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Telephone-linked care for physical activity: A qualitative evaluation of the use patterns of an information technology program for patients

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Abstract

Automated health behavior interventions that involve discretionary use by patients or consumers over extended periods of time are becoming more common and it is generally assumed that adherence to the recommended schedule is related to the impact of the system on users. Yet reasons for use or non-use of such systems have not been carefully explored. An understanding of factors that influence people to use, not use, or underutilize these automated behavioral change and self-care management systems can help in designing systems that are more effective and acceptable to users. Using qualitative research methods, this study explored the experiences of 45 users of a multiple-contact health promotion application with the goal of understanding the major factors that affect patterns of use (frequency of and duration of contact). The in-depth exploration of users' perceptions and views made possible by the qualitative research methods revealed a number of important themes. Reported reasons for underutilization or non-use were found to be both user-related and system-related. User-related reasons encompassed personal and individual events that prevented or impeded system utilization. System-related reasons included those that related to the medium itself as well as the content of the application. The qualitative methods employed in this study created a forum through which users' feedback could be fully explored and then synthesized to assist in the improvement of this and other automated health behavior interventions.

Keywords: Evaluation; System utilization; Qualitative research methods

1. Introduction

The use of information technologies in health care is beginning to change the health care industry in important and perhaps irreversible ways. By facilitating patient education, patient lifestyle change, and self-care as well as patient–provider communications, these technologies promote patients' involvement in their own care, assist in health care delivery, and improve patient outcome [1]. Evidence suggests, however, that a substantial number of programs that use these new technologies do not reach their potential, because of underutilization or non-use by providers, patients, and consumers (defined as users who are healthy) [2–4]. The adoption and diffusion of technological innovations, to a great extent, depend on a critical factor: *utilization* [5]. In fact, it is believed that the societal value of an innovation is ultimately determined by the repetition and range of "use" that the system receives [5].

Even among people who use a program, there are significant variations in patterns of use. These differences are an important issue to consider when evaluating health promotion and disease prevention applications, particularly those that involve discretionary use by patients and consumers over extended periods of time. Many automated behavioral change and self-care management interventions are designed to be utilized over

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time and consequently, it is assumed that to achieve and maintain the targeted effects user adherence to the intervention schedule is necessary. However, reported research on the variations in use patterns of these systems is scant. Thus, an effort to identify and explore the factors that influence people to use, not use, or underutilize these systems would provide an important perspective for evaluation of these systems from the users' viewpoint. This in turn will help in designing systems that are more acceptable to users, and perhaps more effective.

Using qualitative research methods, we explored the experiences of users of a multiple-contact health promotion application with a focus on understanding factors that affected patterns of use (frequency and duration of contact). We recruited 82 healthy adults to use a physical activity promotion computer telephony program. Subsequently, 45 individuals were selected for in-depth interviews based on their use patterns. The results of the in-depth interviews provided insights into the factors that contribute to *use*, *non-use*, and *underutilization* with significant implications for design of the physical activity telephony system, in particular, and health technology systems used by patients, in general.

2. Methods

2.1. Telephone-linked care technology

Telephone-linked care (TLC) is a computer telephony technology with applications for behavioral change and chronic disease management. Most TLC applications are designed to be used repeatedly over time. Through totally automated telephone conversations, TLC uses digitized human speech to *talk* with patients; and either through touch tone or speech recognition technologies *understands what the patient communicates*. TLC asks questions, gives feedback based on the user's response and embedded logic, and provides education and counseling for a targeted health behavior. Either TLC or the user can initiate a conversation. In the TLC behavioral change programs, patients are asked to contact TLC, depending on the application, anywhere from daily to monthly for a period that varies from 1 to 12 months. TLC stores the user's feedback in a database, based on which current and future TLC conversations are carried out. These responses also provide the information for reports that are sent to users and/or to their providers.

