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## EFFECTIVENESS OF A TELEHEALTH AND TELE CARE LEARNING RESOURCE WITHIN AN UNDERGRADUATE NURSING CURRICULUM

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### Abstract

This paper discusses the impact of a telehealth and telecare eLearning resource on a cohort of undergraduate nursing students in the United Kingdom. The resource was designed to raise awareness of telehealth and telecare applications, and to introduce learners to some of the drivers, challenges and research evidence associated with these interventions.

**Methods:** Questionnaires were constructed that explored students' views on the resource itself, and on their knowledge of, and attitudes towards, telehealth and telecare. Both questionnaires included a 5-point Likert scale containing items linked to knowledge, awareness and opinions of telehealth and telecare. A pre-resource questionnaire provided a baseline measure that was compared subsequently with results from a post-resource questionnaire to identify the impact of completing the learning.

**Results:** 104 students completed the learning resource. 51 students (49%) completed either the pre- or post-course questionnaire, with 44 (42%) completing both questionnaires. Feedback from students suggested high levels of satisfaction with the quality and utility of the resource. Responses to items in the knowledge and attitudes Likert scale were analysed primarily using non-parametric tests to identify any changes in responses before and after completing the resource. Wilcoxon signed-rank testing demonstrated statistically significant changes in responses in all but one of the Likert items, suggesting an increase in students' positive attitudes towards telehealth and telecare and their knowledge related to the topic.

**Conclusions:** The research suggests that pre-registration nursing students value the opportunity to learn more about telehealth and telecare, and that a well-designed resource can increase awareness and knowledge.

**Keywords:** telehealth; eHealth; nursing informatics; education; nursing.

### Introduction

Providers of health and social care are facing a challenging combination of an aging population, increased prevalence of long-term conditions and, in some countries, restrictions on public sector spending. The pressures on service delivery resulting from these factors have led healthcare providers to seek new and innovative methods to provide care. Telehealth and telecare are two such innovations.

Telecare is the use of technology to remotely support independence and enhance safety. Often seen as a subset of 'assistive technology', telecare applications include the provision of emergency personal alarms, fall detectors and environmental (e.g. smoke, carbon monoxide) alarms, all with the back-up of call centre support.<sup>1</sup> The terminology of telehealth is more complex. It is often used synonymously with telemonitoring and telemedicine, even though these represent more specific applications. In addition, there are a plethora of terms describing the use of technology in healthcare, such as eHealth, mHealth and digital health. For the purposes of this paper, telehealth will serve as an 'umbrella' term, encompassing any use of technology to remotely support healthcare or promote well-being.<sup>2</sup>

Given that telehealth and telecare are becoming more commonplace modalities for delivering care, there is recognition that the nursing workforce needs to be prepared properly to actively develop and deliver care pathways that include remote care technologies.<sup>3,4</sup> In the case of telehealth and telecare, a gap in the skill set of many nurses has been identified through previous qualitative and quantitative studies. For example, Carter and colleagues explored the views of nurses in Canada, finding that there was general agreement that newly-qualified nurses were not equipped with the

skills and knowledge necessary for using telehealth.<sup>5</sup> Efforts have been made to address these gaps. Gallagher-Lepak and colleagues describe embedding telehealth education into undergraduate nursing programmes,<sup>6</sup> whilst other authors discuss the use of educational interventions for registered nurses already delivering care via telehealth.<sup>7</sup>

In other areas of healthcare, there have been reports of telehealth and telecare education being integrated with 'traditional' curricula. Delivery of a four week elective resource for medical students, focused on the use of 'telemedicine', has been described.<sup>8</sup> The module included both practical and theoretical components and proved popular with students. In relation to post-graduate continuing professional development, provision of telehealth-focussed courses has been reported from Norway, Finland, Spain and Brazil.<sup>9</sup>

This study sought to explore the impact of a telehealth and telecare learning resource on the knowledge and attitudes of undergraduate, pre-registration nursing students. The study took place in the United Kingdom (UK), where standards for nurse education are governed by the Nursing and Midwifery Council (NMC). Though there is no explicit necessity for student nurses in the UK to be aware of telehealth and telecare, there is an expectation that by the point of registration, they will be able to "...practise safely by being aware of the correct use, limitations and hazards of common interventions, including nursing activities, treatments, and the use of medical devices and equipment...".<sup>10</sup> It therefore seems reasonable to argue that pre-registration nursing curricula should include content related to innovative services such as telehealth and telecare.

