

Expert consensus in times of COVID-19: health applications of the Delphi method

Consenso experto en tiempos de COVID-19: aplicaciones del método Delphi en materia de salud

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Abstract

The COVID-19 epidemic has led to changes in the culture of communication. The solution to health problems is assertive when it is consensual. The Delphi method, a tool for agreement, uses rounds of question lists to gather information from the knowledge of a panel of experts who discuss approaches and possible solutions to problems. It is based on the premise that, with the freedom of anonymity, combined intelligence improves individual judgment and captures collective expert opinion. The process of the method is very flexible since the rounds of questions can be carried out in person or remotely. In this article, we describe how to implement the conventional Delphi method in times of confinement, analyze the usefulness and limitations of the method for use by health experts to solve treatment, diagnostic or administrative problems. Current technologies for collecting data allow great flexibility in the format of questionnaires and facilitate the collection of expert opinion. Thanks to its adaptability, the Delphi method is becoming a popular strategy that involves both qualitative and quantitative domains.

Keywords: Health service areas. COVID-19. Delphi technique. Decision-making.

Resumen

La epidemia de COVID-19 ha modificado la cultura de la comunicación. La solución para los problemas de salud puede ser asertiva cuando es consensuada. El método Delphi es una herramienta de consenso que emplea rondas de listas de pregun-

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tas para recopilar información del conocimiento de un panel de expertos que analizan planteamientos y posibles soluciones a problemas. Se basa en la premisa de que, con la libertad del anonimato, la inteligencia combinada mejora el juicio individual y captura la opinión colectiva experta. El proceso del método es muy flexible, pues las rondas de preguntas pueden realizarse de manera presencial o remota. En este artículo se describe cómo implementar el método Delphi convencional en tiempos de confinamiento, y se analizan la utilidad y las limitaciones del método para su uso por expertos en salud para la resolución de problemas de tratamiento, diagnóstico o administrativos. Las tecnologías actuales para recolectar los datos permiten gran flexibilidad en el formato de los cuestionarios y facilitan la recopilación de la opinión experta. Gracias a su adaptabilidad, el método Delphi se está convirtiendo en una estrategia popular que involucra los ámbitos cualitativo y cuantitativo.

Palabras clave: Áreas de servicio de salud. COVID-19. Técnica Delphi. Toma de decisiones.

Introduction

Confinement in current SARS-CoV-2 pandemic has altered personal and collective dynamics. The pandemic mainly affects medical personnel activities – who directly care for patients–, but also those of political actors –who manage programs and plan the distribution of resources–, both efforts urgently focused on decision-making for the mitigation of adverse outcomes caused by COVID-19. The development policies and decision-making with regard to complex problems may have the option of formulating a common opinion of experts from different disciplines.

According to current trend of evidence-based medicine, expert consensus is the lowest level among the levels of evidence proposed by Sackett three decades ago¹. This perspective categorizes consensus within expert “opinion” category V because it is exclusively based on naïve or unthinking evaluations, or based on physiology, or on theoretical research². This kind of consensus were the rule in the past, and many were published in official mass media.

The purpose of this article is to describe and present an adaptation of the Delphi method that contributes to answer to the needs generated during the course of the COVID-19 pandemic. The consensus that are to take place during this contingency can use this methodology to systematize expert opinions, including clinical experience, which provides valuable information when priorities are identified, ideas are developed and actions planned. This is particularly useful in epidemic crises (among other emergencies), when there is limited knowledge about the phenomenon in question, but the situation demands for decisions to be immediately made. The Delphi method is a consensus tool that provides higher reliability by applying statistics as a quantitative criterion, and also allows the incorporation of qualitative criteria that consider cultural, regional and local variations in order to

always put an emphasis on the well-being of those who are care recipients. There are also variations of the method, such as an adaptation of face-to-face discussions, which is also known as mini-Delphi or Estimate-Talk-Estimate (ETE).

Origin

The name Delphi derives from the Oracle of Delphi; in ancient Greece, it was a sanctuary consecrated to the god Apollo in which a divination system was developed, the description of which has been lost in ancient history. The Delphi method (we will simply refer to it as “the method”) was developed during the 1950s by Norman C. Dalkey from the Research and Development (RAND) Corporation, to forecast, through expert consensus, the impact of technology during wartime. It was publicly presented at the second Long-Range Forecasting and Planning symposium held in Alamogordo, New Mexico, on October 11 and 12, 1967³. The described method includes a group of anonymous experts who must answer a questionnaire and then receive feedback in the form of a statistical presentation of the responses as a group. The larger the group, the higher the expected statistical accuracy. This process is iterative and aims at narrowing the range of responses to achieve the broadest possible consensus between experts.

Some successful forecasts, according to the same RAND Corporation, were those obtained in 1964 during a consensus that included 84 experts: the advancement in pharmaceuticals, space exploration, artificial intelligence and climate control. However, the criteria for being classified as success are not clear and, conversely, other forecasts dramatically failed, such as the calculation of a population of 8,000 million people by the year 2100, when currently we already have a population of 7,800 million⁴.

