. For example, the Google Maps API allows The New York Times to use Google Maps data on their website or create interactive visualizations by simply “plugging into” the program. Over the last decade, we have seen a significant increase in locative and ubiquitous technologies that allow us to be constantly connected. This combined with new social media outlets create unprecedented opportunities to create, share, cooperate, and take collective action. In terms of healthcare, the volume of tools in the market to track human data has exploded and adoption is showing momentum. Today, users can easily track their activity with a Nike+ and Fitbit; weight and body composition with wireless scales; blood pressure with a Withings monitor; sleep cycle and patterns using sleep-monitoring devices. Even without complicated peripherals, the everyday mobile phone with its multitude of sensors, can broadcast information about our location, preferences, body patterns etc. In the past, mostly doctors utilized the patients’ health data, but with enabling technology, patients themselves have become new consumers of the data. In this sense, Human API introduces new ways to collect, process and consume patient health data. Furthermore, people now have access to comprehensive platforms that allow them to broadcast and transmit this information to a network of other users.

In Palo Alto, California, a commercial Human API platform called the “human/api”, is founded on the belief that this new human data being created every second can be fully leveraged only when we have the tools to seamlessly track the data, and the tools to make the data meaningful. Brian Solis said in his presentation at LeWeb 2012 in Paris (and subsequently in his weblog) that the idea of the Human API sets the stage for devices to not only talk to one another, but also talk to us and affect how we process and adapt information to influence how we go through life every day. He claims:

Products such as Fitbit and Nike’s FuelBand build upon the Human API by collecting the digital breadcrumbs of users and assembling them in a way that makes sense of daily activity and validates progress. Perhaps more importantly, these devices, the data they collect and present, and the social relationships linked by publishing this information in social channels drives the ongoing pursuit of goals, and brings people together to help one another live better...Imagine if they could also talk to one another...across devices and also across the various contexts of usage, personal, professional, medical, etc. (Solis 2013)

The most important characteristic of this experience is that the users themselves willfully contribute the data, often in exchange for experiences or challenges that the platforms provide. In Nike+ for example, users share their activity data with Nike, and a network of other users in exchange for creative running, exercise challenges. This connected information system, with users as nodes interacting with devices and platforms to generate data, creates what we call the “Human CPU”. The Human CPU (in form of the users who generate data) is a highly contextual, socially aware intelligence that is able to pre-process what information is appropriate and what is not for the overall health of the system.

In a graduate level course at the Institute of Design, we explored the Human API as a platform for organizations to access “Human CPUs.” Through such platforms, organizations can track real world data such as preferential biases and group validations, generated from users willing to share a portion of their life, which is a much more viable source of information than any feedback from focus groups, surveys, or market studies. Eventually both the quantified self and the Human CPU provide validation, feedback, and insights for organizations that can lead to better products, services, and experiences for users. Using the example of Nike+, the framework can be explained as: people using Nike+ become the sources of information; they use Nike+ device as interface to “plug in” to the Nike+ platform, which connects network of users sharing running information and exercise challenges. Using this framework, organizations can help build two types of data:

1. Self quantification data (useful for the person and networks using the system),
2. Research data (useful for networks and institutions that can modulate their services based on the information).

In this paper, we describe this exploration and the proof-of concept which came out of the exploration. Our research and proof-of-concept builds upon these design principles and

frameworks of Human API to utilize it as a research source in cancer recovery. In the paper, we also describe how existing frameworks from this project can be useful in other areas of healthcare that require monitoring and changing patient behaviors.

## **RESEARCH AND CONCEPT DESIGN**

The eleven students in the course had fifteen weeks to develop theoretical proof-of-concept and present to MSKCC under the guidance of Professor Anijo Mathew. The group was divided into teams such that each team had diverse backgrounds related to 1) people: ethnography, user research; 2) product: product design, hardware installation, physical prototyping; 3) communication: graphic design, user interfaces, usability, interface design; 4) place: architecture, spatial design; 5) information: information architecture, programming, logic structures. This was essential to the project since our objective was to employ technology to create a new experience and service for a unique user group, an endeavor which required considerations in all five aspects mentioned above. This paper describes the research and proof-of-concept developed by one of the teams. The team consisted of Knowl BaeK, with a background in industrial design and ethnographic research; Kyle Duke, with a background in architecture and ethnographic research; Roy Luo, with a background in computer science and interaction design; and Monica Lee, with a background in graphic and industrial design, in particular, information and communication technology (ICT) products. Joining our expertise from various fields, we built a research study to understand post treatment cancer experience and developed a theoretical proof-of-concept for extended cancer care using the concepts of the Human API.

