



Female university students' knowledge, attitudes, and behaviours towards sun exposure and the use of artificial tanning devices: the essence of reducing risky behaviours

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Abstract

Aim To investigate female university students' knowledge, attitudes, and behaviours towards sun exposure and the use of artificial tanning devices.

Subject and methods A descriptive correlational survey design using online questionnaires, targeting a population of female university students aged 18–25 from one university in the United Kingdom.

Results Three hundred and thirty-five students participated (response rate = 26.4%). Students demonstrated average knowledge and good attitude to tanning behaviours, but neither were statistically significantly associated with tanning behaviours. Students showed a history of substantial tanning behaviours, including the use of sunbeds, primarily because having a tanned skin made them look good and thus feel better.

Conclusion This study has re-affirmed that there is no simple correlation between individuals' knowledge and attitudes and subsequent sun-tanning behaviours. *Feeling good and looking good* are critical attributes to female university students' self-esteem, and these values and beliefs outweigh risk perception of sun-tanning behaviours, and female university students continue to engage in risky tanning behaviours. Focused health promotion activities by public health authorities and higher education institutions should target students' principal belief of *looking good feeling good*, as such targeted health promotion may reduce harmful sun tanning behaviours and ultimately mitigate the rising incidence in skin cancers.

Keywords University students · Skin cancer · Tanning behaviour · Health promotion

Introduction

The incidence and prevalence of people diagnosed with skin cancer have been increasing steadily worldwide, with the World Cancer Research Fund (2019) reporting that 1.3 million people were diagnosed with skin cancers in 2018. This incidence is thought to be an underreporting, as the

World Health Organisation (2019) indicated that between 2 and 3 million non-melanoma skin cancers occur globally each year. In the United Kingdom (UK), 15,000 new cases of melanoma skin cancer were diagnosed annually between 2014 and 2016, with a 134% rise in the incidence rate since the early 1990s, and occurring more commonly in people over 85 years of age (Cancer Research 2019). The incidence and prevalence of melanoma are higher in females than males up to the age of about 55 (2012–2014 data), at which point the incidence in males becomes greater than in females.

The UK ranks 32nd out of 172 in the world for deaths secondary to skin cancer, and malignant melanoma is now one of the commonest cancers in people aged 15–34. As reported by Robertson and Fitzgerald (2017), the UK population has inherent non-modifiable physical risk factors to skin burning such as light eyes (45% of the

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population) and blond hair (25%), signifying that the majority of the UK's population is at an enhanced risk of acquiring skin cancer.

In Northern Ireland, the region of the UK in which our study took place, Cancer Focus Northern Ireland (2018) reported that skin cancer is the most common form of cancer, accounting for over 30% of all cancers. Based on figures from N. Ireland Cancer Registry (2016), there was a 4.2% increase in the annual incidence of malignant melanoma in males and a 2.4% yearly increase in the incidence of malignant melanoma in females between 2011 and 2015.

Ultraviolet (UV) radiation is associated with many different kinds of skin cancer, including malignant melanoma (Xiu 2015). While precise aetiology is unknown, UV radiation is thought to induce the formation of linkages between pyrimidine bases on the DNA molecule, and repeated exposure to UV radiation is thought to play an important role in malignant melanoma development. People are exposed to natural UV radiation from the sun, but in recent years there has been an increase in the availability and uptake of artificial tanning options such as sunbeds. World Health Organization (2017) stated that *...the deliberate exposure to UVR radiation for cosmetic purposes is increasing the incidence of the major types of skin cancer*, and Waters and Adamson (2018) asserted that there is sufficient epidemiological data to conclude that the use of such artificial tanning devices is causally associated with cutaneous melanoma.

