Revista Brasileira de Enfermagem
REBEn
SUPPLEMENTARY EDITION 5
THE EVOLUTION OF NURSING IN THE 200 YEARS OF FLORENCE NIGHTINGALE
ORIGINAL ARTICLE

Mobile application development structured in self-care for occupational post-exposure prophylaxis to biological material

Desenvolvimento de aplicativo móvel, estruturado no autocuidado, para profilaxia pós-exposição ocupacional a material biológico

Desarrollo de aplicaciones móviles, estructuradas en cuidado personal, para la profilaxis ocupacional posexposición al material biológico

Camila Maria Cenzi[I]
ORCID: 0000-0003-3277-2972

Maria Helena Palucci Marziale[II]
ORCID: 0000-0003-2790-3333

[I] *Universidade Federal de Mato Grosso. Cuiabá, Mato Grosso, Brazil.*
[II] *Universidade de São Paulo. Ribeirão Preto, São Paulo, Brazil.*

How to cite this article:
Cenzi CM, Marziale MHP. Mobile application development structured in self-care for occupational post-exposure prophylaxis to biological material. Rev Bras Enferm. 2020;73(Suppl 5):e20190721. doi: http://dx.doi.org/10.1590/0034-7167-2019-0721

Corresponding author:
Camila Maria Cenzi
E-mail: camilacenzi@gmail.com

Submission: 01-02-2020 **Approval:** 06-29-2020

ABSTRACT

Objective: to develop and validate an application for cellphones structured in self-care to encourage adherence to antiretroviral prophylaxis after occupational exposure to biological material. **Methods:** phase 1 - descriptive study to identify characteristics of occupational exposure; phase 2 - methodological study to construct and validate an application content aiming to increase adherence to antiretrovirals. **Results:** phase 1 - 55 occupational exposures were recorded; 32 (58.2%) antiretroviral indication. Blood was present in 96.9% of exposures; most professionals have insufficient knowledge about exposure risks. A statistical relationship was identified between self-care and adherence (p<0.001). Phase 2 - application was constructed, validated by 11 experts, and considered appropriate to encourage health professionals for self-care and adherence to antiretrovirals. **Conclusion:** the application "Exposição Ocupacional ao HIV" was considered adequate to expand self-care and adherence of professionals to prophylactic treatment to occupational infections arising from biological risks.
Descriptors: Post-Exposure Prophylaxis; Self Care; Mobile Applications; Occupational Health; HIV.

RESUMO

Objetivo: desenvolver e validar aplicativo para celulares, estruturado no autocuidado, para estimular adesão à profilaxia antirretroviral pós-exposição ocupacional a material biológico. **Métodos:** fase 1 - estudo descritivo para identificar características da exposição ocupacional; fase 2 - estudo metodológico de construção e validação de conteúdo de aplicativo objetivando ampliar a adesão aos antirretrovirais. **Resultados:** fase 1 - registradas 55 exposições ocupacionais; 32 (58,2%) receberam indicação de antirretrovirais. O sangue esteve presente em 96,9% das exposições; a maioria dos trabalhadores tem conhecimento insuficiente sobre riscos de exposição. Identificou-se relação estatística entre autocuidado e adesão (p<0,001). Fase 2 - aplicativo foi construído, validado por 11 especialistas e considerado adequado para estimular profissionais de saúde para autocuidado e adesão aos antirretrovirais. **Conclusão:** o aplicativo "Exposição ocupacional ao HIV" foi considerado adequado para ampliar o autocuidado e a adesão de trabalhadores ao tratamento profilático de infecções ocupacionais oriundas de riscos biológicos.
Descritores: Profilaxia Pós-Exposição; Autocuidado; Aplicativos Móveis; Saúde do Trabalhador; HIV.

RESUMEN

Objetivo: desarrollar y validar una aplicación para teléfonos celulares, estructurada en el autocuidado, para fomentar la adherencia a la profilaxis antirretroviral posexposición ocupacional al material biológico. **Métodos:** fase 1 - estudio descriptivo para identificar características de exposición ocupacional; fase 2: estudio metodológico de construcción y validación del contenido de la aplicación con el objetivo de aumentar la adherencia a los antirretrovirales. Resultados: fase 1 - se registraron 55 exposiciones ocupacionales; 32 (58.2%) recibieron indicaciones para antirretrovirales. La sangre estuvo presente en el 96.9% de las exposiciones; La mayoría de los trabajadores tienen conocimientos insuficientes sobre los riesgos de exposición. Se identificó una relación estadística entre el autocuidado y la adherencia (p <0.001). Fase 2: se creó una aplicación, validada por 11 especialistas y considerada adecuada para alentar a los trabajadores de la salud a cuidarse y adherirse a los antirretrovirales. **Conclusión:** la aplicación "Exposição ocupacional ao HIV" se consideró adecuada para aumentar el autocuidado y la adhesión de los trabajadores al tratamiento profiláctico de las infecciones ocupacionales derivadas de riesgos biológicos.
Descriptores: Profilaxis Posexposición; Autocuidado; Aplicaciones Móviles; Salud Laboral; VIH.

