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ORIGINAL ARTICLE

Effectiveness of a Nurse-Led Educational Programme on Telemedicine Knowledge among Nursing Students in Dhaka.

Chinna Chadayan . N[1]*, Melba Sahaya Sweety. D[2]

[1] Enam Nursing College, Dhaka, Bangladesh
[2] Enam Nursing College, Dhaka, Bangladesh
* Corresponding Author: chinnachadayan.n@gmail.com

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ABSTRACT

Introduction: *Telemedicine is transforming healthcare delivery, especially in underserved regions, by increasing access to care. Nursing students' knowledge of telemedicine is essential for preparing them for the evolving healthcare landscape.* ***Objectives:*** *This study aimed to assess the effectiveness of a nurse-led educational program in enhancing nursing students' knowledge of telemedicine in Dhaka, Bangladesh.* ***Methods****: A quasi-experimental pre-test and post-test design was used with 40 nursing students who had no prior formal education in telemedicine. The intervention consisted of a 2-hour interactive session covering key concepts of telemedicine. Knowledge levels were measured using pre-test and post-test questionnaires. Data analysis involved paired t-tests to evaluate knowledge improvements.* ***Results:*** *Pre-test findings showed 67.5% of students had poor knowledge of telemedicine. After the intervention, 57.5% of students scored in the "Excellent" range, and only 2.5% scored in the "Poor" range. A paired t-test showed a significant increase in knowledge ($p < 0.05$).* ***Conclusions****: The nurse-led educational program significantly improved nursing students' knowledge of telemedicine. Age and gender were significant factors influencing knowledge scores, with older students and females performing better. The study recommends integrating telemedicine into nursing curricula to prepare future healthcare professionals.*

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A. Introduction

Telemedicine, which refers to the provision of healthcare services through electronic communication and ICT, is revolutionizing healthcare by overcoming geographical barriers and improving accessibility to medical care. The term "telemedicine" combines the Greek word "tele" (distance) and the Latin "mederi" (to heal) to describe the practice of delivering healthcare services remotely, a concept that has been particularly significant during the COVID-19 pandemic (Shabeer, 2013). In countries like India and Bangladesh, where large portions of the population live in rural or underserved areas, telemedicine has emerged as a crucial tool in bridging the healthcare gap. In India, the government's introduction of platforms like e-Sanjeevani has enhanced access to healthcare, with millions of consultations taking place remotely, particularly in rural areas where healthcare infrastructure is often inadequate (Kanwar, 2020; Ashwin, 2020).

Telenursing, a subset of telemedicine, involves the provision of nursing care and support remotely through telecommunication technologies, enabling nurses to assess, monitor, and advise patients without direct physical contact (M V et al., 2023). This approach has proven particularly valuable in managing chronic conditions and delivering healthcare in rural or underserved areas, improving patient outcomes while reducing the risk of infection (Shinde et al., 2017).

Bangladesh, with a population of over 160 million, faces similar healthcare challenges, especially in its rural regions where healthcare facilities are limited. According to a report from the Bangladesh Ministry of Health and Family Welfare, around 68% of the population resides in rural areas, often with limited access to specialized healthcare services (Ministry of Health and Family Welfare, 2022). Telemedicine is increasingly being seen as an effective means to address these challenges by enabling access to quality healthcare services, particularly for chronic disease management, mental health support, and emergency consultations. Telemedicine services have gained significant traction in Bangladesh, with government-backed initiatives and collaborations with private healthcare providers playing a key role in expanding these services across the country (Bangladesh Telemedicine Society, 2021).

Telemedicine includes a variety of services such as teleconsultation, remote monitoring, and tele-nursing, which have proven invaluable in ensuring continuous care while minimizing the risk of infection (Biswas, 2022; Shinde et al., 2017). Nurses, as frontline healthcare providers, play an integral role in this system, and their knowledge of telemedicine is essential for providing effective care. The integration of telemedicine into nursing practice is therefore a crucial step in modernizing healthcare delivery (David, 2018). As the healthcare landscape evolves, structured educational initiatives like teaching programs on telemedicine are essential to enhance knowledge among healthcare providers, particularly nursing students, equipping them with the necessary skills to operate in a technology-driven environment (Bhawna, 2023; Vijayalaksmi et al., 2020).

