Effectiveness of Intervention with Health (m-Health) Technology for Health Care Compliance: Literature Review

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Abstract
The integration of cellular technology in healthcare (M-Health) has the potential in coping with the constraints of the medical service system and to become a breakthrough to support the patients' medication adherence. This review was conducted to compare and evaluate the effectiveness of M-Healthin terms of the patients' medication adherence.The literature review conducting on PubMed, Cochrane Library, Ebsco Health and Taylor & Francis was confined to the articles published between 2010 and 2019. Fifteen articles relating to medication adherence were reviewed, eleven of which employed RCT methods including quasi-experiment that assessed the effectiveness of M-Health to measure the adherence, while four other researches employed qualitative studies to explore patients' perceptions.The review showed that the intervention of m-Health is effective to drive the compliance of the treatment in accordance with healthcare promotion efforts as well as the prevention, screening and the management of the diseases. Two studies have shown inconsistent results regarding the prevention of obesity and the management of hypertension patients. The development of such model abd the integration of parallel m-Health and healthcare promotion will improve the long-term medication adherence.

Index Terms— **effectiveness, compliance, M-health, health care**

I. INTRODUCTION

The rapid development of information technology in the digital revolution era has now penetrated the health realm. Mobile Health (m-Health) or cellular health as a sub-segment of e-Health comprises medical and public health practices which includes prevention, health promotion, healthcare, or the transmission of information resources, and services related to health using cellular gadgets.1 With the intervention of m-Health, health services are expected to be personal, participatory and cheaper.2 The communities can access health services and interact with mobile devices through mobile applications3. This study was conducted to provide input related to health innovation in healthcare compliance.

II. METHODS

A. Search Strategy

Literature review uses the database from PubMed, Ebsco Health, Cochrane Library, and Taylor & Francis with the articles analyzed by peer reviewers between 2010 and 2019.

B. Inclusion and Exclusion Criteria

The search was limited to the studies related to the

utilization of M-Health in public health issues that focused on the intervention for the healthcare compliance.

C. Selection Process

Articles are identified by titles and abstracts, which are then screened according to inclusion criteria.

D. Design and Synthetic Data

The extraction of the articles in the literature review is shown in Table 1.

TABLE I

Study, Year of publication, Location	Study design	Sample	Technology	Intervention	Relevant Findings
Margaret et al (2016) Australia	RCT	250 children aged 18-35 years with over weight	SMS and email	Education through 2 telephone calls, text messages, monthly emails. Duration for 6 months	Weight loss, The difference between the intervention and control groups was 4.3 kg. (SE 1.3) P <0.001, (OR = 3.2 (95% CI: 1.4, 7.3) and 3.4 (1.4, 8.0), p <0.01
Partridge et al (2017) Sidney	RCT	250 children aged 19-35 years	SMS, email and website	8 weekly text messages, 113 weekly reminder emails, and access to 114 educational applications and 15 websites Duration: 9 months	Fruit consumption (p =0.029), maintenance-change stages (respectively p < 0.001 and p = 0.012).self-efficacy, 8% - 37% of the total effect.
Nystrom et al (2018) Sweden	RCT	315 children aged 4.5 years	Web based application	Diet behavior with MINISTOP or basic pamphlets, weekly feedback, Duration: 6 months	FMI (p = 0.57) changes in composite scores ± standard deviation + 0.53 ± 1.49 units and + 0.35 ± 1.27 units, p = 0.25 between groups
Yousuf H. et al (2016) South Africa	Mix method	108 children (2-15 years), 598 (16-85 years).	application	Smartphone-based hearing screening	Adult reference rate (p <0.05) (4.3%) in the younger, in the older (13.2%)
Adolfo Rubinstein et al (2016) Amerika Latin	RCT	Intervention: control 316:321	SMS	Monthly telephone calls and weekly text messages	Changes in systolic blood pressure p = 0.43) or diastolic blood pressure (0 · 01 mm Hg p = 0.99). body weight (−0 · 66 kg [−1.24 −0 · 07]; p = 0 · 04) and high fat and high food intake p = 0 · 008)
Maria Odette Gore et al (2018) Colorado	A quasi-experimental	Case: control 204: 504 (over 18 years)	SMS	Automatic Cardio SMS send text messages according to schedule	Large reduction in fat intake, Intervention vs. control group (26.3% vs 10.6%, p = 0.001). Greater program retention (p = 0.03)
Lakshmi Narayana et al (2018) India	RCT	56 people with acute stroke (40-85 years	Smart phone and wireless BP monitor	M-health-based HTN management monitors its own blood pressure every day for 90 days	In AT, HTN was controlled at 89% (23/26) IA and 58% (14/24) CA, (p = 0.015) m-Health had excellent uses in HTN control
Maurielloet al (2016) New York	(RAL)	335 pregnant women	application	Cessation of risky behavior for pregnant women with education through applications on the iPad	The risk was significantly less at 1 month (0.85 vs. 1.20, odds ratio [OR] 1⁄ 4.70) and 4 months postpartum (0.72 vs 0.91, or 1⁄4 .81).
Johnson et al (2016) Kenya	RCT	5164 married couples	SMS	Survey with text messages through the m4RH system with 3 stages for 6 months	Full access to m4RH increased consumer scores on contraceptive knowledge tests by 14% (95% confidence interval: 9.9% -18.2%)
Jasemzadeh et al (2017) India	RCT	130 pregnant women	application	EPPM-based cellular telephone interventi	There were no significant differences between the mean

