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Effectiveness of educational interventions in knowledge, attitude, and practice for preventing respiratory infections: a systematic review and meta-analysis

Efetividade de intervenções educacionais na prevenção das infecções respiratórias: revisão sistemática e metanálise

Efectividad de las intervenciones educativas en conocimiento, actitud y práctica para la prevención de infecciones respiratorias: revisión sistemática y metaanálisis

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ABSTRACT

Objectives: to demonstrate the effectiveness of educational interventions in knowledge, attitude and practice for preventing respiratory infections in adults and older adults. **Methods:** this is a systematic review carried out in 11 databases. Primary studies, without language and time restrictions, of the randomized, non-randomized and before-and-after clinical trial type, were selected. The risk of bias was assessed by two independent researchers, and the methodological quality was generated by the Grading of Recommendations, Assessment, Development and Evaluation. **Results:** the intervention effectiveness was evidenced in seven studies. The results of the random effects meta-analysis show that there is a statistically significant difference between knowledge about preventing respiratory diseases, with an OR of 2.82 (95%CI 1.70 to 4.69) for the occurrence of events represented by improved knowledge. **Conclusions:** most studies show the effectiveness of educational interventions, which was determined through the Knowledge, Attitude and Practice survey.

Descriptors: Evaluation of the Efficacy-Effectiveness of Interventions; Respiratory Tract Diseases; Health Education; Disease Prevention; Systematic Review.

RESUMO

Objetivos: evidenciar a efetividade das intervenções educacionais no conhecimento, atitude e prática para a prevenção de infecções respiratórias em adultos e idosos. **Métodos:** revisão sistemática, realizada em 11 bases de dados. Selecionaram-se estudos primários, sem restrição de idiomas e de recorte temporal, do tipo ensaio clínico randomizado, não randomizado e antes e depois. O risco de viés foi avaliado por dois pesquisadores independentes, e a qualidade metodológica foi gerada pelo *Grading of Recommendations, Assessment, Development and Evaluation*. **Resultados:** a efetividade da intervenção foi evidenciada em sete estudos. Os resultados da metanálise de efeitos aleatórios mostram que existe diferença estatisticamente significativa entre o conhecimento sobre prevenção de doenças respiratórias, com OR de 2,82 (IC95% 1,70 a 4,69) para a ocorrência de eventos representados por melhora de conhecimento. **Conclusões:** a maioria dos estudos evidencia a efetividade das intervenções educacionais, a qual foi determinada por meio do inquérito Conhecimento, Atitude e Prática.

Descritores: Avaliação de Eficácia-Efetividade de Intervenções; Doenças Respiratórias; Educação em Saúde; Prevenção de Doenças; Revisão Sistemática.

RESUMEN

Objetivos: demostrar la efectividad de las intervenciones educativas en conocimiento, actitud y práctica para la prevención de infecciones respiratorias en adultos y ancianos. ***Métodos:*** revisión sistemática realizada en 11 bases de datos. Se seleccionaron los estudios primarios, sin restricciones de idioma y marco de tiempo, del tipo de ensayo clínico aleatorizado, no aleatorizado y de tipo antes y después. El riesgo de sesgo fue evaluado por dos investigadores independientes y la calidad metodológica fue generada por el Grading of Recommendations, Assessment, Development and Evaluation. **Resultados:** la efectividad de la intervención se evidenció en siete estudios. Los resultados del metanálisis de efectos aleatorios muestran que existe una diferencia estadísticamente significativa entre el conocimiento sobre la prevención de enfermedades respiratorias, con un OR de 2,82 (IC del 95%: 1,70 a 4,69) para la aparición de eventos representados por un conocimiento mejorado. **Conclusiones:** la mayoría de los estudios muestran la efectividad de las intervenciones educativas, la cual se determinó a través de la encuesta Conocimiento, Actitud y Práctica.

Descriptores: Evaluación de Eficacia-Efectividad de Intervenciones; Enfermedades Respiratorias; Educación en Salud; Prevención de Enfermedades; Revisión Sistemática.

