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RESEARCH ARTICLE

Use and Perceptions of Information and Communication Technologies Among Ecuadorian Nurses: A Cross-sectional Study

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Abstract:

Background:

Nurses represent a key group for the implementation of Information and Communication Technologies (ICTs), however, few studies have explored the current use of these technologies among healthcare professionals in developing countries. Our study aims to achieve a better understanding of how Ecuadorian nurses perceive the theoretical advantages and limitations of ICTs, as well as to explore the current use of these technologies in the setting of the professional nursing practice.

Methods:

We conducted an anonymous survey-based cross-sectional study where 191 nurses rated their frequency of use and level of agreement to specific statements on perceptions related to ICTs. For the statistical analyses, adjusted binomial logistic regressions and the chi-squared test for association were applied.

Results:

In general, 96.3% of nurses reported the use of ICTs to communicate with colleagues, and 80.1% reported the use of ICTs to communicate with patients. More than 70% of participants agreed that ICTs can be useful to promote professional services, help in the search for new job opportunities and/or professional development, foster health promotion, and improve the workflow with colleagues. Meanwhile, 78.6% of nurses had privacy or security concerns about personal and/or patient information, and 60.6% reported not having enough time neither to learn how to use ICTs nor to use them.

Conclusion:

High use of ICTs was found among Ecuadorian nurses for communicating with both colleagues and patients. Most of the participants had a positive perception of the use of ICTs in the healthcare practice, particularly among younger nurses. Finally, the major reservations perceived were related to privacy and patient confidentiality, and lack of time to learn how to use, or use ICTs.

Keywords: Information and communication technologies, Latin America, Nursing informatics, Public health, Social media, Internet, Patient education.

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1. INTRODUCTION

A few years ago, the United Nations approved 17 “Sustainable Development Goals” in which decreased mortality from

non-communicable diseases was an example concerning the objective of enhancing health and wellbeing [1]. Nevertheless, health care systems are struggling to provide quality care for an

increasing burden of patients with chronic diseases, while simultaneously facing a global shortage of nurses [2 - 4]. The emergence of new methods of communication providing multidirectional participation can offer new opportunities that could significantly change the landscape of medical care [2]. The implementation of information and communication technologies (ICTs) among healthcare professionals, defined as digital technologies that support the capture, processing, storage, and exchange of information, offers easy access to updated information, simplifies communication between colleagues and patients, and creates new opportunities for clinical education [5 - 9].

Despite the aforementioned benefits, many ICTs resources have been observed to be insufficient, particularly among developing countries [10]. There are other barriers commonly identified for the implementation of ICTs in the healthcare practice, such as concerns about privacy and patient confidentiality, and lack of time to train or use ICTs in the professional practice [7, 8, 11, 12]. These barriers could lead to the misuse of technology and potentially impact communication at the workplace. For instance, a recent study found that nurses often felt that physicians ignored their emails, feeling belittled and frustrated during working hours, while some nurses even considered ICTs as a distraction instead of a work tool [13, 14].

Nurses represent an important target for ICT implementation, not only because they constitute the largest health provider group of the healthcare workforce, but also due to the significant input they provide to patient safety, recovery and healthcare quality [15 - 17]. However, only a few studies have explored the ownership and use of these technologies among nurses in developing countries, presenting limited but highly interesting findings [18]. For instance, one study found that more than one-third of nurses are considered novices in their understanding of ICTs, with another study suggesting that many nurses and nursing support staff may not have the minimum computer competencies to effectively and efficiently perform their work [19, 20]. With this in mind, our study aims to achieve a better understanding of how Ecuadorian nurses perceive the theoretical advantages and limitations of ICTs, as well as to explore the current use and interest of these technologies in the setting of the professional nursing practice.

2. MATERIALS AND METHODS

2.1. Study Design and Population

We conducted an anonymous survey-based cross-sectional study, from August 2018 to November 2018, where 191 Ecuadorian nurses rated their frequency of use and perceptions toward ICTs. Participants were selected through convenience sampling, and in order to be included, they had to be i.) either a registered nurse according to the professional legislation of Ecuador or a certified nursing assistant and ii.) enrolled in an active healthcare practice that provides public or private services, including hospitals, long-term care centers and/or

outpatient clinics. Students without an official certification were excluded. Additionally, this study was conducted and reported according to the most recent STROBE statement guidelines [21].

