

## TELEHEALTH NURSING RESEARCH: ADDING TO THE EVIDENCE-BASE FOR HEALTHCARE

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### Abstract

This paper reviews recent, nurse-led telehealth research with the goal of describing research findings that provide evidence for practice. **Methods:** Using an iterative search method, of eight electronic databases, 84 nurse-led research papers were separated into intervention research, systematic reviews and meta-analyses, and descriptive research. The main emphasis was on full text analysis of the intervention research. **Results:** Fifteen intervention research papers reported findings related to cardiovascular disease, diabetes mellitus, older age, young adults, early adolescents, children with special health care needs, people with a stoma, post-partum mothers and nurses. Also reviewed for useable evidence for practice were 10 systematic reviews, two meta-analyses and two papers that described reviews plus meta-analyses. Fifty-five papers with descriptive designs are briefly described. Nurse-led intervention research is increasing knowledge about the use of telehealth technology and applications in care delivery. People with healthcare needs do better with individual attention and increased follow-up. People have a tolerance for technology used with them to advance their quality of life and healing but there is a point at which too much technology is overwhelming. Clinical research is a challenge due to the number of extraneous variables that are difficult to control and that can affect a person's response to the research intervention. **Conclusion:** Continuation of nurse-led telehealth intervention research will help to ensure that technology used to support and advance care delivery will be evidence-based.

**Keywords:** nursing; telehealth; intervention research; evidence-based practice; review

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### Introduction

More than 20 million nurses worldwide are involved in health professions and care delivery 24/7.<sup>1</sup> Nurses have been involved with telehealth technology and applications for decades; the telephone has always been used by nurses to educate, consult with, and support patients and families. Mobile phones and digital capability have extended the reach and scope of nurses for healthcare delivery. Successful nurses use the technology that most appropriately supports their practice. Nurses' roles in the development of research-based evidence for practice should not be overlooked. Those nurses who lead randomised controlled trials or other intervention research in the telehealth environment are a small fraction of all nurses worldwide. However, these role models show how nurses can be leaders in advancing evidence-based practice. Nursing, with its ethos of holistic caring, will use research to strengthen its impact on healthcare with a growing body of evidence-based knowledge. This is all to the good for health and well-being of people worldwide.

Since late 2016, a constant search of the English language

literature has been underway for telehealth research publications that have a nurse as first author. While nurses may be listed among the author group on some articles, or they may clearly have participated in the research interventions without direct attribution, by using the nurse-as-first-author criterion nurses can be given full credit for leading the research team. Literature searches in 2016, 2017 and early 2018 found nurse-led research publications with predominantly descriptive designs that covered telehealth nursing, clinical practice, education and research.<sup>2-4</sup> These demonstrated the depth and breadth of nursing in the telehealth environment. Of 51 papers identified in 2017 plus first quarter 2018, 38 used descriptive designs and 5 described technology (apps) evaluations. Eight papers used quasi-experimental designs, resulting in some evidence for practice.<sup>4</sup> The papers represented nurses from 19 countries.

The purpose of this paper is to discuss nurse-led telehealth research from 2018 through first quarter 2019, organising the papers by design: intervention research, systematic reviews and meta-analyses, and descriptive designs. The greatest emphasis will be on intervention

research and resulting outcomes that can be used to support evidence-based practice. The goal of this work is to encourage more nurses to do intervention research, thus generating observable and measurable evidence for healthcare delivery.

**Methods**

The design for this paper is a critical analysis of nurse-led intervention research, systematic reviews and meta-analyses, and a brief discussion of the descriptive research papers found during the study period. The literature searches supporting the prior and current work are iterative. A medical librarian regularly and repeatedly reviews dozens of tables of contents of health-related publications and then forwards to this author all telehealth research publications found in the ongoing reviews. This provides a steady flow of multidisciplinary papers involving telehealth, e.g., 357 papers in 2018. We recognise that this contrasts with traditional, one-time searches that use one or several search terms and inclusion criteria with databases such as PubMed, CINAHL, PsychINFO, EMBASE, Global Health, HealthStar, ISI Web of Science and Google. However, established databases are slow to add new journals and, with PubMed, to assign MeSH subject headings to new titles. Also, the headings for different databases may overlap or be different. Further, the terms and keywords used in telehealth articles vary a great deal, e.g., tele-(specialty), eHealth, mHealth, mobile health, digital health, artificial intelligence. And, databases that use automatic term mapping make searches more difficult as the search terms are identified wherever they are in the article, making a more detailed manual search necessary after all.