INTRODUCTION

The work of health professionals is involved in occupational risk factors that may compromise their physical and mental integrity. This study pays attention to biological risks because, although preventive measures are mandatory in most countries, the number of work accidents with potentially contaminated biological material (WABM) is frequent and worrisome[1-2]. More than 20 pathogens can be transmitted by exposure to body fluids and cause damage to health. Among them are the Human Immunodeficiency Virus (HIV), Hepatitis B virus (HBV) and hepatitis C virus (HCV) due to the possibility of lethality[3].

Work accidents at risk of infection should be considered as an emergency. Searching specialized care and immediate start, when appointed, of Post-Exposure Prophylaxis (PEP), can sharply decrease the risk of seroconversion[4].

After the occurrence of a WABM, professionals should be examined by a expert physician, who, if necessary, will prescribe prophylaxis with antiretroviral medications for 28 days, according to international protocol[3-4]. However, statistics[4] show that, in 51% of prescriptions, exposed professionals do not take prophylactic medications for more than 21 days. Considering that adherence to antiretroviral treatment is fundamental for the efficacy of PEP, professionals exposed to biological material potentially contaminated with HIV should understand and adhere to treatment indicated to prevent infection[4].

Nursing literature shows that adherence to medication treatment may be related to self-care and professional/patient relationship[5]. Nursing professionals use in their daily routine nursing appointment as an intervention instrument to plan nursing care, perform them and assess them, and self-care encouragement is included in this context. Self-care demand knowledge helps nurses to know the fundamental factors for decision regarding adherence, and nurses are able to identify deficits, or the lack of information of individuals about their treatment, planning what measures can be established or negotiated to improve or maintain health and well-being[5].

The Dorothea Orem's Self-Care Deficit Theory[6] is part of a model of professional practice that focuses on the meaning of self-care and the various factors that affect its provision. The specificity of this theory is identified in relation to therapy follow-up, since, for adherence, it is necessary a continuous educational process between nurses and individuals who, comprising the orientations received, appropriate their treatment and commit to its performance[7]. Therefore, it is suggested that using this theory may help professionals exposed to potentially contaminated biological material to adhere to prophylactic treatment of HIV infection.

In health education, where the focus is self-care, there are possibilities to use applications for mobile phones, aiming to convey timely, reliable and relevant information to a large number of people[8]. Using technology in education is a growing movement in nursing, in which mobile applications have collaborated to construct a new modality of health care, because it is a resource capable of expanding access to information, since internet access has become popular with[9].

Mobile applications represent a valuable means to improve adherence to therapeutic regimens, as they can provide information about medications (such as dosages and adverse effects), include instructions on health care and monitor pre-established parameters, in addition to including reminders and recording of ingested doses[10].

Scientific evidence reveals low adherence to treatment with antiretroviral medications after occupational exposure of health professionals, and the use of educational technologies in health has been shown to be an excellent resource[3-4,9-10]. In order to produce an application (APP) for mobile phones to assist and increase adherence to the prescribed treatment and prevent illness, an answer was sought to the following question: can the self-care capacity of health professionals interfere with their adherence to post-occupational exposure prophylaxis to biological material?

OBJECTIVE

To develop and validate the content of an APP for mobile phones to encourage self-care and adherence to antiretroviral prophylaxis after occupational exposure to potentially contaminated biological material.

METHOD

Ethical aspects

The ethical principles required by the regulation of the Brazilian National Health Council (*Conselho Nacional de Saúde*, abbreviated CNS) 466/2012[11] were followed. The research was approved by the Research Ethics Committee of *Escola de Enfermagem de Ribeirão Preto*.

Study design, period, and location

This study was conducted in two phases. The first phase is a descriptive study, with a quantitative approach to data, conducted from August/2015 to January/2016, at the Central Specialty Reference Center (*Centro de Referência em Especialidades Central*, abbreviated CREC) in Ribeirão Preto, Brazil, which aimed to identify the personal and occupational characteristics of professionals who suffered WABM and were recommended for antiretroviral prophylaxis; conducts taken after exposure; the professionals' prior knowledge of exposures to biological material; assessment of the service received at CREC; self-care skills; and adherence to treatment recommended. The second phase is a methodological study of construction and validation of the content of an APP called "*Exposição ocupacional ao HIV*", conducted from August to November 2016.