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INTRODUCTION

Respiratory infections (RI) are considered a serious public health problem and correspond to the fourth leading cause of morbidity and mortality. In Brazil, between February and August 2020, 46,028 deaths due to RI were registered. Worldwide, due to the current pandemic situation of COVID-19, the World Health Organization (WHO) in January 2021 had recorded more than 2 million deaths[1].

Although RI can be caused by bacteria, fungi and protozoa, most are caused by viruses - pathogens associated with this high rate of morbidity and mortality. They can affect both the upper and lower respiratory tracts and can manifest themselves acutely or chronically, including several pathologies, such as pneumonia, bronchitis, influenza and bronchiolitis[2-3].

Despite being preventable diseases, RI have caused concern to the general population, health professionals and researchers, as they sometimes manifest themselves in a serious manner[1]. In this context, the high mortality rate among older adults[4] and adults with chronic diseases and low immunity is emphasized, and it is necessary to implement preventive measures strategies[5].

Educational actions in health aimed at professionals in the service and the entire community have been highlighted, in recent years, as focuses on the dissemination of preventive measures for RI[6]. Thus, adopting educational interventions seems to be timely and necessary for preventing these diseases[7-8].

The effectiveness of an educational intervention can be assessed from the Knowledge, Attitude and Practice (KAP), as shown by a study that showed a positive impact on RI prevention among older adults[7]. The KAP survey allows measuring the knowledge that a person or group has to understand aspects of the learning process. Attitude consists of beliefs and feelings linked to predispositions to accomplish something. Practice, on the other hand, refers to decision-making, which determines a behavior in the face of pre-existing knowledge[9].

The quality of an educational intervention can interfere with the KAP regarding the preventive measures for RI[10], as this is a process by which individuals or groups learn to position themselves and practice behaviors about health maintenance, promotion, or recovery[11-12].

Given the high morbidity and mortality rates among adults and older adults due to RI, especially in the current context of the COVID-19 pandemic, educational interventions have been implemented in order to prevent them through increased knowledge and changes related to attitude and practice[7,11-12]. In this aspect, the study is justified by the need to generate evidence on the topic, with a view to contributing to public policies aimed at preventing RI.

Thus, in the search for better scientific evidence to summarize the results as to the relevance of a more effective educational intervention for preventive measures against RI and due to the impact and threats generated at the current moment, it is important to develop studies that inform decision-making in health and assess the effectiveness of educational interventions with approaches to preventive actions in combating these diseases.

OBJECTIVES

To demonstrate the effectiveness of educational interventions in knowledge, attitude and practice for preventing RI in adults and older adults.

METHODS

Ethical aspects

As this is a review study, there was no need for approval by a Research Ethics Committee.

Study design

This is a systematic review developed in accordance with the recommendations of the Cochrane Manual, version 6.1[13], for conducting systematic intervention reviews, with a protocol registered in the International Prospective Register of Systematic Review (PROSPERO) (CRD42020199972)[14]. The study report complied with the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) recommendations[15].

Data collection and organization

The PICO[16] strategy was used to formulate the research question: what is the effectiveness of educational interventions in terms of KAP for RI prevention among adults and older adults? P (Population) - Adults and older adults; I (Intervention) - Educational intervention; C (Comparison) - No intervention; O (Outcome) - Effectiveness in preventing RI as measured by KAP.

Studies involving adults and older adults, regardless of education level, race and socioeconomic status, and which had outcomes measured using the KAP survey, were included. Multimodal studies that did not analyze educational interventions separately were excluded.

The search took place in August 2020 in 11 databases and/or portals, namely: MEDLINE/PubMed, Embase, Scopus, Web of Science, LILACS), CINAHL, Cochrane Library, ERIC/ProQuest, SciELO, ProQuest (Dissertation and Thesis) and Google Scholar. Controlled descriptors indexed in MeSH terms (Medical Subject Headings) were selected, as well as their synonyms in the title and abstract. Furthermore, the Boolean operators "AND" and "OR" were used to combine the terms. The search strategy was initially carried out in MEDLINE/PubMed and later adapted to the other databases. The study did not delimit year, language or publication status.

