Original Article

Association between smoking and vaping usage and perceived stress levels of undergraduate nursing students in Manila, Philippines

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Background: Nursing students have used cigarettes and electronic cigarettes (ECs) to cope with stress, but such behaviors appear to worsen issues in mental health. Descriptive data are necessary to inform interventions that will strengthen the health-promoting behaviors of the students, which can influence their well-being and professional nursing roles. This cross-sectional study assessed the association between cigarette smoking and EC use and perceived stress levels (PSLs) among nursing students.

Methods: An online-based self-assessment survey was used with 249 nursing students in a private university in Manila as study participants. Information on the participants' socio-demographics, personal and family/peer history of smoking and vaping, and the Perceived Stress Scale (PSS) were gathered. Generalized linear models (GLMs) with a Poisson distribution and robust variance were utilized to estimate the association between the smoking/vaping usage of the students and their PSL.

Results: Participants had a mean (± SD) age of 19.4±0.9, and the majority (90.4%) of them belonged to the lower classes (1st and 2nd). Results showed that 61.0% never smoked nor vaped, and 22.1% have smoked and vaped. Exclusive cigarette and EC users were 4.0% and 12.9%, respectively. Being ever dual users [adjusted prevalence ratio (aPR): 2.47; 95% confidence interval (95% CI): 1.29–4.73; P value <0.01] or exclusive smokers (aPR: 2.16; 95% CI: 0.89–5.26; P value <0.10) were approximately twice more likely to have high PSLs than those who have never smoked nor vaped.

Conclusions: The use of cigarettes and ECs is prevalent among undergraduate nursing students in Manila, Philippines. Dual use of cigarettes and EC, or exclusive use of cigarettes, is associated with increased stress levels among nursing students. Hence, strengthened smoking and vaping prevention measures for the youth are advisable in the Philippines, and further understanding nursing students' health behaviors, such as those related to stress management, seems necessary.

Keywords: Smoking; electronic cigarette (EC); stress level; nursing students; health promotion

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Introduction

As future health professionals, nursing students have a pivotal role in health promotion and disease prevention (1). They will be expected to counsel, advocate for, and model a smoke-free lifestyle (2,3). In terms of mental health care, proper coping skills and attitudes are essential aspects of health promotion (4). Direct health counseling and psychosocial support, school-based interventions, and community-based programs describe some possible roles of nurses in promoting stress management (4,5).

Numerous studies also provide evidence of the stressful experience of nursing students in their undergraduate education—clinical exposure, academic demands, and financial limitations being some familiar sources of stress (6-8). Likewise, there have been successful attempts that address nursing students' mental health difficulties to minimize their impact on academic performance, clinical duties, and well-being (9). Nursing scholars have proposed that specific coping skills and other predictors of stress be investigated further to develop culturally competent interventions that would support positive coping strategies among the students (7,10).

Researchers have found that smoking and vaping are prevalent among nursing students, with their cigarette and electronic cigarette (EC) use seemingly intended to reduce stress (11-13). Studies suggest that nursing students have also engaged in smoking and vaping in the Philippines, but the associations with mental health outcomes are less likely to be investigated (14,15). Furthermore, adolescent substance use has been associated with psychosocial distress, and utilization and availability of mental health services in the country are concerningly limited (16-18).

Personal health risk behaviors and ineffective coping can be detrimental to nursing care performance (19). Nurses who have smoked are 13% less likely to encourage smoking cessation in patients and 25% less likely to arrange follow-up interventions, according to a meta-analysis (20). A descriptive study also revealed that patients strongly believe nurses should model health-promoting behaviors (21). However, the latter study also found that among the six dimensions in Health Promoting Lifestyle Profile-II survey, nurses scored the lowest on stress management and overall had no significant difference in practicing a healthy lifestyle compared to the general population.

