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How can technology enhance elderly adherence to self-managed treatment plan?

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Abstract

Patient non-compliance with treatment care is one of the leading causes of increasing healthcare costs and hospital readmissions. Elderly patients, those 65 years and older, are especially prone to losing motivation to adhere to treatment, particularly when self-management is required and they are infrequently checked by providers. This study investigates the effect of information systems on retaining motivation to adhere to self-management and satisfaction with treatment. Drawing upon goal-setting and control theories, we found that clearly defined and revisited goals are more likely to be followed by elderly patients if progress is monitored and regular and timely feedback is provided by their provider.

Keywords: Goal Setting Theory, Control Theory, Motivation to Adhere, Older Adults, Technology to Motivate the Elderly

1. Introduction and Background

Elderly patients often face chronic illnesses that require long-term, complicated treatment plans that involve behavioral and lifestyle changes. Older adults are often encouraged to maintain their physical condition by exercising even beyond monitored physical therapy [1], [2]. Older patients must sustain, through self-management, certain tasks that satisfy complicated medication, exercise, or diet regimens. Self-management is defined as "The care taken by individuals towards their own health and well-being; encompasses the actions needed to lead a healthy life; meet social, emotional, and psychological needs; care for a long-term condition; and prevent further illness" [3]. Self-

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management-related tasks may include giving up smoking, following an exercise program, controlling triggers to symptoms, and maintaining a certain diet [4]. Research has found that increased compliance with long-term treatment plans and self-management practices are positively correlated with clinical outcomes [5], [6]. In addition, better provider-patient communication is shown to increase self-management effectiveness and health outcomes [7]-[9].

Well-defined health goals result in effective self-management[4]. The trend in regard to defining patient health goals had moved from a directive style, whereby the provider instructs the patient on goals and tasks, to a collaborative style, whereby the provider and patient jointly define problems, treatment goals, and self-management strategies [10], [11]. Greater patient understanding of and engagement in self-care have been shown to increase motivation to follow a treatment plan [10]. Nevertheless, older patients lose motivation after some time, which may jeopardize the success of their medical care [12].

Counseling patients about self-management can consume the majority of time during a clinical encounter with primary care providers (PCPs) [13], and follow-up adds to that time. Providers are usually not trained properly to provide self-management techniques during patient care [14], and the infrequent provider-patient encounters are often brief and spent in addressing mandatory documentation and reporting requirements. There is usually an insufficient amount of time remaining to discuss self-management, and older patients are left with a limited understanding of how to achieve the goals defined in the treatment plan [15].

Sustainable lifestyle and behavioral changes usually include goal setting between the provider and patient, with reminders via telephone calls [16], [17], which require significant resources from the provider. A recent survey [18] found that most mobile users have downloaded health-related mobile applications but that almost half of those discontinued use due to data entry burden or loss of interest, among other factors. Thus, we developed a simple and customizable goal-tracking application to capture regular input from patients in regard to their accomplishments and measured its effect on patient adherence to a self-management regimen.

2. Theoretical Background

The first theoretical foundation of this study is goal-setting theory, which was developed by Locke [19]. Goal, which are the immediate regulators of human actions, are cognitive and volitional. Goal-setting theory posits that more specific goals lead to higher performance levels and that challenging goals related linearly to performance. Acceptance of the goals by the performers and feedback are necessary conditions to the achievement of goals. Feedback is the performance and progression evaluation relative to the goal and is a necessary condition for goals to positively affect performance [20]. Feedback includes goal adjustment, praise for success, and encouragement, which are found to increase motivation to follow the treatment plan and to result in better health outcomes [21], [22]. In the context of this study, older patients need a clearly defined goal to be given by their healthcare provider, which follows the theory's notion that goal attributes are relevant to achieving good health outcomes. The goal attributes include the following components, adapted from Lee at al. [23] and modified by the principal investigator for patient-provider goal setting (the performance review section was excluded for the purposes of this study):