To exclude duplicate studies, the bibliographic software EndNote was used. Subsequently, titles and abstracts of the studies were read by two reviewers independently in the Rayyan software[17], considering the eligibility and inclusion criteria. The chosen articles were read in full by the reviewers and those excluded were justified in the PRISMA flow diagram (Preferred Reporting Items for Systematic Review and Meta-Analysis)[18]. A third reviewer was needed to resolve differences between five selected articles, which were not clear about the study design[19].

After sample selection, information from the included studies was extracted by two independent reviewers, using a specific instrument[20], adapted for this review.

Data analysis

To assess the risk of bias, the RoB 2 tool[21] for Randomized Clinical Trials (RCT), and the ROBINS-I tool[22], for Non-Randomized Clinical Trials (NRCT) and for before-and-after studies, were used. For the individual assessment of risk of bias, the following outcomes were taken into account: KAP. The risk of bias, as proposed by the Cochrane Effective Practice and Organization of Care (EPOC)[23] was assessed by two independent researchers and disagreements between them were resolved by a third researcher.

The qualitative synthesis is found in the synoptic table that included title, objective, authorship, year and country of publication, participants, educational resource, KAP dimensions/outcome, medication, duration of educational intervention, and effectiveness of interventions.

The quantitative synthesis of data considered the clinical and methodological homogeneity of the individual studies. Those who were homogeneous in terms of design, effect measures and sample characteristics were included. Only the studies that addressed knowledge, with the presentation of dichotomous data, except for one[24], met the established homogeneity criteria. Thus, the meta-analysis synthesized the effect of interventions on knowledge regarding RI prevention, using the Mantel-Haenszel random effects model and Chance Ratio calculations, with respective 95% Confidence Intervals. The meta-analysis was conducted using Cochrane Review Manager software (RevMan, version 5.3.5).

Statistical heterogeneity was assessed using the Higgins test (I^2). Cut-off points of $I^2 \leq 40\%$, I^2 between 30 and 60%, I^2 between 50% and 90% and I^2 between 75% and 100% were used to determine that heterogeneity is probably not important, there may be moderate heterogeneity. There may be substantial heterogeneity and the presence of considerable heterogeneity, respectively[25]. The interpretation of results of the I^2 statistical test also considered the magnitude and direction of the effect. Publication bias was not assessed due to the number of studies included.

The quality of evidence was assessed according to the Grading of Recommendations, Assessment, Development and Evaluation (GRADE)[26], through risk bias, inconsistency, indirect evidence, imprecision and other considerations. For RCT, certainty of moderate evidence was generated. For NRCT and before-and-after studies, the certainty of evidence resulted in very low.

RESULTS

The search resulted in 5,082 references. A total of 41 studies were read in full, of which 33 were excluded for not answering the research question. Eight studies comprised the final sample (Figure 1).