## Methods

The sample was a cohort of undergraduate student nurses from a University in the North of England. All students were studying in the adult field of practice (as opposed to child, mental health or learning disabilities), were in the final few months of their second year (total course duration is three years) and had just started a generic adult nursing module. The cohort numbered 104 students in total.

The learning resource introduced as part of the study was a standalone eLearning course developed by a

number of partners, including a private online learning provider, a statutory body within the National Health Service and two Universities. The resource was developed to raise awareness of telehealth and telecare across the broad health and social care communities. It had been piloted by a number of individual health and social care practitioners, but had not previously been integrated into any nursing curricula. For the purposes of the study, the resource was accessible by students online and free of charge. The resource was developed primarily for practitioners working within health and social care, but was not focused specifically on the role of nurses. Contents of the resource included a description of drivers for telehealth and telecare, an overview of the evidence base and a number of case studies (including videos) outlining the user experience. The resource could be completed in stages (rather than a single sitting); with the total time commitment required approximately three hours. Further information on the resource is available at <http://www.virtual-college.co.uk/products/telecare-telehealth.aspx>.

Directed study time was provided for students to complete the learning resource (outside the classroom) as part of the module timetable. Completion of the resource was a compulsory part of the module, but participation in the related research was entirely voluntary. Approval for the project was granted by the Faculty of Health and Social Care Ethics Committee at the University of Hull.

Students were introduced to the resource via a short face-to-face classroom presentation by the project investigator. Students who wished to participate were asked to complete a questionnaire prior to completing the learning resource and a second questionnaire after completion of the resource. Completion of questionnaires was assumed to indicate consent to participate in the research.

Both questionnaires included an identical Likert tool, utilising a five-point scale (Strongly Agree, Agree, Neither Agree or Disagree, Disagree, Strongly Disagree) and eight items for students to respond to. The statements addressed knowledge of (e.g. "I understand what is meant by the term 'telehealth'") and attitudes towards (e.g. "Many people will not want to use technology in their own homes") telehealth and

telecare. Four of the statements were ‘positively’ worded (i.e. suggesting knowledge of, or a positive attitude towards, telehealth and telecare) and four were ‘negatively’ worded. The purpose of including this mixture of positively and negatively worded items was to reduce the impact of response acquiescence bias.<sup>11</sup>

In addition, the post-resource questionnaire included a Likert scale containing eight additional items related to students’ opinions of the learning resource itself. Again, this evaluation scale included a mixture of positively and negatively framed questions to reduce the impact of acquiescence bias. During their development, both Likert scales were peer-reviewed by academics with telehealth and telecare knowledge and experience to enhance content validity.<sup>12</sup>

### Data analysis

Responses to Likert statements were entered into SPSS version 19,<sup>13</sup> with scores attached to responses to reflect the level of positivity. For example, in a positive statements such as “I have a good understanding of how technology can help people live more independently”, a response of ‘Strongly Agree’ was scored as 5; a response of ‘Agree’ was scored a 4, and so on. Responses to negative statement were scored using a mirror-image system (i.e. ‘Strongly Agree’=1; ‘Agree’=2; etc.)

For primary analysis, Likert scale data were viewed as ordinal, as is generally considered good statistical practice.<sup>14</sup> Overall responses to individual statements were summarised in relation to frequencies and the median score. Non-parametric testing (specifically, the Wilcoxon signed-rank test) was carried out to identify whether there had been perceived changes in knowledge or attitudes after completing the resource.

The null hypothesis was that there would be no significant differences in students’ responses to statements before and after completion of the module. Responses to statements regarding students’ perceptions of the module were described in relation to the frequency of each response.

### Results

A total of 104 students (100% of the cohort) completed the learning resource, of whom 51 (49%)

completed at least one of the research questionnaires. Forty-two percent of those students who completed the learning resource returned both pre and post-resource questionnaires; before-and-after analyses were carried out with this sample (n=44).

