Information Technology-Based Interventions for Health Care Support in Patients

by ninuk Dian Kurniawati

Submission date: 22-Oct-2021 01:40PM (UTC+0800)
Submission ID: 1680819985
File name: ed_Interventions_for_Health_Care_Support_in_Patients_with_1.pdf (304.03K)
Word count: 4985
Character count: 28440

Jurnal Ners
Jurnal Ners
Vol. 14, No. 3, Special Issue 2019
http://dx.doi.org/10.20473/jn.v14i3(si).17030

Systematic Review

Information Technology-Based Interventions for Health Care Support in Patients with Chronic Kidney Disease: A Systematic Review

Inda Rian Patma Putri, Nursalam Nursalam and Ninuk Dian Kurniawati

Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

ABSTRACT

Background: Self-management and support in managing therapeutic regimens is very important for patients with CKD. Information technology-based interventions are increasingly being used to support the self-management of patients with CKD. This study aimed to conduct a systematic review to evaluate information technology-based interventions in relation to the support of the health management of patients with CKD.

Method: We conducted a systematic review using electronic databases (Scopus, Science Direct, ProQuest) limited to the last 8 years from 2010 to 2018 with the relevant keywords. The studies included used RCT, pilot and case-control methods focusing on patients with CKD stage 1-5 and that reported on at least one outcome from the health management of patients with CKD. Out of the 7.852 studies taken, 13 studies fulfilled the inclusion criteria.

Result: The interventions in this systematic review are multifaceted, including smartphone/PDA (6/13), telematics devices (2/13), internet/web (3/13) and a combination of several interventions (2 studies). In total, 12 (92%) out of the 13 studies showed a positive outcome from the intervention, 7 studies showed improved outcomes in the clinical points, 3 studies had improved adherence and 2 studies improved knowledge.

Conclusion: This evidence indicates the potential of IT-based interventions (i.e. smartphone/PDA, computer, internet/web, telematic device) to support the health management of patients with CKD. The variety of interventions in this systematic review requires further research on which interventions are best applied.

ARTICLE HISTORY

Received: December 26, 2019
Accepted: December 31, 2019

KEYWORDS

information technology; health care support; chronic kidney disease; self-management

CONTACT

Inda Rian Patma Putri
inda.rian.patma-2017@fkp.unair.ac.id
Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

Cite this as: Putri, I. R. P., Nursalam, N., & Kurniawati, N. D. (2019). Information Technology-based Interventions for Health Care Support in Patients with Chronic Kidney Disease: A Systematic Review. *Jurnal Ners, 14(3si)*, 259-265. doi:http://dx.doi.org/10.20473/jn.v14i3(si).17030

INTRODUCTION

The prevalence of chronic kidney disease is increasing around the world. This has a major impact on the health system resources related to care. Hemodialysis is the main alternative therapy for modalities to help increase the survival of patients with chronic kidney disease (Chiou & Chung, 2012). Studies have stated that the success of hemodialysis is related to patient compliance, both to the therapeutic regimen and to the fluid and dietary restrictions (Kim, Evangelista, Phillips, Pavlish, & Kopple, 2010). Personal involvement is needed to integrate the complex recommendations about compliance with the lifestyle modifications (Diamantidis & Becker, 2014). Self-management is about how individuals know their illness, how they manage their symptoms, how they monitor themselves at home and how they implement daily care plans including following a complex treatment regimen, diet and fluid restrictions, even for those who do dialysis as in (Bonner et al., 2018). Innovation and efficient ways to improve the health behavior in patients with chronic kidney disease are needed. At present, the use of the internet and mobile devices in providing health care is growing rapidly (Lin, Wang, Jing, & Chang, 2014). Technological developments provide convenience and access to various health information applications and it helps the service patients with chronic diseases (Diamantidis & Becker,

2014). In the current phenomenon, the application of mobile computing related to health will increasingly play a role for chronic disease patients and even elderly users (Diamantidis & Becker, 2014). The development of electronic health implementations is very promising to increase access to the relevant health information, to improve the quality of services and to support the management of self-care and positive health behavior (Ong et al., 2016)

The aim of this study was to conduct a systematic review of the effectiveness of information technology-based interventions for self-care support in patients with chronic kidney disease. The results of this systematic review are expected to be applicable to the relevant health services. This systematic review is presented in the form of articles consisting of an abstract, introduction, method, results, PICOT, discussion, implications for practice, conclusions and a bibliography.