- Provider support, e.g., "My health provider lets me participate in setting my goals for my treatment plan"
- Goal clarity, e.g., "I understand exactly what I am supposed to do to follow the treatment plan"
- Goal stress, e.g., "I often fail to achieve my goals"
- Goal efficacy, e.g., "I feel proud when I get feedback that indicates that I have reached my goals"
- Goal rationale, e.g., "My provider tells me the reasons for the goals"

The second theoretical foundation of this study is the control theory of self-regulation [24], [25]. This behavioral regulation theory suggests that performers (1) manage their behavior by knowing what they want to achieve, i.e., have a specific goal in mind; (2) put effort into trying to achieve that goal, i.e., perform certain actions; (3) monitor their behavior; and (4) assess their progress toward their goal. Feedback is an important part of the assessment, and receiving feedback from an expert helps patients to find the discrepancy between their behavior and the goal. Performers also react to the feedback and may modify their behavior as needed to progress toward the goal. In the context of this study, the control theory of self-regulation will be used to guide the understanding of older patients' thoughts, behavior, and motivation to reach their health goals.

This study also will investigate the role of health information systems in enhancing goal setting, self-management, and provider feedback mechanisms. Health information technology (HIT) is designed to capture, store, retrieve, and

share patient health information for authorized persons to provide support for dealing with symptoms and behavior changes to improve health. HIT can aid clinical decision making, as it can be shared among physicians to enhance coordination of care [26]. Patient data can be captured during patient visits, but patients also may update information, using patient portals [27], [28].

This study will explore the role of a self-management application in the goal-setting and feedback methods of a trusted provider. To this end, this study was guided by the following research question:

To what extent will treatment plans with specific goals that are regularly monitored and on which feedback are provided by qualified healthcare providers sustain self-management among the elderly through a customized self-management application?

The study tests the research question empirically and provides theoretical, practical, and regulatory recommendations.

3. Research Design and Method

Changes in perceptions of goal attributes due to the use of a customized self-management application were measured among the elderly. Older adults were asked to follow their health goals, using the customized self-management application developed by the principal investigator. The application offered a daily goal-tracking capability designed to capture information based on participants' preferences. The self-management application can notify a user to enter daily task completion information or can be used only when the user remembers. Questions may be as simple as, "Have you completed today's task?" with a "yes or no" option. Some users have asked for options to enter additional details, such as blood pressure, pulse, or pain.

The self-management application was available on a tablet, phone, or computer, and users were provided with a brief user manual. Users were asked to submit their data, and the summary could be viewed on the device or printed on paper. See Figure 1 for sample screenshots. Participants in the study were randomly assigned to one of two groups. Both groups were able to use the self-management applications, but only one group had a feedback option enabled. Participants in this group were asked to designate a close family member who would be willing to provide feedback on the patient's self-management tracking. The result was sent to the designated person through email, and a link in the email was available to provide feedback, such as encouragement or suggestions if the goal was not met or difficulty was indicated. It was recommended that feedback, which appeared on the top of the form, be provided at least once a week.

