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Research Article

Genetics in Nursing: A Cross-Sectional Study on Knowledge, Attitudes, and Readiness to Practice among Final-Year Diploma Nursing Students in Western Province, Sri Lanka

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Abstract

Introduction: Genetics and genomics are increasingly integrated into nursing practice worldwide, influencing disease prevention, risk assessment, and personalized care. However, in Sri Lanka, nursing curricula provide limited exposure to genetics, leaving gaps in competence despite national advances in healthcare genetics. This study assessed the knowledge, attitudes, and readiness to practice genetics among final-year diploma nursing students in the three National Schools of Nursing in the Western Province, Sri Lanka.

Methods: A descriptive cross-sectional study was conducted between May 2024 and February 2025 among 297 final-year nursing students, selected through systematic sampling. Data were collected using a pre-tested, structured, self-administered questionnaire adapted from internationally validated instruments designed to assess nurses' genomic knowledge, attitudes, and readiness for practice. The adapted tool demonstrated good psychometric properties, with established validity and reliability in preliminary testing. Descriptive statistics summarized demographic data, while chi-square tests, t-tests, ANOVA, and Pearson's correlation explored associations between knowledge, attitudes, and readiness to practice.

Results: Most participants were female (90.2%), aged 23–28 years. Nearly half (46.5%) demonstrated poor knowledge of genetics, while 29.3% had good knowledge. Knowledge levels were not significantly associated ($p < 0.05$) with age or gender. Positive attitudes were reported by 65% of participants, with no significant socio-demographic associations. A large majority (95.3%) expressed readiness to practice genetics in nursing, though weak positive correlations were observed between knowledge and attitudes ($r = 0.15$, $p = 0.009$), and between knowledge and readiness ($r = 0.25$, $p < 0.001$).

Conclusion: Nursing students in Sri Lanka show high readiness and positive attitudes towards incorporating genetics into practice; however, knowledge remains inadequate across institutions. These findings highlight the need to strengthen nursing curricula, faculty development, and competency-based genomics training to ensure a well-prepared nursing workforce capable of delivering personalized, genetics-informed care.

Keywords: *Genetics, knowledge, attitudes, readiness to practice, student nurses*

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Introduction

The term "Genetics", is defined as the science of human biological variation with respect to health and disease, which encompasses the study of individual genes and their role in rare single-gene disorders (Epstein, 2006). Genomics extends this scope to the study of the entire genome, gene–gene interactions, and environmental influences, which have critical implications for personalized diagnosis and treatment (Greco et al, 2012). Advances in these fields have significantly impacted global healthcare, shaping prevention, diagnosis, and individualized management strategies (Dissanayake, 2012; Sirisena & Dissanayake, 2019), highlighting a global mandate for comprehensive genetic and genomic training across all healthcare professionals (Adejumo et al., 2021).

Nurses, as the largest group in the global healthcare workforce, are central to translating genomic knowledge into patient care playing an essential role in genetic health risk assessment, counselling, and patient education and often serving as a bridge between patients and genetic specialists (Munroe, 2014). Recognizing this, international organizations such as the Consensus Panel on Genetic/Genomic Nursing Competencies (Consensus Panel, 2009) and the International Society of Nurses in Genetics (ISONG, 2021) emphasize the inclusion of genetics in all levels of nursing education.

Globally, integration of genetics into nursing curricula has been prioritized for over six decades (Ward, 2017). However, research consistently reveals that nursing graduates often lack adequate knowledge and confidence to apply genetics in clinical practice (Puddester et al., 2022; Thomas et al, 2023). Although nurses often hold positive attitudes toward genomics, limited educational preparation may hinder their readiness for practice (Calzone et al., 2019). Recent regional studies underscore similar gaps in genetics integration across Asian and lower-middle-income countries, including India, Malaysia, and the Philippines, where limited curricular exposure has led to poor confidence among nursing students and educators (Adejumo et al., 2021; Bala et al., 2023; Tang et al., 2020). Within the WHO South-East Asia Region (SEAR), initiatives promoting the inclusion of genomics in health professional education highlight the need to align nursing competencies with emerging genomic medicine practices (WHO-SEARO, 2021). Despite these developments, most regional curricula, including those in Sri Lanka lack structured genomic content.