TLC behavior change applications have been applied to changing dietary behavior [6], promoting physical activity [7], helping cigarette smokers quit [8], and promoting medication adherence in patients with hypertension [9] and depression [10,11] as well as promoting regular screening mammography. TLC chronic disease applications have been developed for chronic obstructive pulmonary disease (COPD) [12], coronary heart disease [13], and diabetes mellitus [13]. Two other TLC applications have been developed which help clinicians better manage cancer patients who are receiving chemotherapy [14,15]. Although pattern of use has varied across these applications, most TLC systems that have been fully evaluated have generally been effective and well-accepted.

2.2. Telephone-linked care for physical activity

This study evaluated an interactive health promotion technology application, TLC-physical activity (TLC-PA), which promotes moderate-intensity physical activity like brisk walking, to a healthy general adult population. The program's goal was the recommendation set by the Center for Disease Control (CDC) and the American College of Sports Medicine (ACSM) that all adults should engage in at least 30 min of moderate-intensity physical activity on most days of the week. To promote the regular attainment of physical activity, TLC-PA employed behavior change strategies derived from the transtheoretical model (TTM) of behavior change [16,17]. Stage of change (motivational readiness) is the central organizing construct of the TTM. The following five stages of change are integrated into the design of TLC-PA: (1) Precontemplation (not thinking of meeting the physical activity goals in the next 6 months); (2) contemplation (thinking about becoming physically active within 6 months); (3) preparation (intention to achieving activity recommendations in the next 30 days); (4) action (being sufficiently physically active for less than 6 months); and (5) maintenance (being physically active at or above recommendations for more than 6 months). During each TLC-PA conversation, the system assesses the user's current stage. The system then selects behavior change strategies for use during the conversation that are based on the user's stage. The theoretically based tailoring was expected to increase the relevance of the messages to each individual participant and thus contribute to the effectiveness of the system. It is generally believed that tailoring is an effective strategy when health messages are directed at a diverse population [18].

The duration of the study was 3 months and the study participants were asked to call the system two times per week. All participants met with the study staff prior to using the system. Based on the information users provided during this meeting, they were assigned to an appropriate stage of physical activity readiness. Users initiated all calls to TLC-PA.

At the beginning of each telephone conversation, the system begins with a salutation and information about the TTM stages and what it means to be in one stage versus another. The system describes the "*meaning of exercise*" (i.e., the definition of moderate or greater

intensity physical activity) at the beginning of each contact by saying: "just to make sure that we are talking about the same thing, when I talk about exercise I mean structured physical activity that makes you breath hard or break a sweat. This does not include things like housework, golfing using a cart, or walking around the office. This does include brisk walking, bicycling, or playing sports." The system then asks about the user's current level of physical activity, defined as the number of days and minutes/day during the previous week the user engaged in "exercise" and then stage of change.

The user's stage of readiness determined the content of the TLC-PA conversations. For example, those who were in the precontemplation stage were given information about the benefits of physical activity. This included such topics as "impact of physical activity on blood pressure," "prevention of breast cancer," "prevention of diabetes," "lowering stress," and more. Similarly, those in the contemplation and preparation stages were provided with information on the benefits of physical activity as well as suggestions for overcoming barriers to physical activity and were encouraged to set weekly exercise goals. Users in the *action* stage were given an option to hear the information on the barriers if there had been a decline in activity level, and were encouraged to increase their level.

3. Study design

We conducted in-depth interviews to evaluate reasons for the participants' use patterns of TLC-PA. The interviews explored: (1) how people felt about the system in general, and (2) why some people did not use or underutilized the system. The context of users' experiences, i.e., their lifestyle and cultural norms, were also queried.

3.1. Study participants

Eighty-four volunteers were recruited and found eligible by screening of whom 80 completed the study (two withdrew). Individuals were excluded if they had a serious medical condition or who were in the maintenance stage for physical activity. The study population included 48 women (58%), 29 blacks (35%), 7 Asians (8%), 3 Hispanics (3%), and 6 "Other" (7%). Over one-fourth (23%) of the participants were married while 37% were employed and nearly 63% had education beyond high school. The participants' age ranged from 21 to 74 with the mean age of 45.