Study	Method	Participants	Platform	Intervention	Outcome / Findings
				on behavior promotion pollution protection, short message for 2 months	vulnerability scores ($p > 0.05$), high response, and self-efficacy, protective behavior; $p < 0.05$.
Yan Guo at al (2018) China	RCT	62 people are gay or bisexual	WeChat	Weekly SMS reminders, and articles three times a week through WeChat for 3 months	m-Health can be accepted and facilitate access
Natalie Leon (2015) South Africa	Qualitati	2 focus groups of each 11 participants	SMS	Receiving SMS as a motivation to remind obedience	Technology using text messages is acceptable, relevant and useful, providing practical and emotional support for improving compliance behavior
Sheridan W (2016) Amerika Serikat	Qualitati	30 partisipants FGD	Wereless Health and Wellness Intervention	User views in promoting individual activities	The design of partnership and service integration technology increases the existence of users for sustainable behavior change
Hirsch M (2017) Lesotho	Qualita	71 patients	SMS	Treatment reminders by sms, monthly in-depth interviews	SMS messages support compliance with improved access to services for people with HIV / TB.

E. Intervention Using m-Health

Various innovations have been made by adopting smartphone technology to create health care services in order to easily monitor patients' health. This modification comes in different forms such as medication reminder services, motivation, health promotion via SMS, telephone calls, software or applications. SMS intervention requires the most sophisticated hardware that can be used to send simple information to patients on their personal phones. Special software or applications including patient portals, management systems, and other complex communication platforms require commercially available smartphones [1].

III. RESULTS

A. Characteristics of Study and Intervention

All studies that integrated technology-based interventions in the application of m-Health entirely focused on behavioral changing so that compliance arises in healthcare, especially in the intervention in preventive efforts[2][3][4][5], health promotion for behavioral change interventions [6][7][8], compliance with the treatments of the diseases [9][10][11][12][13][14][15]. Interventions are not limited to the intervention using SMS. There are various technological platforms used to inform patients about healthcare.

Eleven studies have used SMS or e-mails to remind patients about their medication on a daily and weekly basis, encourage them to do physical activity and give them nutritional advice [4][15]. The interventions were carried out for 12 weeks to 6 months, which is later evaluated to find the effects they had. We also found other studies that used website, multimedia and apps, wireless technology, WeChat, Pro Ask [2][3][14]. Four of which delved into the perspective of the community in relation to the experience of using m-Health for health promotion as well as its integration to traditional health services and the identification of risk factors in preventive programs of childhood obesity [16][8].