MATERIALS AND METHODS

This systematic review was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Search Strategies

The systematic search using the PICOT framework utilized electronic databases through keywords. The first step was to search the electronic databases based on the determined keywords according to the topics contained in the PICOT framework (Science Direct, Sage Journals, Scopus, ProQuest) to identify the relevant studies published from 2010 - 1018. The search strategy included a combination of keywords related to IT (such as information technology, m-health, e-health, monitoring) and also chronic kidney disease (such as kidney disease, renal transplant, hemodialysis).

Eligibility Criteria

The selection criteria in this study were determined based on population, intervention, results and study design. The inclusion criteria included: 1) IT-based interventions in chronic kidney disease with stage 3-5 chronic kidney disease, patients undergoing hemodialysis and kidney transplant patients, 2) information technology with mobile health (smartphones, PDAs), e-mail, internet / web, computers, telematics / electronic transmission devices, 3) the research design included RCTs, pilot studies and quasi-experiments and 4) they were in the English language.

The exclusion criteria were: 1) studies where the health care providers were the users, 2) studies that only offer the feasibility or validity of the IT-based interventions, 3) pediatric patients and 4) peritoneal dialysis patients.

Selection of Articles

This systematic review used the PRISMA method for systematic reviews followed by selection including

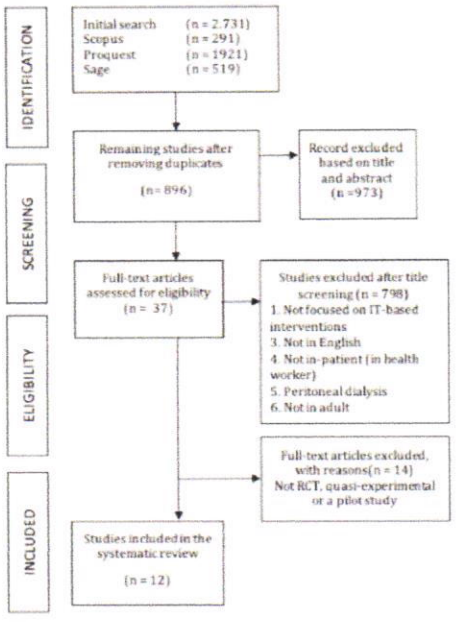

Figure 1. Searching for the Articles Following Tthe PRISMA Flow.

removing duplicates. Then, three reviewers chose the titles, abstracts and keywords, then they deleted any studies that were irrelevant according to the selection criteria. The three reviewers independently screened the titles and abstracts including the reasons for choosing the study and the selection of the inclusion and exclusion criteria through an electronic search. The full text of all articles were taken and assessed. Differences in opinion about the relevance of any articles were resolved through a discussion. After the article was completed, the record sheet was prepared for systematic data extraction. The data was extracted by the first reviewer and then the other reviewers examined and verified the accuracy and identified any information that might be missing.

RESULT

This study reviewed the 13 selected articles from various countries. Overall, 12 out of the 13 studies (92%) indicated that using technology-based interventions was effective at supporting health care in CKD patients (An, 2011; Blakeman et al., 2014; Cicolini et al., 2014; Cottrell, Chambers, & Connell, 2012; Cueto-Manzano et al., 2015; Gordon et al., 2016; McGillicuddy et al., 2013; Neumann et al., 2013; Ogna et al., 2014; Ong et al., 2016; Rifkin et al., 2013; Welch et al., 2013). This review contained several studies on chronic kidney disease: stage 3-4 chronic kidney disease (Cottrell et al., 2012), kidney transplant (Cueto-Manzano et al., 2015; McGillicuddy et al., 2013) and patients undergoing hemodialysis (Ogna et al., 2014; Welch et al., 2013). The number of samples

varied between 20-436 respondents. This systematic review included several study designs including RCTs (Blakeman et al., 2014; Gordon et al., 2016; McGillicuddy et al., 2013; Neumann et al., 2013; Ogna et al., 2014; Rifkin et al., 2013; Sevick et al., 2015), experimental queries (An, 2011; Cottrell et al., 2012) and pilot studies (Cueto-Manzano et al., 2015; Welch et al., 2013) which are intended to get a broad picture of the coverage of IT-based interventions.