3.2. Qualitative evaluation methods

After 4 weeks of using the system, the utilization pattern of each participant was classified into one of five categories. Four of these utilization patterns closely resembled those identified in other TLC studies. A new fifth category was defined based on the utilization pattern observed in this study of the TLC-PA system for a subset of participants who ended each conversation with the system by hanging up before the call was complete. The final five utilization categories, along with their size and the number interviewed, are as follows: (1) $\geqslant 80\%$ adherence to the call schedule ($N = 8$, 7 interviewed), (2) Intermittent but continuous use ($N = 18$, 11 interviewed), (3) Discontinued use (consecutive use of the system for two or more times after which the calling ceased completely) ($N = 36$, 16 interviewed), (4) Non-use or one-time-use ($N = 14$, 7 interviewed), and (5) Incomplete calls (one or more) ($N = 6$, 4 interviewed).

The participants were interviewed over time, with data collection (interviews) and analytic work (coding and interpretation of interviews, described below) occurring simultaneously in accordance with standard qualitative research methodology [19]. In qualitative research study samples are usually small and the selection method is purposive rather than random. Furthermore, the sample size is not predetermined, with recruitment for a particular cohort (in our study, each utilization group) ending when there are no longer any substantial new findings from the interviews. After this point there is little "incremental learning" as the researchers observe "phenomena seen before." Methodologically, this process is called "information saturation" or "redundancy" [19].

All members of the smaller utilization groups (groups 1, 4, and 5) were invited for in-depth interviews. As demonstrated above, the proportion who accepted the invitation varied considerably with 88% of the high adherence group (group 1) agreeing to be interviewed, whereas only 50% of group 4 agreed to be interviewed. Given the nature of these groups, this variation is to be expected. In each of these groups, however, saturation was fully achieved. In the larger groups (groups 2 and 3) saturation was judged to have occurred after 11 and 16 interviews, respectively.

In-depth interviews were conducted by the first and second authors together. Interviews took place at the date and time most convenient for the participants. The interviews followed a "general interview guide approach" in which a set of predefined issues were explored with the study participants. These issues were written in an interview guide that served as a question check list for the interview, to ensure that all relevant topics were covered. The interviews lasted between 20 and 45 min. The issues that were discussed during the in-depth interviews dealt with the following: (1) specific features and components of the system, such as the TLC-PA's voice, its tone, duration of the conversation, etc.; (2) participants' overall impressions such as their

likes/dislikes, satisfaction with the program, opinions about the program's helpfulness, their initial expectations, degree to which their expectations were met, possible behavior change effects, etc.; (3) reasons for participants' patterns of use including questions about why they used the system in a certain way. As we were interested in both negative and positive opinions about the TLC-PA program, addressed reasons for utilization and non-utilization with all participants, including those who were highly adherent to the planned twice a week calling schedule.

The interviews were tape-recorded, transcribed, coded, and stored both in a database and in hard copy. A systematic coding of transcripts by two independent coders identified 27 *constructs* or themes of interest. A secondary analysis of the coded transcripts condensed the constructs to 10. We also conducted a content analysis of the transcripts in which these *constructs* or *themes* were counted for frequency of occurrence (see Table 1). Constructs were defined as those that either shed light on the users' opinions and views about the system or helped reveal the reasons or provide explanations for certain behaviors, including the participants' TLC-PA use patterns and their physical activity behavior.

4. Results

4.1. ⩾80% Adherence group

Individuals in this category ($N = 8$, 7 interviewed) adhered to the call schedule ⩾80% of the time. Among the four individuals (57%) who reported behavior change, i.e., an increase in physical activity levels, only 2 (29%) reported benefits (i.e., description of outcome benefits such as a decrease in blood pressure, decrease in cholesterol, weight loss, general well-being, etc.). This group also had the highest ratio (86%) of individuals (6) who complained about too much repetition in the content of TLC-PA. Of the seven individuals interviewed four had positive views about the system (57%) while the other four felt neither positive nor negative. Two of the individuals in this group said that the program did not enhance their physical activity levels. These individuals, however, used the program to keep physically active and one said that using the system kept him aware of the amount of time that he was devoting to exercise. Of the seven individuals, two said that they used the system regularly because they had committed themselves to the study.