Aside from the crucial role of nurses in health promotion, the problem with cigarette or EC use as a coping strategy is that nicotine intake and stress tend to have a bidirectional relationship, which means that smoking and vaping can increase psychological distress and vice versa (22). These researchers found more significant stress and anxiety symptoms among individuals who have exclusively used EC and had no smoking history. While smokers believe nicotine relieves negative affect, an experimental study showed that adolescent nicotine intake and stress exposure synergistically enhanced adult nicotine consumption—without significant difference from baseline stress response or anxiety-like behavior (23). Similarly, Siegel and colleagues in 2019 found that smoking predicts maladaptive stress coping, supporting a longitudinal study in New Zealand that followed adolescents into adulthood at the age of 32 years (24,25). These findings emphasize that smoking facilitates ineffective coping responses. Another study related depression to nicotine dependence, pointing out that overlapping neurobiological processes may occur at the behavioral level—whereas excessively relying on smoking to counteract mood disturbances can prevent individuals from acquiring more effective coping responses (26). Significantly, there is increasing evidence that smoking is a causal factor in the onset of common and severe mental illnesses, including major depression and bipolar disorder (27).

There is a convincing body of knowledge that smoking and vaping can be barriers to optimal health. Moreover, such health risk behaviors predispose individuals to several physical and mental health disturbances. Nursing students

Highlight box

Key findings

- Two out of five nursing students in the Philippines have used cigarettes and/or EC, and more students have used EC than cigarettes.
- Smoking cigarettes with or without concurrent use of EC is linked with increased perceived stress level among nursing students.

What is known and what is new?

- Smoking, smoking-related diseases, and mental health issues are prevalent, and vaping is a rapidly emerging addictive behavior.
- Nursing students in the Philippines who have used both cigarettes and EC or cigarettes only tend to have higher perceived stress levels than those who have not.

What is the implication, and what should change now?

- Smoking and vaping behavior, as well as coping strategies for stress, must be investigated further among future nurses, including other health professionals. Youth smoking and vaping prevention programs and policies must be intensified, especially in school and community settings.

who will be among the key players in addressing this public health issue have also been found to have used cigarettes and EC as coping mechanisms. However, local research on the perceived stress of nursing students, its correlates, and their smoking and vaping behavior is scarce. We, therefore, examined the association between cigarette and EC use and the perceived stress levels (PSLs) of nursing students in a private university in Metro Manila, Philippines. We present the following article in accordance with the SURGE reporting checklist (available at https://jphe.amegroups.com/article/view/10.21037/jphe-22-52/rc) (28).

Methods

Study design and participant recruitment

This study was conducted using a cross-sectional quantitative study design from March to April 2020 upon approval from the institutional ethics review board. Nursing student participants were recruited on-site and online in the College of Nursing of a private university in Manila, Philippines. However, after the implementation of community quarantine and lockdown measures due to the COVID-19 pandemic, online participant recruitment was fully employed.

A total of 830 nursing students were currently enrolled based on the official student registry. There were 390 first-year, 317 second-year, 52 third-year, and 71 fourth-year nursing students; 210 were male, and 620 were female. The sample size was 263 based on Krejcie and Morgan's formula (29), which uses population size, proportion, chi-square, and degree of accuracy to compute for small representative samples. Inclusion criteria were legal age (18 years and older) and current enrollment status in the current school term. Additionally, those who had no access to an internet connection were excluded from the recruitment stage.

Upon request, the university registrar's office handed a sample frame consisting of the number of nursing students per class block. The population was stratified into class blocks, and students were randomly selected using Research Randomizer (30). This web-based software allows random sampling from a set of pre-determined codes, which serve as unique identifiers for the students. The number of participants selected was proportionally representative of each year level. Students from each class block could not be stratified further by sex because the number of male and female students per class block was unavailable in the sample frame.

The response rate was calculated as the ratio of the number of surveys returned and the total number of surveys sent. Out of 830 potentially eligible participants, 666 surveys were sent to randomly selected students. Of these students, 249 (37.4%) nursing students participated.

Instrument

The online-based self-assessment survey gathered socio-demographic information, personal and family/peer history of cigarette smoking and EC vaping, and the participants' PSLs after giving written informed consent. Questions were adapted with permission from the aforementioned researchers and institutions. In addition, consultations with content experts were made to improve content validity and logical flow.

History of cigarette smoking and EC vaping

The first section of the instrument asked for the following socio-demographic information: the participants' age, sex, year level in the program, and monthly household income. Additionally, information about the participants' social influences were also asked—whether their father, mother, other family members, and peers had ever used cigarettes and/or EC.

