

Influence of Patient Experience on Digital Health Intervention Effectiveness for Older Adults with Diagnosed Diabetes in Taiwan: A Multilevel Modeling Approach

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Format: Final Paper

Background

Patient experience in mobile health (mHealth) behavior change interventions is thought to be important for intervention effectiveness, though how it enhances efficacy has been somewhat unclear in the literature.

Research Question and Hypothesis

What is the relationship between patient experience and digital intervention among older adults with diabetes in Taiwan? We want to explore the above relationship. More specifically, what are the factors that will affect the effectiveness of digital intervention on outcomes? What are the key patient experience variables in term of depression scale, diabetes empowerment scale, patient activation measure, life satisfaction scale, and satisfaction with health and social services? How these variables affect the outcomes (is it a mediator)? We hypothesize that depression scale and life satisfaction scale are at patient-level. Secondly, diabetes empowerment scale, patient activation measure, and satisfaction with health and social services are within-cell (patient and site) level variable (description in Appendix).

Data and Clinical Trial Design

Intergenerational Mobile Technology Opportunities Program (IMTOP) app is a graphic-based and user-friendly diabetes self-management app. IMTOP app consists of several tracking functions (blood sugar level, blood pressure, diet, exercise, weight, water input and urine output, and medication adherence) that help control chronic health conditions (see Appendix). Study population: aged 55+ with diabetes (N = 305) from outpatient clinics of one urban hospital and one rural hospital in Taiwan. Clinical trial design:

Profile	0-4 Month	4-8 Month
Immediate Arm (N = 146)	Intervention Group	Retention
Waitlisted Arm (N = 159)	Control Group	Intervention Initiation

Digital intervention: Teaching and tracking self-management behaviors using mobile technology.

Methods

To estimate intervention effect, I compare the intervention group and the control group on self-care behaviors and A1c level at 4-month follow-up. Our primary dependent variables are diet, exercise, and blood sugar testing outcomes. Our secondary outcome is A1c level (%). I then compare immediate arm (0-4-month) and waitlisted arm (4-8-month) for robustness check. In the first stage, I will apply multilevel mediation models to examine whether a participant's experience mediates the digital intervention on diabetic self-care activities (description in Appendix). In the second stage, I will compare the results from previous stage with results from multilevel propensity score models where these models account for the confounding nature of hospital location setting (site) by including site fixed effects in the models predicting the likelihood of experiencing the intervention. By addressing site setting, we can limit bias in the estimate attributed to local differences. The above methods are likely appropriate in a study of patient experience and adherence as it is possible that the factors with high predictive power in urban setting may be relatively inconsequential in rural setting.

The data analytic scripts and supplemental materials for this project will be available at <https://github.com/chouchuw/PSYC-575.git>

Reference

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Appendix

Introduction and Motivation

Diabetes can be difficult to manage, and it requires frequent contact with clinicians and self-monitoring. Current diabetes management gradually adopts the use of digital technology (Lee, Choi, Lee, & Jiang, 2018). Despite its usefulness, only an estimated 8% of older adult patients with diabetes adopted a diabetes app to support the above self-management activities (Lum et al., 2019). As for those who did use an app, they may have low continual use (Lum et al., 2019). It is not only important to promote using these apps but also critical to improve self-care engagement among older adults (Wu, Tai, & Sun, 2019).

A mediation model concerns whether a mediator variable can significantly account for the relationship between a predictor variable and an outcome variable (McCormick, O'Connor, Cappella, & McClowry, 2013).

Data Description

Data source: IMTOP app platform (IMTOP cloud storage)

IMTOP trial timeline: From user-entered data recorded by the IMTOP app that was uploaded to the IMTOP cloud storage and downloaded from the cloud storage for analysis, analyzed based on weekly tracking record from 2015 to 2016.

Outcome variable: Whether a patient conducts or follows a recommended self-care activities (see The Summary of Diabetes Self-Care Activities)

Control variables: age, sex (male = 1), education level (Junior high (7th to 9th grade) or lower, High school (10th to 12th grade), College or above), marital status (Married, Widowed, Divorced, Never married), living status (living alone or not), financial status (Completely adequate, Somewhat adequate, Just enough, Somewhat inadequate, Completely inadequate), app skill level (Novice, Intermediate, Expert), and health status (Diabetes Symptoms and Complications).

1. Geriatric Depression Scale - Short Form (GDS-SF)

Choose the best answer for how you felt over the past week.

	Yes	No
1. Are you basically satisfied with your life?	1	2
2. Have you dropped many of your activities and interests?	1	2
3. Do you feel that your life is empty?	1	2
4. Do you often get bored?	1	2
5. Are you in good spirits most of the time?	1	2
6. Are you afraid that something bad is going to happen to you?	1	2
7. Do you feel happy most of the time?	1	2
8. Do you often feel helpless?	1	2
9. Do you prefer to stay at home, rather than going you and doing new things?	1	2
10. Do you feel you have more problems with memory than most?	1	2
11. Do you think it is wonderful to be alive?	1	2
12. Do you feel pretty worthless the way you are now?	1	2
13. Do you feel full of energy?	1	2
14. Do you feel that your situation is hopeless?	1	2
15. Do you think that most people are better off than you are?	1	2

2. The Summary of Diabetes Self-Care Activities (Toolbert et al, 2000)

The following questions ask you about your diabetes self-care activities during the past 7 days. If you were sick during the past 7 days, please think back to the last 7 days that you were not sick.