Some of the information technology-based interventions used in this study included smartphone/PDAs computers and internet/web (Cueto-Manzano et al., 2015; McGillicuddy et al., 2013; Ong et al., 2016; Sevick et al., 2015; Welch et al., 2013). Overall, 12 out of the 13 studies showed that the use of information technology-based interventions was effective at improving self-health management in patients with chronic kidney disease as indicated by the positive results in the clinical, compliance and knowledge values (An, 2011; Blakeman et al., 2014; Cicolini et al., 2014; Cottrell et al., 2012; Cueto-Manzano et al., 2015; Gordon et al., 2016; McGillicuddy et al., 2013; Neumann et al., 2013; Ogna et al., 2014; Ong et al., 2016; Rifkin et al., 2013; Welch et al., 2013) . The study (3 out of 10) used telematics devices as interventions (Neumann et al., 2013; Ogna et al., 2014; Rifkin et al., 2013), four studies used PDAs and smartphone technology (applications/software/ SMS) (Cueto-Manzano et al., 2015; Neumann et al., 2013; Ong et al., 2016; Sevick et al., 2015; Welch et al., 2013), two studies used interactive messaging services (Cottrell et al., 2012), 1 study used a combination of smartphones with electronic devices (McGillicuddy et al., 2013), and 1 study used the web and e-mail (An, 2011; Blakeman et al., 2014; Gordon et al., 2016). Most studies reported high values of satisfaction and acceptance of the interventions, as well as effective results related to managing patient health.

Some of the studies using interventions in the form of telematics tools (drug monitoring, blood pressure monitoring, weight monitoring) showed good results related to the clinical results in the form of IDWG, blood pressure and medication adherence (Neumann et al., 2013; Ogna et al., 2014; Rifkin et al., 2013). In addition, the intervention used involved a combination of other modalities such as the presence of web-based applications which were found to have positive results (Gordon et al., 2016). Other interventions with the internet were combined with telematics devices (electronic drug tray that records the real time when the bottle was opened connected to the internet to automatically transmit data) and blood pressure monitoring devices. They showed success in the indicators of adherence to the treatment regimens and decreased blood pressure (Neumann et al., 2013; Ogna et al., 2014; Rifkin et al., 2013). In the study using the M-health intervention in the form of the smartphone application, in addition to the improvement in terms of the results of the indicators of compliance, it was also reported that there was satisfaction in the patients (Welch et al., 2013). The advantages that can be observed in interventions using smartphone applications are related to its interesting features (Ong et al., 2016). Smartphone applications have the potential to overcome the complexity of non-compliance behaviors related to lifestyle with respect to complete, unique and interesting features (Ong et al., 2016). Another study using PDAs stated that there was no significant difference in IDWG changes but that there were difference in sodium intake (Sevick et al., 2015).

M-Health (smartphones, PDAs)

Several studies evaluating interventions using smartphones/PDAs included using applications (software) (Sevick et al., 2015; Welch et al., 2013), automatic text messaging and electronic monitoring. The development of smartphones has made apps a potential tool for increasing the adherence to treatment (Santo et al., 2017). Several studies using interventions with smartphone applications have shown positive results regarding the indicators of health and self-management behavior in patients with chronic kidney disease (Cottrell et al., 2012; Cueto-Manzano et al., 2015; McGillicuddy et al., 2013). A pilot study conducted on 23 kidney transplant patients using text messaging applications and reminders that contained information on the risk factors for kidney disease, a healthy lifestyle diet and medication adherence have been reported to have the potential to influence the patients' health behavior and clinical outcomes (Cueto-Manzano et al., 2015). In another study, research conducted over 6 months in Canada with an Mhealth intervention, namely a smartphone application including data servers for information management combined with wireless blood pressure monitoring devices (with Bluetooth), on 47 stage 4 and 5 CKD patients showed good results regarding the clinical results of blood pressure monitoring and their access to care resources (Ong et al., 2016). The application allows for feedback to be sent to the service provider (via email) when the patient's clinical value is at the threshold (Welch et al., 2013).