**Results**

In all of 2018 through first quarter-2019, 84 nurse-led research papers from 21 countries were identified. (Table 1) Fifteen papers described intervention research, ranging from intervention-control studies to randomised controlled trials. Fourteen papers described systematic reviews and/or meta-analyses and 55 papers used descriptive research designs.

**Table 1.** Papers by country.

Australia	3	Netherlands	1
Brazil	2	New Zealand	2
Canada	5	Norway	1
China	5	Singapore	1
Denmark	1	South Korea	2
Finland	2	Spain	2
Greece	1	Sweden	4
Hong Kong	1	Switzerland	1
Iran	2	Taiwan	2
Italy	2	United Kingdom	2
		United States	42

*Intervention Research*

The 15 full-text papers were organised by research target group to lead current and future nurse researchers to their areas of interest. Research participants were as follows: those with cardiovascular disease,<sup>5-9</sup> diabetes mellitus,<sup>10,11</sup> older age;<sup>12,13</sup> those who were young adults,<sup>14</sup> early adolescents,<sup>15</sup> children with special health care needs,<sup>16</sup> people with a stoma,<sup>17</sup> post-partum mothers,<sup>18</sup> and nursing students.<sup>19</sup> Ten studies used power analysis to guide their participant recruitment.<sup>5-8,10,13,15-18</sup> Each paper’s aim(s) and findings are briefly summarised. The papers themselves must be consulted for detailed methods, care delivery or replication.

The study by Abbasi et al<sup>5</sup> used a non-randomised controlled clinical trial with 111 subjects. Their aim was to compare the effects of the self-management education programme using a multi-method approach or multimedia approach on the quality of life among patients with chronic heart failure. Findings were that the multi-method approach and multi-media approach groups had statistically significantly improved total quality of life (QOL) and knowledge compared with the control group. The multi-method approach was statistically significantly more effective than multimedia in terms of increasing QOL and self-efficacy in the knowledge domain.

Dadosky et al<sup>6</sup> used a prospective nonrandomised trial design comparing a historical control group that had received standard care with a prospective intervention group receiving standard care plus tele-management. Their aim was to investigate whether tele-management of heart failure patients throughout the post-acute continuum of care would reduce rehospitalisation rates and improve patient self-care knowledge and satisfaction. Patients who were re-admitted within the tele-management group had significantly higher cardiac ejection fractions and significantly higher Centre for Outcomes Research Evaluation scores predicting rehospitalisation risk compared with the historical group. Clinically significant findings were noted for risk reduction in time to intervention for the tele-management group.

Ghezeljeh et al<sup>7</sup> completed a randomised clinical trial with control group among people with hypertension (HTN). The aim was to compare the effects of self-management (SM) education using telephone follow-up and smartphone-based social networking follow-up on SM behaviours among patients with HTN. Six weeks after the intervention, there were statistically significant findings. Participants in the telephone and smartphone social networking follow-up groups had statistically significant differences in SM behaviours compared to the control group and the group without follow-up. The telephone and smartphone social networking groups were not significantly different in the effectiveness of the SM education.

Mols et al<sup>8</sup> used a single-centre, prospective, randomised controlled design to assess the 30-day impact of a nurse-led telephone follow-up performed 2 to 5 days after same-day discharge following percutaneous coronary intervention

pathways. No differences were found between the groups in terms of adherence to platelet inhibitors or aspirin regimens. The portion of patients readmitted, the self-initiated contacts to general practitioners and the knowledge of how to manage symptoms of angina were all significantly lower in the intervention group when compared to the control group. Carrying out healthy physical activity was significantly higher in the intervention group.

Ni et al<sup>9</sup> used an exploratory randomised controlled trial to evaluate the feasibility of using mHealth (WeChat and BB Reminder) as a tool to assist people with coronary heart disease to take their cardio-protective medications. While medication adherence increased at the 30-day follow-up for both groups, the intervention group had a greater increase but these changes were not significant. Changes in blood pressure were not significantly different but heart rate significantly decreased at 30 days in the control group.