In Sri Lanka, medical genetics services were established in the early 1980s with the Human Genetics Unit at the University of Colombo (Jayasekara et al, 1988). Since then, clinical genetics has gradually expanded across some tertiary and teaching hospitals, most prominently in the private sector. The National Health Strategic Master Plan 2016 – 2025 of the Ministry of Health, Sri Lanka, has recognized Clinical Genetics as a specialty to be developed in the country. The Postgraduate Institute of Medicine (PGIM) has introduced a three-year board certification in clinical genetics for medical specialists (De Silva & Sirisena, 2019). Despite this progress, up-to-date genetics education in nursing remains minimal.

National Schools of Nursing, which produce the majority of the nurses in the country, have not comprehensively integrated genetics into their curricula (Dissanayake, 2012; Yasarathne, 2019). This educational gap is particularly concerning in the context of Sri Lanka's universal healthcare system, where nurses play pivotal roles in primary, secondary, and tertiary care settings.

Addressing the aforementioned gap is essential to ensure a nursing workforce capable of contributing to personalized and preventive healthcare. This study aimed to assess the knowledge, attitudes, and readiness to implement genetics in nursing practice among final-year diploma nursing students in the Western Province of Sri Lanka, and to explore the interrelationships among these factors.

Methods

Study design, participants, and recruitment

A descriptive cross-sectional study was conducted from May 2024 to February 2025 at the three National Schools of Nursing in Sri Lanka: Colombo, Kandana, and Kalutara, representing diverse healthcare training environments within the Western Province. The target population comprised all final-year diploma nursing students enrolled in these institutions, totaling 832 individuals.

Inclusion criteria encompassed all final-year students in the aforementioned schools. Students who were physically or mentally unfit, or absent during the data collection period, were excluded from participation. The required sample size was determined using Yamane's formula (Yamane, 1967); n = N / [1 + N(e²)] with a total population of 832 (N) and a margin of error (e) set at 0.05. This calculation yielded 270 participants; allowing for a 10% anticipated non-response rate, the final target sample size was adjusted to 297. Systematic random sampling was employed; with skip intervals calculated separately for each school based on the respective population sizes. The skip interval/sampling interval (k) was calculated with use of the known population size (N) and the sample size (n), k= N/n. Selection of sample from each school is shown in table 1.

Table 1: Selection of sample from each nursing school

National School of Nursing	Calculation	Skip interval (K)
Colombo	K= 367/131= 2.8	~ 2
Kandana	K= 235/84=2.7	~2
Kalutara	K= 230/82= 2.7	~2

Study instrument

A structured, self-administered questionnaire was adapted from previously published articles (Adejumo et al., 2021; Munroe, 2014), with cultural and contextual modifications to suit the Sri Lankan nursing education environment. It incorporated selected items from the Genomic Nursing Concept Inventory (Ward, 2017). The instrument was comprised four sections:

Section 1: Socio-demographic details of participants.

Section 2: Questions assessing participants' knowledge of genetics, comprising 30 true-

false questions, scoring 1 for each correct and 0 for each incorrect response.

Section 3: Items evaluating readiness to integrate genetics into nursing practice, comprising 10 questions, measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) with a score range of 10 to 50.

Section 4: Items assessing attitudes toward incorporating genetics into nursing practice, also measured using a 5-point Likert scale with a score range of 7 to 35.

The questionnaire underwent content validation by a three-member expert panel comprised of one senior nursing educator and two clinical geneticists. The panel evaluated each item for clarity and contextual relevance, resulting in an average content validity index (CVI) of 0.91. Internal consistency reliability was assessed using Cronbach's alpha, resulting in values of 0.83 (knowledge), 0.87 (readiness to practice), and 0.89 (attitudes). The content validated questionnaire was pre-tested among 30 non-participating students who were selected from National School of Nursing in Galle to assess clarity, cultural appropriateness, and comprehensibility prior to the main study. Minor revisions were made to the questionnaire following feedback of the pre-test.

Data collection

The structured questionnaires were administered to the students in person, and participants were given 30 minutes to complete them. All completed questionnaires were collected immediately upon completion to ensure data integrity and minimize the risk of response contamination. To minimize response bias, anonymity was ensured, questionnaires were administered without the supervision by the academic staff, and participation was voluntary. Students were informed that their responses would not influence their studies or training. Systematic random sampling assured representative coverage across institutions.

Data analysis

The collected data were screened for completeness and consistency. Before conducting parametric tests, data were checked for normality using the Shapiro–Wilk test and for homogeneity of variances using Levene's test. All assumptions were satisfied. Descriptive statistics were used to summarize the socio-demographic characteristics of the study population, including frequencies, percentages, means, and standard deviations.