The following section consisted of multiple choice and Likert scale questions adapted from the International Tobacco Control Policy Evaluation Project—Youth Tobacco and Vaping Survey and Population Assessment of Tobacco and Health (ITC-PATH) (31,32). Questions came from institutional survey projects with no available reports of psychometric properties, except those concerning PATH's potential use for investigating tobacco dependence (33,34). This section classified participants into four groups according to their personal history of cigarette and EC use: (I) never smoker and vaper; (II) ever cigarette smoker only (current or former smoker); (III) ever vaper only (current or former vaper); and (IV) ever cigarette smoker and vaper (current or former smoker and current or former vaper).

PSLs

The global instrument Perceived Stress Scale (PSS) was used with the authors' permission to measure the participants' stress levels (35). PSS is a 10-item Likert scale in English. The PSS with ten items has a Cronbach's alpha at >0.70 in all 12 studies (36). The validity and reliability of the instrument have been evaluated recently (37,38). No efforts for cross-cultural validation were made as English

is one of the official languages of the Philippines and a medium of instruction in schools and colleges.

This questionnaire asks about the feelings and thoughts of the respondent in the past month. Responses "never", "almost never", "sometimes", "often", and "very often" were encoded as 0–4, respectively. Four out of 10 statements were reversely scored. The total of the scores determined and categorized the PSL of the respondent as low (<14), moderate (14 to 26), or high (>26).

Participants were then classified into two groups according to their PSL score (low to moderate perceived stress: score ≤26; high perceived stress: score >26).

Data collection

The online-based survey was generated using Google Forms, which allowed the participants to independently and anonymously answer the survey. Written online informed consent was required before answering the questionnaire. Every participant was assigned a unique numerical identifier that would be used for monitoring during data collection. All other direct personal identifiers were removed for data analysis. These measures were informed and emphasized to the participants to minimize social desirability and reporting biases.

Contact persons of the survey were block representatives or class officers, and the researchers shared information about the study via instant messaging platforms (i.e., SMS, Facebook Messenger). The list of randomly selected eligible participants identified only by their class number was also provided along with the survey link for those willing to participate.

Before lockdown and quarantine measures due to the COVID-19 pandemic, the on-site survey was done among 150 nursing students. In-kind incentives were initially handed out but were terminated upon shifting to an online-based survey. Follow-up messages were sent in the succeeding weeks to encourage participation despite the remote online setup.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics board of the University of Santo Tomas College of Nursing (No. USTCON 2020-SR01), and individual consent for this retrospective analysis was waived.

Statistical analysis

Descriptive statistics for smoking and EC use, PSLs, and other covariates were calculated. Bivariate and multivariate analyses were used to evaluate the associations between every ascertained covariate and the PSL health outcome using generalized linear models (GLMs) with a Poisson distribution, log link function, and a robust variance; a more suitable method for cross-sectional data with a common health outcome (39-41).

Crude and adjusted prevalence ratios (cPR and aPR) with a 95% confidence interval (CI) were used to report the effect size estimates for the associations of smoking and EC use and other *a priori* identified confounding factors with the PSL health outcome. In addition, the effect of unmeasured confounding was assessed using sensitivity analysis and expressed using E-values (42). STATA 17 software (www.stata.com/stata17/) was used to conduct all statistical analyses.

Results

There were 249 participants whose mean age (± SD) of 19.4 (±0.9) years old, of which approximately 2 out of 5 students were 20 years old and above. Most of them belonged to lower year levels (90.4%). In addition, about three out of five were non-smokers and non-vapers, and 1 out of 5 were known to be dual users. About 4.0% and 12.9% of the participants were exclusive cigarette users and exclusive EC users, respectively. On the other hand, most of them had peers who were either smokers or vapers (93.2%), which was also observed for their family members (83.5%). Regarding their stress levels, around three-fourths of the participants were considered to have moderate stress levels, while 16.1% of them were screened to have a high level of stress. See *Table 1* for details.

cPR and aPR with a 95% CI were calculated to estimate the association of smoking and vaping with the risk of having a high PSL. In the crude bivariate analysis, students who were ever smokers and/or vapers were almost twice more likely to have high PSLs (cPR: 1.93; 95% CI: 1.05–3.56; P value <0.01) compared to those students who were never smokers nor vapers. However, after adjusting for covariates, *Figure 1* showed that exclusive smoker students were also twice more likely to have high PSLs (aPR: 2.16; 95% CI: 0.89–5.26; P value <0.10) compared to those students who were non-smokers and non-vapers. A similar result was also seen for students who were ever smokers and vapers (aPR: 2.47; 95% CI: 1.29–4.73; P value <0.01) compared to non-smoker and non-vaper students (see full details in *Table 2*).