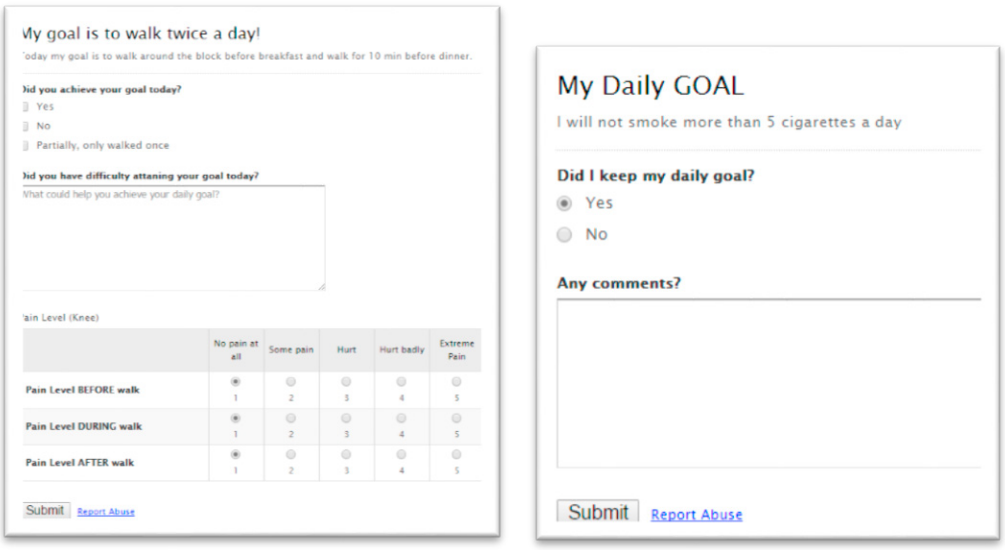

Fig. 1 Sample screenshots of the customized self-management application.

This part of the app modelled the patient-provider interaction by providing documentation in regard to a clear and understandable goal. Participants could track their progress toward the goal as frequently as they desired, and

reminders could be set. Data entry was as simple or complex as the user desired. The feedback, provided by a close family member who was comfortable with computers (usually a spouse or a child), served the purpose of modelling, as the patient progressed, the use of encouragement or suggestions in a timely fashion. It can take months before an older patient sees a provider and has the opportunity to discuss the progression in detail or which part was difficult or to report that he or she may have given up following the plan and for what reason. The other group was designated as a control group, and the feedback feature was not enabled or introduced to them.

4. Participants

Participants were older adults, 65 years or older, with adequate computer experience to open an application or webpage and click with a mouse. A convenience sample was used, and recruitment for the study involved personal networks and the survey was also disseminated among a network of elderly individuals and they were asked to do the same. All participants needed to have a computer, tablet, or smartphone and, if using a computer, a basic understanding of the use of a mouse. A constant Internet connection was not required for tablet or smartphone users, as submissions could be done once connected. The study encouraged participants to submit progress at least once a week. Informed consent was provided to participants, and no remuneration was provided.

5. Instruments

This study used the goal-setting questionnaire [23] to test older users' comfort with their health goals and their confidence that they could sustain the tasks required by their self-management. The items were answered on a 5-point Likert scale, with responses' ranging from "completely disagree" (1) to "completely agree" (5). Reverse-coded question scores were transposed. The mean rating was calculated prior to use of the self-management app and 6 weeks afterward. Higher scores represent higher comfort with the goals and the likeliness to continue with the self-management regimen.

Content validity tests were conducted by educators who work with the elderly to ensure that the measurements were appropriate for older adults. The reliability alpha-coefficient was 0.81. The follow-up questionnaire also included questions in regard to the intention to continue use of the self-management application. Questions for behavioural intention to continue using the self-management application were adapted from intention-to-use measures of the unified theory of acceptance and use of technology model (UTAUT) [29]. Other studies have used these measures for continuance intention[30].

6. Results

A total of 78 participants were recruited for the study, and 12 dropped out. The treatment group initially included 33 participants, but only 24 finished both surveys. The control group also started out with 33 participants, and 22 completed both surveys. Age and gender was about equal in the treatment and control group.

Welch's two sample *t*-test was used to compare the means of the goal-setting questionnaire. The mean of the scores across the treatment and control groups were used and then determined again 6 weeks later. Welch's *t*-test was chosen due to the unequal sample size (and, therefore, degrees of freedom) between the groups and the unequal variances of error [31]. Welch's *t*-test is more robust than a Student's *t*-test, and the power and Type I error rate are comparable to the Student's *t*-test [31]. The null hypothesis was confirmed before the use of the self-management application. Six weeks after the use, however, the null hypothesis was rejected, as a statistically significant difference was shown between the goal-setting mean scores between the group that received feedback on their progress and the group that only tracked their progress.

Welch's two sample *t*-test indicated that scores were not statistically significantly higher for the treatment group prior to the study ($M = 3.19$, $SD = 0.87$) than for the control group ($M = 3.02$, $SD = 0.79$), $t(44) = 0.40$, $p = 068$, 95% Confidence Interval for the Difference (-0.39 , 0.59). After 6 weeks of usage of the self-management application, Welch's two sample *t*-test indicated that scores were not statistically significantly higher for the treatment group prior to the study ($M = 3.92$, $SD = 0.45$) than for the control group ($M = 3.31$, $SD = 0.32$), $t(44) = 5.41$, $p < 0.01$, $d = 1.14$ effect size = 0.496 (medium effect, half standard deviation), 95% Confidence Interval for the Difference (0.39, 0.85).