To investigate the relationships between variables, inferential statistics were employed. An independent samples t-test or one-way ANOVA were used to compare means between groups and assess the relationship between the level of knowledge and socio-demographic data. The Chi-squared/Fisher's exact test was applied to examine associations between categorical variables. Pearson's correlation was performed to determine the strength and direction of linear relationships between continuous variables, specifically to identify the relationship between knowledge and readiness to practice, and knowledge and attitudes. Statistical analysis was conducted using SPSS version 27.0. All statistical tests were two-sided, with a significance level of

$p<0.05$. The knowledge score was classified as poor (<60%), fair (60–80%), or good (>80%) (Calzone et al., 2019). A readiness score of ≥25 indicated readiness to practice, while the attitude score of ≥26 indicated a positive attitude toward genetics integration as per Adejumo et al., 2021. High scores indicate greater readiness to integrate genetics into clinical practice and more positive attitudes toward genetic nursing competencies.

Ethical considerations

Ethical approval for the study was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo (EC - 24-080). Permission to conduct the study was secured from the three National Schools of Nursing in Colombo, Kalutara, and Kandana and the Ministry of Health, Sri Lanka before starting the data collection.

All participants were informed about the study's purpose and procedures. Voluntary informed consent was obtained from each participant before data collection. A dedicated helpline was established to address any questions or concerns participants might have. Participants were assured of their right to withdraw from the study at any time without penalty.

To ensure confidentiality and privacy, all collected data were anonymized by removing personal identifiers. A serial number was used to link survey data. The data were stored securely in a limited-access Google document sheet, with access restricted to the research team and supervisors. Data backup copies were maintained to prevent loss. All research data will be securely retained for five years and then permanently destroyed.

Results

Socio-demographic characteristics

The participants' ages ranged from 23 to 30 years (mean±SD; 25.7±1.0), with the majority aged 26–28 years (58.2%), followed by 23–25 years (41.1%) and 29–31 years (0.7%). Most were female (90.2%), with males comprising 9.8% of the sample. The ethnic distribution was predominantly Sinhalese (99.0%), with small representations of Tamil (0.3%) and Burgher (0.7%). Buddhism was the most common religion (91.2%). Regarding institutional affiliation, 44.1% were from the School of Nursing, Colombo; 28.3% from the School of Nursing, Kandana and 27.6% from the School of Nursing, Kalutara (Table 2).

Knowledge

A poor level of knowledge was observed among 46.5% of the participants, whereas 24.2% of participants had a fair level of knowledge and 29.3% of participants had a good level of knowledge in genetics.

As shown in Table 3, the level of knowledge on genetics in nursing was not significantly associated with gender ($p = 0.37$) or age group ($p = 0.41$). The majority of participants had poor knowledge (40.7% of females and 5.7% of males). Fair knowledge was reported by 22.6% of females and 1.7% of males, while good knowledge was reported by 26.9% of females and 2.4% of males. Students aged 26–28 years demonstrated the lowest knowledge levels, with 26.9% in the poor category. Overall, gender and age group did not significantly influence knowledge

Table 2: Socio-demographic characteristics of the study sample (n=297)

Variable	Category	**Frequency (n)**	**Percentage (%)**
Gender	Male	29	9.8
	Female	268	90.2
Age (in years)	23-25	122	41.1
	26-28	173	58.2
	29-31	2	0.7
Ethnicity	Sinhalese	294	99.0
	Tamil	1	0.3
	Burger	2	0.7
Religion	Buddhism	271	91.2
	Hinduism	1	0.3
	Christian	18	6.1
	Catholic	7	2.4
School of Nursing	Colombo	131	44.1
	Kandana	84	28.3
	Kalutara	82	27.6

Table 3: Socio-demographic characteristics associated with level of knowledge (n = 297)

Characteristics		**Knowledge level**						**Knowledge score**	**p value**
		Poor		**Fair**		**Good**		**Mean (± SD)**	
		Frequency (n)	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**		
Gender	Male	17	5.7	5	1.7	7	2.4	17.76 ± 7.31	0.37[#]
	Female	121	40.7	67	22.6	80	26.9	19.53 ± 6.29	0.21[*]
Age (in years)	23-25	56	18.9	27	9.1	39	13.1	19.39 ± 6.74	0.41[#]
	26-28	80	26.9	45	12.2	48	16.2	19.35 ± 6.22	0.91[*]
	29-31	2	0.7	0	0.0	0	0.0	17.50 ± 0.71	

[#] *Chi-square/Fisher's exact test*
[*] *Independent samples t-test or One-way ANOVA test*

levels. Female students showed higher knowledge about genetics in nursing compared to males. Participants aged 23–28 had the highest knowledge levels, while those in older age groups scored lower. However, neither gender nor age showed a significant association with knowledge levels.