Based on the conversations with MSKCC in planning this project and our understanding of Human API, we formed an initial hypothesis that giving access to real time patient health data using Human API may help MSKCC to improve remote communication with patients and to motivate patients to adopt healthy behaviors while recovering at home. In order to give some focus for the research, we initially chose to focus on the recovery process of lung cancer, which is the most deathly and predominant type of cancer. (American Cancer Society 2013) During the later phases, however, we decided that the focus on lung cancer was not critical and generated concepts for cancer recovery in general. The goal was to ultimately empower cancer survivors to proactively adopt a healthy lifestyle, support them to overcome social and psychological challenges, and help MSKCC to support their patients in a holistic perspective. The project plan was four-fold: a) contextual ethnographic research to understand the patient perspective in post-critical treatment issues, b) analysis of research and development of design principles, c) concept generation and prototyping with users for refinement, d) proof-of-concept and video for presentation. In some user interviews, we used a paper prototype of initial concepts to facilitate conversation and used the feedback to refine the concept.

## ETHNOGRAPHIC INTERVIEWS: TRANSITIONS TO LIFE AFTER CANCER

The team started contextual ethnographic research by interviewing various stakeholders involved in post-treatment care process including oncologists, a cancer nurse, and psychologist at a cancer center. The purpose of these interviews was to confirm the insights we received from the previous MSKCC New Patient Experience project and to understand current attitudes and behaviors with respect to engaging and connecting with patients after surgery and major treatments. In addition, we spoke with cancer survivors, and caregivers to understand the patient perspective in post-critical treatment issues. As we learned from the previous MSKCC New Patient Experience project, we heard that the current patient experience can be fragmented. For example, an oncologist at a leading Chicago university hospital told us:

I have a long discussion with the patients in their first visit, but try not to get them too scared. I during the first few visits but there are time constraints for us to address all of their concerns. Most people accept the condition and their chance of survival but some do get depressed from initial diagnosis. The treatments can cause physical changes that cause depression, and we refer them to psychiatrist and medication.

We also heard that once the surgery is done, it is hard for the patients to keep frequent communication with the oncologist that the patient was initially diagnosed by. In fact, cancer surgeons usually have only brief interaction with the patient. A cancer nurse at a leading Chicago university hospital said:

Surgery is a one-time deal - once they are diagnosed, doctors see them for surgery and one post-operation visit, but rarely see them afterwards. Nurses are the people who help patients when they go through chemotherapy and follow up visits. Because of the economy, not many patients stay in hospital for long time, especially for lung cancer it's mostly outpatient unless they have some complications or right after their surgery.

Even though the onus of interaction is often placed on them, nurses too face significant constraints in consulting for the patients and struggles to help with patients' emotional challenges:

About 90% of patients are depressed but only about half would seek help for it, we often trick them because they lose appetite and have trouble sleeping, we say we'll give you a little bit of medication (antidepressant) to help you with that.

From these interviews we learned that coping with the emotional burden of having cancer is as much a challenge as the physical hardships and that many cancer survivors suffer

from depression. In fact, for many cancer patients and families, the depression associated with cancer is as big an issue as the disease itself. We also learned that patients are often handed over from critical treatment stage to home recovery stage without clear expectations, and the new life after returning home is full of uncertainty and questions.

Even if a patient had a successful surgery and recovered enough to return home, many cancer survivors experienced fatigue, loss of appetite, brain-fog, bad short-term memory, emotional instability etc. Thus, when the cancer survivors could not function as what they considered 'normal' in their life before cancer, they felt frustrated that they cannot take care of their children, perform as well in their jobs, or get exhausted doing minimal physical activities and felt like a burden to others. From this initial research, we reframed a perspective: cancer recovery is not merely about preventing death and regaining physical ability, but also accepting and adjusting to what we called the "new normal" life.

