SHINE-L: Sensing Health and Family Behavior Routines for Latino Families

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Abstract

Childhood obesity rates are significantly higher in
Latino families than other ethnic groups and even
higher in Mexican immigrants compared to other Latino
families. Family routine plays a significant role in
preventing child obesity. In this late breaking work, we
present early work in studying and designing SHINE-L
for Mexican immigrant families. The SHINE-L system
uses acoustic sensors of mobile phones/smartwatches
to detect and record family routines, including family
meal frequency, sleep, and screen time. This routine
information will be shared with families through
ambient displays and used among families for social
learning. Mexican families, due to complex immigration
status and socio-economic diversity, bear unique design
constraints around privacy and preferences over social
learning. We conducted focus groups and interviews
with 17 Mexican immigrant parents who have young
children (ages 5-12 years old). We present implications
in choosing the target population and strategies for
social learning using ubiquitous sensors in
socioeconomically and culturally diverse immigrant
populations.

Author Keywords

Family routine; acoustic sensor; Latino; Mexican
immigrants; family health; wellness
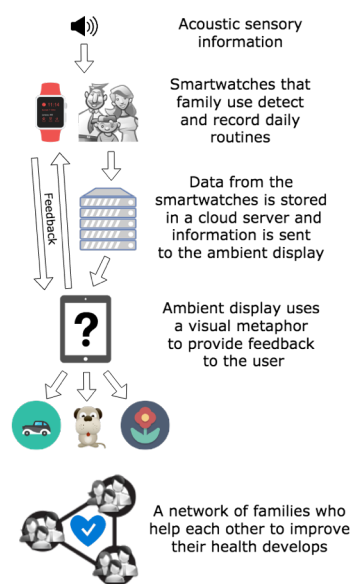
Figure 1: The SHINE system overview. The smartwatches that the family members wear detect acoustic sensory information. That information is stored in a cloud server and is sent to the ambient display. The ambient display uses a visual metaphor to provide feedback to the users. Families can view each other's progress and a conducive environment for progress is established.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

Introduction

Childhood obesity has more than doubled in children age 2 to 4 (from 7% in 1980 to 18% in 2010) and tripled in adolescents (from 5% to 18% for the same period) in the past 30 years [23]. Families' home routine related behaviors, such as decreased sleep [16], increased sedentary behaviors (e.g., screen viewing time [14]), less frequent family meals [37], and parental involvement have major influences on child obesity. Family-based interventions involving both parents and children making behavioral changes to support healthy behaviors were shown to be effective methods to treat child obesity [11].

We are developing an innovative family behavior routine sensing and feedback system called SHINE (Sensing Health and Family RoutINEs), which empowers families to actively engage in increasing healthy lifestyle behaviors and improving family wellness [7]. The acoustic sensors from users' phones will detect any screen viewing duration, family dinner frequency, and sleep. The family's progress toward improved behavior routines will be reflected through the visual metaphors, such as active pets or blossoming flowers. This information will be available in the periphery of the family's activities via a living room display and/or the parents' smartphones. Family members will also be able to see how other families are doing and motivate behavior change. SHINE-L (Figure 1) is an extension of SHINE [7] (the acoustic sensors technology) and will be culturally designed to support Latino families as they develop healthier behavior

routines. SHINE-L as a system framework will provide new methods and technologies to engage all family members and a community of families in improving child and family health. In this late breaking work, we will present the results of initial focus groups and interviews with Mexican immigrants to inform the design and cultural appropriateness of SHINE-L.

Background

According to the Social Ecological Model [21], the environment of family, friends, and the community, such as other families, can have tremendous effects on childhood obesity. Parents' eating habits and physical activity greatly influenced child eating and activity behaviors [25,29,36], and parents' weight loss during pediatric weight control program predicted child weight loss [40]. Regularly eating dinner as a family, obtaining an adequate amount of nighttime sleep, and limiting screen time was associated with lower rates of childhood obesity [3,25,29,36]. Reducing sedentary behavior (e.g., screen time) found to be as effective as increasing physical activity in reducing obesity [3].