In two systematic reviews of tanning behaviours, one scoping over 490,000 participants from 88 studies across 16 countries (Wehner et al. 2014), and one focused on United States (US) college students (Gambala et al. 2017), a high prevalence of indoor tanning exposure was found. Prevalence of exposure was highest in university students, with higher prevalence in females than males. Heckman et al. (2008), in a US general population health survey, Gambala et al. (2017) in a systematic review, and Rodgers et al. (2016) in a qualitative study of college students, found high indoor tanning rates among individuals who were young, white, and female, and reported indoor tanning rates of 20.4% for those aged 18 to 29. Other studies (Holman and Watson 2013; Thomas and Peñas 2017) have also linked tanning behaviours to attitudes (preferring tanned skin), reporting that social factors correlated with intentional tanning such as peer influence (having friends who tan), and watching reality TV beauty shows (Fogel and Krausz 2013). In conclusion, Watson et al. (2013) noted that the toxic combination of risk factors such as young age and female gender with risk behaviours such as frequent alcohol use, smoking, recreational drug use, poor diet, and irregular sunscreen use,

ranks university students as a high priority for health promotion interventions.

Materials and methods

Aim

This paper reports a study that aimed to assess the knowledge, attitudes, and self-reported behaviours of female university students aged 18–25 towards sun exposure and tanning bed practices.

Objectives

In a population of female university students aged 18–25, the objectives were:

- to describe knowledge, attitudes, and tanning behaviours;
- to investigate participants' reasons for their tanning behaviours;
- to investigate correlations between knowledge, attitudes, and tanning behaviours.

Gaining in-depth understanding of female university students' knowledge, attitudes, and tanning behaviours could provide a platform from which public health agencies could intervene effectively in order to mitigate the increasing skin cancer rates in this population.

Design

This study used a survey design in which data was collected through an online questionnaire [powered by Qualtrics© (Qualtrics.com)]. Descriptive correlational surveys are often used to describe populations and to establish associations between variables within such populations (Hasson et al. 2015).

Sampling

This study utilised a probability sample of female students aged 18–25 who were registered at one UK university. There were no exclusion criteria from the female population sampled. A power calculation using Raosoft© (www.raosoft.com/samplesize.html), based on student figures provided by the university (female student population 9500), showed a minimum sample of 369 was required to achieve statistical power to generalise findings to the target population.

Instrument

The online questionnaire comprised questions developed by the authors, based on a thorough literature review and guided

by the principles of survey design (McColl and Thomas 2000). The survey was divided into five sections:

- (1) Demographic characteristics (five items, including skin colour and hair colour).
- (2) Knowledge (four sections), with a range of answer options.

What are the precautions people should take when exposed to the sun/sunbathing?
 Which of the following are potential outcomes of excessive sun tanning?
 What are the main reasons for burning and damage to the skin when sun tanning?
 What SPF factor sunscreen should people wear to sufficiently protect them from the sun based on current guidelines?

- (3) Self-reported behaviours (five sections), with a range of answer options.

Do you intentionally tan if there is sunny weather in Northern Ireland?
 How often has your skin been burnt in the last year, whether it be at home or on a sunny holiday?
 If exposed to the sun, which of the following sunscreen practices do you partake in, if any?
 Have you ever engaged in the use of indoor tanning beds?
 Please select the statement that applies to your use of indoor tanning beds.

- (4) Attitudes (ten items), answered on a 5-point Likert-type scale (*Strongly agree to Strongly disagree*).

If I use sunscreen > 20 SPF I can stay out in the sun for much longer.
 If I use sunscreen, I will fail to absorb any vitamin D.
 Using sunbeds is a good way to get a good base on your skin before going on a sunny holiday.
 If I only use tanning beds a few times a year this will not increase my risk of skin cancer.
 Having tanned skin makes me feel more attractive.
 I look healthier with a good tan.
 I have more confidence and greater self-esteem with a tan.
 Most of my friends/people I know use tanning beds or sunbathe frequently, and they are fine.
 I will not worry about my sun exposure practices until I am much older.
 If someone close to me became ill as a result of over-exposure to the sun I would re-consider my own behaviour.

- (5) Reasons for tanning (two items), with a range of answer options.

If you intentionally tan by sunbathing or using tanning beds, please indicate the main reasons why.
 If you intentionally tan and you are also aware that excess sun exposure is harmful to your skin and health, why do you continue to practice this?

Reliability and validity

Reliability was addressed by carrying out a Cronbach's alpha co-efficient on Likert scale questions within the survey. Cronbach's alpha is acknowledged as an appropriate tool for measuring internal stability of an instrument, and is the most widely used objective measure of reliability (Tavakol and Dennick 2011). Face validity was considered by the authors, and peer review was undertaken by academic colleagues who confirmed content validity. Face and content validity are commonly and consistently used in medical research to establish the validity of medical measurement scales — see, e.g., Holloway et al. (2014).

