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Original article

Validation of the eHealthResp online course for pharmacists and physicians: A Delphi method approach

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ABSTRACT

Framework: The inappropriate use of antibiotics for respiratory tract infections is dispersed worldwide, thus being a strong contributor to antibiotic resistances. As the use of educational interventions among health practitioners is shown to have an impact on judicious antibiotic use, an online course (eHealthResp) has been developed, especially targeted to pharmacists and physicians. Thus, the main goal of this study is to validate the contents of the online course eHealthResp.

Methods: This two-round Delphi study involved the recruitment of a multidisciplinary panel (n = 19), to which the questionnaires of the first round were sent. After the first round, a report summing up the results has been forwarded to the panel, along with a new, reformulated version of the questionnaire.

Results: After the two rounds of the Delphi process, consensus was evaluated. Six clinical cases and fifty-one treatments obtained minor consensus [60–75%] or full consensus (≥75%). The question on antibiotic practice has obtained a consensus >90% on both rounds.

Conclusions: The validation of the contents based on experts' consensus has been an essential approach to improve eHealthResp's online course, as valuable feedback has been provided by the panel on both rounds.

1. Introduction

Antibiotic resistance (ABR) is currently one of the major Public Health threats worldwide, having as leading cause of new bacterial resistance mechanisms the inappropriate use of antibiotics [1,2]. In response to this global public health threat, several national and international actions and initiatives have been developed in recent years aiming to strengthen health systems and surveillance, reduce antibiotics misuse, and improve ABR prevention [1,2]. Respiratory tract diseases, particularly infections of the respiratory tract, constitute one of the leading causes of death and disability in the world [3,4]. These highly incident respiratory tract infections are predominantly caused by virus [5]. The inadequate use and overuse of antibiotics has shown to be very common in respiratory tract [6], being dispersed worldwide [7–11], rising up to two-thirds of prescribed antibiotics [8].

Healthcare quality can be improved using educational interventions among health practitioners [12], especially when using digital health tools [13,14], ultimately helping to minimise the gap between optimal practice and actual clinical care. Among other benefits, the impact of these interventions is deeply reflected in the reduction of both medication errors [15–17] and antibiotic prescription [18,19]. Furthermore, studies have demonstrated the positive impact that e-health tools have on antibiotic prescription and on its conscientious use, namely when directed to prescribing by healthcare professionals and respiratory tract infections management [14].

Considering the already known benefits of both educational interventions and e-health tools, an online course, eHealthResp, has been developed, especially directed to community pharmacists and physicians. In sequence, the main objective of this study is to validate the contents of the online course eHealthResp [20] by using the Delphi

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method.

2. Methods

2.1. Setting

The eHealthResp online course is part of an educational intervention designed for community pharmacists and physicians. This intervention will take place on the catchment area of Portugal's Centre Regional Health Administration (ARS-C), through a cluster randomised controlled trial. The project's website, in which eHealthResp online course is embedded, has been already validated in terms of usability by pharmacists [20], and will also be validated by physicians.

2.2. eHealthResp online course

eHealthResp [21] is an online course that provides a series of presentations addressing respiratory infections management. This online course's main goal is to provide support to health practitioners particularly on upper respiratory tract infections management, which will consequently improve patients' assistance and care. eHealthResp also includes a series of clinical cases to be solved at its end. The contents of the online course, composed by several presentations, provided clinical information on respiratory tract infections management, retrieved and adapted from national [22–24] and international [25–29] clinical practice guidelines, as well as from an online course already designed and developed in Spain for the same purpose [19]. Considering that most content was derived/extracted/obtained from up-to-date clinical practice guidelines, the only contents subjected to validation were the clinical cases to be included at the end of the online course.

2.3. Phase I: Content validation questionnaire

The questionnaire was composed of two main sections: demographic data and validation of the course contents [30,31]. The first section assessed gender, age, education level, medical specialty, and years of experience. The second section was initially composed by eight different clinical cases, each case being presented individually, as a subsection of the questionnaire. Experts were asked to determine which diagnosis, among the options provided, would fit best considering the information presented. Pharmacological and non-pharmacological therapy adequacy was also assessed, using a 5-point Likert scale, from "Very inadequate" to "Very adequate" [32–34]. An additional clinical practice question regarding delayed antibiotic therapy was added by authors on the last clinical case, as the positive impact of delayed antibiotic prescription was not unanimous on the literature [5,35]. At the end of each clinical case, panellists were also able to add observations if they deemed necessary. As all questions were of mandatory response, participants would only be able to proceed to the next section if they had responded to every question on the previous section/subsection. However, as some panellists did not answer to the last sections, the questions left unanswered by panellists were considered as missing cases for the purpose of data analysis.