Latino families face a large health disparity with regards to healthcare access, which can be attributed to socioeconomic status and cultural perspectives on the management of chronic illness [13]. A study found 23% of Latino children (ages 10 to 17) are obese and 41% are overweight, whereas 13% of white children are obese and 27% are overweight [34]. Many of these health disparities attribute to acculturation level. Acculturation describes the results of contact between two or more cultures and any cultural or psychological change that occurs as the consequence [15,31]. "Culture learning" [30] describes the acculturation process on three levels. The first level describes

Figure 2: The main components in the SHINE system include planning, sensing, and feedback. These images are the examples of the SHINE system using visual and textual feedback as the family improves their behavior routines.

superficial change in abandoning prior culture and adopting new practices in consuming food and media. The second level describes behaviors central to a person's social life, such as language preference and use. The last level describes the non-linear adoption of cultural values and norms. For example, *Familyism*, a value deeply embedded in Latino culture, changes as people become more acculturated, but the idea that "support is received and expected from family members" is kept constant between people of different levels of acculturation [17].

The effect of acculturation levels on Latino health outcomes is complex and difficult to measure, and particularly more complex in Mexican immigrants due to their proximity to the border [10,26]. Several studies show that acculturation has negative effects – primarily in areas such as substance abuse [2], dietary practices [9], and birth outcomes [15]. However, there are positive health outcomes that are attributed to acculturation—primarily increased use of healthcare. Researchers showed that more acculturated Latinos are more likely to use preventive services like cancer prevention [15] and vision and dental check-ups [37]. These results are due to the lack of regular access to healthcare in the case of low acculturated Mexican immigrants. Compared to other Latino immigrants, Mexican immigrants show higher barriers to healthy living due to a lack of access to health insurance, language barriers, immigration status, and cultural perspectives on the treatment of illnesses [13,22,38]. These barriers have caused some Mexican immigrants to obtain needed medical care in the form of self-medication and home remedies [6].

Mobile health applications can address such lack of access to regular healthcare. To help improve family behavior, CoDine [39] used an ambient table cloth and interaction screen at meal time to bring families together although they were physically apart. TigerPlace helped to monitor individuals' health status, detect emergency situations, and notify health care providers [28]. To further support Latino population through sensors and mobile technologies, SenseCam [18] project developed photograph-based sensing to measure features of the environment in Latino neighborhoods [33]. Mobile text messaging and applications were used in Latino population for obesity prevention [1] and wellness monitoring [19]. Researchers investigated technology use and acculturation for Latino population [5]. The field is just beginning to understand Latino family user preferences towards mobile health. More exploration is necessary in understanding use of sensors in Latino families considering the community's cultural diversity.

In sum, childhood obesity is more prevalent in Latino families compared to other racial/ethnic groups, and unobtrusive, family-oriented sensor and feedback systems have great potential to change behavior. To extract design requirements and create a culturally sensitive system, we invited Mexican immigrant parents to participate in focus groups and key informant interviews to shape the design of the SHINE-L system.

Methods
We conducted 4 focus groups (FG1-FG4) and 2 interviews (JP1, JP2) each lasted 1.5 hours with 17 low and middle income Mexican immigrant parents who have children aged between 5 and 12. We recruited the participants through *promotoras de la salud*

Figure 3-1: A focus group participant explaining a potential solution to improving their family behavior routines.

Figure 3-2: A screen shot of affinity diagramming process.

(community-based health education and promotion programs for Hispanic populations) (n=15) as well as personal networks (n=2).

In the focus groups, we presented the SHINE-L system and its goal (Figure 2) as we asked questions about their family behaviors around dinnertime, physical activity, sleep time, and screen viewing. Example questions include: Could you walk us through yesterday's dinner time? What do you think about your smartwatch audio-recording your house? What families would you share/not-share your routines with? The participants also made sketches about how they imagined a solution to their family routine challenges (Figure 3-1). Lastly, we received feedback from the participants regarding our research study design on the formative and summative evaluation of SHINE-L (Figure 4). The focus groups and interviews were conducted in Spanish and were audio-recorded. The research team captured the data transcribed to English in sticky notes. To analyze the data, we used affinity diagramming (Figure 3-2) where the notes obtained from focus groups and interviews were grouped to uncover emerging themes around improving family health. Our institution's Human Research Protections Program determined this study as exempted from IRB.