2.2. Procedures

We designed a questionnaire to measure: i) the frequency of use of ICTs among nurses in a professional setting, ii) the frequency of using ICTs to communicate with colleagues and patients, and iii) their agreement toward statements concerning perceptions and barriers of ICTs. The survey was designed based on data provided by other publications assessing the most critical aspects concerning the attitudes and perceptions on the use of mobile computed devices and ICTs in M-learning and healthcare. A pool of 43 selected questions was reviewed by an expert panel of professionals. They provided their judgment on the viability and suitability of the items in terms of design, language and clarity of meaning. Based on these criteria, items were further modified or deleted, while other new items were added [22 - 24]. The final questionnaire consisted of 11 items and took roughly 5 minutes to complete. The content of the final version, including the sections and selected items of the questionnaire, is best summarized in Table 1.

Nurses were asked to quantify, through a self-applied questionnaire, their use of each ICT in the professional setting (web browsers, email, SMS, WhatsApp, Facebook, Facebook Messenger, YouTube, Instagram, Twitter, LinkedIn, and Skype) under a specific scale (daily, two to three times a week, at least once a week, at least once a month, or never). Additionally, participants were asked to quantify their frequency of use of ICTs to communicate with colleagues and patients using the same scale. Furthermore, the agreement toward statements concerning perceptions and barriers of ICTs were measured using a dichotomy (agree and disagree).

Before filling the survey, all participants were informed of the purpose of the study and their role. During the survey, nurses completed the questionnaire either by themselves or with the help of a previously trained individual.

2.3. Ethical Considerations

This study was approved by the local ethics committee "Comité de ética e Investigación en Seres Humanos" (CEISH). Informed consent was obtained prior to participation in the survey. We assured that the identity of participants would not be revealed.

2.4. Statistical Analysis

Descriptive statistics were performed for demographical data. Categorical variables were summarized as frequencies and percentages, and continuous variables as means and standard deviations. For the frequency of use of ICTs, each category was dichotomized as "low" (at least once a month, and at least once a week) and "high" (two to three times a week, and daily). Adjusted binomial logistic regression analyses were performed between the independent variables (age, gender, years of experience, type of nurse, and type of institution) and the frequency of use of ICTs to communicate

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with colleagues and patients. Finally, Pearson's *Chi*-squared test, or Fisher's exact test when appropriate, were used to assess the associations between the same independent variables and the agreement (agree, disagree) toward statements concerning perceptions and barriers of ICTs. The data was analyzed using SPSS version 24.0 software (SPSS Inc., Chicago, IL, USA). A value of less than 0.05 was considered statistically significant for all tests.

3. RESULTS

3.1. Demographics, Smartphone Ownership and Frequency of Use of ICTs

A total of 191 nurses were surveyed for the study, with a gender distribution of 71% female, and a mean age of 37.8 (SD, 12.2) years (Table 2). Among them, 57.1% had more than

five years of working experience, 55% were registered nurses, and 74.9% worked at public institutions. Regarding smartphone access, 97.9% of participants reported owning one.