Attitudes

Among the 297 study participants, the majority (65%) exhibited positive attitudes toward genetics in nursing, while 35% demonstrated negative attitudes.

As summarized in Table 4, the majority of female students demonstrated a positive attitude (59.3%), while 31% had negative attitudes. Among male students, 5.7% expressed positive attitudes and 4% expressed negative attitudes. Male participants (26.34±4.14) had a slightly higher mean score than their female counterparts (26.08±4.052). Positive attitudes were also the most common finding across all age categories. Participants in the 26-28 age group demonstrated the highest mean attitude score (26.13±4.25), followed by those aged 23-25 (26.10±3.74), and 29-31 (24.00±7.07). Despite these observed differences in attitudes based on gender, no significant statistical relationships were found between the level of attitudes and gender (p=0.45), and age range (p=0.76).

Readiness to practice

According to the findings of the study, the majority (95.3%) of participants were found to be ready to practice and 4.7% of participants were not ready to practice genetics in Nursing.

As summarized in Table 5, the majority of participants, particularly females (85.5%), reported being ready to practice genetics in nursing, while only 9.8% of males indicated readiness. Readiness was most common among those aged 26–28 years (55.2%). Although mean readiness scores were slightly higher among females (35.01 ± 5.58), those aged 29–31 years (40.50 ± 0.71), none of these differences were statistically significant. Overall, no significant associations were observed between readiness to practice and gender and age range ($p > 0.05$).

Correlation among knowledge, attitudes, and readiness to practice

A weak, positive correlation was observed between the knowledge and attitudes score ($r=0.15$, $p=0.009$) as well as between participants' total knowledge and their readiness to practice genetics ($r=0.25$, $p<0.001$).

Discussion

Our study assessed knowledge, attitudes, and readiness to practice genetics among final year diploma nursing students in Sri Lanka, addressing an important gap in the integration of genetics into nursing education. We observed an inadequate knowledge, moderately positive attitudes, and notably high readiness to practice genetics among the nursing students. Overall, the findings reveal a discrepancy between readiness to practice, which was notably high, and actual knowledge, which was poor to fair. This inconsistency may reflect that although students are motivated and perceive genetics as important, their limited theoretical foundation could hinder its practical applicability. Attitudes were generally positive, but weak correlations between knowledge, attitudes, and readiness suggest that enthusiasm may not translate into effective practice without targeted educational interventions.

Nearly half of the participants (46.5%) demonstrated poor knowledge, with only 29.3% achieving good knowledge scores. This high proportion of poor knowledge may reflect outdated or insufficient genetics content in existing curricula, limited faculty expertise, or lack of emphasis on genetics

Table 4: Socio-demographic characteristics associated with levels of attitudes (n=297)

Characteristics		Attitude status				Attitudes Score	p value
		Negative		Positive		Mean (± SD)	
		Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)		
Gender	Male	12	4.0	17	5.7)	26.34 ± 4.14	0.45#
	Female	92	31.0	176	59.3	26.08 ± 4.05	0.74*
Age (in years)	23-25	45	15.2	77	25.9	26.10 ± 3.74	0.76#
	26-28	58	19.5	115	38.7	26.13 ± 4.26	0.76*
	29-31	1	0.3	1	0.3	24.00 ± 7.07	

[#] *Chi-square/Fisher's exact test*
[*] *Independent samples t-test or One-way ANOVA test*

Table 5: Socio-demographic characteristics associated with levels of readiness to practice genetics in nursing (n= 297)

Characteristics		Level of readiness to practice				Readiness to Practice Score	p value
		Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Mean (± SD)	
Gender	Male	0	0.0	29	9.8	34.86 ± 4.82	0.08#
	Female	14	4.7	254	85.5	35.01 ± 5.58	0.87*
Age range (years)	23-25	5	1.7	117	39.4	35.34 ± 5.53	0.82#
	26-28	9	3.0	164	55.2	34.70 ± 5.48	0.22*
	29-31	0	0.0	2	0.7	40.50 ± 0.70	