Administration of study/data collection

Permission to administer the survey was sought from the appropriate university authority. Participants were recruited via an e-mail sent to students registered at the university by the Information Services Department gatekeeper, asking them to complete the survey if they met the inclusion criteria. A reminder email was sent 3 weeks later.

Pilot study

A pilot study that included ten paper copies and ten electronic copies was completed by female students who were approached at random in the university library, and feedback resulted in some literary changes that served to enhance the clarity of the questions and to ensure all potential options were available.

Data analysis

Data analysis was carried out using IBM SPSS Statistics v25. Confidence intervals were set at 95% ($p < 0.05$). Descriptive analyses were undertaken on the demographic variables, and correlational analyses were carried out between the demographic variables and the three dependent variables of knowledge, attitudes, and behaviour. The relationships between knowledge, attitudes, and behaviour were analysed using correlational analyses.

Results

Demographic characteristics

There was an initial response from 375 students (369 required by Raosoft sample size power analysis); however, 40 surveys were incomplete leaving a total sample size of 335 (response rate = 26.4%). A summary of the demographic characteristics of the sample is shown in Table 1. The mode age was 21, and

Table 1 Demographic characteristics of students

Characteristic	Categories available	<i>N</i>	%
Age	18	7	2
	19	42	12.1
	20	61	17.6
	21	65	18.8
	22	47	13.6
	23	47	13.6
	24	37	10.7
	25	40	11.6
Faculty	Art	20	5.8
	Art, Design and Built Environment	17	4.9
	Life and Health Sciences	200	57.6
	Computing and Engineering	19	5.5
	Social Sciences including Ulster Business School	91	26.2
Hair colour	Red	29	8.4
	Blonde	67	19.4
	Brown	230	66.7
	Black	17	4.9
	Unsure	2	0.6
Eye colour	Brown	63	18.2
	Blue	180	52
	Green	97	28
	Unsure	6	1.7
Skin Colour	Pale	142	41.2
	Pale and freckly	108	31.3
	Olive	39	11.3
	Lightly tanned	51	14.8
	Brown	3	0.9
	Black	1	0.3
	Unsure	1	0.3
Tendency to burn	Practically never	37	10.7
	Some redness	144	41.6
	Burn	122	35.3
	Painful burn	34	9.8
	Burn with blisters	9	2.6

59% of the respondents were students within the Faculty of Life and Health Sciences. A majority of participants had

characteristics associated with the traditional fair-skinned Celtic population found within Northern Ireland such as

Table 2 Overall knowledge scores

Summary of knowledge scores				
Category	<i>N</i>	%	Mean	Standard deviation (SD)
Poor (4–8.24)	33	9.9	11.8	2.75
Average (8.25–12.49)	174	51.9		
Good (12.5–16.74)	114	34.0		
Very good (16.75–21)	14	4.2		

Table 3 Overall attitude scores

Summary of attitude scores				
Category	<i>N</i>	%	Mean	Standard deviation (SD)
Poor (10–20)	5	1.5	32.6	5.93
Average (20.01–30)	116	35.3		
Good (30.01–40)	179	54.4		
Very Good (40.01–50)	29	8.8		

brown hair, blue eyes, pale skin, and history of at least some redness or sunburn on sun exposure, personal characteristics that are associated with an increased risk of skin cancer (Gavin et al. 2010).

Knowledge and attitudes

Table 2 shows calculated knowledge scores of the participants which were divided into four categories, and 51.9% of participants had *average* knowledge with regard to sun exposure and its risks. A Cronbach's alpha coefficient was carried out to determine the reliability of the Likert-type scale used to assess attitudes, reporting a value of 0.712, indicating an acceptable internal consistency (Pallant 2016). Overall score for attitude toward sun exposure and tanning beds were also divided into four categories (Table 3), and 54.4% of the participants demonstrated *good* attitude category with an overall mean attitude score of 32.6.