Two intervention studies targeted people with diabetes. The study by Kotsani et al<sup>10</sup> used a randomised controlled design to evaluate the efficacy of telenursing on the frequency of glucose measurements and the improvement of blood glucose variation in young type 1 diabetic adults (age 18-39). The researchers found a significant improvement in the glucose concentrations in the management group in month 1; the mean morning glucose concentration in month 3 were also significantly lower in the intervention group. In month 2 the difference was not significant. Also, the pre-prandial glucose concentration were significantly lower in the control group than the intervention group in months 1 and 3. The changes in HbA1c were not significant.

Mott et al<sup>11</sup> reported a study of adults with type 2 diabetes undergoing a surgical intervention. The aim of the study was to develop, implement and evaluate a nurse-led telehealth preoperative intervention to improve glycaemic control prior to surgery. On the day of surgery, a fasting glucose was drawn; there were no significant differences between the usual care group and the telephone intervention group. An interesting finding was that 4 of the 25 participants in the intervention group decided to postpone their surgery, possibly because the education and knowledge from the phone call made them realise their glycaemic control should be improved before a surgical procedure.

Two intervention studies involving older people were found. Bakas et al<sup>12</sup> used a quasi-experimental design to test the feasibility of a new programme, the Telehealth Community Health Assistance Team (T-Chat), a nurse-led intervention delivered through a telepresence robot designed to promote chronic disease self-management and healthy independent living among older adults. The primary outcome of the study was unhealthy days based on 2 items in the post-intervention interview and data collection. Depressive symptoms, other symptoms (e.g., fatigue, pain, stress, sleep), aerobic activity, cognitive ability and quality of life were also measured. Trends in positive directions could be seen in the data. For example, the T-CHAT group, in comparison with

the wait list control group showed medium to large improvements in unhealthy days and there was a moderate improvement in depressive symptoms favouring the T-CHAT group.

The aim of the quasi-experimental study by Santana et al<sup>13</sup> was to compare the effectiveness of telephone versus conventional follow-up in post-surgical older adult patients. The study hypothesis was that the intervention would improve patients' autonomy for self-care and surgical recovery. Findings were that the patients in the control group showed significantly increased time for surgical recovery and patients in the intervention group had significantly less impaired mobility, need for assistance for self-care, fatigue and time required for recuperation.

Côté et al<sup>14</sup> used an experimental design to evaluate the efficacy of a web-based tailored intervention with the aim of reducing cannabis use among young people (18-24 years) by promoting a more positive intention to abstain. Findings were that a higher proportion of participants in the experimental group reduced their cannabis use compared with the control group. There was also a significant intention in the experimental group to abstain over time and intention increased significantly in the experimental group but stayed stable for the control group.

Parisod et al<sup>15</sup> used a single-blinded, 3-armed cluster randomised trial to study tobacco-related health literacy among early adolescents (10-13 years). The study aim was to determine the short-term effectiveness of the tobacco-related mobile health game *Fume* and a non-gamified website in comparison with a no-intervention control group. No statistical significance was found in anti-smoking self-efficacy between the groups after the intervention nor were there differences in the five other outcome variables: smoking outcome expectations, attitudes towards tobacco use, motives to use tobacco, motivation to decline tobacco in the future, and knowledge about tobacco. However, the health game group visited *Fume* significantly more frequently than the early adolescents in the website group and *Fume* raised more interest than the website. The authors noted that self-efficacy scores among the early adolescents were high already at baseline and may have hindered favourable results, statistically.

Hooshmand and Foronda<sup>16</sup> used a prospective, quasi-experimental design to examine cost, caring, and family-centred care (FCC) from the family perspective in relationship to paediatric specialty services integrating telemedicine (TM) visits compared to traditional face-to-face visits for children with special care needs (CSHCN) in rural, remote and medically underserved areas. There was no difference between the groups on the perception of the care their CSHCN received or their perception of healthcare providers as caring. Significant differences between groups were found on perception of the system of care as family-centred between the traditional and telemedicine groups, with the TM group having significantly higher scores on all

six facets of the FCC measure. Costs were not significantly different between groups except if the CHSCN needed care by specialists who were not in the local clinic; then the costs for the traditional care group were significantly higher.