Moreover, an exceptionally optimistic cancer survivor and his daughter we interviewed separately illustrated challenges in communication within a family. The patient is still active in his career and social life as his physical condition allows. Although his cancer had metastasized and he was relying on various experimental treatments, sometimes he wanted to just live life and go on an anticipated fishing trip with his friend and miss chemotherapy. Or he might eat foods that are not recommended by the doctors. His wife, being a caring, sensitive and detail-oriented person, often got upset that he was not following rules. The story illustrated how, even though the cancer survivor has a very supportive and caring family, misalignment of expectations and communication can cause friction in the life after cancer. The "new normal" is a stressful experience full of uncertainty, and everyone around the cancer survivor has to accept and adjust to the changes. From these insights, we decided the Human API could play a big role in aiding the three main challenges for post-cancer life:

1. Information: acquiring and managing reliable information to set accurate expectations,
2. Communication: lack of easy way to capture and/or retrieve health data and knowing when, who, how they should contact regarding physical or psychological changes,
3. Psychological: fear of appearing helpless and difficulty adjusting to a new life.

## **ANALYSIS AND DESIGN PRINCIPLES**

In order to identify the pain points and opportunities in this "new normal", we initially documented the process of current patient journey based on our interviews with cancer doctors (see Figure 1.) Therefore, this patient journey represents the doctors' view of the cancer recovery process and their touch points with the patient. From this, we discovered that medical team's perspective is often very transactional and does not account for the emotional aspects of a patient during treatment and beyond.



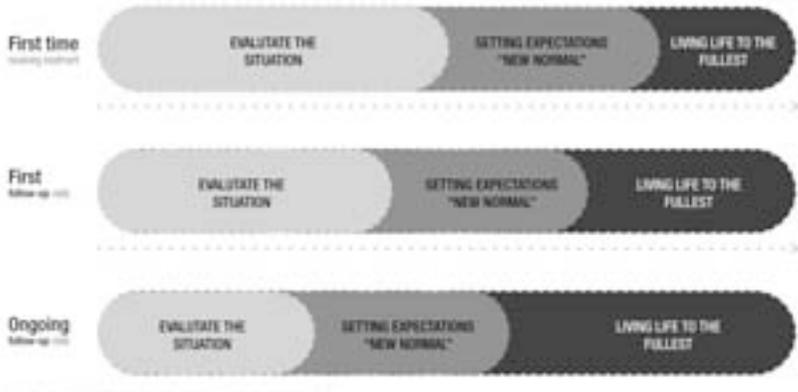
**FIGURE 1. Doctor's view of post cancer treatment patient journey**

To better represent the holistic experience that captures reality of life after cancer, we created a “new” holistic patient journey that consists of three phases: 1) evaluating the situation: understanding the severity of cancer and what will happen, 2) setting expectations of the ‘new normal’: accepting the physical and emotional changes and/or limitations after cancer, and 3) ‘living life to the fullest’: making the most of and focusing on the quality of the new life. (See Figure 2)



**FIGURE 2. Holistic Post Cancer Treatment Patient Journey (using lung cancer as an example).**

Furthermore, we illustrated the need for varying emphasis on each phases depending on what stage in the larger process the patient is in Figure 3. We highlight the fact that there should be more emphasis on evaluation when the patient is receiving treatment for the first time, and we saw greater opportunity in shifting the focus to maximize the quality of day-to-day life during on-going follow up visits.



**FIGURE 3. Varying emphasis on phases of patient journey.**

Interviews with patient and caregivers gave us an empathetic understanding of the patient journey and helped us develop the following design principles to guide our concept design:

1. Help patient's access to reliable data and establish more accurate expectations.
2. Provide a holistic view of patient data to the medical team.
3. Let patients track emotional and physical data.
4. Identify the emotional and physical issues not shared by patients.
5. Help patients set realistic goals and expectations for their "new normal" life. Consider the characteristics of older patients.
6. Provide a supportive network that allows varied levels of involvement.
7. Help patients and family members communicate their emotions effectively.
8. Help patients understand fear and anxiety are normal.

Overall, we saw the opportunity in creating a platform that leverages Human API as an effective source of patient's quantitative and qualitative data in real time, which will help fluid communication and coping with the emotional challenges. All of these findings supported our hypothesis that current experience gives an incomplete view of the patient by only tracking the quantitative information. To move forward into the concept stage, we

questioned how the patient’s quantitative and qualitative data affect each other and how they could be useful to the patient and the institution in terms of supporting the post treatment care. In order to understand how the Human API can play a role in the experience, we mapped out what role different types of data can play in a post-treatment cancer patient’s life.