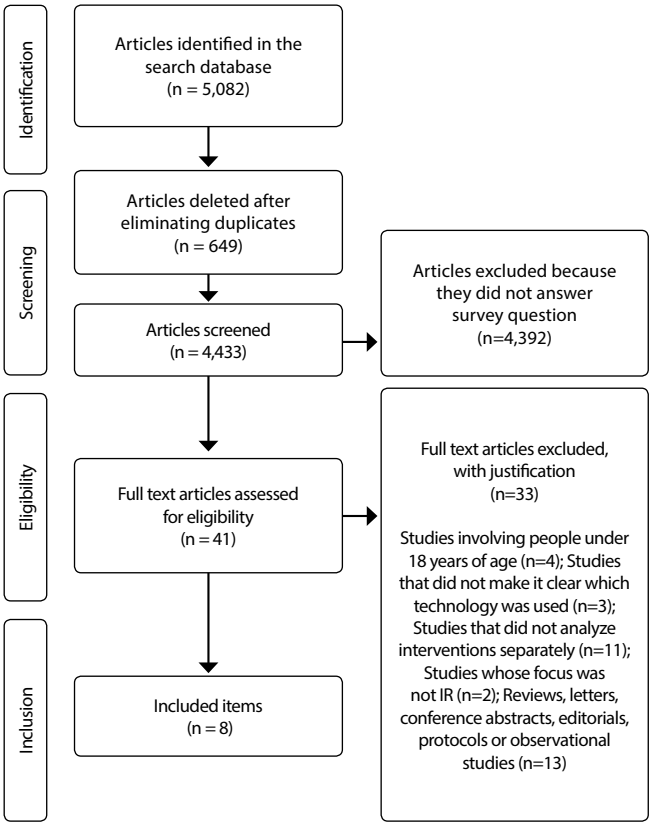

Figure 1 - Flowchart of the selection of studies according to PRISMA[11], 2020

The eight studies in English and published between 1998 and 2019 were included. Three studies were classified as NRCT. Four were classified as a before-and-after study. One was classified as RCT. The United States of America and England were the countries with the highest number of publications. Printed material was the most used resource in educational interventions (62.50%) (Chart 1).

Chart 1 - Summary of selected studies for the final sample of the systematic review, 2020

Title	Year/ Country	Participants/Educational resource/KAP dimensions/ Outcome measurement	Duration time of educational intervention/effectiveness of interventions
1. Increasing knowledge about influenza vaccination in a primary care setting through educational interventional[27]	2018 United States	A total of 40 adults and older adults among men and women in the DMV metropolitan area. All are Family Clinic patients. They are aged between 18-100 years, with different levels of education/ printed text/knowledge/measured through pre- and post-test.	The intervention lasted 90 days. A pre-test instrument was applied, then educational leaflets were used to educate patients about the importance of vaccination against influenza, and a post-test was subsequently applied. Efficacy was observed to increase knowledge about Influenza vaccination, which was verified by the significant difference ($p<0.001$) between the scores obtained by the participants in pre- and post-intervention moments. A 33% increase in knowledge was identified, with a 95%CI from 33.11 to 39.19.

To be continued

Chart 1 (concluded)