Except one person, these regular users were critical of different aspects of the system. One said that he used the system because he was curious and wanted to learn new information about physical activity and health, however, he was disappointed about the amount of repetition and the lack of new information. Others also complained about the repetition, the length of the conversations, and problems with being understood. A woman who maintained she benefited moderately from using the system said she was worried that we were going to ask her to use the program forever.

4.2. Intermittent user group

The intermittent users ($N = 18$, 11 interviewed) were those who used TLC-PA throughout the 2-month test period, but who called less then 80% of the time. Their average utilization was 52% (range 31–77%). The reasons provided by these individuals for not fully utilizing the system were identical to those expressed by users in other groups: life crises, being away, being too busy (including working too hard, being too tired), and health problems. Forgetting to use the system as a result of the reasons referred to above was mentioned frequently.

Surprisingly, these participants, as a group, were neither dissatisfied with TLC-PA nor perceived it to be without benefit to them. In fact, individuals in this group had the highest ratio (91%) of satisfied users (10 individuals) and better reported outcomes both in terms of physical activity levels (9 individuals—82%) (Table 1) and perceived benefits (8 individuals—73%). Even

Table 1
Interviewed participants: summary utilization and user response ($N = 82$)

	⩾80% $N = 8$ (7 Interviewed)	Intermittent $N = 18$ (11 Interviewed)	Block users $N = 36$ (16 Interviewed)	Non-use/one time use $N = 14$ (7 Interviewed)	Partial use $N = 6$ (4 Interviewed)
Positive Opinion	4 (57%)	10 (91%)	3 (19%)	1 (14%)	0
Behavior Change	4 (57%)	9 (82%)	4 (25%)	2 (29%)	2 (50%)
Reported Benefit	2 (29%)	8 (73%)	0	2 (29%)	2 (50%)
Failure and Avoidance	0	2 (18%)	6 (38%)	0	0
Helpful Information	5 (71%)	9 (82%)	5 (31%)	0	0
System as a Monitor	3 (43%)	7 (64%)	0	0	0
System as a Motivator	2 (29%)	4 (36%)	3 (19%)	0	0
Too Much Repetition	6 (86%)	6 (55%)	10 (63%)	0	0
Too Long	2 (29%)	0	10 (63%)	0	0
Voice Recognition Problems	1 (14%)	4 (36%)	6 (38%)	0	0

though utilization was irregular, some individuals in the intermittent group continued to use the system after we had conducted our in-depth interviews with them and their participation in the study was effectively over. Only one person expressed a negative opinion about TLC-PA in this group.

An important aspect of the physical activity behavior of the individuals in this group was the fact that their call pattern mirrored their exercise pattern. These individuals went for walks, to the gym, or performed other activities and subsequently reported the results to TLC-PA. As one of the participants described it: "I usually do it [calling the system] after I exercise, you know, take my walk... After I do it, it is kind of like gratification that I can call in and tell somebody that I did it." It is compelling that in some cases when a person had a "good week" in terms of physical activity behavior, then that person would make more calls to TLC-PA. One participant who exercised a lot during a particular week called the system six times for that week! When asked why he called so many times, he said because he "was doing so good." Similarly, another individual who made additional calls during a particular week said that the reason was because during that period he exercised more.

One important theme generated from the in-depth interviews of intermittent users revolved around the concept of *control*. They described their use patterns as being determined by themselves, not the designers of TLC-PA. For at least half of the intermittent users taking control of system utilization also reflected taking control of their exercise regimen. A man in this group in fact used the study's Users' Guide as a symbol to exercise such control. During the day when he planned to exercise and subsequently call the system, he would place his Users' Guide on his desk and at other times the Guide would "get stuck underneath somewhere." Control of both the exercise regimen and call schedule was thus instrumental in impeding or facilitating system utilization as in several cases the two went hand in hand.