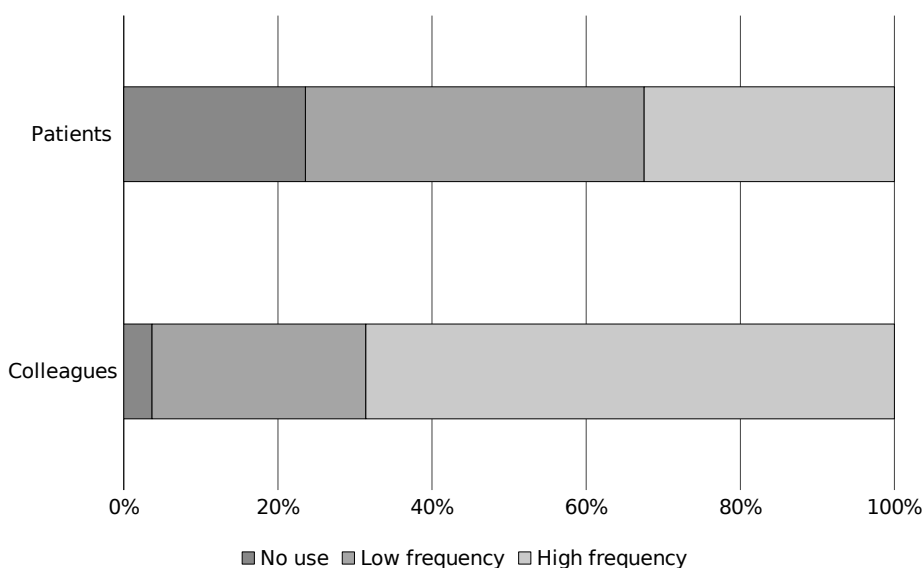
From the surveyed individuals, 96.3% reported using ICTs to communicate with colleagues, and 80.1% to communicate with patients (Fig. 1). Of the demographical variables analyzed, working at a rural area was the only factor found to present with a statistically significant increase in the likelihood of using ICTs to communicate with patients (OR 4.87). No statistically significant differences were found between demographic factors and the frequency of use of ICTs to communicate with colleagues (Table 3). Concerning the frequency of use for professional purposes, WhatsApp (96%), web browsers (93.2%), and email (86.2%) were the most frequently used ICTs (Fig. 2).

Table 1. General summary of the sections and items included in the questionnaire.

Instrument sections	Selected items
Frequency of use of ICT	1. How frequently do you use information and communication technologies to communicate with colleagues? 2. How frequently do you use information and communication technologies to communicate with patients? 3. How frequently do you use each information and communication technology for professional purposes (WhatsApp, Web browsers, Email, Facebook, SMS, Facebook messenger, YouTube, Instagram and Twitter)
Perceptions	<i>Information and communication technologies are useful to me for:</i> 1. Promoting my professional services 2. Search for new job opportunities and/or professional development 3. Participate in research projects 4. Promote health 5. Work in group with colleagues <i>Concerning the use of information and communication technologies I must declare that:</i> 6. I dislike interacting with colleagues through such channels 7. I prefer traditional channels of communications (phone call and/or medical interview)
Barriers	<i>In the professional setting, the use of information and communication technologies is limited because:</i> 1. I am concerned about privacy or security about personal and/or patient information 2. Do not have access to mobile internet 3. Do not have access to internet at work 4. Do not have enough time to neither learn how to use them nor use them

Table 2. General characteristics of the surveyed population n=191.

Characteristics	N	%
Age		
22 to 29	71	37.1
30 to 49	83	43.5
≥50	37	19.4
Gender		
Female	135	71.1
Male	56	28.9
Experience in years		
≤5 yeas	81	42.9
>5 years	108	57.1
Position		
Registered nurse	105	55.0
Certified nursing assistant	86	45.0
Institution		
Public	143	74.9
Private	46	24.1



Notes: The proportion of participants reporting their frequency of use of information and communication technologies to communicate with patients and colleagues is presented as percentages. 80.1% of participants use ICTs to communicate with patients, while 96.3% use them to communicate with colleagues. In addition, the use of ICT to communicate with colleagues presents a greater proportion of high frequency communication with colleagues (68.6 %) than with patients (32.5%).

Fig. (1). Frequency of use of information and communication technologies to communicate with patients and colleagues.

Table 3. Adjusted binomial regression analysis between demographic variables and high frequency of use of ICTs to communicate with colleagues and patients.

Variable	Colleagues		Patients	
	Adjusted OR	95% CI	Adjusted OR	95% CI
Age ^a				
30 to 49	0.72	(0.21, 2.52)	1.19	(0.40, 3.63)
≥50	0.52	(0.12, 2.15)	0.55	(0.13, 2.25)
Women ^b	0.32	(0.11, 0.80)	1.06	(0.48, 2.47)
Registered Nurse ^c	1.49	(0.68, 3.32)	1.10	(0.50, 2.45)
Experience > 5 years ^d	0.53	(0.15, 1.69)	0.50	(0.17, 1.43)
Private institution ^e	0.97	(0.39, 2.49)	2.04	(0.84, 4.95)
Rural area ^f	0.17	(0.06, 0.50)	4.87	(1.80, 14.01)

Notes: Bolded values are significant at the 0.05 significance level. ^a Reference age category is 22 to 30 years. ^b Reference gender category is men. ^c Reference type of position category is certified nursing assistant. ^d Reference category for years of experience is ≤5 years. ^e Reference category for institution is public institution. ^f Reference category for area is urban.