Wang et al<sup>17</sup> used a randomised controlled trial to assess the effectiveness of the follow-up care enhanced with a home care mobile app on the psychosocial adjustment, self-efficacy and stoma-related complications of discharged from hospital patients with stomas. Findings were that both groups had improved psychosocial adjustment over time but the intervention group had significantly greater increase in improvement in psychosocial adjustment at 1, 3, and 6-months over the control group. Similarly, the intervention group had significantly higher stoma self-efficacy than the control group at 1, 3 and 6-months after discharge. The intervention group had a lower incidence rate of stoma complications but the differences were not statistically significant.

Harris-Luna and Badr<sup>18</sup> used a pragmatic research design to evaluate the effectiveness of a breastfeeding telephone support intervention delivered by *promotoras* (lay healthcare workers) to increase exclusive breast feeding (EBF) rates among Hispanic women at 12 weeks after birth. A pragmatic trial was described as taking place in the setting where individuals already receive their usual clinical care with trained research staff responsible for recruitment and data collection to maximise applicability and generalisability. Findings were that at 12 weeks after birth, significantly more women in the intervention group than control group were continuing EBF. Perceived breastfeeding support, lower household income, *promotora* breastfeeding telephone support and higher self-efficacy scores all significantly predicted breastfeeding at 12 weeks after birth.

Liu et al<sup>19</sup> used a retrospective, historical control group design to evaluate the effectiveness of platform-based emergency department (ED) training of nurses compared with the same nurses who received their continuing education programme in conventional classroom settings during the prior year. The number of nurses completing the training significantly increased over the previous year (from 60% to 100%) and the examination scores were also significantly improved in the intervention group.

#### *Systematic Reviews and Meta-analyses*

Fourteen reviews (systematic or integrative) and meta-analyses were found in this literature review: 10 systematic/integrative,<sup>20-29</sup> two meta-analyses,<sup>30,31</sup> and two combined.<sup>32,33</sup> Traditional search methods were used with hundreds, if not thousands, of citations first found, with a range of 66<sup>31</sup> to 14,292.<sup>32</sup> Years covered by the searches ranged from 1<sup>24</sup> to 28,<sup>32</sup> with two papers<sup>26,30</sup> noting 'inception to' or 'up to' (current year) and two papers<sup>23,31</sup> not noting the range in years. The papers evaluated by the 14 studies ranged from 5 (of 185)<sup>29</sup> to 70 (of 3622).<sup>21</sup>

Topics addressed in these papers were cardiovascular disease,<sup>27,29,32,33</sup> cancer,<sup>23,31</sup> chronic disease,<sup>21,25</sup> chronic

obstructive pulmonary disease,<sup>30</sup> teledermoscopy,<sup>20</sup> follow-up after discharge,<sup>28</sup> nurses,<sup>22</sup> apps for quality improvement,<sup>24</sup> and physical activity in elders.<sup>26</sup>

A study by Jin et al<sup>32</sup> reported a significant finding, that being telehealth significantly improved cardiovascular risk factors. Rush et al<sup>25</sup> reported virtual education delivered to patients with chronic diseases was comparable or more effective than usual care. More commonly, authors noted that the studies showed lack of homogeneity,<sup>21,22,31</sup> methodological inconsistencies or limitations,<sup>23</sup> variable quality,<sup>24,29,33</sup> lack of studies,<sup>26</sup> or limited evidence.<sup>20,27,28,30</sup>

#### *Descriptive Research*

Of the 55 descriptive research papers, 28 reported studies of availability, acceptability, perceptions, and attitudes of the study targets (patients, people in various age groups, people with various diseases, caregivers in the home or community, and nurses). This set consisted of 12 papers targeting people with diseases or conditions.<sup>34-45</sup> Seven papers looked at nurses or nursing students.<sup>46-52</sup> Four papers were about maternal-child issues.<sup>53-56</sup> Three papers looked at elders or homecare,<sup>57-59</sup> and two papers looked at care in limited resource settings.<sup>60,61</sup>