Another theme that emerged was the central theme of being "monitored" as a motivator of behavior. The individuals in the intermittent group felt that the system was watching them and this perception motivated them to engage in physical activity. One woman described it this way: "You are more aware and more responsible. I think we need to be accountable. It's like answering to a higher... [authority]" And, a man who started going to the YMCA upon his participation said: "It kept me in check." In fact, seven of the individuals (64%) interviewed in this group considered the TLC-PA as an effective monitor. Monitoring in turn seems to have generated a certain degree of anxiety in a few individuals who said they exercised because they wanted to report that they had done well. For example, a woman who accomplished most of her exercise goals commented: "The next time I called, I wanted to be able to say I did this." This woman subsequently elaborated that the system changed her [physical activity] behavior "a little bit" because she wanted to report that she had accomplished her tasks. Another woman also commented, "I want to report accurately for myself as well. Umm, I felt re-encouraged that *I didn't get penalized.*" [Emphasis added.]

It is of great interest to us that the system's response might have seemed "penalizing" to this woman as the designers had done their utmost to ensure that the system's responses to the unaccomplished goals were polite, pleasant, and supportive with a positive tone. For example, "It is great that you are doing some exercise, but you did less than your goal. To receive the maximum benefits from an exercise program you need to gradually work yourself up to exercising at least 4 days per week for at least 30 minutes per day. Don't feel too badly. I will set another goal with you later in the call. Use the rest of this call to increase your commitment to regular exercise." The anxiety that these study participants felt about accomplishing their physical activity goals was in fact constructive as it reinforced their resolve and thus helped them achieve their goals. A young woman tried to describe her feelings this way: "I feel obligated. It's like something- I don't know what it is. Before, I didn't go to gym because I did too much and didn't have time, but now I make the time... I don't know how they [TLC-PA] make me like that, you know."

Finally, despite the overall positive opinions, six individuals (55%) in this group complained about too much repetition, while four (36%) had problems being understood by TLC-PA.

4.3. Non-users or one-time-users group

Of the 82 participants, 14 did not use the system at all or used it only once. We have put non-users and one-time users into a single utilization group because their reactions to the system were remarkably similar. Of note, it was difficult to arrange interviews for subjects in this group. We were eventually able to interview seven individuals among the 14, but two had disconnected their telephones and five did not return repeated calls. Of the seven individuals we interviewed, four claimed that they had actually used our system a few times although the system's log files did not show any contacts (three of them called TLC-PA for the first time on the day they were to meet with us for the in-depth interview). Two of the seven interviewees had called TLC-PA once; and two explained that they had lost the Users' Guide and thus did not have the information necessary (for example, the telephone number or the password) to use the system.

The results of the in-depth interviews with individuals in this group demonstrated that the reasons for non-use and one-time use mostly overlapped. They identified

personal events or situations in the users' lives such as the death of a loved one, getting robbed, financial distress (e.g., unemployment), illness (personal or family), being away (on a vacation or a business trip), working too hard, being too busy, and forgetting as the reasons for not calling TLC-PA. During our interviews, the majority of the individuals in this group presented their lives as too hectic, too disorganized, or too eventful for them to use a health promotion and disease prevention program. Most of those affected by "life events" were women, some of whom were parents (one a single parent) and all were experiencing financial problems. One woman said that she did not have water and heat in her apartment and that a close friend of hers was in the hospital dying of cancer. Another woman told us that she could not spend time to use the system because it took too long and she had to "deal with too much lately."

Devastating life events, however, were not the sole reasons for non-utilization. Among non-users were two participants who were not experiencing life crises. For these individuals using the system was not a priority. One woman commented: "this was not as important as other things in my life" and kept repeating "I forgot." Surprisingly, even though this individual had never used the system, she claimed that the idea of being in the study was a sufficient incentive to bring about behavior change. She said that she was now walking between 5 to 7 miles/day and had lost more than 70 lb. There was no way for us to verify the accuracy of this information. She said that she had pictures that could prove her claim. We gave this young woman a chance to use the system by explicitly asking her to use it and thus evaluate it for us. She enthusiastically accepted but she made no calls. We heard similar comments from another individual who had made only one call. Most individuals in this group had difficulty articulating the reasons why they could not reserve 15 minutes a few times a week to a health promotion program considering their perceived and reported need. One person chalked it up to "laziness."