Population and sample; inclusion and exclusion criteria

The population was composed of 55 health professionals who were victims of occupational exposure to biological material who received indication of prophylaxis with antiretrovirals. Health professionals of both sexes, attended at CREC and who received PEP prescription were included. Health professionals with prescription for PEP and who did not attend follow-up appointments at CREC were excluded.

Study protocol

Data were collected using three instruments:

- Socio-demographic and occupational information questionnaire, applied on the day of the participants' first attendance at CREC. This instrument was constructed by the authors and submitted to content semantic validation by five experts in occupational nursing and considered appropriate.
- *Escala de Avaliação da Capacidade de Autocuidado*[12] (ASA-R), translated and validated version for use in Brazil of the Appraisal of Self-Care Agency Scale, format A[13], based on Orem's Self-Care Deficit Theory[6]. The ability to perform productive self-care operations is assessed, with the 15-item Likert scale, with five response options each. It was translated and validated for Brazil by Stacciarini[12]. The instrument was used to assess the self-care capacity of participants through PEP prescription, being applied, together with the first instrument, on the first day of care at CREC.
- Treatment Adherence Measure (*Medida de Adesão aos Tratamentos*, abbreviated MAT). Delgado and Lima[14] constructed the instrument with seven response items, in the form of a Likert scale, and adherence was determined by the instrument mean. It was used to verify adherence to antiretrovirals by the research participants, who responded on the last day of antiretroviral use (after 28 days of exposure), during the first scheduled return to CREC.

This information was analyzed and structured the construction of the APP, which was based on Orem's Self-Care Deficit Theory[6], with the purpose of increasing adherence of health professionals to antiretroviral treatment, when indicated, after WABM. Initially, a list of theoretical topics that the educational instrument should cover was organized, and a review of national and international literature on each of these topics was performed; thus, it was possible to structure the instrument's scientific content to be validated by experts.

Analysis of results and statistics

The information collected in the instruments was recorded, with double typing, encoded in a spreadsheet database, Excel for Windows, and analyzed by Statistical Package for the Social Sciences (SPSS). All data were analyzed through descriptive statistics. Socio-demographic and exposure characteristics were presented in frequency format (%), means and Standard Deviation (SD). Data from the ASA-R instrument were collected using the Likert scale. Self-care capacity scores were obtained, with a minimum value of 15 (lower self-care capacity) and the maximum value of 75 (higher self-care capacity). Data from the MAT instrument were collected using the Likert scale, as in the original study[14]. Adherence and non-adherence responses were obtained by calculating the mean of the instrument items. Adherence was considered value greater than or equal to 5 and non-adherence values lower than 5. The Mann-Whitney U Test was applied to verify the difference in the self-care capacity score with PEP adherence.

In the second phase, the Delphi technique was used to validate the APP for mobile phones, with all steps performed by email. To comprise the committee of judges, 15 nursing researchers, experts in self-care, adherence, health education, health technology and/or occupational nursing were selected, of which 11 participated in all stages. The experts' judgment was about the technical-scientific content of the APP through opinion scales, comments, and suggestions. Assessment took place from August to November 2016 through opinion scales (strongly agree; agree; neither agree nor disagree; disagree; strongly disagree). All judges assessed whether content was easy to understand, whether it conveyed the necessary information, whether this information was complete and if it was relevant, in addition to the possibility of making comments and suggesting modifications. After analyzing the judges' answers and modifications, the first group version of the educational instrument was created, which was sent by email to all experts. In the second stage of validation, judgment was made as to clarity and objectivity of items, through an opinion, comment, and suggestion scale, as in the previous stage. The experts' responses were analyzed and, as the level of agreement between the judges was over 70.0%, small changes were made and the educational instrument's final version was prepared.

RESULTS

In the first phase, during the data collection period, CREC cared for 55 health professionals who suffered occupational exposure to biological material. Of these, 32 (58.2%) received PEP prescription for 28 days; that was the total number of participants in this study, since all agreed to participate. It was found that the mean age was 36 years old (SD=10.99), the highest number of participants was female (84.4%), and marital status was single (50.0%).

Concerning occupational characteristics, the highest frequency was of nursing professionals, 14 (43.7%); of these, eight (25.0%) were nursing assistants. In relation to occupational accidents, in the 31 (96.9%) exposures, the biological material involved was blood, and in 21 (65.6%) cases, the object that caused the accident was the needle with lumen.

The way exposure occurred varied in each case, and in eight (25.0%) accidents, exposure occurred at the time of disposal of sharp material, and in six (18.8%) due to sharp material left in an inappropriate place. The body part most affected was the finger, in 24 (75.0%) accidents. Concerning Personal Protective Equipment (PPE) use, 25 (78.1%) professionals were using at least one when the accident occurred, and procedure gloves were used by 21 (65.6%) participants.