Median scores for responses to before-and-after statements related to knowledge and attitudes were calculated. There was an increase in median score for responses to the statements “I have a good understanding of how technology can help people live more independently” (median increased from 4 before completing the resource to 5 afterwards); “Many people will not want to use technology in their own homes” (median increased from 3 to 4); “I know enough about telehealth and telecare to recommend it to people who I care for” (2 to 4) and “Telehealth and telecare will be an important element of care delivery in the future (4 to 5).

The Wilcoxon signed-rank test was used to compare differences in responses before and after, with the null hypothesis being that there would be no significant difference. The null hypothesis was rejected in relation to all statements except “I’m not particularly interested in finding out any more about telehealth and telecare” which saw a non-significant change ( $z=-0.393$ ;  $p=0.695$ ). In all other statements, a statistically significant ‘positive’ shift in responses was seen. The smallest (but still statistically significant) changes were seen in response to “People will not want technology in their own homes” ( $z=-2.736$ ;  $p=0.006$ ) and “Technology will be used to cut jobs and save money” ( $z=-3.403$ ;  $p=0.001$ ). The largest effect was seen in relation to the statement “I know enough to recommend telehealth and telecare to people who I care for” ( $z=-5.436$ ;  $p<0.001$ ). Median scores and Wilcoxon signed-rank test results for all Likert items are summarised in table 1.

To triangulate findings, a secondary analysis was carried out using the mean sum of Likert responses before and after the learning resource to identify any change. There is controversy regarding the use of parametric testing in relation to Likert scale data. At one end of the argument it is suggested that parametric testing should never be used for Likert scale data.<sup>14</sup> Conversely, others argue that standard parametric tests are robust enough to give reliable findings related to

Likert data, even with small sample sizes and without normal distribution.<sup>15</sup> Carifio and Perla suggest a ‘middle way’ in which parametric testing of the sums of Likert items (as opposed to testing of individual items) is appropriate.<sup>16</sup> This was the approach selected for triangulation of findings. Again, the null hypothesis was that there would be no statistically significant difference in mean sums. The mean sum pre-course was 27; mean post-course sum was 33. This

difference was statistically significant (paired t-test;  $t=11.125$ ;  $p<0.001$ ). The means for individual items (pre and post course) are described (but not analysed) in table 1.

Forty-one students completed the Likert scale exploring their views of the learning resource itself in the post-course questionnaire. The responses to items are summarised in table 2.

**Table 1.** Median and mean scores of pre and post course questionnaire assessment. Statistical analysis by Wilcoxon signed-rank test ( \*  $p<0.001$ , \*\* $p<0.01$ ).

Likert Item	Median score (pre-course) (n=44)	Median score (post-course) (n=44)		Mean score (pre-course) (n=44)	Mean score (post-course) (n=44)
I understand what is meant by the term ‘telehealth’	4	4*		3.5	4.4
I have a good understanding of how technology can help people live more independently	4	5*		3.6	4.5
I’m not particularly interested in finding out any more about telehealth and telecare	4	4		4.1	4.1
Many people will not want to use technology in their own homes	3	4**		3.2	3.6
I do not really understand the term ‘telecare’	4	4*		3.4	4.3
I know enough about telehealth and telecare to recommend it to people who I care for	2	4*		2.2	3.9
Technology will just be used to cut jobs and save money	3	4*		3.3	3.7
Telehealth and telecare will be an important element of care delivery in the future	4	5*		3.9	4.5

**Table 2.** Responses to Likert statements related to satisfaction with the learning resource.

	<b>Strongly Agree (%)</b>	<b>Agree (%)</b>	<b>Neither agree nor disagree (%)</b>	<b>Disagree (%)</b>	<b>Strongly disagree (%)</b>
I enjoyed the course	19.5	68.3	4.9	7.3	0
The presentation of the content didn't really fit with my preferred learning style	2.4	14.6	31.7	39.0	12.2
I thought that the level of the course content was a bit too easy	0	24.4	29.3	43.9	2.4
I would recommend this course to my colleagues	17.1	63.4	12.2	7.3	0
The course was a bit boring	2.4	19.5	19.5	48.8	9.8
I understand much more about telehealth and telecare following the course	53.7	41.5	2.4	2.4	0
The assessment tasks were too difficult	0	2.5	22.5	55.0	20.0
I would really like to learn more about telehealth and telecare	14.6	65.9	17.1	2.4	0