The relationship between participants' overall knowledge and attitude scores was investigated using Spearman's rank correlation coefficient and showed a small positive correlation (0.103, $p = 0.061$) that did not reach statistical significance. Spearman's rank correlation was used to ascertain correlations between demographic characteristics and knowledge or attitude scores. Table 4 highlights differences found in knowledge scores between students in the Faculty of Life and Health Sciences (highest knowledge) and Computing and Engineering (lowest knowledge) as well as between students' reported tendency to burn. ANOVA indicated a sub-group difference in the variable "Tendency to burn" with knowledge ($p = 0.011$) between those who practically never burn and those who have experienced painful burns ($p = 0.006$), with those who had an experience of painful burns demonstrating higher level of knowledge. There were no statistically different findings in relation to attitudes to tanning practices.

Self-reported behaviours

Intentional tanning behaviour was ascertained by asking participants about their sun exposure and sunbed use; 52% reported they intentionally tanned in sunny weather and 34% of participants said they had used indoor tanning beds. Of those using indoor tanning beds, 30% do so regularly (72% > 12 times per year), although 50% of respondents stated that they had stopped using tanning beds (Figs. 1 and 2).

Reasons for tanning

The reasoning behind intentional tanning behaviour was investigated with an open-ended question, and the analysis of the qualitative comments suggests one dominating theme: tanning enhances appearance and thus self-esteem. Some of the

Table 4 Correlation between demographic variables and knowledge and attitudes

Demographic characteristic	Dependent variable tested	Significance
University faculty	Knowledge	.000*
	Attitude	.680
Age	Knowledge	.499
	Attitude	.063
Skin colour	Knowledge	.404
	Attitude	.106
Tendency to burn	Knowledge	.011*
	Attitude	.719
Hair colour	Knowledge	.959
	Attitudes	.062
Eye colour	Knowledge	.442
	Attitude	.110

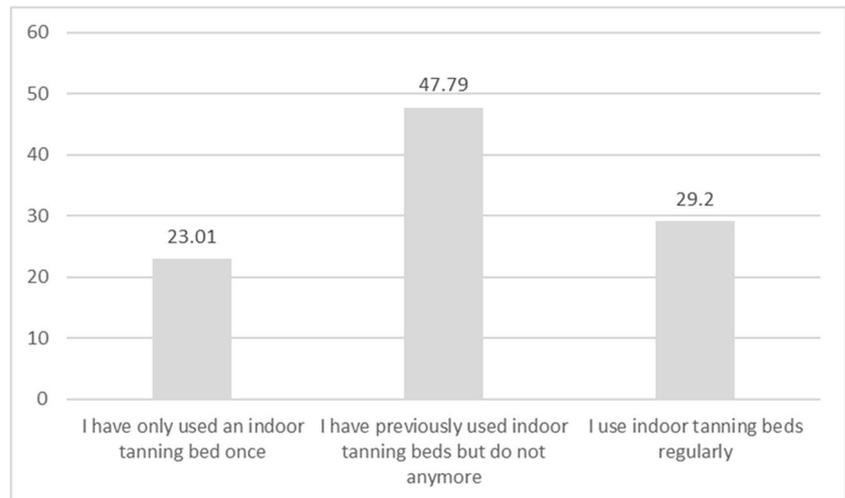
* = statistically significant

most common reasons are listed in Table 5, with the highest-rated answer being *To continue to look and feel attractive*.

Discussion

This study reports the knowledge, attitudes, and self-reported behaviours of female university students aged 18–25 towards intentional tanning and sunbed use. This study has added new evidence from Northern Ireland, a region of the UK in which literature on tanning behaviour remains scarce, and our study is the first study to specifically investigate the knowledge, attitudes, and behaviour of female university students within this region.

The study has highlighted many important findings. Firstly, the overall knowledge of the participants was only *average*. This is not consistent with some other international studies (Felts et al. 2010; Hedges and Scriven 2010; Mousavi et al. 2011) as well as a Northern Ireland study by Boyle et al. (2010) who, in 2008, found knowledge of participants to be high. Contrary to Mousavi et al. (2011), our study suggests that being at university is not associated with better knowledge on skin cancer and safe sun exposure practices, but

Fig. 1 Nature of tanning bed use (percentage)

instrument design may have allowed for slightly different testing of knowledge.

