

Mobile Phone Based System Opportunities to Home-based Managing of Chemotherapy Side Effects

Somayeh Davoodi¹, Zeinab Mohammadzadeh¹, and Reza Safdari¹

¹Health Information Management Department, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran

Corresponding author: Reza Safdari. Health Information Management Department, Tehran University of Medical Sciences, Tehran, Iran, Postal Code: 1417744361, Tel: +98-21-88982782, fax: +98-21- 88983037, E-mail: s-davoodi@razi.tums.ac.ir

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ABSTRACT

Objective: Applying mobile base systems in cancer care especially in chemotherapy management have remarkable growing in recent decades. Because chemotherapy side effects have significant influences on patient's lives, therefore it is necessary to take ways to control them. This research has studied some experiences of using mobile phone based systems to home-based monitor of chemotherapy side effects in cancer. **Methods:** In this literature review study, search was conducted with keywords like cancer, chemotherapy, mobile phone, information technology, side effects and self managing, in Science Direct, Google Scholar and Pub Med databases since 2005. **Results:** Today, because of the growing trend of the cancer, we need methods and innovations such as information technology to manage and control it. Mobile phone based systems are the solutions that help to provide quick access to monitor chemotherapy side effects for cancer patients at home. Investigated studies demonstrate that using of mobile phones in chemotherapy management have positive results and led to patients and clinicians satisfactions. **Conclusion:** This study shows that the mobile phone system for home-based monitoring chemotherapy side effects works well. In result, knowledge of cancer self-management and the rate of patient's effective participation in care process improved.

Key words: mobile phone based system, chemotherapy, home-based managing and side effects.

1. INTRODUCTION

In recent decades, using of mobile phones in chemotherapy has been receiving much attention by clinicians (1-3). By using information technology it is possible to connect health care centers and patients in remote areas and with lowest training needs for users and personnel (4). Mobile technology is rapidly used in everyday life especially in care processes for better disease management and delivery of health interventions (5). Safe and high quality follow-up in the cancer through use of mobile phone technologies has been grown (6). Cancer is a major cause of death in the world with high health priority and has become an important issue in public health (7, 8). According to GLOBOCAN 2012 estimations, there were about 14.1 million new cancer cases, 8.2 million cancer deaths and 32.6 million people who living with cancer (within 5 years of diagnosis) in 2012 worldwide (9). Chemotherapy is one of the main stages of cancer treatment. Adverse effects of chemotherapy have negative in-

fluences on cancer patient's quality of life (10). And control of these side effects is one of the core components of chemotherapy self-managing (11). Thus intervention by mobile phone in health can be cost-effective through increase access to health care, improve diagnosis, treatment and rehabilitation and support public health programs (12, 13). Therefore, this study describes some studies that verify positive impacts of mobile phone based systems to manage chemotherapy side effects.

2. METHODOLOGY

The following article investigates existing articles on interventions using mobile technology to improve home-base management chemotherapy side effects. In this literature review study, search was conducted with keywords like cancer, chemotherapy, mobile phone, mobile health, information technology, side effects and self managing in Science Direct, Google Scholar and Pub Med databases since 2005. Non English, unavailable full texts and ab-