Another randomized study of 20 kidney transplant patients for 3 months was with an intervention using a smartphone (automatic text message) combined with a blood pressure measurement device (automatically sent via Bluetooth to a cellphone) and an electronic drug tray. This showed significant results in relation to medication adherence and systolic blood pressure in the intervention group (McGillicuddy et al., 2013). An RCT study with an intervention using an automatic text messaging application that was connected to a server to deliver reminders to take their blood pressure measurements applied to 490 CKD patients showed significant results in terms of their blood pressure reduction (Ogna et al., 2014). The mHealth of electronic diet monitoring (DIMA) applications used on PDAs gave positive results regarding patient IDWG (9). Not all of the interventions with Mhealth

showed significant results. Randomized research in Pennsylvania with electronic diet monitoring interventions through PDA and diet counseling with 179 patients undergoing hemodialysis stated that there were no significant differences in the IDWG changes. However, positive results were seen in the behavior related to sodium intake, although this behavior was maintained in the short term (16 weeks during the intervention) (Sevick et al., 2015).

Internet / Web

Interventions with web-based education were conducted in Chicago with 63 Hispanic kidney patients who underwent dialysis. It was found that the internet can effectively improve the knowledge of kidney transplants. Most stated that interventions through the web could increase the patients' knowledge of kidney transplants, and so the interventions were declared feasible and accepted (Gordon et al., 2016). Another study was conducted on 436 stage 3 CKD patients randomly for 6 months by giving them an intervention in the form of providing information through the internet (interactive website) with a combination of telephone access guides. There were positive results on the patient's quality of life by 26.3% (EQ-5D), blood pressure control and their positive involvement in life (heiQ). The patients stated that they accessed the website and 62% of patients said that this intervention encouraged them to be more active in their daily activities (Blakeman et al., 2014). Other studies showed that the use of interventions with the e-mailing of information in 40 patients undergoing hemodialysis had results that were effective in terms of reducing stress levels. This was indicated by a lower level of serum cortisol and lower epinephrine results compared to the control group, in addition to increased compliance with fluid restrictions in the patients (An, 2011).

Telematics / wireless devices

Interventions were carried out on 120 patients undergoing hemodialysis with telematics measuring the weight transferred by telemetry daily to their mobile phones, which were automatically connected to e-mail. They showed there to be a significant difference in the patient's IDWG (Neumann et al., 2013). This study states that interventions with technology can be accepted for patient self-monitoring as the telematics tool has the potential to be one method to optimize IDWG and ultrafiltration (Neumann et al., 2013). Although it does not affect the IDWG, it can reduce the intake of sodium in the diet (Neumann et al., 2013). Interventions using electronic drug devices in 50 patients undergoing hemodialysis had significant results regarding the increase in cinacalcet adherence, making it possible to reduce the dose of cinacalcet and to increase the number of patients, thus reaching the target (Ong et al., 2016). The intervention with wireless blood pressure monitoring devices connected to the internet (web server) conducted in the elderly with stage 3 CKD with hypertension that was not controlled showed good results regarding their blood pressure (Rifkin et al., 2013).

M-Health (smartphones, PDAs)

Several studies evaluating interventions using smartphones/PDAs included using applications (software) (Sevick et al., 2015; Welch et al., 2013), automatic text messaging and electronic monitoring. The development of smartphones has made apps a potential tool for increasing the adherence to treatment (Santo et al., 2017). Several studies using interventions with smartphone applications have shown positive results regarding the indicators of health and self-management behavior in patients with chronic kidney disease (Cottrell et al., 2012; Cueto-Manzano et al., 2015; McGillicuddy et al., 2013). A pilot study conducted on 23 kidney transplant patients using text messaging applications and reminders that contained information on the risk factors for kidney disease, a healthy lifestyle diet and medication adherence have been reported to have the potential to influence the patients' health behavior and clinical outcomes (Cueto-Manzano et al., 2015). In another study, research conducted over 6 months in Canada with an Mhealth intervention, namely a smartphone application including data servers for information management combined with wireless blood pressure monitoring devices (with Bluetooth), on 47 stage 4 and 5 CKD patients showed good results regarding the clinical results of blood pressure monitoring and their access to care resources (Ong et al., 2016). The application allows for feedback to be sent to the service provider (via email) when the patient's clinical value is at the threshold (Welch et al., 2013).