Abbreviations: ICTs, Information and Communication Technologies; OR, Odds Ratio

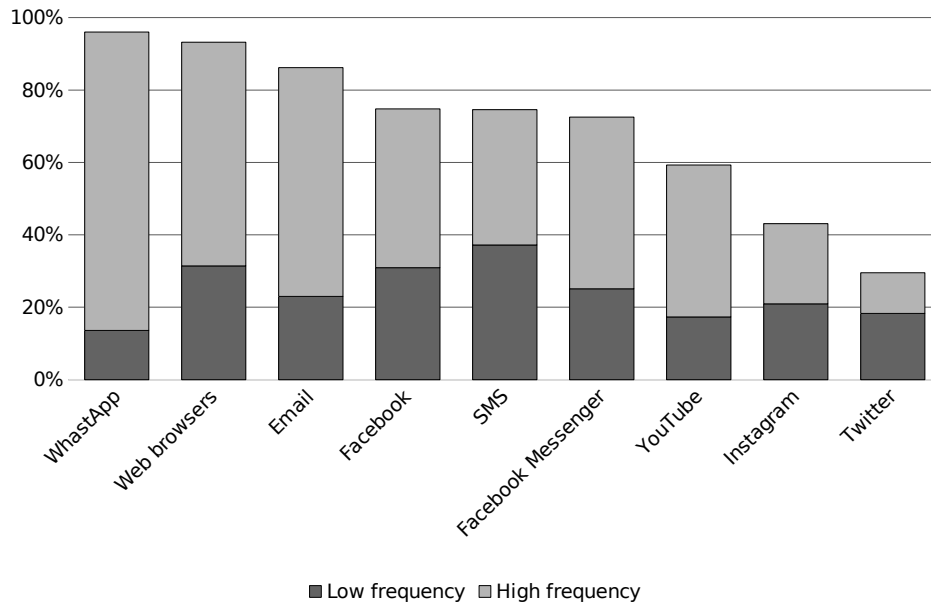
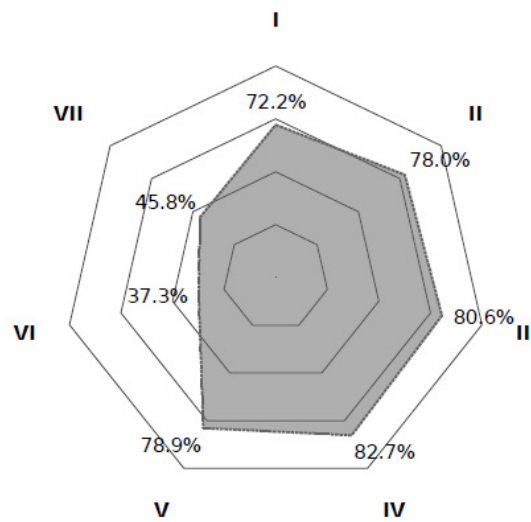


Fig. (2). Frequency of use of information and communication technologies for professional purposes among Ecuadorian Nurses.

3.2. Perception and Barriers of ICTs

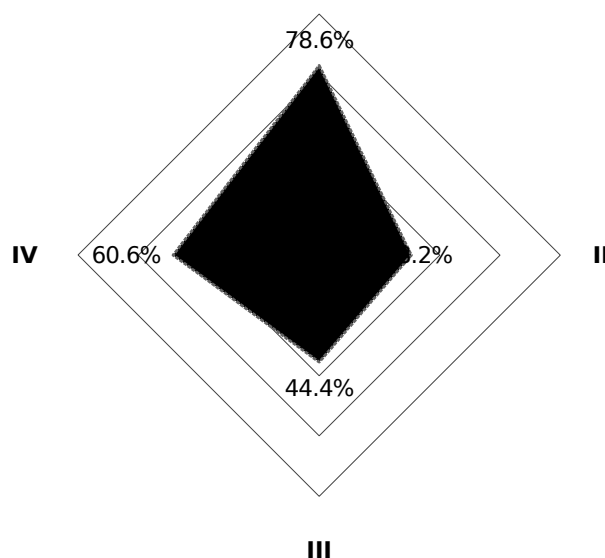
More than 70% of the surveyed participants agreed that information and communication technologies can be useful to promote professional services, help in the search for new job opportunities and/or professional development, foster health

promotion, and improve the workflow with colleagues (Fig. 3). However, 37.3% of the participants disliked interactions with colleagues through such channels, while 45.8% preferred traditional channels of communication like phone calls or medical interview.