In 21 (65.6%) accidents, it was not possible to identify the material origin; and in six (18.8%) accidents, it was possible to identify the source patient, but he or she refused to collect tests for serology. It is noteworthy that in three (9.4%) accidents, the source patient was HIV-positive.

At the initial moment of chemoprophylaxis, the mean score of self-care among participants was 56.63 points (SD=13.01); the minimum score was 35 points and the maximum score was 75 points. According to the Spearman coefficient calculation, self-care capacity did not show a statistically significant correlation with the age of participants (p=0.782). A comparison of means was performed by the Mann-Whitney U test to verify the differences in score between female and male participants and no

statistical significance was found between them (p=0.436). No statistically significant difference was found between self-care capacity and PPE use (p=0.855).

All participants received PEP prescription for 28 days, and, after using the antiretrovirals, returned to CREC for the first follow-up visit. PEP adherence was measured and it was observed that 22 (68.8%) participants joined PEP and 10 (31.2%) did not adhere to the 28 days of medication use.

The mean age of participants who did not adhere to PEP was 36.40 years (SD=12.72). Participants who adhered to the 28 days using antiretrovirals had a mean age of 35.82 years (SD=10.44). The Mann-Whitney U test was performed and there was no statistically significant difference between age and adherence (p=1,000).

Fisher's exact test found that there was no statistically significant association between adherence and sex (p=0.293) and between adherence and marital status (p=0.469).

Concerning PPE use and PEP adherence, Fisher's exact test showed no statistical association (p=0.648), and 18 (56.2%) participants adhered to the use of PPE and PEP and three (9.4%) participants did not use PPE and did not adhere to PEP. According to Fisher's exact test, adherence also showed no statistically significant association in relation to the source causing exposure (p=0.720).

The Mann-Whitney U test was applied to verify the statistical difference in self-care capacity score with PEP adherence among the study participants, and it was observed that there was a statistically significant difference (p<0.001).

The 10 (31.2%) participants who did not adhere to PEP presented self-care capacity scores with a mean of 42.40 (SD=6.04) and a median of 41.50, with a minimum score of 35 and a maximum score of 51. The mean self-care value of the 22 (68.8%) participants who adhered to PEP was 63.09 (SD=9.71) and the median was 65.50, with a minimum score of 43 and a maximum of 75.

After analyzing these results, it was observed that some variables directly interfered with adherence and self-care capacity. To encourage self-care by the support-education system of Orem's Self-Care Deficit Theory and improve adherence to PEP, the APP construction was planned, with information presented interactively.

In the second phase, the APP construction started by creating a script with the following informative items: presentation; occupational exposure to biological material; post-exposure ducts; post-exposure prophylaxis; PEP antiretroviral medicines; adverse effects of medicines and how to minimize them; adherence to treatment and self-care; post-accident appointments, etc. The literature review was carried out, and based on national and international protocols, the instrument's technical-scientific content was developed. Subsequently, a search was performed for APPs for existing cellphones that aimed at health education, self-care and/or medication adherence, in order to observe interactions and resources used. It was observed that there was no APP aimed at health professionals who suffered occupational exposure to biological material.

Dynamic interactions were developed and added to the instrument's scientific content. Based on deficits in self-care and adherence to antiretrovirals identified after applying the ASA-R and MAT instruments in the first phase of the study, the APP also contemplated self-care strategies to improve adherence to treatment, encouraging individuals to commit with their care and providing support for decisions related to follow-up of post-exposure behaviors.

The Delphi technique was used to validate the APP, and all steps were performed by email. Of the 15 invited experts, 13 (86.7%) agreed to participate and two (13.3%) refused. They received the instrument to assess the APP, but two (15.4%) did not send their assessment back and did not respond to contact emails, even though they had received all the material necessary for the process. The 11 (84.6%) answered instruments were analyzed, and it was observed that some items of scientific content, such as "objective" and "what to do when exposed", did not reach the 70.0% agreement recommended by the Delphi technique. All experts made comments and suggestions, which were considered relevant, making the necessary changes.

Therefore, the APP's first group version was created; the assessment instrument for the second stage of validation was prepared, which followed the same pattern as the instrument in the previous step. Experts were asked to assess the APP's objectivity and clarity, in addition to the possibility of making comments and suggestions, including observations on content changes previously made.

The instrument was sent by email, and the 11 experts (100.0%) sent their assessment back in this second stage of the process. It was found that the agreement index among judges was higher than 70.0% in all items, as recommended by the Delphi technique, ranging from 81.8 to 100.0% agreement. Thus, APP validation was ended.