Another randomized study of 20 kidney transplant patients for 3 months was with an intervention using a smartphone (automatic text message) combined with a blood pressure measurement device (automatically sent via Bluetooth to a cellphone) and an electronic drug tray. This showed significant results in relation to medication adherence and systolic blood pressure in the intervention group (McGillicuddy et al., 2013). An RCT study with an intervention using an automatic text messaging application that was connected to a server to deliver reminders to take their blood pressure measurements applied to 490 CKD patients showed significant results in terms of their blood pressure reduction (Ogna et al., 2014). The mHealth of electronic diet monitoring (DIMA) applications used on PDAs gave positive results regarding patient IDWG (9). Not all of the interventions with Mhealth showed significant results. Randomized research in Pennsylvania with electronic diet monitoring interventions through PDA and diet counseling with 179 patients undergoing hemodialysis stated that there were no significant differences in the IDWG changes. However, positive results were seen in the behavior related to sodium intake, although this behavior was maintained in the short term (16 weeks during the intervention) (Sevick et al., 2015).

Internet / Web

Interventions with web-based education were conducted in Chicago with 63 Hispanic kidney patients who underwent dialysis. It was found that the internet can effectively improve the knowledge of kidney transplants. Most stated that interventions through the web could increase the patients' knowledge of kidney transplants, and so the interventions were declared feasible and accepted (Gordon et al., 2016). Another study was conducted on 436 stage 3 CKD patients randomly for 6 months by giving them an intervention in the form of providing information through the internet (interactive website) with a combination of telephone access guides. There were positive results on the patient's quality of life by 26.3% (EQ-5D), blood pressure control and their positive involvement in life (heiQ). The patients stated that they accessed the website and 62% of patients said that this intervention encouraged them to be more active in their daily activities (Blakeman et al., 2014). Other studies showed that the use of interventions with the e-mailing of information in 40 patients undergoing hemodialysis had results that were effective in terms of reducing stress levels. This was indicated by a lower level of serum cortisol and lower epinephrine results compared to the control group, in addition to increased compliance with fluid restrictions in the patients (An, 2011).

Telematics / Wireless Devices

Interventions were carried out on 120 patients undergoing hemodialysis with telematics measuring the weight transferred by telemetry daily to their mobile phones, which were automatically connected to e-mail. They showed there to be a significant difference in the patient's IDWG (Neumann et al., 2013). This study states that interventions with technology can be accepted for patient self-monitoring as the telematics tool has the potential to be one method to optimize IDWG and ultrafiltration (Neumann et al., 2013). Although it does not affect the IDWG, it can reduce the intake of sodium in the diet (Neumann et al., 2013). Interventions using electronic drug devices in 50 patients undergoing hemodialysis had significant results regarding the increase in cinacalcet adherence, making it possible to reduce the dose of cinacalcet and to increase the number of patients, thus reaching the target (Ong et al., 2016). The intervention with wireless blood pressure monitoring devices connected to the internet (web server) conducted in the elderly with stage 3 CKD with hypertension that was not controlled showed good results regarding their blood pressure (Rifkin et al., 2013).

DISCUSSION

Self-management support is seen of as a priority for people with long-term health problems. The effective management of health and CKD can prevent the development of the disease and reduce the risk of the complications of cardiovascular disease(Ong et al., 2016). This review provides evidence regarding the effectiveness of IT-based interventions in the health management of CKD patients related to clinical, compliance and knowledge values. Substantial advancements in information and mobile technology, as well as the increasingly widespread mobile-health, has become a promising new alternative tool for improving health services by increasing the adherence to treatment therapy(Santo et al., 2017). Interventions using monitoring/reminders are mainly based on the principles of learning behavior(Welch et al., 2013). The techniques used in self-care programs include the use of cellphones, computer networks and web-based tools. This is very useful especially in developing countries as mobile phones have high penetration and can even reach large areas(Diamantidis & Becker, 2014).

This study provides evidence related to the short-term effectiveness (<6 months) of electronic reminder interventions in terms of improving treatment compliance in patients with chronic kidney disease (Clark-Cutaia, Ren, Hoffman, Burke, & Sevick, 2014; Gordon et al., 2016; McGillicuddy et al., 2013; Neumann et al., 2013). IT-based interventions here included a smartphone / PDA (as well as a combination with telematics), internet / web (combination with e-mail) and telematics / wireless devices (Cueto-Manzano et al., 2015; McGillicuddy et al., 2013; Neumann et al., 2013; Ong et al., 2016; Sevick et al., 2015). In this study, blood pressure and IDWG values were the clinical outcomes that were assessed and they showed significant improvements in most studies. Another outcome that was assessed was adherence to treatment, which can help in the treatment of patients with chronic kidney failure.