[#] *Chi-square/Fisher's exact test*
[*] *Independent samples t-test or One-way ANOVA test*

during clinical training. These findings are consistent with international reports evidencing that the nursing students and practicing nurses frequently lack adequate genetic knowledge despite the growing relevance of genomics in clinical care (Puddester et al., 2022; Thomas et al., 2023). Systematic comparison across settings reveals a global pattern. Studies in Nigeria and other low- and middle-income countries limited knowledge but high interest in learning genetics (Adejumo et al., 2021). In contrast, developed countries such as the United States and the United Kingdom, where genetic education has been integrated for several decades, still report gaps in competence but at comparatively higher baseline levels (Calzone et al., 2019). This gradient suggests that while structural integration improves overall competence, knowledge retention and translation into practice remain challenges. These differences

underscore the urgent need to strengthen the Sri Lankan nursing curriculum to include structured, competency-based genetics education.

The majority of students (65%) expressed positive attitudes, regardless of gender, age, or institution. This aligns with prior literature indicating that nurses are generally receptive to the role of genetics in patient care, even when their knowledge is insufficient (Puddester et al., 2022). Recent Asian studies have similarly shown positive attitudes but low confidence in applying genomics in practice (Wang et al, 2020; Kaur et al, 2022). The weak but significant correlation between knowledge and attitudes observed in this study (r=0.15) suggests that positive attitudes can serve as a foundation for targeted interventions. However, the low strength of this correlation indicates that attitudes and knowledge operate relatively independently, and positive attitude alone may not ensure skill development. Integrating attitude-driven motivation into curriculum reform; for instance, by coupling theoretical teaching with simulation or case-based learning may transform enthusiasm into competence.

An overwhelming majority (95.3%) reported readiness to integrate genetics into practice. While encouraging, this finding should be interpreted cautiously. International research indicates that self-reported readiness often reflects perceived importance and willingness rather than actual competence (Kaur, et al, 2022; Calzone et al., 2018). The weak correlation between knowledge and readiness in this study reinforces this
77 n. Practically this implies that
ess reflects optimism and professional willingness, more than true preparedness. Notably, no demographic or institutional factors significantly influenced readiness, implying that readiness is broadly uniform but not knowledge driven. This mismatch between high readiness and poor knowledge highlights a potential "confidence-competence gap," where students may overestimate their ability to apply genetics in practice, emphasizing the importance of aligning perceived readiness with actual competence through outcome-based learning and performance assessments.

Previous Sri Lankan reports have documented limited integration of genetics in curricula related to health education, despite the expansion of medical genetics services nationally (Sirisena & Dissanayake, 2019). Similar disparities have been reported in other Asian contexts (Himes, 2024; Limoges, 2024). The observed gaps therefore represent both a curricular deficiency and a missed opportunity to align nursing education with emerging national health priorities, such as personalized medicine and genetic counseling services. Leveraging students' positive attitudes and readiness could be instrumental in future curriculum reforms aimed at bridging the knowledge gap and preparing nurses for genomics-integrated care.

This study comprises several limitations that should be acknowledged. Reliance of self-reported data through self-administered questionnaire have introduced response bias, including social desirability and self-selection biases, particularly regarding the findings of attitudes and readiness to practice, reflected by the weak correlation between

knowledge and attitudes and knowledge and readiness as mentioned in the discussion section. Furthermore, although the questionnaire was adapted and reviewed for clarity, full local cultural validation may have been limited. Also, the sample representativeness is restricted as the geographical scope in the study is limited only to the western province of Sri Lanka hindering the generalizability of the findings to nursing students in other regions of the country. In addition, the cross-sectional design of the study which captures data at a single point in time precludes the establishment of any causal relationships between the variables examined.

Conclusions

This study reveals that Sri Lankan nursing students report high readiness and positive attitudes toward genetics in nursing, although their actual knowledge remains insufficient. The weak correlations between knowledge, attitudes, and readiness highlight the risk of overestimating preparedness based on self-reported measures. These findings align with global trends, particularly in low- and middle-income contexts, and emphasize the urgent need for curricular reform, incorporating core genetic competencies, case-based learning, and practical scenario integration. Developing faculty capacity through targeted simulation-based training and promoting student-centered, competency-based approaches will be crucial for effective implementation. Future longitudinal and interventional studies are recommended to evaluate the impact of such educational strategies and monitor competency growth over time. Strengthening genetics education in nursing will be vital to preparing the workforce for the challenges of person-centered health care supported by a clearly defined national competency framework for genetics and advancing patient care in Sri Lanka.

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Conflicts of interest

The authors declared that they have no conflicts of interest.

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