Family behavior routines and acculturation
We found acculturation process as a strong theme in affecting participants' family behavior routines, distinct from common challenges in behavior change around habits and self-efficacy [4,24,35].

Family routines of our participants were driven by their practices and values. Sense of family is a strong value in Mexican culture and it is retained when immigrating

to the U.S, as the literature on Familyism shows [8]. Such value is stronger in the 1st generation than higher generations [27,32]. Familyism value affected our participants' eating routines. For instance, most of our participant families tried to eat together as a family as much as possible. The eating routine was challenged by parents' long work hours and struggles with younger kids who became hungry before the working parent came back home (FG2-4). 2nd generation participants showed less emphasis in eating together as a family. For more acculturated family, eating time revolved around work, rather than family. Also, children's independence was stronger in acculturated families than recent immigrant participants (FG1, FG3). For instance, older kids tended to eat dinner with friends rather than the family (FG1, FG3), and the language barrier—kids speaking fluent English vs. parents speaking Spanish—generated challenges in retaining the value of familyism.

One of the themes that drove challenges in acculturation and healthier eating practices included the proximity to the border of Mexico from where they lived. Comparing food prices and quality between Mexico and U.S. was a continuous process for the participants (JP1, FG1). These comparisons were more common among 1st generation of immigrants and those who geographically had immediate access to Mexico. The prominent perception about food in the U.S. was that the healthier food (e.g., meat) and vegetables, were expensive, similar to the literature on food perceptions of low-income individuals [23]. A bunch of cilantro in U.S. is ~$1.30, whereas in Mexico it can be purchased in 3 cents. Accordingly, for those participants who lived near the border would either wait for their family members to visit from Mexico or would
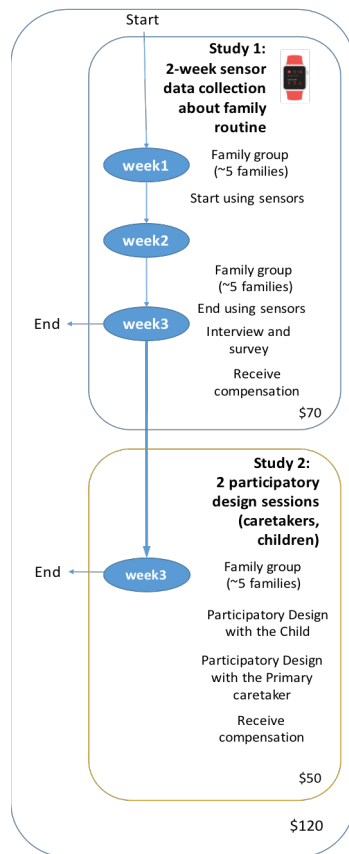
Figure 4: This figure shows future research design for evaluating SHINE-L we shared with the participants. We showed procedures of participation and incentives for completing the study.

travel back to Mexico to purchase healthier food. Until then, they would live off of easier, cheaper foods available near them.

Screen viewing behaviors were also driven by practices and values, but somewhat contradicting among our participants. Some participants felt positive in watching TV because it is about family time and space, aligning with Familyism as a value: "Screen viewing positively affects family value, it maintains us together during this activity" (FG2.1). On the other hand, screen time was perceived as negative by some of our participants because of sedentariness. Younger participants and 2nd generation participants had more negative perception of screen time compared to older counterparts. For example, FG2.4 said, "I prefer physical activities instead of staying at home watching TV, and I know that is better for my son".

Studying and designing SHINE-L for Mexican immigrants

The participants also gave insights to privacy issues involved in automatic recording of routines and developing SHINE-L as a culturally appropriate system to improve family routines in Latino-Mexican families.