- I, "Promote my professional services"
- II, "Search for new job opportunities and/or professional development"
- III, "Participate in research projects"
- IV, "Promote health"
- V, "Work in group with colleagues"
- VI, "Dislike to interact with colleagues through such channels"
- VII, "Prefer traditional channels of communications"

Fig. (3). Perceptions of information and communication technologies by nurses. Each perception is represented by one vertex. All proportions depicted are individuals that agree with the statement.



- I, “Concerned about privacy or security about personal and/or patient information”
- II, “Do not have access to mobile internet”
- III, “Do not have access to internet at work”
- IV, “Do not have enough time to neither learn how to use them or use them”

Fig. (4). Barriers of information and communication technologies in nurses. Each barrier is represented by one vertex. All proportions depicted are individuals that agree with the statement.

Concerning the barriers for ICTs, 78.6% of participants had privacy or security concerns about personal and/or patient information, 38.2% described lacking access to mobile internet, and 44.4% reported lacking internet at work. Finally, 60.6% of the participants were found to not have enough time to either learn how to use ICTs or to use them.

From the demographical variables analyzed, age, working experience and type of institution were found to have statistically significant association with some perceptions and barriers. Less experienced nurses were associated with higher agreement rates that ICTs can be useful for promoting

professional services (85.2%), searching for new job opportunities (87.7%), participating in research projects (90.1%), and promoting health (91.4%), than more experienced nurses. Younger nurses (<50 years of age) were also more likely to agree that ICTs can be useful for promoting their professional services than their counterparts ($p=0.002$).

On the other hand, more than 40% of the nurses (≥ 30 years), and with more years of experience, reported no access to internet on mobile, and internet at work (Table 4). Finally, nurses in public institutions were more likely to prefer traditional channels of communication than their counterparts.

Table 4. Associations between demographic characteristics and the studied perceptions and barriers toward ICTs among Ecuadorian nurses.

	Age								Experience				Institution				
	22 to 29 years		30 to 49 years		≥ 50 years		p-value	≤ 5 years		> 5 years		p-value	Public		Private		p-value
	N	%	N	%	N	%		N	%	N	%		N	%	N	%	
Perceptions																	
I Promote my professional services	55	77.5	65	78.3	18	48.6	0.002	69	85.2	68	63	0.001	98	68.5	38	82.6	0.097
II Search for new job opportunities and/or professional development	57	80.3	68	81.9	24	64.9	0.096	71	87.7	77	71.3	0.012	109	76.2	38	82.6	0.483
III Participate in research projects	60	84.5	67	80.7	26	72.2	0.316	73	90.1	79	73.8	0.009	116	81.7	35	76.1	0.537
IV Promote health	59	83.1	71	85.5	28	75.7	0.416	74	91.4	83	76.9	0.015	119	83.2	37	80.4	0.834
V Work in group with colleagues	56	78.9	67	80.7	27	75	0.781	69	85.2	80	74.8	0.118	115	80.4	33	73.3	0.421
VI Dislike to interact with colleagues through such channels	22	31	30	36.6	19	51.4	0.114	26	32.5	45	41.7	0.259	51	35.9	19	41.3	0.63

(Table 4) contd.....