Another important finding in the study, although potentially expected, was that students studying a degree within a life and health sciences faculty (health courses such as nursing, physiotherapy, and occupational therapy) had significantly better knowledge scores than students from other faculties such as computer and arts faculties. It is entirely plausible that such health care students, including health promotion students, have had specific learning on health promotion activities about tanning behaviours within their courses, and their knowledge should be expected to be higher than non-health care students.

This study has corroborated previously reported findings, in particular the long-standing view that having a tan is more physically attractive (Schneider et al. 2013; Rodgers et al. 2016; Thomas and Peñas 2017). Ashinoff et al. (2009) found that 80% of participants thought celebrities were tanned and 60% perceived this to be an attractive feature, a view

supported in a qualitative study by Rodgers et al. (2016). In our study, only 3.2% of respondents intentionally tanned *because all the celebrities look tanned* (Table 5), suggesting (perhaps) that US respondents adore celebrities in terms of their looks and behaviours more than UK students do. However, the study by Ashinoff et al. (2009) focused on high-school students aged 14–18 and the data may not be directly comparable, as the participants in the study by Rodgers et al. (2016) were female college students.

Peer influence was not significantly reported in our study (2.7%) as a factor in intentional tanning. Mayer et al. (2011) investigated adolescents' use of indoor tanning beds and suggested that parent-related and peer-related factors were principal predictors of indoor tanning, noting if their own parents used sunbeds, the adolescents were 70% more likely to engage in the practice themselves. Over a quarter of participants (27.2%) claimed they used tanning beds *to get a base tan on skin before going on holiday*. Literature suggests that obtaining a *base tan* does not add protection (Sivamani et al.

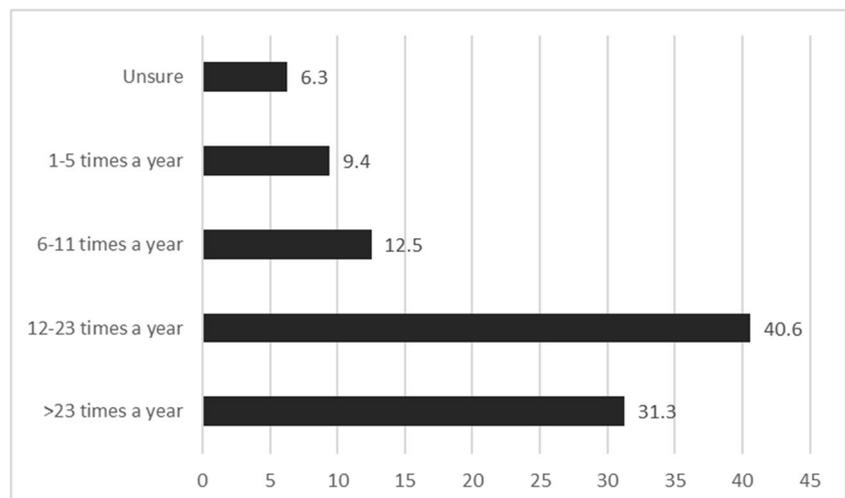
Fig. 2 Frequency of tanning bed use annually (percentage)

Table 5 Reasons for intentionally tanning

Respondents' answers *	N	%
To look and feel more attractive	144	38.7
To get a base tan on skin before going on holiday	101	27.2
Due to lack of sun in Northern Ireland	99	26.6
Sun exposure is good for your health	55	14.8
I get compliments which make me feel good	54	14.5
Because all the celebrities look tanned	12	3.2
Because my friends use them	10	2.7

* respondents may have provided multiple answers

2009) but does in fact increase damage to the skin (Mendese and Gilchrest 2012) and, as pointed out by Hollovary (2009), there is no such thing as a safe tan.

Several studies and public health organisations (Gambla et al. 2017; Robertson and Fitzgerald 2017; Cancer Focus Northern Ireland 2018) have found that people with fair white skin that is often freckled, and those who had previous exposure to serious sunburn, were at particularly high risk for sunburn when exposed to the sun. Cancer Focus Northern Ireland (2018) reports that 80% of the population in this UK region has type 1 or type 2 skin, and our sample reflects this, with over 70% stating they have such fair skin; and nearly half of our sample self-reported that they burn when exposed to the sun. The findings that people who had experienced *painful burns* demonstrated higher knowledge than students who *practically never burn* can be interpreted in different ways. Firstly, having experienced a painful burn has resulted in learning that has increased knowledge of this risk, probably through discussions with family members and health care professionals they may have consulted (e.g., emergency department clinicians or GPs). Secondly, students *who practically never burn* may think they are not at risk of skin cancer and engage in increased tanning activities, not seek additional knowledge on this topic and potentially put themselves at increased risk. Overall, the study found that having average knowledge combined with high-risk skin type prevalence increased the students' susceptibility to skin cancers.