Title	Year/ Country	Participants/Educational resource/KAP dimensions/ Outcome measurement	Duration time of educational intervention/effectiveness of interventions
2. Evaluation of Influenza Prevention in the Workplace Using a Personally Controlled Health Record: Randomized Controlled Trial [28]	2008 Canada	Intervention group: 71 (adults); Control group: 54 (adults). Employees Hewlett Packard companies/digital text (media)/ KAP/measured through pre- and post-test.	The intervention duration ranged between 27 and 29 days. It proved to be effective in increasing knowledge about Influenza, with a statistically significant difference (p<0.05) between the control and experimental groups. Participants in the intervention group were more likely to consider that: the Influenza vaccine is effective (OR=5.6; 95%CI=1.7 to 18.5); there are actions that make it possible to prevent the flu (OR=3.2; 95%CI=1.1 to 9.2); the influenza vaccine probably does not cause serious reactions (OR=4.4; 95%CI=1.3 to 15.3). However, Influenza immunization rates did not differ between the intervention and control groups.
3. Improving older adults' knowledge and practice of preventive measures through a telephone health education during the SARS epidemic in Hong Kong: A pilot study[29]	2007 China	A total of 118 adults and older adults registered in a social service, aged 55 years and over and who speak Cantonese/structured guidance/knowledge and practice/ measured through pre- and post-test.	The intervention lasted 7 days. There was no statistically significant effect (p>0.05) in increasing knowledge about the main transmission routes (droplets, direct physical contact and urine/stool) of SARS before and after the intervention. The intervention proved to be effective for the practical outcome regarding the adoption of preventive measures. Practice in this context was statistically different (p<0.01) for the following actions after receiving the intervention: covering the mouth when sneezing/coughing, washing hands after sneezing/coughing, washing hands after feeding and wearing a mask in public (p<0.05)
4. Patient and family education in HSCT: improving awareness of respiratory virus infection and influenza vaccination. A descriptive study and brief intervention[30]	2010 Australia	Patients undergoing hematopoietic stem cell transplantation (HSCT), their families and friends/ structured/knowledge and practice/measured through self-administered questionnaires before and after the session and participants' self-report about vaccination.	The intervention lasted 60 days. Using the Health Belief Model, a 5-minute education session was developed to inform participants about the risks of respiratory virus infection, preventative measures, and their effectiveness. Participants received a letter, addressed to their general practitioner, requesting flu vaccination. The intervention increased awareness (knowledge) that post-transplant influenza can be fatal or require intensive care (68-87%, p=0.003). The intervention increased knowledge of effective prevention strategies (41-78%, p<0.0001), including vaccination (11-58%, p<0.0001) and belief (practice) among friends (but not patients/family members) that home vaccination reduces the risk of post-HSCT flu (57–97%, p<0.0001 and 76–81%, p=0.2, respectively).
5. Tuberculosis prevention and the effect of correctional staff education on practice outcomes[31]	2008 United States	A total of 42 adults in the prison context (team: prison officers, administrators, dentists, nurses, nursing technicians, medical service providers and maintenance staff from different areas of the prison)/ printed text/knowledge/measured through pre- and post-test.	The intervention lasted 7 days. After the pre-test, an increase in compliance with tuberculosis policies was observed. The study presented a 1.2 – 3.3 CI, a percentage variation of 10.1% and a coefficient of variation of 13.5%.
6. Development of an intervention to reduce transmission of respiratory infections and pandemic flu: Measuring and predicting hand-washing intentions[32]	Miller S, Yardley L, Little P./2012/ England	A total of 84 adults attending 15 UK universities/digital text (media)/ attitude/measured using scales.	The intervention duration was not informed. Effectiveness was evidenced for attitude (p<0.05), since those who received coping messages (messages about the effectiveness of hand washing to reduce the risk of infection) had a 2.44 times higher probability (95%CI=0.96 to 6.18) of having intentions to increase their frequency of hand washing. In contrast, the threat condition (messages about the negative consequences of pandemic flu) had very little effect on the intended increases in handwashing frequency (OR=0.93, 95%CI=0.36-2.38).
7. Evaluation of a cold/ flu self-care public education campaign[24]	1998 England	Intervention group: 105 (families*); Control group: 102 (families)/ printed text/knowledge/measured through pre- and post-test.	The intervention lasted 14 days. It showed low effectiveness in knowledge about prevention and self-care measures against colds. This conclusion is supported by the fact that only two of the thirteen questions analyzed presented significant results (p<0.01) in the acquisition of adequate knowledge, which presented an increase variation from 13 to 44%.
8. The impact of a health campaign on hand hygiene and upper respiratory illness among college students living in Residence halls[33]	2005 United States	University students from 4 residences on a university campus (Intervention group: 188/control group: 295)/printed text, digital texts (e-mail) and inputs/KAP/ measured by means of pre- and post-test.	The intervention lasted 56 days. In terms of knowledge, regarding hand washing, there was a mean score of 5.14 (±0.98) in the experimental group after the intervention and 4.70 (±1.34) in the control group, with differences statistically significant (p<0.01). The attitudes of hand washing and use of sanitizers increased over time in both groups, but more so in the experimental, with statistically significant differences (p<0.01). The effectiveness of the intervention on handwashing behavior (practice) increased over time, with statistically significant differences (p<0.01) between the experimental and control groups. Among the participants who received the intervention, women washed their hands significantly (p<0.01) more frequently than men (washes per hour score: 0.49 vs. 0.40, respectively), but the same difference was not significant for gel sanitizer use.

**The sample consisted of families and did not discriminate which members were.*

For the randomized study, the final assessment of outcomes (KAP) was considered to be a high risk of bias. For non-randomized studies and before-and-after studies, regarding knowledge, five presented moderate risk and one study presented serious risk. For attitude, one study was considered at moderate risk and one at serious risk. As for practice, three studies were assessed with moderate risk. Confusion bias and measurement of results were the main domains that contributed to the risk of bias.

Results of individual studies

As for knowledge, seven studies[27-33] showed effectiveness in the intervention. Among these, two[27,30] presented a variation between 33% and 78% regarding the increase in the respective outcome. A study[24], still in this domain, only qualitatively brought the low effectiveness of educational intervention.