## DESIGN CONCEPT DEVELOPMENT AND PROTOTYPING

With the design principles, we generated ideas for a new service that will improve the post treatment cancer recovery experience. In order to design for the various aspects of the challenge and the three phases that we identified during the research, we used a grid with one axis being the three main challenge areas: information, communication and psychological; and the other axis as the three phases of holistic patient journey: evaluating situation, setting expectations, and living life to the fullest. Then we clustered the individual ideas into related theme categories such as: gamification, planning tools, navigation and decision-making helper etc. Finally, we mapped theme categories of ideas on the two axes of Physical to Psychological, and Social to Information. This process helped us to organize the partial ideas and use them as building blocks to construct service concepts (see Figure 4).

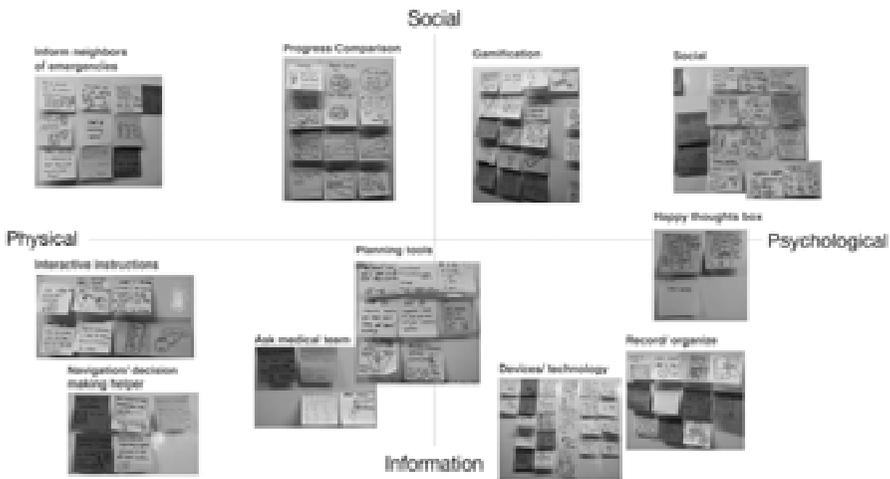


FIGURE 4. *Idea cluster mapping.*

From these themes we developed several preliminary service concepts. The early stage concepts envisioned were focused on helping patients to easily track their health data, streamline communication with the medical team, and provide visualization, planning, and suggestions to the patient and caregivers. We then roughly sketched these concepts and

sought feedback from patients, caregivers, and MSKCC. While these concepts were perceived as valuable and necessary, we received critiques that they did not align with our objective of addressing social and psychological challenges in cancer care. We also received feedback that the early concepts were utilitarian but did not take full advantage of Human API. From the feedback, we decided that motivating cancer survivors to adopt healthy lifestyle required more than a practical utility solution. We built new concepts that leverage the real-time, nuanced, qualitative data that patients voluntarily feed into the Human API system. The aim was to use the data to create new experiences that will change the cancer recovery behavior over time. We wanted to help cancer survivors to not only track their own health conditions, but more importantly get motivated from social interactions and support from their family and friends. We also referred to B.J. Fogg's Behavior Model (Fogg 2009), which argues that in order to change behaviors, one needs to provide motivation, proper triggers, and abilities.

Later concepts explored the idea of 'healthy points' when being active and social, and tangible rewards when the patient reaches certain goals. The hospital could give suggestions through the platform to stay active, and family and friends can gift points to cheer for the patient. The patient multiplies healthy points when being active with other patients or interacting with friends and family. Here, we leverage widely adopted self-quantification devices such as Nike+ and Fitbit to 'plug-in' the patient's Human API into the platform. We also referenced related work like LifeMash (Bentley and Tollmar 2013), which highlight the importance of contextual awareness in order to paint an accurate picture of the patient's physical and social activities. As a result, we designed a proof-of-concept mobile application that collects the patient's health data through a social gaming interface. Alongside the concept development, we created various paper prototypes and conducted heuristic evaluation and ideation sessions with patients and caregivers. (Figure 5) Using the prototypes to mimic the use of the application helped us to refine the proof-of-concept, and we created a video to present the final concept.