VII Prefer traditional channels of communications	31	43.7	36	43.9	20	54.1	0.531	34	42	53	49.5	0.378	73	51.4	14	30.4	0.021
Barriers																	
I Concerned about privacy or security about personal and/or patient information	54	76.1	65	78.3	31	83.8	0.649	64	79	84	77.8	0.98	115	80.4	33	71.7	0.3
II Do not have access to mobile internet	16	22.9	39	49.4	16	43.2	0.003	19	23.8	51	49	0.001	56	40.3	14	31.1	0.355
III Do not have access to internet at work	23	32.4	41	51.2	19	52.8	0.035	25	30.9	57	54.8	0.002	59	42.4	23	50	0.47
IV Do not have enough time to neither learn how to use them or use them	37	53.6	55	68.8	20	55.6	0.134	46	58.2	65	62.5	0.665	88	63.8	24	53.3	0.284

4. DISCUSSION

Although computer and information systems have been used in healthcare since the 1980s, mobile technologies in the nursing practice are relatively new but necessary for communication and educational purposes [25]. Currently, it is estimated that approximately 77% of adults in the U.S general population own a smartphone [26]. In our study, we found a higher proportion of smartphone ownership among nurses (97.9%); a finding that agrees with a recent study on the ownership and clinical use of smartphones by healthcare professionals in the U.K [18]. In the same study by Mohammed and colleagues, despite the proportion of smartphone ownership among physicians and nurses being roughly the same, physicians were more likely than their counterparts to use their phones for communication with colleagues [18].

In our study, 96.3% of the nurses used ICTs to communicate with their peers. On the other hand, there was less use of these technologies for communicating with patients (80.1%). A possible explanation to such observation could be the risks associated with their use such as: privacy violation, unmoderated content, unprofessional behavior and organizational risk [27]. Furthermore, of the demographic variables analyzed, working in a rural area was the only factor that was found to be responsible for increasing the likelihood of using ICTs to communicate with patients (OR 4.87). Given the fact that in remote areas, nurses are usually limited in resources and support, ICTs represent a viable channel to increase access and equity to health care information and services [28]. For instance, a pilot study found that the quality of life for older, rural adults and family members living at homes with advancing chronic illness, improved with early palliative support of a nurse navigator, not only through visits but also through cellphone consultations [29]. Telehealth technologies then, through the use of a wide array of ICTs, can provide a platform for remote patient monitoring, videoconferencing, and computer-mediated communications [30].

Despite the theoretical benefits that ICTs can offer, the development and integration of health information technology create significant changes in the nursing practices that have been associated with a low intention to use ICTs by nurses [31, 32]. In this regard, a recent integrative literature review found that i) offering adequate education and training, ii) having an adequate representation of nurses during the design phase of ICTs to be implemented, and iii) having sufficient technological support in the practice, are factors that could foster an organizational culture that supports the use of ICTs in a day-to-day practice [33]. In another study, Lavin and

colleagues identified several common issues among nurses and electronic health records, that included issues with medication safety, documentation, standards of practice, and efficiency; while also identifying barriers with technology related to interoperability, vendors, innovation, nursing voice, education, and collaboration [34].

Discussing specific ICTs, we found the instant messaging application WhatsApp to be rated with the highest frequency of use among nurses (82.4%). In the setting of healthcare, a study by Ganasegeran and colleagues exploring the perceived benefits of WhatsApp in the clinical practice found that almost 70% of surveyed health professionals perceived this application as beneficial during clinical practice [35]. This ICT has the potential to enhance and improve the efficiency in communication between health professionals, relaying quick information that could, in turn, reduce medical errors [35]. Additionally, the potential for using WhatsApp is particularly relevant in resource-poor contexts, due to the widespread use and affordability, which in turn could be used for learning purposes in the nursing practice [36]. For instance, one study undertaken in Nigerian student nurses found that participants reported the WhatsApp enabled learning space as valuable, in particular, for the transfer of knowledge in day-to-day teaching practices, and for their professional development [37]. This interesting finding indicates a feasible opportunity for the use of this platform to provide supervision and learning in situations where there are limited face-to-face interactions [37].