As for attitude, three studies[28,32-33] showed an increase in this outcome. Two of them[28,32] reported the use of digital resources with an OR variation of 0.93 to 5.6. In one study[33], the effectiveness of the intervention was identified through a multimodal strategy, which used inputs for hand hygiene, with statistically significant differences (p<0.01).

With regard to practical outcome, four studies[28-30,33] showed effectiveness of the educational intervention. Three[29-30,33] of them showed statistical significance (p<0.01). Also regarding this outcome, there is a study[28] that did not report any statistical difference regarding the aforementioned outcome between the intervention group and the control group.

As for the resources used in the interventions, four[24,27,31,33] made use of printed texts (leaflets); three[28,32-33], digital resources (web, telephone); two[29-30], structured verbal guidance (lectures); one, input (hand sanitizer)[33]. Among these, seven studies[27-33] used printed and digital texts, structured guidance and the offer of sanitizers for hand hygiene were effective in educational interventions in terms of KAP outcomes as an educational resource. This study[24], in which the intervention was not effective, used a booklet as an educational resource.

Synthesis of results

Of the eight studies included in the final sample, seven addressed knowledge[24,27-31,33]. Of these, six[27-31,33] had an effective educational intervention. As for attitude and practice, three[28,32-33] and four[28-30,33] studies showed effective educational intervention, respectively.

Summary of the effect of educational interventions

Three[28-30] primary studies containing dichotomous results on knowledge domains about RI prevention were included in the meta-analysis. Studies[28,30] had two outcomes related to knowledge, while another study[29] had three. Thus, although only three[28,30] studies were included in the meta-analysis, seven results were summarized.

The general results of the random effects meta-analysis show that there is a statistically significant difference between knowledge about RI prevention, identified before and after educational interventions, with an Odds Ratio (OR) of 2.82 (95%CI 1.70 to 4.69) for the occurrence of events represented by knowledge improvement. A total of 70% heterogeneity was identified among the studies included in the quantitative synthesis (Figure 2). Publication bias was not assessed due to the number of studies included in the quantitative synthesis.

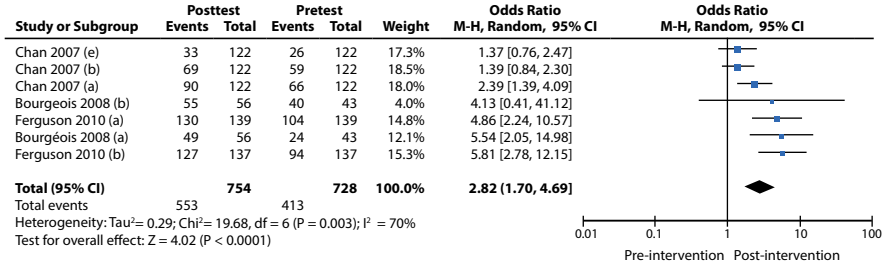

Figure 2 – Forest graph with the effect of educational strategies to increase knowledge about the prevention of respiratory infections, 2020

Assessing the quality of evidence and ranking the strength of recommendations

The methodological quality of the studies was generated by GRADE. For the RCT (Chart 2), non-blinding for educational intervention generated certainty of moderate evidence for KAP outcomes. For NRCT and before and after studies (Chart 3), the evidence for such outcomes was considered very low for the risk of bias, inconsistency and inaccuracy due to the time difference between intervention and outcome, different contexts and resources used.

Chart 2 - Quality assessment for Randomized Clinical Trials, 2020

	Certainty assessment							Certainty
Nº	Outcome	Study	Risk of bias	Inconsistency	Indirect evidence	Inaccuracy	Others	
1	Knowledge	Randomized Clinical Trials	Grave*	Non-severe	Non-severe	Non-severe	None	⊕⊕⊕○ MODERATE
1	Attitude	Randomized Clinical Trials	Grave*	Non-severe	Non-severe	Non-severe	None	⊕⊕⊕○ MODERATE
1	Practice	Randomized Clinical Trials	Grave*	Non-severe	Non-severe	Non-severe	None	⊕⊕⊕○ MODERATE