Table 1 Study participants' characteristics (N=249)

Characteristics	Values[a]
Age, years (%)	19.4±0.9
18 to 19 years old	58.6
20 years old and above	41.4
Sex (%)	
Male	22.1
Female	77.9
Year level (%)	
Lower class (1st–2nd year)	90.4
Upper class (3rd–4th year)	9.6
Monthly household income, PhP (%)	
<50,000.00	26.5
50,000.00 and above	73.5
Cigarette smoking and vaping status of peers (%)	
No cigarette smoker or vaper	6.8
≥1 cigarette smoker or vaper	93.2
Cigarette smoking and vaping status of family members (%)	
No cigarette smoker or vaper	16.5
≥1 cigarette smoker or vaper	83.5
Exposure: smoking/vaping status (%)	
Non-smoker and vaper	61.0
Cigarette smoker only	4.0
Vaper only	12.9
Both cigarette smokers and vapers	22.1
Health outcome: perceived stress level (%)	
Low	6.4
Moderate	77.5
High	16.1

[a], distributions of variables are reported as percentages or mean ± standard deviation. PhP, Philippine Peso.

The E-values for the point estimate and the CI resulting from the sensitivity analysis of the unmeasured confounding were also summarized in *Table 2*. With an observed point estimate prevalence ratio of 2.47, an unmeasured confounder associated with both smoking/vaping status and PSL by a prevalence ratio of 4.38 each, above and beyond the measured confounder, could explain away the prevalence ratio estimate. Furthermore, with an observed lower bound CI prevalence ratio of 1.29, an unmeasured confounder was associated with both smoking/vaping status and PSL by a prevalence ratio of 1.90 each, above and beyond the measured confounders, which could shift the CI to include the null. However, weaker confounding could not.

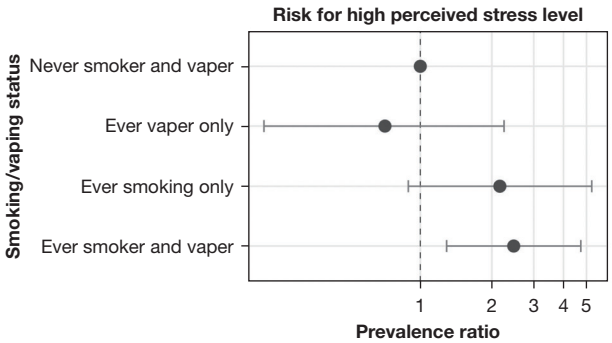

Figure 1 aPR for the association between smoking and vaping use and the risk of having a high perceived stress level. Error bars indicate 95% confidence intervals. aPR, adjusted prevalence ratios.

Discussion

The study found that dual users of cigarettes and EC or exclusive cigarette smokers were twice more likely to have high PSLs than those who had never smoked or vaped. The majority (61%) of the nursing students in the current study have never used cigarettes and EC, which varies in other nursing and health sciences schools: 25% in the United States, 47% in Italy, and 62% in Spain (43-45). Interestingly, the study also noted that among ever users, most had used both cigarettes and EC at 22%, slightly higher than the combined prevalence of those who have used cigarettes (4%) or EC (13%) only. This trend is consistent with a cross-sectional study of university students in South Korea (46). In contrast, a longitudinal study in the United Kingdom revealed that exclusive cigarette smokers still predominate over dual users and exclusive EC users (47). Other studies also found a higher prevalence of cigarette use among nursing students than EC (13,43,45,48). Cross-cultural differences can account for variations in smoking and vaping prevalence estimates. In the Philippines, the decreasing prevalence of current tobacco use since 2000 has been observed (49). In addition, based on the preceding report, the country's population-based Global Adult Tobacco Survey found that the current use prevalence among people aged 15 years and older was 25.3% in 2015