**FIGURE 5. Prototyping with caregiver to refine concept.**

## PROOF OF CONCEPT: UNA – A SOCIAL GAME APPLICATION

Una is a social game and health monitoring service that encourages cancer survivors to lead a healthy lifestyle. Through its always-on, patient-approved data collection, Una also allows the hospital medical team to monitor patient's progress and provide a higher (and personalized) level of care. Una tracks three types of data: physical activity, diet, and social interaction. To portray our concept in an intuitive story, we created a scenario of fictional character Laura, a cancer survivor who is about to leave the hospital and is introduced to Una (see Figure 6):

Before leaving the hospital, Laura is given the Una package which contains a Nike FuelBand and the Una application which works in tandem with Nike+. The nurse at the hospital walks Laura and her primary caregiver through the application and explains its purpose. The hospital, or Laura can send invitations to other caregivers and family members to connect with each other on Una. As she gets home, Laura receives important updates about extended cancer care at home. The application also prompts her to set up goals for each of these care protocols – healthy eating, exercise, periodic medical reviews etc. Laura can also select what kinds of tangible rewards she would like. The rewards are partially sponsored by participating vendors interested in supporting the cause, and Laura sees several rewards that she likes. When Laura's family and friends see the goals, they too can pledge to further motivate Laura to achieve her goals.

Within days after her treatment, Laura starts working towards her goal by being active and earning Nike Fuel Numbers. She also earns points by taking photos of her healthy meals, getting positive feedback from her family, and by hanging out with her friends and family. A clinical team at the hospital tracks Laura's post treatment progress on the Una dashboard. On one occasion, the nurse notices that Laura's activity meter has gone down. He sends a notification to Laura's circle of caregivers through a quick pop up window:

*Laura could use your support with hitting her fuel goal for exercise today. Want to send her a message?*

Jen, Laura's close friend who has been supporting her recovery sees the notification and invites Laura to talk a walk outside:

*Hey, the weather's beautiful today. How about a walk in the park?*

Laura accepts the invite and meets Jen at the park. Since they both have Una application installed, a quick bump of their phones can let the system know that Laura is exercising with Jen. She has a great walk in the park with Jen, doubles her Fuel numbers, and works up towards her goals. Since the application automatically tracks Laura's activity using the accelerometer in the phone, the Laura and Jen can enjoy the walk together without further prompts, until she returns home:

*Great Laura! You've earned 8 points with Jen!*

Through being active, eating healthy, and socializing, Laura earns points, eventually unlocking the reward of a healthy meal voucher at a local sushi restaurant. She enjoys a dinner with her husband, knowing that she is maintaining a healthy lifestyle, aware that her care team at the hospital is monitoring her progress without intruding in her life, and in general spending more time with her family and friends.



**FIGURE 6.** *Screenshots from Una concept video.*

## **HUMAN API IN THE SOCIAL GAME APPLICATION**

This proof-of-concept incorporates design principles and frameworks from B.J. Fogg's theory of captology, as well as game theory, and social motivation theories from applications such as Pain Squad. (Berkowitz 2012) The application is based on the concept of a social game where we explored the types of quantitative and qualitative data as meaningful metrics of holistic wellness while easily captured through the patient's Human API. Laura is motivated to use the application because she knows there is a tangible reward for doing so. Moreover she is motivated by the fact that her friends and family can see her progress after cancer. The ability of the clinical team to have constant access to Laura's health data with minimal effort on her part to input the information is also an important aspect of the application.

How would the application work? We envision leveraging existing platforms wherever possible to track the Human API. Over 60% of adults in U.S. now own a smartphone (Nielsen 2013) and there are 11 million users of Nike+. (Laird 2013) Knowing such large population have access and knowledge to use such platforms, we envisioned possibilities of using Evernote Food to document photos of their meals and Nike+ and Fuel Numbers to track physical activity. (see Figure 7) The rewards will reflect the overall aim of encouraging healthy lifestyle, such as discounts for fitness lessons, vouchers for healthy local restaurants, or coupons for athletic shops. We envisioned a 'pledge system' (see Figure 8) similar to that of Kickstarter, so that the friends and family supporting the patient is backing up the health cause and giving a gift when the patient reaches the goals. This concept also appeals to

Corporate Social Responsibility and asks the relevant businesses to offer the rewards at a lower price. The sponsoring businesses will benefit from being featured as a sponsor of cancer cause, while help offset the cost to provide the tangible rewards. We also envisioned the need for a “game master”, a doctor or medical professional from the treatment provider who is knowledgeable about the patient to adjust the difficulty level of reaching the goals. Further development of guidelines is needed to change the game depending on diagnosis so that the patient does not feel discouraged or the game becomes too easy.