**There was no blinding for educational intervention.*

Chart 3 - Quality assessment for Non-Randomized Clinical Trials and before-and-after studies, 2020

		Certainty assessment						Certainty
Nº	**Outcome**	**Study**	**Risk of bias**	**Inconsis-tency**	**Indirect evidence**	**Inaccuracy**	**Others**	
6	Knowledge	Non-Randomized Controlled Trials and before-and-after studies	Severe[*]	Severe[†,‡,§]	Non-severe	Severe[‖]	None	⊕◯◯◯ VERY LOW
2	Attitude	Non-Randomized Controlled Trials and before-and-after studies	Severe[*,‖]	Severe[¶]	Non-severe	Severe[**]	None	⊕◯◯◯ VERY LOW
3	Practice	Non-Randomized Controlled Trials and before-and-after studies	Severe[*,†,‡,§,‖,¶]	Severe[¶,††]	Non-severe	Severe[**]	None	⊕◯◯◯ VERY LOW

[*]The assessment time between intervention and outcome, in most studies, was considered inadequate; [†]Different types of educational technologies used in the intervention; [‡]Study participants ranged from adults to older adults; [§]Different ways of recruiting participants; [‖]Pre- and post-tests were applied by different evaluators (students, health service professionals and researchers); [¶]Participants came from different scenarios and realities; [**]Different sample sizes; [††]Inaccuracy of the effectiveness of multimodal educational interventions.

DISCUSSION

In this systematic review, eight studies assessed the effect of educational interventions related to RI prevention among adults and older adults, which were measured using the KAP survey. Most studies assessed the effectiveness of RI prevention actions in terms of knowledge[24,27-31,33]. Two[27,30] presented 33% and 78% regarding increase in knowledge. Also in this outcome, 50% of the studies used printed materials as an educational resource.

Among the studies that assessed the effectiveness of the action that addressed knowledge, only one of them[24] showed low effectiveness, as knowledge assessment in the pre-test identified that the target audience already had prior knowledge regarding cold and flu prevention. Furthermore, the study signaled the low impact of the campaign due to the lack of publicity and the choice of educational resource (booklet).

It is believed that the high level of education and access to health services interfere in the results of educational interventions, as the target audience comes from a developed country (England). It is also hypothesized that the low effectiveness of this educational intervention may be related to the lack of clarity regarding the access to the resource by the target audience and the choice of the educational resource (booklet), since this may not have been effective in the educational intervention application.

The booklet has been used as a teaching resource that contributes to increasing knowledge. However, the information must be clear, objective and easy to understand. It must be developed with a graphic designer and undergo a validation process by experts, in order to provide greater clarity on the topic of interest[34].

Three studies[28,32-33] reported an increase in the attitude towards RI prevention through the use of digital resources (OR variation from 0.93 to 5.6[28,32]). In the educational intervention that used the web, there was an increase in the attitude of the participants regarding preventive measures on RI[32]. Computers and the internet make it possible to obtain information from different sources, places, times and at great speed, which impacts the mass education process regarding preventive measures for diseases[35-36].

Four studies[28-30,33] assessed the educational effectiveness regarding the outcome of practices related to RI prevention. Three[29-30,33] had statistical significance. One study[28] did not show any statistical difference between the intervention and control groups in relation to the immunization rate.

There was an association between increased knowledge and practice in one of the study samples[33], due to the use of multi-media intervention, in which it associated educational resources (printed and digital texts); in addition, it provided supplies (sanitizers) for hand hygiene, and reported that this strategy may have had a positive impact on the educational intervention. A research[37] supports this finding, as it portrayed that the use of hygiene supplies, during an educational intervention for RI prevention, contributed to hand hygiene practice. In this way, the effectiveness of the educational intervention can be enhanced when there are resources available that enable preventive practice[38].

The use of more than one educational resource can favor learning and stimulate the senses of hearing, vision and touch, contributing to enhance the effectiveness of the educational intervention. Thus, it is believed that the realization of multimodal educational interventions should be used as a strategy to promote preventive measures in the context of RI and should be inserted in health services.