To verify the APP's action script and its dynamic interactions, information technology and professionals were consulted; thus, the APP was remodeled and adapted to the iOS and Android operating systems. The APP was constructed by a company specialized in virtual systems and publications and made available for free download on the Apple Store and Google Play Store platforms, with the name "*Exposição Ocupacional ao HIV*" and acronym "EoHIV".

DISCUSSION

The general characteristics of participants are similar to the profiles found in studies carried out in several countries on occupational exposure to biological material. Regarding the age of participants, who, in this study, had an average of 36 years old, researches that focused on occupational exposure to biological materials showed a predominance of ages between 20 and 50 years old[15-16].

The predominance of females found in this study corroborates results found in national and international studies on occupational exposure to biological material among health professionals[15-18].

Nursing professionals represent the group most vulnerable to occupational exposure to biological material due to the specificities of their work activities, which involves direct and continuous care to patients[1,16].

National and international studies have shown that blood is the body fluid most involved in WABM[16,19-20]. An international study[21] showed that WABM prevalence involving blood is a consequence of activity performed at the time of the accident, which, in most cases, results in percutaneous injury as a consequence of sharps. When assessing occupational exposures in five Chinese hospitals, the researchers found that, in five years, sharps accounted for 75.0% of exposures, with the activity performed in 42.7% of cases was venipuncture with a needle.

National and international protocols recommend PEP to all WABM at risk of HIV infection, especially in cases of positive HIV source[4,22]. In this study, it was observed that in three (9.4%) cases, the source was positive for HIV, a mean higher than those found in the literature. A study carried out by the CDC, to analyze the WABM that occurred from 2011 to 2015, showed the value of 2.9% as an average positive source for HIV[23]. In Brazil, in a study on occupational exposures to biological material, it was found that, in 2.56% of cases, the source was positive for HIV[17].

Health professionals must be aware of the risk of infection from their professional activities, in order to feel encouraged to protect themselves from accidents or to seek help after being exposed[24]. In this perspective, self-care is responsible for actions directed at oneself or the environment in which one lives, in order to regulate the interests of life with well-being[6]. Self-care actions involve decision-making and are affected by basic factors, such as age, sex, health status, factors in the health care system and adequacy and availability of resources[25].

Among these factors, it was observed in this study that age and sex did not correlate with self-care, although the literature shows that young people are generally more willing and easier to learn. This factor contributes to the acquisition of skills related to self-care[26].

Engagement for self-care is important, as it allows individuals, families and communities to take initiatives and take responsibility for the effective development of their own care towards improving quality of life, health and well-being. One of the goals of Orem's Self-Care Deficit Theory[6] is to help individuals meet their therapeutic requirements.

In this study, 32 (100.0%) participants received prescription to use antiretroviral medications, and it was observed that 22 (68.8%) adhered to the 28 days of PEP. In studies carried out in several countries to assess adherence to PEP after occupational exposure, similar results were found, as in a study carried out in Denmark, in which the adherence rate was 65.5%. Moreover, a study in India had a 64.6% adherence rate, and in the United States, 62.5%[20,23,27].

Adherence to antiretrovirals did not show a statistically significant association in relation to the source causing exposure. However, the international literature shows that, upon knowing that the source of exposure was HIV-positive, injured professionals feel more encouraged to adhere to treatment[23].

It was identified that the professionals who adhered to prophylaxis had the highest scores of self-care capacity. Several studies point to the direct relationship between behavior and attitude acquisition to develop self-care skills and health need improvement, such as adherence to medications[5,28]. Such adherence is strongly linked to social support and the encouragement received by patients to assume their care. Researchers warn that counseling for behavioral changes and encouraging self-care are practices that should be developed by health professionals (especially nurses) when caring for individuals[29].

Several strategies are used to promote encouragement and development of self-care capacities, especially educational interventions, which demonstrate to assist patients more actively in the management of their health[5,30]. Educational interventions aim to fill the knowledge gaps of individuals, in addition to making them aware of appropriate behaviors for the best care of themselves. It is essential to highlight the use of instruments capable of measuring the actions resulting from these interventions, and can be used in assessing patients' responses to the performance of their self-care[31].

A study carried out in the United States[32], to analyze the influence of an educational health program on increased adherence to medication treatment in patients with HIV, showed that patients who participated in the program had a rate of adherence to treatment 16.0% higher than patients who were not inserted in the program.

Introducing a technology in the field of health should be seen as an ally to solve the health needs of the population, and APPs for mobile phones, aimed at medication adherence, should be constructed with simple language and easy to understand[33]. In this study, health technology was used to construct the educational instrument aiming to improve health professional adherence to PEP after occupational exposure to biological material.