The behavioral intention to continue using of the self-management application showed a statistically significant difference in the mean scores, treatment group ($M = 4.1$, $SD = 0.638$ vs. the control group ($M = 3.6$, $SD = 0.62$), $t(44) = 2.6$, $p < 0.01$, $d = 0.76$ effect size = 0.36 (small effect), 95% Confidence Interval for the Difference (0.13, 0.87).

7. Discussion

The results of the initial questionnaire for goal setting and comfort showed no statistically significant difference in the mean scores between the treatment and control groups. At that time, participants had not used the self-management application, and both groups had come up with a goal that they felt was feasible and with which they were comfortable. The literature shows that established goals may increase patient satisfaction among elderly patients [32], [33] if they are properly aligned with the abilities and interests of the patient. If goals are established without the patient's agreement and commitment, the objectives of goals may be ignored. Goal establishment in the provider-patient relationship is the product of the mutual agreement between the provider and patient and is also known as "shared treatment decision making" [34], [35]. Even though the study did not involve physicians, the results show that older patients feel more comfortable with goals and more satisfied with their treatment plan if they feel that they had agreed to the approach and had a clear understanding of what they needed to do.

The results of the concluding questionnaire in regard to goal setting and comfort showed a statistically significant difference, with the mean score's being higher for the treatment group. The two most important conditions of goal setting and acceptance are monitoring goals and providing feedback on progress[19]. Monitoring the goal is defined in this study as patients' regularly self-capturing their goal progression and sharing it with their physician. Capturing treatment plan-related information takes commitment and can be overlooked by the elderly. The findings show that, with the help of technology, self-reporting goal progression may be easier and provide more value to both patients and physicians.

The higher goal-setting and comfort scores for the treatment group may be due to the regular and timely feedback that the treatment group received from a trusted source. This is supported by the literature that shows that feedback through technology can be timely and more regular than that in a face-to-face doctor visit [36], [37] and can increase satisfaction with the treatment plan.

Scores for the self-management application intention to continue use on the second questionnaire showed that elderly people have the desire to use technology to receive feedback from their physician on their goal progression. The statistically significant difference showed a strong correlation between goal setting and comfort and the desire to use technology through which elderly patients can receive feedback in a regular and timely manner. The literature indicates that, when a system is found useful and experience using is present, users will be more likely to continue to use the system. This study showed that elderly people intend to use the self-management application if the feedback feature is available, which is valuable information for researchers and physicians. Determining the exact technology and features that the elderly patient population can appreciate and that can fulfil their desire to receive feedback from their physicians will be a worthwhile direction for further research. Receiving feedback is important to elderly patients to maintain their motivation or to have a timely opportunity to revise their goals if they fail to sustain their progression. If their goals are discussed only during face-to-face visits, patients may abandon the goals, and information about lack of goal attainment may not be available for the physicians for months, which could jeopardize the treatment effectiveness.

A policy implication of this study concerns the management of patient-submitted health information and how it should be captured, stored, and processed in electronic health records. With the availability of smart devices that can capture vital signs and lifestyle-related data without users' input, a large amount of patient-specific health information can be captured and should be properly analyzed to enhance patient care. Privacy and security policies should be considered now, as the devices are readily available. Planning for the use patient-generated data should be encouraged by policies because capturing information during face-to-face visits reduces the opportunity to react to sudden health changes to which the elderly are more susceptible.

This study also has certain limitations. Only a small number of participants were available, and some dropped out during the study, which decreased the statistical power. Further, many other factors may influence elderly patients' motivation to adhere to treatment that requires lifestyle changes, and, in some respects, they may be on their own to

ensure that they continue with prescribed methods, for example, a change in diet or regular exercise. This study shows the promise for further research in this domain.

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