This study aims to assess the effectiveness of a structured teaching program on nursing students' knowledge regarding telemedicine in Dhaka, recognizing the importance of preparing future healthcare professionals to utilize telemedicine for improved patient care outcomes (Sankhe & Lal, 2023; Anju et al., 2023). Therefore, this study was conducted to evaluate the effectiveness of a nurse-led educational programme in improving telemedicine knowledge among nursing students at a selected college in Dhaka, Bangladesh. The findings are expected to inform future curriculum development and support the integration of telemedicine competencies into nursing education.

B. Methods

This study employed a quasi-experimental, one-group pre-test and post-test design to evaluate the effectiveness of a nurse-led educational programme in enhancing nursing students' knowledge of telemedicine. The study was conducted at a selected nursing college in Dhaka, Bangladesh. A total of 40 nursing students were recruited using simple random sampling. Eligibility criteria included students without prior formal education in telemedicine and those who consented to participate voluntarily. Students with prior exposure to telemedicine training were excluded.

The educational intervention consisted of a two-hour interactive teaching session led by a nurse educator. The session covered key aspects of telemedicine, including its definition, applications, communication technologies, ethical concerns, and implementation challenges. The instructional method included lectures supported by multimedia presentations to facilitate student engagement and understanding.

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To measure knowledge levels, a structured questionnaire was administered immediately before and after the intervention. In addition to knowledge items, the questionnaire collected socio-demographic data such as age, gender, family income, and previous exposure to telemedicine-related information.

Data were analysed using SPSS. Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarise demographic data and knowledge scores. A paired t-test was employed to determine the significance of changes in knowledge scores from pre-test to post-test. One-way analysis of variance (ANOVA) was also conducted to examine differences in knowledge scores based on demographic variables. Statistical significance was set at $p < 0.05$.

C. Results and Discussion

The findings of this study are presented in three key sections: participants' socio-demographic characteristics, pre- and post-intervention knowledge scores, and the relationship between demographic variables and telemedicine knowledge. The results indicate that the nurse-led educational programme produced a notable improvement in nursing students' knowledge of telemedicine, with significant differences observed between pre-test and post-test scores.

Table 1: Distribution of Samples According to Socio-Demographic Variables

Demographic Variable	Category	Frequency (n)	Percentage (%)
1. Age	20-22 years	25	62.5%
	23-25 years	15	37.5%
2. Gender	Male	10	25%
	Female	30	75%
3. Family Monthly Income	<6174	5	12.5%
	6175-18496	10	25%
	18497-30830	8	20%
	30831-46128	7	17.5%
	46663-61,662	5	12.5%
	61,663-123,321	3	7.5%
	>123,322	2	5%
4. Type of Family	Nuclear	18	45%
	Joint	10	25%
	Extended Nuclear	7	17.5%
	Separated	5	12.5%
5. Family Member from Health Science	Yes	15	37.5%
	No	25	62.5%
6. Information about Definition of Telemedicine	No	10	25%
	Yes	30	75%
7. Source of Information Regarding Telemedicine	Internet	18	45%
	Hospital	10	25%
	Social Media	7	17.5%
	Other	5	12.5%
8. Inclusion of Telenursing in the Nursing Curriculum	No	23	57.5%
	Yes	17	42.5%

Table 1: Most participants (62.5%) were aged 20-22 years, with 37.5% in the 23-25 year range, indicating a younger student population that may benefit from tailored educational strategies (Sankhe & Lal, 2023). The majority (75%) were female, which aligns with typical

nursing program demographics, and highlights the need to consider gender differences in teaching telemedicine (Tabudlo, Garma, & Macalintal, 2021).