## Discussion

The study has demonstrated that student nurses gave broadly positive feedback about the use of an online learning resource focused on telehealth and telecare. A large majority of respondents (over 80%) agreed or strongly agreed with positively worded Likert items related to enjoying the course, having an increased knowledge of telehealth and telecare, and recommending the course to others. However, some more negative views were also apparent, with a minority of participants agreeing with the statements that "...the level of the course content was a bit easy" (25%) and "The course was a bit boring" (22%). The positive attitude of students reflects not only previous work that suggests students are enthusiastic about embarking on learning related to new technologies,<sup>8</sup> but also the effectiveness of online learning generally. Previous studies of the utilisation of online learning

resources for nurses have shown similar levels of satisfaction amongst participants.<sup>17,18</sup>

Tellingly, the generally positive view of participants towards the resource itself is supported by the impact on knowledge and attitudes towards telehealth and telecare. In seven of the eight Likert items, there was a statistically significant change between pre and post responses.

The largest changes between pre and post resource response were seen in those items related to the development of knowledge in the area of telehealth and telecare (e.g. "I understand what is meant by the term 'telehealth'"). This suggests that the baseline knowledge of participants, or at least their perception of their baseline knowledge, was low. This resonates with previous studies that have identified a dearth of information related to telehealth and telecare in health curricula<sup>8</sup> and a lack of knowledge amongst nurses –



from newly qualified through to experienced practitioners - about these modalities of care.<sup>5,19</sup>

Previous studies have supported the finding that online learning resources can increase knowledge of telehealth and telecare. Gallagher-Lepak and colleagues embedded telehealth content into pre-registration nursing programs across five campuses in the United States, resulting in an increase in skills and knowledge of informatics in students.<sup>6</sup> Other authors have described the design and delivery of educational interventions for registered nurses to enhance the use of telehealth for carrying out pre-operative and oncology assessments. The intervention was well received and participants reported improvements in their knowledge and practice.<sup>7</sup> Outside nursing, it has been demonstrated that a telemedicine elective for medical students can increase awareness and knowledge of remote care technologies, and provide a useful adjunct to the standard medical curriculum.<sup>5</sup>

Those Likert items that reflected attitudes rather than knowledge also demonstrated statistically significant changes, but the effect of the resource was smaller. This suggests that though it may be relatively straightforward to increase awareness and knowledge of telehealth and telecare, changing some attitudes may be more challenging. For example, baseline attitudes and resource effect were less positive in relation to the Likert item “Telehealth and Telecare will be used to cut costs and save money.” This supports the findings of previous work in this area. Nkosi and colleagues explored the attitudes of post-basic nursing students towards information technology in practice. Though attitudes were largely positive, their data suggested some areas of doubt amongst respondents – notably, over one-third of respondents agreed that “The more computers in an institution, the fewer jobs for employees.”<sup>20</sup>

The only Likert item in which there was no significant change (indeed, there was a non-significant negative change) was the statement in relation to the students’ interest in finding out more about telehealth and telecare. Despite the resource seemingly not whetting the students’ appetite for more information, it should be recognised that the score for this statement was highly positive both before and afterwards (median of 4; mean of 4.14 pre and 4.09 post), suggesting a

general feeling that more information would be useful.

The study has a number of limitations. A relatively small sample was recruited and the response rate (for both questionnaires) was only 42%. In addition, one cohort of undergraduate nurses in a single University was studied, making the generalizability of findings questionable. The chosen methodology leaves findings open to self-selection bias. The Likert scale was simplistic in design, providing only a superficial understanding of students’ knowledge and attitudes. Finally, there was no exploration of whether views on telehealth and telecare were associated with demographic factors.

## Conclusions

Nurses are the largest part of the healthcare workforce, so it is important that they are properly prepared to work with new innovations in care delivery. This study suggests that embedding an eLearning resource into a pre-registration nursing curriculum can prove popular with students and have a significant impact on their knowledge of, and attitudes towards, telehealth and telecare.

Further work is required to explore the attitudes of the nurses towards telehealth and telecare and identify the optimal methods for educating the workforce about new and innovative methods of providing care.

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**Conflict of Interest.** The author declares no conflict of interest.

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