The literature shows that using technology to provide health guidance does not just mean telling people what to do, but providing individuals with a good level of information about their health in order to make them proactive and empowered to self-care[34]. Furthermore, APPs can also be used to support and support patients, to overcome treatment concerns, in addition to promoting information about medications[33]. The APP constructed in this study aimed to encourage the self-care of health professionals, providing information about WABM, conduct after exposure, and PEP, focusing on antiretroviral medications, their doses and adverse effects.

In a review study[35], carried out to verify the different modalities of educational interventions for self-care in diabetic patients, it was observed that a technology that has been used is sending text messages by cellphones, in order to reinforce the educational process of patients. For the authors, the effect of the educational intervention is proportional to the time of exposure to information so that daily reinforcements should be used as a way to promote self-care.

In addition to the theoretical content, the APP constructed in this study provides dynamic interactions to encourage self-care through reminders sent every two days, with catch phrases to empower the individual about their self-care. The APP's resources also enable health professionals to be encouraged to adhere to PEP by sending daily messages reminding them to take antiretrovirals.

Virtual strategies are easy to be implemented and can function as a complementary service to existing reference services, as they are able to provide encouragement and support for patients to self-care and adhere to beneficial behaviors for their treatment, in addition to requiring few human resources[36].

The subjects' manifestations about their knowledge deficits serve to support the elaboration of the material to be used in educational practice, however, the experts' view on the theme is essential[37]. A study carried out to validate a children's serial album to promote body weight control[38], in which 33 experts participated in the process of adapting educational technology, concluded that the experts' suggestions were an essential step in making the material suitable for target audience and with greater scientific rigor, making it relevant for use in intervention programs in health units.

Thus, in this study, we opted for content assessment through validation by an expert committee. The APP was validated by the Delphi technique in terms of content, clarity, and objectivity. According to the literature[39], employing the Delphi technique

confers content validity when the judges participating in the first stage remain in the validation process until its closure and when the approval index for all items that make up the instrument is above established as satisfactory, i.e., when the degree of agreement among experts is above 70.0%.

Suggestions were made by experts, who, even though agreeing with content, made comments in order to highlight ideas and include information. After making changes, in the second assessment stage, all items presented a degree of agreement from 81.8 to 100.0%. Therefore, the educational instrument was validated with approval rates, in all items, higher than 70.0%.

Study limitations

Data collection was carried out for six months during which the researcher stayed for eight hours a day at the health institution, allowing 32 health professionals from the city of Ribeirão Preto to participate in the study, a limiting factor for conducting more in-depth statistical analysis. some variables. However, based on that number and with the support of evidence described in the literature, it was possible to construct and validate the content of the educational instrument.

Contributions to nursing and health

The APP is available free of charge and can be used to encourage health professionals to adhere to prophylactic antiretroviral treatment indicated after occupational exposure to potentially contaminated biological material.

CONCLUSION

It was verified that there was a statistically significant difference ($p<0.001$) between the self-care capacity score and PEP adherence among health professionals who were victims of occupational exposure to biological material; thus, it was found that self-care influences adherence to antiretrovirals after occupational exposure to biological material.

The APP "*Exposição Ocupacional ao HIV*- EoHIV" was developed and considered adequate by the judges who performed content semantic validation.

FUNDING

National Council for Scientific and Technological Development.