Regarding family income, most students came from lower to middle-income households, with 25% earning between 6,175 and 18,496, and 20% earning between 18,497 and 30,830. This suggests that economic background is unlikely to be a barrier to accessing telemedicine education (Al Baalharith et al., 2022). In terms of family structure, 45% lived in nuclear families, which may influence how they access and share health information (Sousa et al., 2022).

About 37.5% of students had a family member in health sciences, potentially increasing their awareness of telemedicine (David-Olawade et al., 2024). Most students (75%) were familiar with telemedicine, but 25% were not, indicating a need for more basic education in the field (Al Afik & Pandin, 2021). The main sources of information were the internet (45%), hospitals (25%), and social media (17.5%), highlighting the importance of digital platforms in shaping students' knowledge of telemedicine (Uslu, Aker, & Infal, 2016).

Finally, 57.5% of students said telenursing was not included in their curriculum, pointing to a gap in formal education that could be addressed by integrating telenursing into nursing programs, given the growing role of telemedicine in healthcare (M V et al., 2023).

Table 2: Knowledge regarding Telemedicine before Nurse-Led Educational Programme among students by using frequency and percentage

Pre-Test Score	Frequency	Percentage
Poor (0-10)	27	67.5%
Average (11-20)	9	22.5%
Good (21-30)	4	10%
Excellent (31-40)	0	0%
Total	40	100%

Table 2: The pre-test results show that most students (67.5%) scored in the "Poor" range (0-10), indicating limited knowledge of telemedicine before the educational program. A smaller group of students (22.5%) scored in the "Average" range (11-20), while 10% scored in the "Good" range (21-30). No students scored in the "Excellent" range (31-40). This suggests that, prior to the program, the majority of students had a basic or limited understanding of telemedicine (Sankhe & Lal, 2023).

Table 3: Knowledge regarding Telemedicine after Nurse-Led Educational Programme by using frequency and percentage

Post-Test Score	Frequency	Percentage
Poor	1	2.5%
Average	4	10%
Good	12	30%
Excellent	23	57.5%
Total	40	100%

Table 3: The post-test results show a significant improvement in students' knowledge of telemedicine after the educational program. Only 2.5% of students scored in the "Poor" range, compared to 67.5% in the pre-test. A small percentage (10%) scored in the "Average" range, while 30% scored in the "Good" range. The majority of students (57.5%) scored in the "Excellent" range, indicating a high level of knowledge following the program. This reflects the effectiveness of the educational intervention in enhancing students' understanding of telemedicine (Sankhe & Lal, 2023; M V et al., 2023).

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Table 4: Comparison of Knowledge Level on telemedicine between Nursing Students' demographic variables.

Demographic Variable	Test Value	p-value	Significance	Mean	Standard Deviation (SD)
1. Age 20-22 years	4.21	0.03	**Significant**	23.5	5.3
23-25 years				25.1	6.1
2. Gender Male	2.87	0.01	**Significant**	22.3	4.5
Female				24.5	5.2
3. Family Monthly Income <6174,	4.79	0.09	Not significant	18.0	3.1
6175-18496				20.3	4.2
18497-30830				22.0	4.8
30831-46128				23.5	5.5
46663-61,662				25.0	5.6
61,663-123,321				26.2	6.2
>123,322				28.0	6.8
4. Type of Family Nuclear	7.99	0.11	Not significant	24.0	4.7
Joint				23.0	5.1
Extended Nuclear				22.5	4.6
Separated				21.5	5.2
5. Family Member from Health Science Yes	0.65	0.95	Not significant	24.3	5.0
No				23.8	4.9
6. Information about Telemedicine No	1.63	0.44	Not significant	22.1	4.3
Yes				24.4	5.0
7. Source of Information Regarding Telemedicine Internet	3.92	0.41	Not significant	25.2	5.4
Hospital				23.8	5.0
Social Media				22.4	4.8
Other				21.5	5.1
8. Inclusion of Telenursing in Nursing Curriculum No	7.96	0.13	Not significant	23.0	4.7
Yes				24.5	5.2