In several of the studies reviewed, IT-based interventions allow the providers to manage patient data remotely so then they can monitor and provide the direction needed by the patients. Telematics equipment, which allows for the direct wireless transmission of patient data to the central system, can reduce the risk of errors caused by manual entry (human error).

There are some potential limitations related to this systematic review; (1) the heterogeneity of study design and (2) this review has diversity in its results and in the interventions reviewed, so further research is needed regarding which interventions are best applied.

Based on the results of the study, the use of interventions with smartphones / PDAs can support health management, especially for medication adherence as well as clinical values of blood pressure and IDWG in patients with chronic kidney disease. Smartphone applications have the potential to overcome the complexity of non-compliance behaviors related to lifestyle with respect to complete, unique and interesting features.

CONCLUSION

IT-based interventions can be an alternative in interventions to improve the health management olf patients with chronic kidney disease. Technological advances make IT-based interventions a promising alternative but more research is needed in terms of evidence-based outcomes, especially in developing countries.

By knowing some IT-based interventions, it can be used as a consideration in terms of the alternative interventions suggested by the health providers. This study shows that IT-based interventions can improve self-management and patient empowerment as in blood pressure control, IDWG and medication compliance. IT-based interventions can therefore be used in further clinical practices, like a combination of smartphones and health devices.

REFERENCES

An, G. J. (2011). Effect of e-mail education on stress and compliance in Korean elderly on hemodialysis. *Hong Kong Journal of Nephrology, 13*(2), 68–73. https://doi.org/10.1016/j.hkjn.2011.10.002

Blakeman, T., Blickem, C., Kennedy, A., Reeves, D., Bower, P., Gaffney, H., ... Rogers, A. (2014). Effect of information and telephone-guided access to community support for people with chronic kidney disease: Randomised controlled trial. *PLoS ONE, 9*(10). https://doi.org/10.1371/journal.pone.0109135

Bonner, A., Gillespie, K., Campbell, K. L., Corones-Watkins, K., Hayes, B., Harvie, B., ... Havas, K. (2018). Evaluating the prevalence and opportunity for technology use in chronic kidney disease patients: A cross-sectional study. *BMC Nephrology, 19*(1), 4–11. https://doi.org/10.1186/s12882-018-0830-8

Chiou, C. P., & Chung, Y. C. (2012). Effectiveness of multimedia interactive patient education on knowledge, uncertainty and decision-making in patients with end-stage renal disease. *Journal of Clinical Nursing, 21*(9–10), 1223–1231. https://doi.org/10.1111/j.1365-2702.2011.03793.x

Cicolini, G., Simonetti, V., Comparcini, D., Celiberti, I., Di Nicola, M., Capasso, L. M., ... Manzoli, L. (2014). Efficacy of a nurse-led email reminder program for cardiovascular prevention risk reduction in hypertensive patients: A randomized controlled trial. *International Journal of Nursing Studies, 51*(6), 833–843. https://doi.org/10.1016/j.ijnurstu.2013.10.010

Clark-Cutaia, M. N., Ren, D., Hoffman, L. A., Burke, L. E., & Sevick, M. A. (2014). Adherence to Hemodialysis Dietary Sodium Recommendations: Influence of Patient Characteristics, Self-Efficacy, and Perceived Barriers. *Journal of Renal Nutrition, 24*(2), 92–99. https://doi.org/10.1053/j.jrn.2013.11.007

Cottrell, E., Chambers, R., & Connell, P. O. (2012). *Using simple telehealth in primary care to reduce blood pressure : a service evaluation.* https://doi.org/10.1136/bmjopen-2012-001391

Cueto-Manzano, A. M., Gallardo-Rincón, H., Martínez-Ramírez, H. R., Cortés-Sanabria, L., Rojas-Campos, E., Tapia-Conyer, R., ... Medina, M. (2015). A pilot study of a mobile phone application to improve lifestyle and adherence of patients with kidney disease. *Journal of Telemedicine and Telecare, 21*(2), 119–120. https://doi.org/10.1177/1357633X14566591

Diamantidis, C. J., & Becker, S. (2014). Health information technology (IT) to improve the care of patients with chronic kidney disease (CKD). *BMC Nephrol, 15*, 7. https://doi.org/10.1186/1471-2369-15-7

Gordon, E. J., Feinglass, J., Carney, P., Vera, K., Olivero, M., Black, A., ... Caicedo, J. C. (2016). A website intervention to increase knowledge about living kidney donation and transplantation among hispanic/latino dialysis patients. *Progress in Transplantation, 26*(1), 82–91. https://doi.org/10.1177/1526924816632124

Kim, Y., Evangelista, L. S., Phillips, L. R., Pavlish, C., & Kopple, J. D. (2010). The End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ): Testing The Psychometric Properties in Patients Receiving In-Center Hemodialysis. *Nephrology Nursing Journal, 37*(4), 377–393.