4.4. Discontinued use group

A fourth group of TLC-PA users called the system for a period of time (calling from 2 to 14 times) but then stopped and never called back. This group had the highest number of participants (36). We interviewed 16 individuals from this group (nine women).

Two important themes emerged from the in-depth interviews with these participants: (1) most of the reasons for discontinuing TLC-PA were system-related, and (2) these individuals had negative opinions of the system as 10 (63%) complained of too much repetition, and 10 (63%) felt that the calls were too long, while six (38%) had problems being understood.

4.4.1. Failure and avoidance

Some of the interviews with participants in the discontinued group suggested an intriguing combination of complex emotional and psychological reactions to the system's content. We learned that six participants (38%), five of whom women, stopped using the system because they were reluctant to report that they had not exercised. These individuals stopped using the system once they had *failed* to accomplish the physical activity goals they had negotiated with TLC-PA during the previous conversation. If they had not exercised, they were reluctant to use the system to report that they had *not* accomplished their physical activity goal. This reluctance involved wanting to avoid reporting an unaccomplished goal to the system, and concern about the system' response to such as admission.

We were told by these individuals that having negotiated goals for physical activity and then having to report to the system that the goals were not met, felt like an admission of failure to an authority figure. One young woman, who attributed the problem to the tone of the TLC-PA's voice, said that it reminded her of her mother's admonishments. Another woman said that reporting unaccomplished physical activity goals to the system was like having to show a "bad report card" to her father. The following example is a remarkable testimony that speaks to this experience. "Cause, in the way you are talking to the system, it expects you to do better each day, you know. So, every day the system wants you to do a little bit better. It was an encouragement. But, when you didn't meet that goal, you are not happy with it. I wasn't too happy because I'd like to meet that goal... And, then I didn't-, I stopped. I don't know how to describe it. It's a feeling kind of like you failed; you failed a goal. Psychologically but then it's a study; you are just talking to the computer..."

There was one man in this group who said he felt uneasy about unaccomplished goals to TLC-PA. This individual called the system 10 times before stopping. It seems that for this individual the unease and anxiety initially worked in a positive manner, helping to increase his physical activity levels. However, in the long run, he could not keep up with the goals that he had negotiated with the system, and thus he stopped using the system altogether: "I tried to look at it objectively from the very beginning. I tried to walk more you know. Is it encouraging me or is it not? Is this lady on the recording going to embarrass me if I don't? ((laugh)). It's, uh, the recording – the lady on the recording said, 'do you intend to exercise four times a week?' And I said, 'yes.' So, now I had to live up to it. That's what encouraged me to do the exercise. Each time I came back it was like a building pattern. Do you remember what we did last time?' How can a recording be so smart? With the recording, there is no way of reversing what you promised the week before. And that is the part that kind of

frustrated me. The lady said, 'I am sorry to hear that.' ((laugh)) [He is referring to the system's response when he reported unmet goals.]

We have no self-evident explanation as to why there were more women among those who expressed anxiety about reporting unaccomplished tasks. Possible explanations may include gender differences in relation to exercise achievement and to negative judgment by others and/or the women felt more at ease with the two female interviewers than the men did. It is thus possible that the women more openly expressed their feelings, while the male participants were more reserved and reluctant to express a perceived *weakness* to the two female interviewers.