B. Effectiveness of M-Health

We analyzed 11 studies (68.75%) with randomized controlled trial in various disease management strategies that measured the effect of compliance to treatment. We found that there was a statistically significant difference between groups ($p < .05$ to $p < .001$) in 5 studies. One study that employed a mixed method in hearing screening showed a significant effect on clinical utility and the development screening conducted by Community Care Workers with continued intervention at home via smartphone. This has shown to have a positive impact on compliance.

Two studies (13.33%) found a tendency of differences in outcomes among groups, but mostly did not reach statistical significance, except for a greater reduction in fat intake as reported in the intervention and control groups (26.3% vs 10.6%, p = 0.001).6 Also, a subset of survey participants who read SMS messages as encouragement showed a greater program retention (p = 0.03). In accordance with Margaret et.al. a weight loss occurred in the intervention group and with the difference of 4.3 kg to the control group, (SE 1.3) P <0.001, (OR = 3.2 (95% CI: 1.4, 7.3) and 3.4

(1.4, 8.0), P <0.01[3][15].

Studies in weight loss showed that there weren't any statistically significant differences for body composition, food variable, or physical activity variable between the intervention group and the control group [2]. Comparing the common treatment to m-Health-based intervention on people with the risk of cardio metabolic diseases, we found that there wasn't any change in the blood pressure. Yet, it affected a minor weight loss and gain on a few diet habits [10-11].

Text messaging can be an effective method for increasing the insight of family planning, but perhaps it's not enough to make a behavioral change. It is necessary to identify barriers to be able to develop the strategy to reduce the risk of infant obesity [5][8] The high response and self-efficacy of both experiment and control groups in the parallel-based cell phone interventions can increase the awareness among pregnant women to develop the protective behavior against air pollution. The results are p<0.05. self-efficacy, 8% -37% of the total effect [1] [5-7]. Four qualitative studies (26.66%) were conducted to find the perception of the community of the advantages of m-Health. They employed interview methods, Focus Group Discussion to inform the community about m-Health.

These studies found that m-Health can sustain the accessibility of information in terms of the punctuality of the treatment. People with HIV/AIDS need the information to improve the quality of life, as strategies to reduce anxiety and depression [8][13].

The content of the SMS, the courteous nature of the messages, the frequency of SMS delivery as well as the relational aspects made the participants feel respected. The sub-groups that benefit the most are those who have struggled with compliance because of high levels of personal stress. The studies showed from monthly in-depth interviews that the participants found SMS reminders important to encourage the compliance [12].

IV. DISCUSSION

Short Message Service (SMS) reminders offers the confidentiality of recipients (especially people with HIV / AIDS). SMS reminder is effective in targeting isolated populations in rural areas and those with limited access to health information [14]. Qualitative studies provided feedback to the participants.

In addition, it is important to consider designing voice messages for people with poor literacy. It is also necessary to identify constraints especially those related to areas without internet connection and anticipatory efforts to resolve the situation [9]. It is essential to design m-Health technology with partnership in order to maintain the motivation, attain the behavioral change and a significant and sustainable compliance [16][9]

The users of m-Health argued that the application can be more effective if it provides various medical information, integrated with traditional health treatments which are parallel with the information of health promotion. It is also necessary to provide a supervision in terms of the roles of m-Health application [9][16].

The increase of the treatment compliance is influenced by the choice of technology platforms with application design modifications that includes motivational texts using multimedia messaging and interactive programs [12]. SMS reminders have a measurable impact and have a greater ability to influence behavior than through radio and television campaigns.

Also, a subset of participants surveyed that saw SMS messages as motivation showed a greater program retention ($p = 0.03$) on the prevention of cardiovascular disease [3]. There were no significant results between the intervention and control groups in weight loss. This is possibly due to the short duration of interventions which is unable to sustain behavioral changes in weight loss [2]

Utilization of technology in health services requires the infrastructural support, human resources and funds which is why the involvement of stakeholders and policyholders is necessary for the empowerment of the regulations for the implementation. Areas with limited internet coverage need different approaches in terms of tackling the constraint in order to reach all targets. With adequate support, a sustainable service can be achieved.

V. CONCLUSION

Health services through m-Health effectively encourage behavioral change in prevention interventions, health promotion and screening. Various designshave proven to increase people's interest in the use of m-Health.

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