2.4. Phase II: Expert panel recruitment

Nineteen experts were contacted via e-mail to participate in this Delphi study [31,36,37]. As this was a convenience sample, signed consents upon the use of e-mail contacts were obtained. Previously, and according to the General Data Protection Regulation (GDPR), each participant gave their informed consent for the questionnaires to be sent to their e-mails. Furthermore, before the filling of the questionnaire, each participant was informed about the objectives of this study and freely consented to participate in this study. The e-mail sent to the experts provided a hyperlink to the questionnaire. As the filling of the questionnaire was anonymous, the questionnaires respecting to both rounds were sent to the same nineteen experts.

2.5. Phase III: Delphi method

As the Delphi method allows for participation of a greater number of experts and flexibility, and direct communication between experts is not required, the two-round Delphi method was chosen in preference to other methods of consensus, such as the nominal group technique, which requires a maximum of seven panellists [38,39]. The Delphi technique is typically used for clinical practice guidelines drafting, as well as for finding uniform designations of terms for which there usually are conflicting judgments, thus being most appropriate approach for the validation of the online course contents. This study applied a modified Delphi method approach [40], consisting in the request of individual, anonymous information from each expert using a structured written questionnaire, in this case sent via e-mail, with two reminders, three weeks apart. Consensus for pharmacological and non-pharmacological treatments was obtained if the sum of the agreement percentages on "Very Adequate" and "Adequate, or "Very Inadequate" and "Inadequate". We considered consensus was obtained at [60–75%] (minor consensus) or $\geq$ 75% (full consensus) [30,41,42]. An example of a clinical case is provided on the supplementary material (Fig. S1). The suggestions given by the experts during the first round were considered and the clinical cases were reformulated accordingly. As there were reformulations between the first and second rounds, the approved clinical cases would be those that presented a higher agreement percentage and a higher number of respondents between each round. Hence, the treatments considered for the final model were those including the clinical cases with higher agreement between each round. The clinical cases with no agreement above 60% on either round were fully withdrawn from the online course contents.

2.5.1. First Delphi round

The questionnaire designed for the course evaluation initially consisted of eight clinical cases. The first question for each clinical case presented eight options, corresponding to several respiratory tract conditions, and the participants were asked to answer which condition was more adequate as a diagnosis based on the information provided [32]. The second question of each clinical case presented thirteen pharmacological and non-pharmacological treatments [33,34]. Participants were asked to evaluate the adequacy of each treatment for each clinical case. The additional question on the last clinical case presented two options, out of which the participants would choose the one they considered the best in terms of clinical practice. An open question for further feedback was also included at the end of each clinical case.

2.5.2. Second Delphi round

After the first round, a report was sent to the participants presenting the results obtained in the first questionnaire and informing which percentage of agreement was obtained for each question [40]. This report presented each clinical case, followed by a graphical analysis of the agreement obtained for each response – both diagnosis and treatment adequacy questions. The report allowed the experts to reconsider their points of view, as well as the convergence of contrasting opinions, thus obtaining maximum possible consensus. The questionnaire for the second round consisted of seven clinical cases, based on the reformulations suggested by the panel. The first question for each clinical case presented seven options. The second question presented ten pharmacological and non-pharmacological treatments. The Fig. 1 below depicts the different phases of the two-round Delphi process:

3. Results

3.1. Expert panel characteristics

Nineteen experts consented to participate on this study, and the

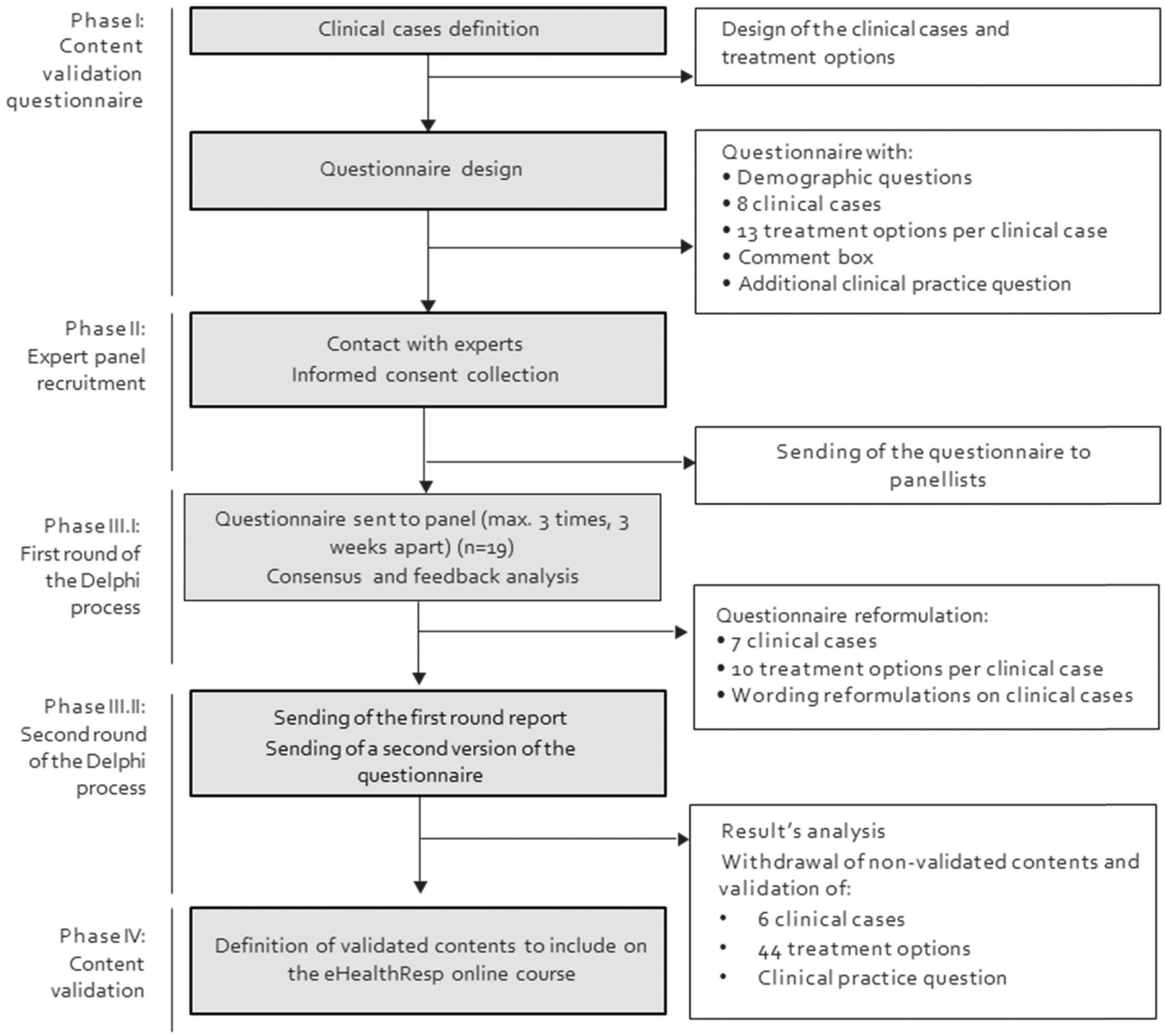

Fig. 1. Schematic representation of the phases of the two-round Delphi study.

questionnaires were sent to all participants on both rounds [37]. As one of the panellists only responded to the second-round questionnaire, eighteen experts responded to the first round and nineteen to the second. Details on the characteristics of the panel are summed up in the Table 1:

3.2. First Delphi round

In the first Delphi round, 19 questionnaires were sent out. A total of 18 questionnaires were answered. Consensus on the diagnosis was obtained on 4 out of 8 clinical cases, one with minor consensus (61.11%), and the other 3 with >90% consensus. Regarding pharmacological and non-pharmacological treatment, most options (79.8%) obtained full consensus (≥70% agreement). The last question obtained 93.3% agreement. As there was a voluntary comment section after each clinical case, some experts provided feedback to improve both clinical cases and treatments. These observations were considered to clarify the clinical cases for round 2. Based on the feedback provided by experts on the first round, the clinical cases were reformulated, and one was removed. Pharmacological and non-pharmacological treatment was also clarified, with ten options instead of thirteen being currently presented. A second version of the questionnaire was then sent to participants. The first question for each clinical case presented seven options, corresponding, similarly to the questionnaire of the first round, to several respiratory tract conditions. The second question of each clinical case presented ten pharmacological and non-pharmacological treatments. The additional question on the last clinical case presented the same two options as the ones from round 1.

3.3. Second Delphi round

As participants were given the possibility to provide suggestions on the clinical cases during the first round, only 7 clinical cases have been presented on round 2. In the second round of the Delphi process, all 19 questionnaires that were sent out, were answered. Consensus on the diagnosis was obtained on 4 out of 7 clinical cases, one with minor consensus (63.2%), and the remainder 3 with >90% consensus. As the second and third clinical cases were considered redundant by the panel, the third clinical case was not included on the second round. Most options (85.0%) regarding pharmacological and non-pharmacological treatment reached full consensus. However, as some options were considered redundant on the first round, they were merged in this second round. Thus, the number of treatment options was reduced from thirteen to ten. The last question, associated to antibiotic treatment timing, obtained 94.7% agreement.