Perceived usefulness & risks toward sensor data
Our participants found the SHINE-L project as useful and fun, but with some privacy concerns about using sensors that collect data from their routines. Participants recognized the need to improve their health and found the sensors as the best way to have accurate understanding of their routines. Medium income participants highlighted the importance in their lives to get professional feedback about their routines and wanted to use SHINE-L for long term. The

participants also asked for close personalization of the feedback to engage all family members to improve routines. For instance, FG1.1, FG1.2, FG2.1, FG2.4, FG3.1, and FG3.2 stated that their kids would prefer to see visualization of their routines through pets or avatars, whereas the adults would prefer to see numbers and graphs instead. Privacy in sensor data collection was a big concern for our participants, especially for those who were low income families. Low income Mexican immigrants often have undocumented immigrants in their families. Thus, they felt insecure about their immigration status. At the same time, they stated they were willing to participate if they could protect their privacy by getting daily feedback on what was recorded and being able to discard their data. Older participants suggested younger participants, referring to their family members or friends, that they would be more willing to participate because they have less concerns about privacy using technology.

Opportunities & challenges in peer family matching
We sought feedback from the participants regarding families sharing their sensor data results for learning and motivation purposes. First, participants preferred to connect with similar families. Literature in social comparison [12] shows contradictory results about attraction. Some theories suggest similar people attract each other, and others suggest opposite people attract each other. In the context of modeling [20], people model those who are similar to them. In our case, the participants felt they preferred similar families in terms of family composition, economic status, and health related behaviors—almost as if they were finding new family friends. For instance, both JP1 and JP2 considered themselves different from the majority of Mexican immigrants: "I get surprised when I run into

another Mexican engineer" (JP2). The differences in occupation and socio-economic status lead to different life styles and family routines (FG2.4, FG1.1), making it difficult to share strategies and model after one another. Furthermore, low-income Mexican immigrants deal with drug problems in their neighborhoods and undocumented immigrant status (FG3), which other participants do not encounter in their daily lives. Second, participants preferred to model after an incrementally better family. Our participants noted they would not necessarily learn much from those families increasingly successful compared to them, who are "too far away (up)" (JP2).

Target population to start. Our initial goal was to work with lower income population to maximize the advantage of the system helping to increase the access to health management. However, we found several challenges in supporting this population. Priorities of low-income Mexican families were less characterized by long-term goals, such as prevention of chronic illness during adulthood. Rather, their immediate goals involved getting enough food for the day and ensuring that their families do not separate due to family members' undocumented immigration status. On the other hand, our participants who had professional job opportunities in the U.S. (e.g., engineer) went through a distinct trajectory of acculturation compared to low income families who immigrated to the U.S. illegally. The immigrants who came for career change were already gaining immediate access to healthier lifestyles, albeit remaining challenges shared with other Mexican immigrants, such as constantly comparing food price with Mexico, which facilitated unhealthy food purchasing behavior. Middle income, documented immigrants who have similar profiles living close to one another emerged

as a good target population for us to start developing SHINE-L. Our findings and the literature on acculturation showed socio-economic and cultural diversity among Mexican immigrants. "Latino families" as a term in characterizing a target population is overly generalizing especially when designing a sensor-based health system. Health is intricately intertwined with socio-economic and acculturation level. In addition, those with undocumented immigration status may be in a vulnerable position if their minute to minute activities are being recorded*.*

Study design. Participants suggested to include an advisory board of parents to help with concerns and ideas of other participants and serve as a link between researchers and participants*.*

Conclusion
We presented preliminary lessons learned for designing a sensor-based technology to support Mexican Latino family's health practices. We described how these practices were intricately weaved with their acculturation processes. Despite differences in income, age, and location of living, the participants commonly desired to improve family health as part of settling in the U.S. as immigrants. We uncovered issues around privacy and immediate needs of our participants. This preliminary identification of family health needs among Mexican immigrants gave us a solid starting point for developing the SHINE-L.

Acknowledgements

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