REFERENCES

1. Souza HP, Otero UB, Silva VDSP. Profile of healthcare workers involved in accidents with exposure to biological materials in Brazil from 2011 through 2015: surveillance aspects. Rev Bras Med Trab. 2020;17(1):106-118. doi: 10.5327/Z1679443520190305
2. Passos EAD, Marziale MHP. Knowledge and attitudes of nursing professionals at a hospital in the brazilian state of São Paulo regarding standard precautions. Cogitare Enferm. 2020;25:e66744. doi: 10.5380/ce.v25i0.66744
3. Centers for Disease Control and Prevention. Sharps safety for healthcare settings, 2015.
4. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância, Prevenção e Controle das Infecções Sexualmente Transmissíveis, do HIV/Aids e das Hepatites Virais. Protocolo Clínico e Diretrizes Terapêuticas para Profilaxia Pós-Exposição de Risco à Infecção pelo HIV, IST e Hepatites Virais, 2018.
5. Feijão AR, Lopes MVO, Galvão MTG. Importance of the supportive-educative system of Orem Model in the patient compliance-Reflexive study. Online Braz J Nurs. 2009;8(2). doi: 10.5935/1676-4285.20092213
6. Orem DE. Nursing: Concepts of Practice. St. Louis: Mosby; 1985.
7. Alves RC, Lima LS, Barbosa DA, Lima SAM, Bettencourt ARC. Impact of an educational nursing intervention in patients with COPD. Rev Enferm UERJ. 2019;27:e30338. doi: 10.12957/reuerj.2019.30338
8. Mendes EV. O cuidado as condições crônicas na atenção primária à saúde: o imperativo da consolidação da estratégia saúde da família. Organização Pan-Americana da Saúde; 2012.
9. Sousa CS, Turrini RNT. Development of an educational mobile application for patients submitted to orthognathic surgery. Rev Latino-Am Enfermagem. 2019;27:e3143. doi: 10.1590/1518-8345.2904.3143
10. Dayer L, Heldenbrand S, Anderson P, Gubbins PO, Martin BC. Smartphone medication adherence apps: potential benefits to patients and providers. J Am Pharm Assoc. 2013;53(2):172-81. doi: 10.1331/JAPhA.2013.12202
11. Conselho Nacional de Saúde (BR). Lei nº 466, de 2012. Dispõe sobre a pesquisa com seres humanos. Diretrizes e normas regulamentadoras da pesquisa envolvendo seres humanos, 2012.
12. Stacciarini TSG, Pace AE. Translation, adaptation and validation of a self-care scale for type 2 diabetes patients using insulin. Acta Paul Enferm. 2014;27(3):221-29. doi: 10.1590/1982-0194201400038
13. Evers GCM, Isenberg M, Philipsen H, Brouns G, Halfens R, Smeets H. The appraisal of self-care agency's ASA-Scale: research program to test reliability and validity. In: Proceedings of the International Nursing Research Conference "New Frontiers in Nursing Research". Edmond, Canada: University of Alberta; 1986. 130 p.
14. Delgado AB, Lima ML. Contributo para validação concorrente de uma medida de adesão aos tratamentos. Psicol., Saúde Doenças [Internet]. 2001 [cited 2019 Sep 25];2(2):81-100. Available from: http://www.scielo.mec.pt/pdf/psd/v2n2/v2n2a06.pdf

15. Aminde LN, Takah NF, Dzudie A, Bonko NM, Awungafac G, Teno D, et al. Occupational Post-Exposure Prophylaxis (PEP) against Human Immunodeficiency Virus (HIV) Infection in a Health District in Cameroon: assessment of the knowledge and practices of nurses. PLoS ONE. 2015;10(4):e0124416. doi: 10.1371/journal.pone.0124416

16. Marziale MHP, Santos, HEC, Trovó MEM. Consequences of occupational exposure to biological material among workers from a university hospital. Rev Enferm UERJ. 2015;23:449-54. doi: 10.5935/1414-8145.20140002

17. Khalil SS, Khalil OA, Lopes-Jr LC, Cabral DB, Bomfim EO, Landucci LF, et al. Occupational exposure to bloodborne pathogens in a specialized care service in Brazil. Am J Infect Control. 2015;43(8):39-41. doi: 10.1016/j.ajic.2015.05.030

18. Lahuerta M, Selenic D, Kassa G, Mwakitosha G, Hokororo J, Ngonyani H, et al. Reporting and case management of occupational exposures to blood-borne pathogens among healthcare workers in three healthcare facilities in Tanzania. J Inf Prev. 2016;17(4):153-60. doi: 10.1177/1757177416645343

19. Di Bari V, Di Carli G, Puro V. Needlestick prevention prior to Directive 2010/32/EU in a sample of Italian hospitals. Med Lav [Internet]. 2015 [cited 2019 Sep 25];106(3):186-205. Available from: https://www.ncbi.nlm.nih.gov/pubmed/25951865

20. Lunding S, Katzenstein TL, Kronborg G, Storgaard M, Pedersen C, Morn B, et al. The Danish PEP Registry: experience with the use of post-exposure prophylaxis following blood exposure to HIV from 1999–2012. Infect Dis. 2015;48(3):195-200. doi: 10.3109/23744235.2015.1103896

21. Wang YJ, Meng ZH, Zheng XF, Tang XX, Sang LY, Du XM. The status of occupational blood and infectious body fluids exposures in five blood centres in China: a 5-year review. Transfus Med. 2015;25(6):399-405. doi: 10.1111/tme.12262

22. Ford N, Mayer KH. World Health Organization Guidelines on Postexposure Prophylaxis for HIV: Recommendations for a Public Health Approach. Clin Inf Dis. 2015;60(3):161-64. doi: 10.1093/cid/civ068

23. Díaz JC, Johnson LA. Health care worker follow-up compliance after occupational bloodborne pathogens exposure: a brief report. Am J Infect Control. 2016;44(12):1738-40. doi: 10.1016/j.ajic.2016.04.243

24. Carrer P, Micheloni G, Campagna M, Bacis M, Belotti L, Biggi N, et al. Focus sulla sorveglianza sanitaria dei lavoratori della sanità esposti ad agente biologici trasmissibili per via ematogena. G Ital Med Lav Erg [Internet]. 2010 [cited 2019 Sep 25];32(3):249-255. Available from: http://www.ddsp.univr.it/?ent=pubbdip&id=956335 Italian.