Still in the practical outcome, two studies[29-30] measured the effectiveness of the educational intervention, using structured guidance (lecture) as an educational resource. One study observed that the use of this tool significantly contributed to the increase in behavior regarding RI prevention[39].

The meta-analysis showed that OR for increasing knowledge about RI prevention after the educational intervention was 2.82. Future studies should be developed in this direction, as this outcome can trigger changes in attitude and practice, and can provide support for planning more effective health education actions.

The lack of knowledge regarding RI prevention results in impacts on individuals' health, increasing the risk of transmission of pathogens that cause these infections[10]. It emphasizes the need to measure knowledge in order to direct actions to increase it and, consequently, promote changes in beliefs and behaviors[40]. However, it cannot be guaranteed that knowledge about preventive measures will lead to proper practice.

Confounding factors and measurement of results were the main domains that contributed to the risk of bias, which compromised the assessment of the effectiveness of interventions. The primary studies in this systematic review presented biases in the selection of participants, compromising the educational intervention.

Although the meta-analysis showed an OR of 2.82 in the effectiveness of educational interventions aimed at preventing RI in knowledge, for studies that used digital text (media) and

structured guidance, it was noticed, based on the GRADE, a weakness in the methodological quality of primary studies. This implies low confidence in the studies and uncertainty about their sustainability for further recommendation.

The number of studies with a before and after design was more expressive than the number of studies with an experimental design. It is believed that this fact occurred due to the possibility of methodological adaptation of quasi-experimental studies regarding the randomization of groups and participant follow-up length, since interventions developed with the theme in focus favor a greater probability of contamination among participants and do not need such a long follow-up time to obtain the result.

That said, one must consider the impact of the design of quasi-experimental studies in the construction of this systematic review, considering that the methodological quality of this type of study implies a weakness in the results obtained, as they generate bias in the follow-up monitoring, for example, the memory bias. Another relevant point is non-randomization, which disadvantages the participation of anyone and everyone in the study, which compromises the ability to generalize the results.

It is believed that the synthesis carried out in this systematic review may fill gaps that still exist in relation to the importance of the association between scientific evidence and clinical practice aimed at preventing RI, as it brings the summary of evidence regarding the effectiveness of educational interventions in RI prevention in adults and older adults.

Study limitations

This review highlights some limitations, such as the included studies addressed interventions that were substantially different from each other, as well as were carried out in different contexts, which limits the potential for generalization of interpretations and recommendations. Although the studies use knowledge domains, attitude or practice, individually and or in combination, to assess the effectiveness of interventions, the outcome measures were not the same in all studies. Furthermore, the strong clinical and methodological heterogeneity limited the potential for summarizing the effects of interventions, and the limited number of primary studies compromised the outcome of this review.

It is noteworthy that, although this systematic review has shown the effectiveness of educational interventions for RI prevention in adults and older adults, primary studies do not provide robust information, especially regarding the quantitative elements of effectiveness. Furthermore, the primary studies were assessed as having moderate and high risk of bias and had moderate and very low certainty in the assessment of certainty. This fact can weaken the recommendation of educational interventions used in the studies.

Contributions to nursing, health, or public policies

The findings of this study contribute to support the development and implementation of actions and policies with an emphasis on RI prevention in adults and older adults, since the effectiveness of educational interventions already carried out for this audience were presented.

Thus, this study makes a great contribution to the health area, especially to nursing, demonstrating the importance of the search for scientific evidence to support preventive actions as a way to reduce morbidity and mortality rates caused by RI.

CONCLUSIONS

Educational interventions were effective for RI prevention in adults and older adults and showed that knowledge was the most statistically significant outcome when compared to attitude/practice. The effectiveness of these interventions is related to the use of different educational resources. It is recommended to carry out RCT focusing on this research theme, using multimodal educational resources.

It is recommended that primary studies with better methodological quality be developed to assess the effectiveness of educational interventions and that present a low risk of bias. Interventions can be used in clinical practice, but they must have methodological rigor, large sample size and must be constantly re-assessed.

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