Schneider et al. (2013) found that the prevalence of sunbed use was lower in those with paler skin type, mirroring the findings in our study, although US studies continue to report high rates of sunbed use (Waters and Adamson 2018). This may signify that people with these personal characteristics are aware of the enhanced sunburn risk associated with their skin type. Conversely, those who have light brown and tanned skin may be more likely to intentionally tan or use sunbeds to maintain a tan all year round because they think they have been afforded more protection by the nature of their skin type. There is evidence that early use of sunbed exposes people to skin cancer, confirmed in a large prospective cohort study in

Norway (Ghiasvand et al. 2017). Perceived risk was explored in our study, and the data overall suggest that perceived risk is not associated with protective behaviour for many female students. This argument is further supported by the fact that high numbers of students are using sunbeds. These findings suggest that there is disconnection between the *good* attitude of the majority of the participants and their self-reported behaviour. Felts et al. (2010) also found a disconnection between knowledge, risk perception, and behaviour.

So, in conclusion, while female university students aged 18–25 have sufficient knowledge to appreciate the health dangers associated with sun exposure, and demonstrate good attitude to tanning, tanning remains an accepted behaviour predominantly because tanning makes the individual look and feel better, thus enhancing self-esteem. The persistent tanning behaviours of this cohort of university students continue to create challenges for health promotion and primary health prevention within the UK and across the world. On the basis that there is a significant health and economic burden, both direct and indirect, associated with indoor tanning (Waters and Adamson 2018), this study has generated some implications for health promotion practice, policy, and research and a multi-faceted approach is warranted. Health promotion and public health practitioners, higher education institutions, and policy generators might want to focus on increasing the knowledge base of female university students, as it cannot be assumed that higher education students automatically have good knowledge of skin cancer and its risks. Universities within the UK should assume considerable responsibility for health promotion to their students, and promotion of healthy skin care practices should be considered as a high priority, as there is ample scope for risk behaviour improvement. Public health officials and health promotion practitioners should work jointly with universities in developing targeted campaigns that may achieve such objectives. As we know that enhancing knowledge about the risks associated with suntanning is insufficient to change risky tanning behaviours, such health promotion campaigns may consider the use of certain health promotion models as frameworks, as some literature has shown that the use of health promotion models have been successful in initiating behaviour change (Donadiki et al. 2014). Another avenue available to health promoters is to encourage students to confront their own beliefs of *looking tanned and good* as promoted in social media. Such *media literacy* education, which aims to promote greater scepticism of appearance-related media messages by enhancing critical thinking skills, has been associated with successful change in students' tanning behaviours (Mingoa et al. 2019). For legislators, the potential action of restrictions on access to tanning beds and other artificial tanning equipment (Madigan and Lim 2016) alongside marketing restriction within tanning salons (Rodgers et al. 2016) may be required. Qualitative methodologies might be used successfully to explore students' ideas on

how tanning behaviours can be best changed, and it may be worthwhile to undertake parallel investigations sampling male and female students. Ultimately, it appears that quite radical interventions may be needed to modify tanning behaviours amongst students, which will indisputably result in shorter- and longer-term health improvements.

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Authors contribution Both authors whose names appear on the submission:

- 1) made substantial contributions to the conception and design of the research;
- 2) revised it critically for important intellectual content;
- 3) approved the version to be published; and
- 4) agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Orla McDaid collected the data, and Orla McDaid and Vidar Melby undertook data analysis and the writing of this manuscript.

Compliance with ethical standards

The authors wish to state that there are no financial interest or benefit arising from the direct applications of their research. This research involved human participants, and informed consent was obtained from each participant.

Conflict of interest The authors declare that they have no conflict of interest.

Ethics approval The questionnaire and methodology for this study were approved by the Ulster University Institute of Nursing and Health Research Filter Committee. All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent to publish Not applicable.

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