Table 1
Expert panel characteristics analysis.

	n = 19
Sex	
Male	15 (79.0)
Female	4 (21.0)
Age	*45 (41, 56)
Education level	
Bachelor's degree	8 (42.1)
Master's degree	4 (21.1)
PhD	7 (36.8)
Expertise area	
Infectious Diseases	1 (5.2)
Pharmacology	2 (11.4)
General Practice/Family Medicine	4 (21.1)
Internal Medicine	2 (11.4)
Otolaryngology	2 (11.4)
Paediatrics	2 (11.4)
Pneumology	2 (11.4)
Public Health	2 (11.4)
Community Pharmacy	1 (5.2)
Hospital Pharmacy	1 (5.2)
Other	5 (26.3)
Years of experience	*20 (15, 32.5)

Data are: n (%), *Median (PCT25, PCT75).

3.4. Validated contents

After both rounds, consensus was obtained on most clinical cases. Two clinical cases, related to the common cold and the flu, were not validated, as the first clinical case, did not obtain consensus on either round, and the third clinical case was removed after the first round. Thus, the treatments provided for each of these clinical cases were also not validated. The Table 2 shows the comparison between the results on round 1 and round 2 of the Delphi process. As defined on the methodology, the clinical cases that were validated within the first round were the fourth, fifth, and sixth. The second, seventh and eight clinical cases (common cold, acute otitis media, and pharyngitis, respectively) were only validated in the second round.

The Table 3 displays a matrix of the adequacy of each validated treatment for each clinical case, defining the pharmacological and non-pharmacological treatments that obtained consensus, either as very adequate/adequate or very inadequate/inadequate. Nine treatment options were validated with minor consensus [60–75%[, while other forty-two options were validated with full consensus (≥75%). As the clinical cases validated were derived from the first and second rounds, the treatments considered were those of each validated case. However, considering the redundancy of the options highlighted by the experts within the first round, ten treatment options were considered for both rounds.

As observed on Table 3, each treatment was validated for at least two clinical cases. Moreover, although each clinical case had a minimum of one adequate treatment, the majority presented between 3 and 4 adequate treatments.

Table 2
Round 1 vs. round 2 results on diagnosis questions.

	Round			
	First		Second	
	Rate	Percentage	Rate	Percentage
Clinical case 1 – Flu	8/18	44%	7/19	37%
Clinical case 2 – Common cold 1	7/18	39%	12/19	63%
Clinical case 3 – Common cold 2	9/18	50%	–	–
Clinical case 4 – Acute rhinosinusitis	11/18	61%	11/19	58%
Clinical case 5 – Acute otitis media	18/18	100%	18/19	95%
Clinical case 6 – Acute bronchitis	15/18	83%	11/19	58%
Clinical case 7 – Community-acquired pneumonia	16/16	100%	19/19	100%
Clinical case 8 – Pharyngitis	15/15	100%	19/19	100%
Question 8.1 – Antibiotic therapy timing for pharyngitis (Wait/Immediate treatment)	14/15	93%	18/19	95%

4. Discussion

The two-round Delphi technique has allowed for the validation of the contents of the eHealthResp online course based on experts' consensus. After the two-round Delphi technique, where most items have reached consensus [37,40,43], the contents of the online course eHealthResp were validated. The items that reached lower consensus were respecting to the first clinical cases (flu and common cold), which have shown to display similar clinical presentations to other upper respiratory tract infections [26–29]. One of the treatment options presenting lower agreement percentages was the one concerning antibiotic treatment, which emphasises the importance of educating health practitioners on conscientious antibiotic use for the treatment/management of respiratory tract infections [14,44,45].

The clinical cases that did not reach consensus were those corresponding to the common cold and flu, thus reflecting the difficulty in differentiating these illnesses considering symptoms alone, and ambiguousness of the clinical presentations of these diseases [21,46], as well as between other respiratory tract infections [26–29]. Thus, considering the overlapping of symptoms of these illnesses, it becomes essential to emphasise the differential diagnosis between different respiratory tract infections [47]. Valuable feedback has been provided on both rounds, especially on the sections where it was made possible for experts to give suggestions. Although the majority of the comments were made on the first round, with these being further used to reformulate the clinical cases, some additional comments were also presented on the second round. These comments provided additional and very valuable information, adapted to the current circumstances caused by the COVID-19 pandemic (i.e., considering the difficulty in differentially diagnose infection from SARS-CoV-2 from other respiratory infections, some experts advised that, for some clinical cases, information on COVID-19 test results could also be included).