4.4.2. TLC-PA as a tailored intervention: ''this is not for Me!''

Even though TLC-PA, based on the TTM, provided behavioral feedback tailored to stage of change for physical activity, an interesting and significant point brought up by several individuals across utilization categories, particularly those in the discontinued group was that TLC-PA was not responsive to their particular needs and personal lifestyles. Probing this issue further revealed that these participants believed the system was not tailored to their personal lifestyle and did not sufficiently address their perceived needs. The TTM cognitive and behavioral processes, as applied to physical activity, addressed such topics as confidence enhancement strategies, information on physical activity benefits, and ways to overcome barriers to physical activity. Some participants pointed out that receiving information about the benefits of physical activity, or overcoming barriers to physical activity, though acceptable and perhaps useful, was not exactly what they had in mind when they joined the study. Several of the participants contrasted TLC-PA with a personal trainer and used this analogy to describe their perceived needs. They maintained that TLC-PA's strategies did not help them engage in physical activity and that only a more personalized and tailored program, structured and planned specifically based on their personal exercise needs and requirement, would be helpful to them.

It seems that the duration and length of the conversation was particularly irritating to those who used cell phones (as the conversation used up their valuable minutes) and also those who called from their work, as the calls took 10–15 or sometimes 20 minutes during which they had to keep saying ''yes,'' ''no,'' etc.

4.5. Incomplete use group

These were users ($N = 6$) who made from 1 to 3 incomplete calls to TLC-PA (calls in which they hung up in the middle of the call); we interviewed four of them. By and large, these individuals disliked the system. Only one woman, who had used the system incompletely on the day of her interview, expressed some enthusiasm. The other three participants had negative views referring to system-related issues such as repetition of content and difficulty being understood and that the program did not address their particular concerns with regard to physical activity. One person who had made three incomplete calls said that she used the system out of sheer guilt but that she ''could not stand it.''

5. Discussion

Our study demonstrated that both user-related and system-related reasons accounted for non-use or underutilization. Among the themes that emerged from the in-depth interviews, one with the most important design implications was the concept of ''failure and avoidance.'' ''Failure and avoidance'' was a negative response that was articulated by users, particularly in the discontinued group, towards the ''monitoring'' and ''goal-setting'' functions of TLC-PA. As was described, the anxiety associated with reporting unaccomplished goals did not always impede physical activity as our interviews with the individuals in the intermittent group demonstrated. In fact, in the intermittent use group, such anxiety was constructive and helped induce behavior change by motivating participants to increase their physical activity. However, it is the negative responses to ''monitoring'' and ''goal-setting'' that reveal the most about underutilization.

One possible explanation for this phenomenon may reside in the social psychological theory of *social facilitation*. Social facilitation occurs when an individual either enhances or diminishes a particular behavior in the presence of another [20]. Many experiments with both humans and animals demonstrate the consequences of such a presence [21]. Zajonc classifies research in social facilitation under two different paradigms: audience effects and co-action effects. Audience effects refer to the impact of the mere presence of others on behavior while co-action effects refer to the simultaneous involvement in action by all parties in full view of each other [22]. Experiments carried out by Zajonc demonstrated that in the audience effects paradigm, the response to the presence of others varied based on the difficulty or simplicity of the task. As a result, in the presence of a spectator if the tasks are easy, the response is enhanced. However, the response is diminished if the tasks are difficult. Similarly, through an experiment in which people completed a task alone, in front of two observers, or in the presence of two persons who were blindfolded, Cottrell demonstrated that the presence of others created heightened arousal. Tasks performed in front of the observers were negatively affected [diminished]; being alone or in the presence of

blindfolded individuals had no impact on performance [23].