25. Bub MBC, Medrano C, Silva CD, Wink S, Liss PE, Santos EKA. A noção de cuidado de si mesmo e o conceito de autocuidado na enfermagem. Texto Contexto Enferm. 2006;15(s):152-157. doi: 10.1590/S0104-07072006000500018

26. Trettene AS, Fontes CMB, Razera APR, Gomide MR. Impact of promoting self-care in nursing workload. Rev Esc Enferm USP. 2016;50(4):633-639. doi: 10.1590/S0080-623420160000500014

27. Sheth SP, Leuva AC, Mannari JG. Post exposure prophylaxis for HIV and Hepatitis B: Our Experience of Thirteen Years at a Rural Based Tertiary Care Teaching Hospital of Western India. J Clin Diagn Res. 2016;10(8):OC39–OC44. doi: 10.7860/JCDR/2016/19876.8387

28. Bureseska RG, Laber ACF, Dalegrave D, Franciscatto LHG, Argenta C. Estimulando o autocuidado com portadores de hipertensão arterial sistêmica: a luz de Dorothea Orem. Rev Enferm FW [Internet]. 2012 [cited 2019 Sep 25];8(8):235-44. Available from: http://revistas.fw.uri.br/index.php/revistadeenfermagem/article/view/490

29. Oberjé E, Bruin M, Evers S, Viechtbauer W, Nobel HE, Schaalma H. Cost-effectiveness of a nurse-based intervention (AIMS) to improve adherence among HIV-infected patients: design of a multi-centre randomized controlled trial. BMC Health Serv Res. 2013;13(274):1-11. doi: 10.1186/1472-6963-13-274

30. Fonseca LMM, Leite AM, Mello DF, Silva MAI, Lima RAG, Scochi CGS. Tecnologia educacional em saúde: contribuições para a enfermagem pediátrica e neonatal. Esc Anna Nery. 2011;15(1):1906. doi: 10.1590/S1414-81452011000100027

31. Alencar RA, Parenti ABH, Lopes CC, Ramos FT, Ciosak SI. Aspects that influence the self-care of patients living with human immunodeficiency virus. Rev Latino-Am Enfermagem. 2019;27:e3112. doi: 10.1590/1518-8345.2746.3112

32. Roth AM, Holmes AN, Stump TE, Aalsma MC, Ackermann RT, Carney TS, et al. Can lay health workers promote better medical self-management by persons living with HIV? an evaluation of the Positive Choice program. Pat Educ Couns. 2012;89(1):184-90. doi: 10.1016/j.pec.2012.06.010

33. Davies MJ, Kotadia A, Mughal H, Hannan A, Algarni H. The attitudes of pharmacists, students and the general public on mHealth applications for medication adherence. Pharm Pract. 2015;13(4):644-58. doi: 10.18549/PharmPract.2015.04.644

34. Fiuza MLT, Lopes EM, Alexandre HO, Dantas PB, Galvão MTG, Pinheiro AKB. Adherence to antiretroviral treatment: comprehensive care based on the care model for chronic conditions. Esc. Anna Nery. 2013;17(4):740-8. doi: 10.5935/1414-8145.20130019

35. Grillo MFF, Neumann CR, Scain SF, Rozeno RF, Gross JL, Leitão CB. Effect of different types of self-management education in patients with diabetes. Rev Assoc Med Bras. 2013;59(4):400-5. doi: 10.1016/j.ramb.2013.02.006

36. Côté J, Godin G, Ramirez-Garcia P, Rouleau G, Bourbonnais A, Guéhéneuc YG, et al. Virtual intervention to support self-management of antiretroviral therapy among people living with HIV. J Med Internet Res, 2015;17(1):e6. doi: 10.2196/jmir.3264

37. Sousa CS, Turrini RNT. Construct validation of educational technology for patients through the application of the Delphi technique. Acta Paul Enferm. 2012;25(6):990-6. doi: 10.1590/S0103-21002012000600026

38. Saraiva NCG, Medeiros CCM, Araujo TL. Serial album validation for promotion of infant body weight control. Rev Latino-Am Enfermagem. 2018;26:e2998. doi: 10.1590/1518-8345.2194.2998

39. Almeida MHM, Spínola AWP, Lancman S. Delphi technique: validation of an instrument to be used by occupation therapist in gerontology field. Rev Ter Ocup Univ São Paulo, 2009;20(1):49-58. doi: 10.11606/issn.2238-6149.v20i1p49-58