Lin, H. W., Wang, Y. J., Jing, L. F., & Chang, P. (2014). Mockup design of personal health diary app for patients with chronic kidney disease. *Studies in Health Technology and Informatics, 201*, 124–132. https://doi.org/10.3233/978-1-61499-415-2-124

McGillicuddy, J. W., Gregoski, M. J., Weiland, A. K., Rock, R. A., Brunner-Jackson, B. M., Patel, S. K., ... Treiber, F. A. (2013). Mobile Health Medication Adherence and Blood Pressure Control in Renal Transplant Recipients: A Proof-of-Concept Randomized Controlled Trial. *JMIR Research Protocols, 2*(2), e32. https://doi.org/10.2196/resprot.2633

Neumann, C. L., Wagner, F., Menne, J., Brockes, C., Schmidt-weitmann, S., Rieken, E. M., ... Schulz, E. G. (2013). *Body Weight Telemetry Is Useful to Reduce Interdialytic Weight Gain in Patients with End-Stage Renal Failure on Hemodialysis.* 480–486. https://doi.org/10.1089/tmj.2012.0188

Ogna, V. F., Pruijm, M., Zweiacker, C., Wuerzner, G., Tousset, E., & Burnier, M. (2014). *Clinical Benefits of an Adherence Monitoring Program in the Management of Secondary Hyperparathyroidism with Cinacalcet : Results of a Prospective Randomized Controlled Study Clinical Benefits of an Adherence Monitoring Program in the Management of Second.* (July 2013). https://doi.org/10.1155/2013/104892

Ong, S. W., Jassal, S. V., Miller, J. A., Porter, E. C., Cafazzo, J. A., Seto, E., ... Logan, A. G. (2016). Integrating a smartphone–based self–

management system into usual care of advanced CKD. *Clinical Journal of the American Society of Nephrology*, *11*(6), 1054–1062. https://doi.org/10.2215/CJN.10681015

Rifkin, D. E., Abdelmalek, J. A., Miracle, C. M., Low, C., Barsotti, R., Rios, P., … Agha, Z. (2013). *Linking clinic and home : a randomized , controlled clinical effectiveness trial of real-time , wireless blood pressure monitoring for older patients with kidney disease and hypertension*. 8–15. https://doi.org/10.1097/MBP.0b013e32835d126c

Santo, K., Chow, C. K., Thiagalingam, A., Rogers, K., Chalmers, J., & Redfern, J. (2017). *MEDication reminder APPs to improve medication adherence in Coronary Heart Disease (MedApp-CHD) Study : a randomised controlled trial protocol*. 1–10. https://doi.org/10.1136/bmjopen-2017-017540

Sevick, M. A., Piraino, B. M., St-jules, D. E., Hough, L. J., Hanlon, J. T., Marcum, Z. A., … Stone, R. A. (2015). *No Difference in Average Interdialytic Weight Gain Observed in a Randomized Trial With a Technology-Supported Behavioral Intervention to Reduce Dietary Sodium Intake in Adults Undergoing Maintenance Hemodialysis in the United States : Primary Outcomes of* . 1–10. https://doi.org/10.1053/j.jrn.2015.11.006

Welch, J. L., Astroth, K. S., Perkins, S. M., Johnson, C. S., Connelly, K., Siek, K. A., … Scott, L. L. (2013). Using a mobile application to self-monitor diet and fluid intake among adults receiving hemodialysis. *Research in Nursing and Health*, *36*(3), 284–298. https://doi.org/10.1002/nur.21539

Information Technology-Based Interventions for Health Care Support in Patients

ORIGINALITY REPORT

15%	13%	12%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

5%

★ onlinelibrary.wiley.com

Internet Source

Exclude quotes	Off	Exclude matches	< 10 words
Exclude bibliography	On		

Information Technology-Based Interventions for Health Care Support in Patients

GRADEMARK REPORT

FINAL GRADE

/1000

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7