Table 2 cPR and aPR with 95% CI for the associations of vaping and smoking status, socio-economic factors, smoking status of family and peers with the risk of having a high PSL

Characteristics[a]	Total (n=249)	High PSL (n=40), n (%)	Low-Med PSL (n=209), n (%)	cPR (95% CI)	aPR (95% CI)	E_{est}[b]	E_{CI}[c]
Smoking/vaping status							
Never smoker and vaper	152	20 (50.0)	132 (63.2)	1.00	1.00		
Ever smoking only	10	3 (7.5)	7 (3.3)	2.28 (0.81–6.41)	2.16 (0.89–5.26)*	3.74	1.00
Ever vaper only	32	3 (7.5)	29 (13.9)	0.71 (0.22–2.26)	0.71 (0.22–2.25)	2.17	1.00
Ever smoker and vaper	55	14 (35.0)	41 (19.6)	1.93 (1.05–3.56)**	2.47 (1.29–4.73)**	4.38	1.90
Age, year							
18 to 19 years old	146	24 (60.0)	122 (58.4)	1.00			
20 years old and above	103	16 (40.0)	87 (41.6)	0.94 (0.53–1.69)			
Sex							
Male	55	5 (12.5)	50 (23.9)	1.00			
Female	194	35 (87.5)	159 (76.1)	1.98 (0.82, 4.83)			
Year level							
Upper class (3^{rd}–4^{th} year)	24	3 (7.5)	21 (10.0)	1.00			
Lower class (1^{st}–2^{nd} year)	225	37 (92.5)	188 (90.0)	1.32 (0.44, 3.96)			
Monthly household income, PhP							
<50,000.00	66	13 (32.5)	53 (25.4)	1.00			
50,000.00 and above	183	27 (67.5)	156 (74.6)	0.75 (0.41, 1.36)			
Cigarette smoking & vaping status of family members							
No cigarette smoker/vaper	41	5 (12.5)	36 (17.2)	1.00			
≥1 cigarette smoker/vaper	208	35 (87.5)	173 (82.8)	1.38 (0.57, 3.32)			
Cigarette smoking & vaping status of peers							
No cigarette smoker/vaper	17	2 (5.0)	15 (7.2)	1.00			
≥1 cigarette smoker/vaper	232	38 (95.0)	194 (92.8)	1.39 (0.37, 5.30)			

[a], distributions of variables are reported as n (%); [b], E-value (point estimate); [c], E-value (confidence interval); *, P value <0.10; **, P value <0.01. cPR, crude prevalence ratio; aPR, adjusted prevalence ratio; CI, confidence interval; PSL, perceived stress level; PhP, Philippine Peso.

and 22.9% in 2020. Local policies such as smoking ban and cigarette excise tax reform suggest contributing to this downward trend and may likely explain the low smoking prevalence of the present study (50,51). However, evidence points out weak vaping regulation policies in the Philippines despite proliferating EC use and encouraging progress in smoking prevalence control (52,53).

The frequency of ever use of cigarettes and EC among nursing students in the current study is not negligible. Estimates in our study support the claim that smoking and vaping are prevalent even among nursing students (43,48,54). A possible explanation is that nursing students lack knowledge about smoking and vaping, including health effects and their essential role in tobacco control (45,48). A cross-sectional study in another university in the Philippines found that most nursing students had poor knowledge of EC and those who currently smoke supported vaping (14). Insufficient knowledge might mean a higher risk of experimental and continued use as well as decreased self-efficacy and effectiveness in performing smoking cessation

interventions as nurses (55,56).