Recent evidence suggests that nurses' attitudes and behaviors are determinants for accessing internet-related health information [11]. For instance, Koivunen and colleagues found that nurses who had positive attitudes toward the internet presented with less stress and more job satisfaction than their counterparts [38]. In another study, most of the surveyed healthcare professionals perceived the clinical use of smartphones and medical apps as positive [18]. We found that the implementation of ICTs in the healthcare practice was perceived by most nurses from our study as useful for promoting professional services, searching for new job opportunities, participating in research projects, promoting health, and working with colleagues as a group. Although most nurses in our study acknowledge some of the benefits related to ICTs, around half of the participants preferred traditional channels of communication, while approximately one-third disliked interaction with colleagues through ICTs. Regarding the latter, one study notes that nurses perceived a negative impact on interprofessional relationships due to the decrease in verbal conversations among healthcare professionals related to the use of technology [13]. It is estimated that in the forthcoming years, web-based consultations will increasingly

replace traditional face to face interactions in patient-provider communications [39]. ICTs might not entirely replace face-to-face interactions, but can be considered a compliment for improving patient care [7].

Many developing countries have embraced the use of e-Health and m-Health applications as a means to improve public health, and primary healthcare delivery [40]. However, its worldwide implementation has faced several challenges along the way. According to the WHO, the absence of legal guidelines on privacy and patient confidentiality is regarded as the most important significant barrier to m-Health implementation in regions such as Europe and America [41]. Furthermore, in a recent overview of systematic reviews assessing the impact of ICTs in nursing care, the most frequently reported themes were related to documentation time; assessment, care planning, and evaluation; nurses' perspective of the quality of care provided; information quality and access; and time spent on patient care [42]. In our study, 78.6% of the participants perceived these privacy and security concerns as a major barrier, even though Ecuador has laws addressing patient's confidentiality and management of medical records. Furthermore, in a study conducted by Tuckett and Turner, almost thirty percent of registered Australian nurses were not aware of existing policies and standard regarding the use of social media in their practice scope, which could potentially lead to breaches in professional regulations and producing harm to patients [8, 43, 44]. It might be possible that most nurses are not familiar enough with these laws, leading to uncertainty and reluctance to implement ICTs in the healthcare practice.

Developing countries are experiencing an unprecedented increase in the number of users for cellphones and internet-related technologies, as well as a decline in the prices for devices and services [45]. Despite this observation, we found a considerable proportion of participants reporting lack of mobile internet as well as unavailability of the internet at work as barriers (38.2% and 44.4% respectively); findings that were compared with a recent study among Greek nurses [46]. In a recent literature review on nurse's use and access to internet for health-related information, busy schedules, not having enough time to search the web, difficulties in searching procedures due to skill deficiency, and lack of access were identified as the main barriers reported by nurses [11]. We found that roughly two-thirds of surveyed nurses reported lack of time to learn or use ICTs in their practice. Training and competency are socio-technical factors that influence health information technology adaptation [47]. As such, nurses may improve their competency and technological proficiency through practice, in particular, through a structured educational program [48]. These findings should be considered when designing strategies that require internet availability, as well as time to train and learn them, as a considerable proportion of nurses could miss the potential benefits these programs offer.

5. LIMITATIONS

There are some limitations to our study. First, even though our survey was conducted based on previous publications and reviewed by an expert panel of professionals, the constructs

based on upon it have not been assessed for reliability and validity, for what we leave under the discretion of the reader, the interpretation of the presented results. Secondly, to the best of our knowledge, there are no studies on this subject conducted on ordinary Ecuadorians, thus we are unable to draw conclusions or compare results with the general population. Third, the lack of standardization in data collection may have caused data bias. Finally, there was missing data that lead to heterogeneous sample sizes for the statistical analyses and might have produced type II errors or biased results. However, some strengths of our study are the significant sample size and the inclusion of participants with varying demographical characteristics. To the best of our knowledge, this is the first study to assess the use, and preferences for ICTs among Ecuadorian nurses.

CONCLUSION

Information and communication technologies have the potential to shape how healthcare is delivered around the world. Low-cost and wide availability allow for a faster transfer of health-related information, as well as scientific knowledge between healthcare professionals. In our study, we found extensive use of ICTs among Ecuadorian nurses for communicating with both colleagues and patients. Most participants had a positive perception of ICTs in healthcare practice, particularly younger nurses. Finally, the major barriers perceived were related to privacy and patient confidentiality, and lack of time to learn how to use, or use ICTs.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the local ethics committee "Comité de ética e Investigación en Seres Humanos" (CEISH).

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Informed consent was obtained prior to participation in the survey. We assured that the identity of participants would not be revealed.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are with the corresponding author and can be made available on reasonable request.

FUNDING

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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