The Delphi method was preferred to other methodologies that also aim to obtain consensus, such as the nominal group technique (NGT). It requires face-to-face meetings, while the Delphi technique is more flexible, being accessible to participants regardless of location, which made it possible to recruit a more diverse expert panel [39]. Furthermore, the Delphi method provides the possibility of recruiting a higher number of participants and, consequently, a more varied expert panel, as NGT usually requires a maximum of seven participants [39,41,48]. Additionally, as the Delphi technique is commonly used to develop guidelines with health professionals, we believe this technique was the most appropriate approach for the validation of the online course contents, considering that NGT is usually employed to explore consumer and stakeholder views [39].

To our knowledge, although there are no known validated quality indicators for Delphi studies, one of the main strengths of this study is that it responded to each key methodologic criterium proposed on Diamond's systematic review [41]. Despite there's a high degree of freedom when it comes to the number of participants, the literature reports a median value similar to that of our study [41,48,49]. When considering similar methodologies, the number of rounds performed during the Delphi process tends to vary. Some studies only report one round, generally when a "real-time" Delphi approach is conducted [49,50]. Yet, most studies report two or three rounds, with a higher prevalence of the former [49]. Despite being in accordance with the literature, one of the limitations of this study can be the fact that only two rounds were conducted, as we would have possibly gotten a higher consensus

Table 3
Treatment adequacy matrix for each validated clinical case and agreement percentage.

	Clinical cases					
	Common cold (%)	Acute rhinosinusitis (%)	Acute otitis media (%)	Acute bronchitis (%)	Community-acquired pneumonia (%)	Pharyngitis (%)
Ibuprofen	VA/A (74)	VI/I (78)	VA/A (72)	VI/I (78)	VA/A (68)	VA/A (100)
Paracetamol	VA/A (68)	VI/I (83)	VA/A (89)	VI/I (72)	VA/A (89)	VA/A (95)
Vasoconstrictor	VA/A (63)	VA/A (83)	VI/I (67)	VI/I (78)	VI/I (100)	VI/I (95)
Antihistamine	VA/A (89)	VA/A (83)	–	VI/I (78)	VI/I (95)	VI/I (89)
Nasal wash	VA/A (89)	VA/A (94)	–	–	–	–
Antitussive	VI/I (100)	VI/I (89)	VI/I (94)	VI/I (83)	VI/I (89)	VI/I (79)
Mucolytic/expectorant	VI/I (89)	VI/I (89)	VI/I (100)	VA/A (63)		VI/I (89)
Antibiotic therapy	VI/I (100)	VI/I (100)	VA/A (72)	–	VA/A (100)	VA/A (79)
Antiviral against influenza	VI/I (89)	VI/I (100)	VI/I (100)	VI/I (89)	VI/I (89)	VI/I (89)
Hydration/rest	VA/A (84)	–	–	VA/A (78)	VA/A (95)	VA/A (89)

VA/A – Very Adequate/Adequate
VI/I – Very Inadequate/Inadequate

rate on some of the clinical cases and/or obtain consensus on a higher number of validated clinical cases and respective treatment options if a higher number of rounds could have been carried out. Furthermore, regardless of the heterogeneity of the expert panel, increasing the number of participants would have possibly given more insightful feedback, especially at the end of the first round, where the questionnaire was restructured based on experts' suggestions. The fact that this study was conducted during the COVID-19 pandemic and most panellists were part of the main workforce combatting the effects of the pandemic, there was the need to send two reminders, as some experts had lower availability to answer the questionnaire. Still, practically all panellists have responded on both rounds, which emphasises the importance and the benefit in integrating these stakeholders on the development of educational material.

Nevertheless, our study has another two main strengths: the high number of years of experience and the heterogeneity of the panel, which reflects the full range of stakeholders who have an interest in the outcomes of this study. As different stakeholders generally have different points of view about clinical practice and quality of care, we believe the heterogenous feedback obtained within this study clearly enriched our results. The response rate obtained was also very positive (~95% on the first round and 100% on the second round), being in agreement with the literature [30,40].

5. Conclusions

The aim of the online course is to aid health practitioners in respiratory tract infections management. The validation of the contents on the online course eHealthResp certainly contributes to a great improvement of the educational intervention that will take place on a cluster randomised controlled trial, which will consequently not only have a positive impact on the research project's outcomes but will also raise awareness on judicious antibiotic use for respiratory tract infections.

Declaration of Competing Interest

None declared

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.biopha.2021.111739.

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