Diet

1. How many of the last SEVEN DAYS have you followed a healthful eating plan?	0	1	2	3	4	5	6	7
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2. On average, over the past month, how many	0	1	2	3	4	5	6	7
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DAYS PER WEEK have you followed your eating plan?

3. On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables? 0 1 2 3 4 5 6 7

4. On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products? 0 1 2 3 4 5 6 7

Exercise

5. On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking) 0 1 2 3 4 5 6 7

6. On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work? 0 1 2 3 4 5 6 7

Blood Sugar Testing

7. On how many of the last SEVEN DAYS did you test your blood sugar? 0 1 2 3 4 5 6 7

8. On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider? 0 1 2 3 4 5 6 7

Foot Care

9. On how many of the last SEVEN DAYS did you check your feet? 0 1 2 3 4 5 6 7

10. On how many of the last SEVEN DAYS did you inspect the inside of your shoes? 0 1 2 3 4 5 6 7

Smoking

11. On how many of the last SEVEN DAYS did you smoke a cigarette-even one puff? 0 1 2 3 4 5 6 7

3. Diabetes Empowerment Scale – Short Form (DES-SF)

Please indicate your level of agreement regarding to your diabetes with each of the following

statements.

In general, you believe that you ... (read each item)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. ...are able to turn your diabetes goals into a workable plan.	1	2	3	4	5
2. ...know what part(s) of taking care of your diabetes that you are dissatisfied with.	1	2	3	4	5
3. ...can try out different ways of overcoming barriers to your diabetes goals.	1	2	3	4	5
4. ...can find ways to feel better about having diabetes.	1	2	3	4	5
5. ...know the positive ways you cope with diabetes-related stress.	1	2	3	4	5
6. ...know what helps you stay motivated to care for your diabetes.	1	2	3	4	5
7. ...can ask for support for having and caring for your diabetes when you need it.	1	2	3	4	5
8. ...know enough about yourself as a person to make diabetes care choices that are right for you.	1	2	3	4	5

4. Patient Activation Measure (PAM-13)

Please indicate your level of agreement with each of the following statements about your health care. Response categories are: Strongly Disagree, Disagree, Agree, Strongly Agree. Your answers should be what is true for you and not just what you think the doctor wants you to say. If the statement does not apply to you, answer "Not Applicable".

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
1. When all is said and done, I am the person who is responsible for managing my health condition	1	2	3	4	5
2. Taking an active role in my own health care is the most important factor in determining my health and ability to function	1	2	3	4	5

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Applicable
3. I am confident that I can take actions that will help prevent or minimize some symptoms or problems associated with my health condition	1	2	3	4	5
4. I know what each of my prescribed medications do	1	2	3	4	5
5. I am confident that I can tell when I need to go get medical care and when I can handle a health problem myself	1	2	3	4	5
6. I am confident I can tell my health care provider concerns I have even when he or she does not ask	1	2	3	4	5
7. I am confident that I can follow through on medical treatments I need to do at home	1	2	3	4	5
8. I understand the nature and causes of my health condition(s)	1	2	3	4	5
9. I know the different medical treatment options available for my health condition	1	2	3	4	5
10. I have been able to maintain the lifestyle changes for my health that I have made	1	2	3	4	5
11. I know how to prevent further problems with my health condition	1	2	3	4	5
12. I am confident I can figure out solutions when new situations or problems arise with my health condition	1	2	3	4	5
13. I am confident that I can maintain lifestyle changes like diet and exercise even during times of stress	1	2	3	4	5

5. Life Satisfaction Scales for Chinese Elders

Please indicate if you are satisfied in the following items.

	Satisfied	Dissatisfied	Not applicable
1 Family relationships	1	2	3
2 Communications with children/grandchildren	1	2	3

		Satisfied	Dissatisfied	Not applicable
3	Friendships	1	2	3
4	Family responsibility	1	2	3
5	Spirituality	1	2	3
6	Living partner	1	2	3
7	Self-respect	1	2	3
8	Recreational activity	1	2	3
9	Food/meal	1	2	3
10	Finances	1	2	3
11	Health	1	2	3
12	Housing	1	2	3
13	Transportation	1	2	3
14	Paid employment	1	2	3

6. Satisfaction with Health and Social Services

Please answer to what degree you are satisfied or dissatisfied with the following health services.

		Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
1	the overall health care available to you for your diabetes	1	2	3	4	5
2	the clinical help you received with emotional problems	1	2	3	4	5
3	the clinic services available to you for assisting with making or changing appointments	1	2	3	4	5
4	the clinic services available to you for assisting with getting prescriptions filled	1	2	3	4	5
5	the clinic services available to you for assisting with scheduling other needed tests and procedures	1	2	3	4	5
6	the courtesy and respect shown to you by your doctors	1	2	3	4	5
7	the courtesy and respect shown to you by your clinic nurses	1	2	3	4	5
8	the courtesy and respect shown to you by your social workers	1	2	3	4	5

		Very dissatisfie d	Dissatisfie d	Neutral	Satisfie d	Very Satisfied
9	taking part in the decisions made about the care you received	1	2	3	4	5
1 0	the overall social services available to you for your diabetes	1	2	3	4	5