The second largest set (11) described studies of apps or mHealth applications used for a particular treatment need. Four papers dealt with cardiovascular issues.<sup>62-65</sup> Three papers were in oncology settings.<sup>66-68</sup> The last four papers addressed single topics: post-operative monitoring,<sup>69</sup> e-outpatient visits,<sup>70</sup> parenting,<sup>71</sup> and eICU.<sup>72</sup>

Six studies described development, testing and evaluation of apps for care delivery.<sup>73-78</sup> Four studies described the use of modelling or other predictive strategies for assessing risks or outcomes.<sup>79-82</sup> Four studies described the use of digital learning, simulation or social media for learning and communication among nurses,<sup>83-86</sup> and two papers addressed telehealth policy and standards.<sup>87,88</sup>

## Discussion

The studies found with this literature review show many areas of interest among telehealth nurses. The topics indicate that nurses want to know more about the who, what, when, why and how of integrating telehealth applications into care delivery and education.

Evidence-based knowledge can be drawn from the results of the intervention studies. Patients or people with healthcare needs do better with individual attention and longer than usual follow-up using phones or mHealth applications.<sup>7,8,10,13,17,18</sup> However, people may be overwhelmed with too much technology given to them at one time.<sup>5</sup> Phone or mHealth follow-up can be a useful adjunct to traditional education for self-management of chronic disease.<sup>7</sup> Nurse-learners preferred mixed methods. Self-directed online learning was not seen as sufficient and may not have accurately reflected the learner's participation.<sup>19</sup> On the other hand, a web-based tailored intervention reduced

cannabis use among 18 to 24-year-olds and increased their intention to abstain over time.<sup>14</sup> And, early adolescents (10-13-year-olds) are willing to participate in education with gaming and digital education applications for tobacco-related health literacy.<sup>15</sup> Cost of care is a consideration; parents with local access to specialty care via telehealth for their children perceive their care as better.<sup>16</sup>

Clinical research, and thus evidence accumulation, is a challenge, given countless extraneous variables that can affect the person's response to an intervention.<sup>6,11,12</sup> Historic data used as a study's control may lack reliability due to missing or unusable data.<sup>6</sup> Adequate sample size and study duration, attentive management of the control group, and minimal study complexity are essential to successful research.<sup>11,12</sup> Pre-programming and automating mHealth applications could facilitate scaling up the sample size and study duration.<sup>9</sup>

What can be learned from the 14 systematic reviews and meta-analyses? The answer, unfortunately, is 'not much.' It may be that systematic reviews and meta-analyses would be best used to bring together all that is known about a specialty or setting. This endeavour could include anecdotal reports, editorials, opinion pieces, economic analyses, quality and process improvement reports, education programme descriptions, historical information and research reports. Until research itself becomes more programme-driven with consistent terminology, measurement tools, interventions and reporting templates, large research reviews are not contributing to the evidence base for practice. The World Health Organization is making a commitment to bringing the digital era to healthcare worldwide and looks to structured systems for data collection, aggregation and analysis. Its MAPS toolkit is one example: mHealth assessment and planning for scale.<sup>89</sup>

Descriptive research findings can establish a basic foundation for programmes of research that can continue toward controlled trials to build knowledge and advance practice. Descriptive studies can also help nurses new to research to learn the process and understand the benefits, barriers and challenges of achieving reliable methods and producing valid results. Most telehealth nursing research involves human beings. Researchers would most likely agree that human subjects' research is difficult due to concern for ethical treatment of the subjects and also to the countless extraneous variables that can diminish the goodness of research results. That said, it is important, if not imperative, that nurse-led research uses intervention studies that generate reliable and valid evidence for practice.

One limitation of this paper is that only English language papers were reviewed. More nurse-led telehealth research has surely been published in other languages. A second limitation is the way that authors are identified in publications; if only the author's name or name plus practice environment are listed some nurse-led research may have been missed.

The main recommendation drawn from this work is that telehealth nurse researchers must continue to lead intervention studies with large, randomised controlled designs wherein, insofar as possible, all extraneous variables are controlled. With telehealth technology and applications rapidly transforming from optional nice-to-have technologies and applications to being integrated with the healthcare infrastructure,<sup>90</sup> nurses know that evidence-based telehealth applications are essential to the capacity of care delivery and quality of care outcomes for people with health needs, their families and their communities.

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