Results	Interventions	Aims	Participants	Type of intervention	Device	Author
There were significantly higher reports of fatigue in the control group compared to the intervention group (odds ratio=2.29, 95%CI=1.04 to 5.05, P=0.040) and reports of hand-foot syndrome were on average lower in the control group (odds ratio control/intervention=0.39, 95%CI=0.17to 0.92, P=0.031).	Intervention group used ASyMS for 4 cycles of chemotherapy. Symptoms in questionnaire completed by patients in the morning, evening and at any time they felt unwell in days 1 to 14. This information sent to the study server. Then according to symptoms and severity of disease, feedbacks and self-care recommendations sent to the patients immediately. Duration: 12–16 wk.	To evaluate the impact of a mobile phone-based remote monitoring ASyMS on the incidence, severity and distress of 6 chemotherapy-related symptoms (nausea, vomiting, fatigue, mucositis, hand-foot syndrome, and diarrhea)	112 patients with lung, breast, or colorectal cancer that receiving chemotherapy treatment or outpatient chemotherapy was divide to two groups (intervention and control). Mean age: Control = 56.9 y (SD: 10.5) Intervention = 56 y (SD: 10.5)	text message	Mobile phone	Kearney 2009 (28)
This trial is currently in the process of recruiting patients.	The PRISMS intervention include two synergistically operating parts: a mobile phone-based remote monitoring system with built in patient self-care advice and clinician alerting algorithms; and a structured nursing support intervention relating to: patient use of the remote monitoring system; patient coaching in self-care strategies and on-going access to 24-hour nursing support/clinical interventions, triggered by real-time system alerts. This system is based on the prototype previously developed and piloted and based on the ASyMS system developed by Kearney et al.	Capture patient-reported health data in real-time and present rapid clinical decision-making/intervention.	222 patients with chronic lymphocytic leukemia/Hodgkin's/ non-Hodgkin's lymphoma selected from two institutions located in two capital cities of two different states of Australia. Then patients divided to two equal control and intervention groups. aged < 18 years	The Patient Remote Intervention and Symptom Management System (PRISMS)	Mobile phone	Breen (2015) (25)
Data entry range was 98% and incomplete data related to temperature. There were 91 alerts—54 red and 37 amber; 54% (29/54) of the red alerts were data delay and transmission problems which were swiftly rectified. Patients had positive experience and high satisfaction. Nurses were confident and satisfied.	Patients entered symptom data onto screens on a mobile phone twice daily. In the event of moderate or severe symptoms, the nurses immediately were alert by the computer via a pager. The nurse then contacted the patient to reinforce the automatic advice sent to the patient on their phone and to assess the patient using clinical algorithms.	Evaluate the home-based monitoring of chemotherapy symptoms (sea, vomiting, mucositis, diarrhea, hand-foot syndrome and temperature) utility via a mobile phone.	6 patients with colon cancer Four men and two women Mean age = 64	Preloaded software in mobile phone	Mobile phone	Weaver 2007 (10)
At last results showed that patients were comfortable (19%) or very comfortable (81%) using the ASyMS system. Almost all (97%) of the patients stated that, received enough training to use the handset on their own and reported that they felt either. Patients were extremely positive about the use of the ASyMS handset to record their symptoms, as 91% of patients felt that using the ASyMS handset had helped in the management of their symptoms. Overall, patients reported positive experiences of being involved in the study, describing their experience as interesting (80%), valuable (77%) and educational (34%). Only one patient reported that they found the study confusing or challenging.	Patient completes a chemotherapy related questionnaire on a mobile phone for 14 consecutive days. (In the morning, evening and at any time they felt unwell). Then patients in the intervention group completed the electronic symptom questionnaire on their mobile phone, take their temperature using an electronic thermometer and enter this value into the mobile phone. This symptom information immediately sent 'real-time' via a secured General Packet Radio Services connection to the study server. Information assessed by the risk model and the results sent to clinician in the two forms of alerts (amber and red). Nurse views symptom reports on web page and initiates appropriate interventions.	To evaluate the impact of a mobile phone-based, remote monitoring ASyMS® on chemotherapy related toxicity in patients with lung, breast or colorectal cancer.	112 Adult patients with breast, lung or colorectal cancer divided to two groups (intervention and control), by5 time points (baseline, pre-cycle 2, pre-cycle 3, pre-cycle4 and pre-cycle 5) randomized controlled trial. all patients Mean age = 56 intervention group mean age=55/1	Electronic symptom questionnaire	mobile phone	McCANN 2009 (29, 30)
Experience with the collection of the temperature measurements and self-reported symptoms demonstrated no problems, and data analyzed successful by the server software and appropriate messages sent. Overall feedback from the patients was positive. The level of clinical agreement between the system and the laboratory standard was good. Only three out of the 48samples; 6% and two out of the 10 patients; 20%had differences in blood results that may have had clinical implications (clinical disagreement).	The telemonitoring system consists of a small point of care hematology analyzer, coupled to a telecommunication hub. The tele-hub used for patient data entry, self-test of blood count and sending result to the server. Patients can also measure their temperature, record the results and answer symptom assessment questions on the tele-hub. The results sent encrypted to the server by a mobile phone link. The server is responsible for analyzing the data and for generating alert messages, based on pre-determined criteria.	To examine the accuracy and acceptability of a home telemonitoring system, that allows the remote monitoring of chemotherapy-related toxicities, temperature, symptoms and blood count compared to the hospital laboratory standard.	Ten patients 40% Male and 60% female attending the Royal Marsden Hospital with a diagnosis of a thoracic malignancy (non-small cell lung cancer, small cell lung cancer and mesothelium) receiving chemotherapy or in which there was a plan to start chemotherapy within two weeks was eligible for inclusion. Mean age= 61	A telephone-based monitoring system	Mobile phone	Nimako (2013) (31)