The current study also showed that students who used both cigarettes and EC were twice more likely to have high PSLs after adjusting for the other covariates. Our finding may be explained by the effect of nicotine on the physiological stress response. Nicotine—which is the primary psychoactive substance in cigarettes and is also present in different concentrations in e-liquids marketed for EC as "freebase nicotine" and "nic salts"—is known to have a dose-dependent increasing effect on epinephrine, cortisol, and adrenocorticotropic hormone and to trigger the release of norepinephrine and corticotropin-releasing hormone (57,58). Based on the last review of human studies about drug-induced stress responses, nicotine appeared to directly stimulate the catecholaminergic and cholinergic pathways of the autonomic nervous system, which then activates the hypothalamic-pituitary-adrenal (HPA) axis. This stress response is clinically manifested by increased blood pressure, increased heart and respiratory rates, increased levels of alertness, and tremors (57). Aside from these biologically plausible mechanisms, other factors, such as rationalized smoking behavior, denial of health risks, and perceived stress, can contribute to the use of cigarettes and EC among nursing students (59,60). If maladaptive coping persists, there could be an increased risk of stress, anxiety, and depression (61). Mental health promotion interventions, such as mindfulness-based techniques and enhanced emotional regulation strategies, may benefit nursing students (9,62). Counseling and smoking cessation are warranted for current cigarette and EC users (55).

On the other hand, in the crude analysis, the smoking and vaping status of family and peers were not significant predictors of high PSLs for nursing students. This finding is acceptable as other factors, such as their academic and clinical environment, can significantly affect their perception of stress (7). Furthermore, the social influence of nursing students would be more appropriately related to their smoking and vaping behavior, as reported in other studies (12,59,63).

Moreover, female participants had an increased risk of having high PSLs, as seen in our crude analysis. This finding supports Martínez and colleagues' multicenter cross-sectional study [2019] on nursing students. The researchers found that stress management is one of the leading reasons for continuing smoking and is more frequently reported by women than men (13). Consistent with other studies, possible explanations include differences in emotional expression and stress reactivity—wherein females tend to be more expressive and biologically vulnerable to stress-induced hyperarousal (64-66). Men, however, were at higher risk for substance use (13,63). In contrast, a multicenter study of undergraduate nursing students in Italy did not find gender differences in stress levels (67). Nonetheless, these findings suggest that interventions such as promoting healthy stress management techniques and having well-planned teaching programs might benefit nursing students regardless of gender (6,9,67).

Meanwhile, age, year level in the program, and household income were not significantly associated with high perceived stress in our crude analysis. These findings do not align with other studies, including a systematic review of studies that involved nursing students in Saudi Arabia. However, the review noted that a few studies also did not find significant associations with age and academic level (6,7,67). It may be the case that other more influential factors influenced the stress among the nursing students, such as uncertainties about their academics, career, and general well-being during the first few months of the COVID-19 pandemic—during which the present study was conducted (68).

This study sought to contribute to developing local health research and policies for smoking and vaping. The results of this study warrant the need to conduct more research on the use of cigarettes and EC, perhaps focusing on the intensity and frequency of use among young adults and health sciences students as at-risk populations. This study is also among the first in the Philippines to offer nursing educators and professionals insights on enhancing their students' personal and professional capacity with regard to smoking cessation and stress management.

However, this study also has limitations. The study site and sample size limit the generalizability of our findings. More research on the perceived stress and health risk behaviors, such as smoking and vaping, among nursing students in the country may be necessary. Furthermore, although data collection was employed after providing the participants with information about the study and ensuring anonymity and confidentiality, social desirability bias could not be eliminated among the nursing students. Surveys on smoking and vaping among the youth tend to be underreported (69-71), therefore, biochemical validation of self-reported smoking or vaping status should be included and conducted in future studies. Mixed method or qualitative studies may give essential details on the needs of nursing students to promote personal health-promoting behaviors. Moreover, unmeasured confounding

factor bias also could not be ruled out. Lastly, the study's cross-sectional design could not guarantee temporality and causality between the variables and perceived stress among nursing students.

Conclusions

This study documents the use of cigarettes and ECs among undergraduate nursing students can be comparable to the general population. Dual use of cigarettes and EC, or exclusive use of cigarettes, may increase high-stress levels among nursing students. In addition, strengthened smoking and vaping prevention measures for the youth are advisable in the Philippines. Further research on nursing education and practice may be necessary to support the students' health-promoting behaviors, including positive coping skills, as they can affect their health and future professional duties in disease prevention and management.

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jphe.amegroups.com/article/view/10.21037/jphe-22-52/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are 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. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics board of the University of Santo Tomas College of Nursing (No. USTCON 2020-SR01), and individual consent for this retrospective analysis was waived.

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