Studies carried out with animated characters and other computer interfaces demonstrate that social facilitation does occur in the presence of automated systems [24,25]. Studies conducted on automated monitoring of work performance also confirm the impact of social facilitation [26]. For example, Rickenberg and Reeves [24] carried out an experiment in which they tested the impact of animated characters on user anxiety and task performance in a Web environment. The authors concluded that when a "social actor communicates an intention to monitor someone's work" there is an enhanced arousal and a diminished performance. In fact, "When the monitoring is obvious, thoughts and behavior change; there is more anxiety and less accurate performance of complex tasks." The finding that automated monitoring evokes anxiety in certain tasks and influences behavior has also been corroborated by other studies [27,28]. Our findings are consistent with these human and computer demonstrations of social facilitation. We observed both positive and negative responses to social facilitation in our study as different individuals responded differently to social facilitation. Positive responses were observed among individuals who accomplished their tasks while negative responses were expressed by those who found the tasks daunting and unachievable. Thus, it seems that social facilitation worked to both enhance and diminish performance as has been demonstrated in the cited studies. This explains both why some individuals in the intermittent group commented that they used the system as a "monitoring" agent and how system utilization and physical activity became interconnected among these individuals. For participants such as the man who called the system six times during the week that he had exercised more (see Section 4.2), being monitored by the system helped sustain his physical activity levels. Indeed, we followed up with this man 2 months after the study was completed and learned that he had stopped exercising once he stopped using the system.

Rickenberg and Reeves have also distinguished between the responses of the people who possess strong internal locus of control and those who have a strong external locus of control. Based on conclusions reached by Rickenberg and Reeves, "being monitored is less worrisome for people who believe that they control their own destiny than for those who think that their destiny is in the hands of others" [23]. We would have liked to explore this concept in our interviews. However, the theme did not emerge until late when most participants had completed the study. We can only speculate that the individuals who responded well to the "monitoring" functions of TLC-PA by increasing their physical activity levels had a strong "internal locus of control," and, conversely, those who stopped using the system because they felt uncomfortable to report unaccomplished goals, had a strong "external locus of control." This is a topic that we intend to explore in future evaluations.

6. Conclusions

The results of this study suggest two important design implications for developers of health information technology programs that use behavioral change strategies to interact with patients and consumers:

- Monitoring does have positive impact on some users' health behavior. However, not all users respond similarly to monitoring. Monitoring may also generate anxiety that is clearly an unpleasant experience and might impede utilization due to avoidance. Designers should be cognizant of this and thus should formulate precautionary measures. These precautionary measures may include the following: (1) providing an initial educational segment delivered by the system itself in which the reasons for the system's goal setting strategies are clearly stated and the likelihood that some goals may not be achieved are discussed. This can prepare the users for possible lapses and thus desensitize them to the resulting anxiety due to unachieved goals. (2) Ensuring that the system's tone and delivery are as supportive and empathetic as possible. The system should be able to provide insight [e.g., "This happens to many people in the process of behavior change and should not be considered as a failure."] and understanding [e.g., "It is not easy to change your lifestyle. It often takes many tries and extraordinary effort. Don't be disappointmented; just keep at it."].
- Users should be given significant *control* over their interaction with a health-promotion system. This may include control over the frequency and the duration of the interaction as well as over the content. For example, in the TLC-PA study, users were told to call the system two times a week with each call lasting between 15 and 20 min. As we noted, individuals in the intermittent group (group #2), appeared to take control of their utilization pattern and had the highest levels of satisfaction. Users also demonstrated a desire to exert more control over the system's content. They felt that they should have been able to select items from various lists of informational topics about exercise benefits and barriers. Even though these participants had some choice over which items they heard, they could not choose exactly what they wanted to listen to. For example, one user told us: "One thing about the call is that it asked you if you wanted to listen to ideas for indoor or outdoor [exercise]. I listened to indoor, but then I would have liked to listen to outdoor but there was no option to go

back. And, there was one other time when there was a choice between listening to this or that, and if you listened to one you couldn't listen to the other. It would be nice to have the option to do both.'' Similarly, there were occasions when users would have liked to have avoided the topics altogether. It irritated many users that they could not since they had to spend additional time interacting with the system. Thus, some individuals hung up in the middle of the conversation and others engaged in other activities as they used the system such as one woman who said sometimes she ''would call'' when she was ''making dinner.'' Another user, who wanted to avoid hearing the ''definition of exercise'' that was repeated at the beginning of every contact, told us: ''If there was a way to delete just certain parts at the beginning—It's, like, you know what's coming.'' These and other examples indicate that providing users with a choice about what they want to learn from a program [29] might positively affect their utilization, thus enhancing the system's impact on their health behavior.

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