Table 4: The study found several demographic factors influencing nursing students' knowledge of telemedicine, though not all factors showed significant effects. Age was a significant factor, with students aged 23-25 years (mean = 25.1) outperforming those aged 20-22 years (mean = 23.5, p = 0.03), indicating that older students may have a better grasp of the material (Sankhe & Lal, 2023). Gender also had a significant impact, with female students (mean = 24.5) scoring higher than male students (mean = 22.3, p = 0.01), suggesting the need for gender-sensitive approaches in educational strategies (Tabudlo, Garma, & Macalintal, 2021). However**,** family monthly income did not significantly influence scores (p = 0.09), with students from various income brackets showing similar levels of improvement (Al Baalharith et al., 2022).

Regarding family type, no significant differences were found (p = 0.11), though students from nuclear families had slightly higher scores (mean = 24.0) (Sousa et al., 2022). The presence of a family member in health science also had no significant effect on scores (p = 0.95), suggesting that familial exposure to the healthcare field did not notably influence telemedicine knowledge

(David-Olawade et al., 2024). Similarly, prior knowledge of telemedicin**e** had no significant impact on students' post-test scores (p = 0.44), with those familiar with telemedicine scoring slightly higher (mean = 24.4) than those who were not (mean = 22.1) (Al Afik & Pandin, 2021).

The source of information regarding telemedicine (internet, hospital, social media) did not significantly affect knowledge scores (p = 0.41), although students who learned via the internet had the highest mean score (25.2) (Uslu, Aker, & Infal, 2016). Lastly, the inclusion of telenursing in the nursing curriculum showed no significant effect on students' scores (p = 0.13), with students who had telenursing included in their curriculum scoring slightly higher (mean = 24.5) than those who did not (mean = 23.0) (M V et al., 2023).

This study demonstrates the effectiveness of the nurse-led educational program in improving nursing students' knowledge of telemedicine. Before the program, most students had limited knowledge, with 67.5% scoring in the "Poor" range, while after the program, 57.5% scored in the "Excellent" range, indicating a significant improvement. Age and gender were the only demographic factors that influenced knowledge, with younger students (20-22 years) and male students performing worse, suggesting they may need additional support or tailored teaching strategies. Although factors like family income, family type, and prior exposure to telemedicine did not significantly impact the results, the study suggests that telemedicine education can benefit all students, regardless of their socio-economic background, making it applicable to a broad range of nursing students, including those from underserved areas.

D. Conclusion

The results of this study show that the nurse-led educational program significantly improved nursing students' knowledge of telemedicine. Before the program, most students had poor knowledge, with 67.5% scoring in the "Poor" range on the pre-test. After the program, only 2.5% scored in the "Poor" range, and 57.5% scored in the "Excellent" range, showing a strong improvement in their knowledge.

The study also found that age and gender were the only demographic factors that significantly affected students' knowledge. Students aged 20-22 years had higher scores than those aged 23-25 years (p = 0.03), and female students performed better than male students (p = 0.01). Other factors, such as family income, family type, health science background, prior knowledge of telemedicine, and sources of information, did not significantly affect the students' test scores.

E. Recommendations

Based on the findings of this study, several recommendations can be made to enhance nursing education and the integration of telemedicine. First, telemedicine should be formally incorporated into the nursing curriculum. Educational institutions are encouraged to provide comprehensive training that not only introduces the technical aspects of telemedicine but also emphasizes its practical application in clinical settings.

Second, the implementation of interactive and multimedia-based teaching strategies is highly recommended. Given the marked improvement observed in students' post-test scores, incorporating simulation-based learning, online modules, and other engaging methods may further enhance knowledge retention and learner engagement.

Finally, further research is warranted to explore the influence of demographic factors—particularly age—on knowledge acquisition. Understanding these variations could inform the development of more targeted and effective educational interventions for diverse student populations.

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