FIGURE 7. Three ways to earn points

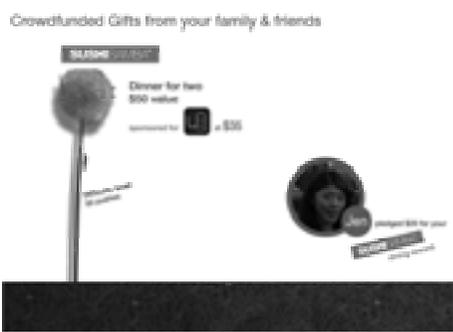


FIGURE 8. Crowd-funding model.

Measuring social interaction was enabled through the simple gesture of ‘bumping’ the phones together that have Una application. Near Field Communication (NFC) technology in new phones can activate a social meter and track the duration of time and movement while the two phones are in close proximity. In the end, the aggregate of all of these measurements (see Figure 7) are used to compose the final concept of Una experience, wherein the Human API aggregates the user’s activity level, eating habits, and social activity into a social game that rewards patients and family members for positive behaviors and encouragement. Patients and family members work together to achieve goals displayed on an engaging data visualization platform and earn tangible rewards when successfully completed.

## VALUE PROPOSITION

The primary value proposition of Una is that it triggers direct communication and interaction between friends, family, and the patient, while also enabling the health institution to keep track of the patient’s wellness. This is beneficial for institutions like MSKCC seeking ways to improve healthcare at lower cost. Because the system is primarily data driven, algorithmic trackers can look for anomalies. This means the medical team can reduce the labor of collecting and processing raw data and spend more time on personal communication with the patient when appropriate, delivering higher quality care. The application will facilitate patient health tracking and looking for anomalies in activity or

behavior that can trigger emergencies, so that medical team can step in to prevent major issues before they happen. Also, important care updates, review questions, periodic messages to the patient and caregivers can all be sent through the application. Family and friends of the patient can feel more connected to the patient by providing words of encouragement and rewarding healthy lifestyle. Finally, various sponsoring companies and local businesses gain awareness as supporters of cancer survivors and their families.

## **CONCLUSION AND FUTURE IMPLICATIONS**

In this paper, we describe a proof-of-concept employing Human API as an effective research source for post treatment cancer care. We chose the concept of Human API because we believe that having access to the real-time, nuanced health data from the patients who opt in to the service presents a strong potential for health institutions to actively respond to patient and caregivers' needs. From the design of our proof-of-concept, we were able to derive a set of guiding principles that can also be used for the development of future Human API applications:

1. Employ an effective metaphor and goals that encourages continued participation and feeling of accomplishment.
2. Keep the interaction and visual representation simple with a clear indication of patient's progress.
3. Choose meaningful quantitative and qualitative data points aligned with the purpose of research and appropriate devices for the patients.
4. Facilitate more offline social interaction between patients and caregivers as the major support network.
5. Help health institutions to see holistic picture of patients' progress rather than as set of metrics.

In conclusion, this research attempts to provide an effective and viable example of applying the concept of Human API with the objective of helping a cancer institution engage and connect with the cancer survivors after their critical treatment is completed. Using Human API as a research source will facilitate collection of valuable quantitative and qualitative patient health data in real time. Furthermore, Human API can help paint a more holistic picture of patients for healthcare organizations when combined with contextual data. Also, such methods have potential to be applied in broader realm of remote health care and/or wide spectrum of remote research that require ethnographic understanding of users.

## **ACKNOWLEDGEMENTS**

This project was supported by funding from the sponsoring organization, Memorial Sloan-Kettering Cancer Center (MSKCC) and IIT Institute of Design. The team is also indebted to Ophelia Chiu, Rebecca Trump, and Hugh Musick who advised on many aspects of the research and proof-of-concept development. We also wish to acknowledge the other

students who were in this class; their critique and feedback helped us challenge and improve the project.

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