<p>Results of interview with both patients and health professionals' show that they were comfortable with using mobile phone based advanced symptom management system (ASyMS) and their perception about training and ease of use of the ASyMS handset, reassurance, self-care advice and overall experience of the study asked. Patients overall experience of the study was positive.</p>	<p>Patient completes symptom questionnaire (twice a day for 14 consecutive days following chemotherapy treatment). Data sent in real time from the mobile phone via the server to the nurse at the relevant clinical site. Problematic symptoms immediately generate alerts on the dedicated pager system nurses carry alerts will be either amber or red. Nurses view the patients symptom data on the dedicated website and contact the patient direct to offer advices, in appropriate based on these symptom reports. Patients can view the self-care advice, symptom graphs and cancer information pages on the handset at any time.</p>	<p>The aim of this pilot study was to test all aspects of a large, multicentre, randomized, controlled trial of a mobile phone based advanced symptom management system (ASyMS) in the remote monitoring of chemotherapy related toxicity with standard symptom management. This included testing of all related study procedures and adherence to agreed protocols.</p>	<p>10 patients divided to intervention (n = 4) and control group (n = 6). All patients were female with ages between 44–74 years. Mean age= 59</p>	<p>Electronic symptom questionnaire</p>	<p>Mobile phone</p>	<p>Maguire 2006 (32)</p>
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Table 1. Experiences of using mobile phone based systems to home-based monitor of chemotherapy side effects in cancer

stracts and studies that not defined as a journal article were excluded from this study.

3. FINDINGS

Application of mobile phone in health

Mobile technologies include mobile phones; personal digital assistants (PDAs); Smartphone's (e.g., iPhone); enterprise digital assistants (EDAs); portable media players; handheld video-game consoles, handheld and ultra-portable computers such as tablet PCs, and Smart books (14).

By the end of 2014, the rate of mobile phone penetration in developing and developed countries was 90% and 121% respectively. And there were 7 billion mobile phones subscriptions globally (15). Quick data transfer for both literate and illiterate populations is the main benefit of mobile phone (16).

Mobile phone is a very popular technology and because of great capabilities including advanced computing capabilities, high resolution cameras with global positioning systems (GPS) and Internet connectivity can be very effective in the health care area (17, 18).

In recent years the use of mobile phone base systems grown in health care area for interventions such as patient's education, disease monitoring at home, cancer screening, deliver medical test results, behavioral change, and setting visits (12, 19, 20). In the low income countries because of insufficient health infrastructures, mobile phone can be a good platform to facilitate access to health care and required knowledge for self-managing (18, 21, 22).

Mobile phone roles in self-managing of chemotherapy side effects

One of the main challenges in chemotherapy is quick detection of side effects and doing appropriate action in time-frame (23). Because side-effects early detection and related action is vital to improve patient outcomes, decrease morbidity, save costs and reduce hospital admission rates (24, 25). Also most cancer patients are dissatisfaction about long waiting time for receiving chemotherapy related services (26). Therefore, mobile phones can be very useful to solve these problems like other area of health care. The following table presents some experiences of using mobile phone based systems to home-based monitor of chemotherapy side effects in cancer. One of the mobile phone based system that used to home-based monitor of chemotherapy side effects is advanced symptom

management system (ASyMS) (27). ASyMS can support the management of symptoms in patients with lung, breast and colorectal cancer receiving chemotherapy (28).

4. DISCUSSION

Although applying mobile phone in cancer is in the initial phase of growth, but studies show that it can be very useful in care process (33). In chemotherapy, mobile phones often used for managing side effects and medication administration through promptly alert healthcare professionals to focus on the patients requiring intervention (10, 34, 35). Other advantages are overcoming geographical and time barriers, saving clinicians time and reduction in errors due to miscommunication, incomplete information and human fatigue (36, 37).

Studies show that behavioral changes can prevent many diseases and decrease mortality (14). And effective symptoms management fulfill with appropriate communication among patients and providers (28).

5. CONCLUSION

Health care systems should look for appropriate means to enhance health care efficiency (38). The limited access to cancer care and continuous traveling of cancer patients between home and hospitals impose high costs and undesirable emotionally effect to patients and their families, therefore can reduce cancer patients quality of life (39). With the use of new technologies, it is possible to change the way of cancer care delivery to patients and their families. In remote areas access to preventing, diagnostic, therapeutic and palliative cancer care is very difficult and sometimes impossible (40, 41); thus using mobile phone systems can be very useful to address this problems. Increasing use of mobile platforms in the health care area, lead to decrease disparities and improve access to health care services. Using chemotherapy mobile phone based systems lead to improve patients and clinician's communication and better home-based management of chemotherapy side effects (29, 37). Since the high quality cancer care and decreasing chemotherapy complications required continuous communication between patients and physician, using mobile phone based technologies can be great suggestion to health care policymakers.

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