Our group considers that the greatest usefulness of the Delphi method is not necessarily in the field of

predicting the future, and thus it would cease to serve as an “oracle”. Instead, we believe that this method can have better performance as a consensus tool for decision-making in medical practice and research, while favoring health education for professionals and the population.

Areas of usefulness

The Delphi method has been used in medicine, social sciences, architecture, ecology, and market research⁵⁻⁸. In the latter area, the prediction has been observed to be better the higher the number of rounds made, and with higher probability of getting it right than with individually made decisions⁹. The method can be used for different purposes and in different areas; for example, it can contribute to government systems organization and operation by evaluating the management capacity with regard to specific problems of public interest¹⁰, to the diagnosis and solution of social problems¹¹, and to the design of public programs and policies¹². This acquires more importance if decisions in a society that is considered itself inclusive must consider the decision of the majority, in case there was homogeneity in the positions of its members. However, if there is wide heterogeneity among members, and groups with different interests are formed, consensus must be sought with plurality being considered¹³.

In Mexico, medical societies have a civic duty to offer practical recommendations to associates, health workers and the general population, especially when it comes to socially and politically sensitive issues, novel and poorly evaluated surgical procedures, dubious medical treatments or urgent health problems ranging from pandemics to lack of resources at primary care level.

Some of the aspects in which having a consensus using the Delphi method may be useful are, for example, when and how to open schools during the times of the COVID-19 epidemic in the country, how to distribute health personnel and their new functions within hospitals during the epidemic, how to distribute and increase resources to serve populations in marginalized conditions or far from health centers, how to inform the population served at health centers about measures to reduce the spread of infection transmission and their families about the care of their patients, or how to prepare hospitals for the management of diseases that are regularly treated (and that continue to generate complications and deaths, such as

Table 1. Records on Delphi in Mexico, retrieved from six databases

Database	Total records*
<i>Biblioteca Virtual en Salud</i>	58
Dimensions	109
Lens	110
PubMed	136
Scopus	100
Web of Science	87

*Search carried out on August 11, 2020, with the terms “delphi” AND “Mexico”.

asthma, neurological problems, diabetes, hypertension and its renal, ocular and cardiovascular complications, among others) as well as for primary care for children and pregnant women during an epidemic.

Within this context, can a possible shortage of medicines and mechanical ventilators or oxygen supply at home for respiratory support be prevented? In the general population, is it possible to prevent the lack of food and the behavior of people with regard to accumulation of staple items (including the shortage of toilet paper, a global icon of panic during COVID-19)? Do we have trained staff for the management of seriously ill COVID-19 patients, or patients with COVID-19 and comorbidity who had been part of daily work in a health center? How can we train health personnel during the pandemic to respond to these demands and to do it in accordance with emerging knowledge about the disease?

It is clear that, to find a solution to these problems, the Delphi method is a tool that can help visualize a solution; however, to achieve realistic goals, each group of researchers must have the willingness and social and political mechanisms to propose solutions and mechanisms for their execution.

Delphi in health

The Delphi method has been frequently used in the medical area. Using electronic systems to look for manuscripts that included “Delphi” and “Mexico” on different scientific literature databases, we retrieved various studies associated with these terms. Table 1 shows the number of records obtained with the search algorithm “delphi AND Mexico”. A fundamental aspect during the research process involves the knowledge and practical mastery of scientific literature, as well

as a systematized strategy for search and retrieval^{14,15}. Having a systematic literature search strategy such as that herein proposed can also contribute to obtaining relevant studies for the problem being addressed. It is possible that, during a Delphi process, new questions arise in subsequent rounds, and that new information may be required. Key words can be used with Boolean operators (AND, OR) and filters to limit the number of results (publication year, language, publication origin). The search can start, for example, with a collection of reviews, preferably limited to meta-analyses and systematic reviews related to the problem to be discussed –since this type of literature includes the studies in an exhaustive and summarized form– and then specific studies can be searched. This information must be shared with the Delphi session participants.

A small proportion of said retrieved studies were initiated in Mexico, referred to as part of the methodology to carry out consensus or clinical practice guidelines, especially in the areas of gastroenterology and dermatology.

Reaching a consensus in medical practice is not an easy task, since there may be a group with particular interests that dominates the opinion of the rest, causing for objectivity and plurality to be lost. Of course, there should be ethical, political and academic willingness by the organizers for consensus to be promoted and even accept that this can challenge their own opinions. One tool that can be used is the Delphi method, an esoteric name that contrasts with our scientific purposes, but that has gained great popularity within methodological tools, with 12,056 records in PubMed since 1972 (Fig. 1). From these records, we present a map of networks of terms associated with said method, in which “treatment”, “evidence”, “guidelines” and “disease” stand out, among others linked to the medical field, and that are in well-defined clusters according to the area this method has been used in for reaching a consensus on the definition and solution of problems. Another important cluster is education, in which “nurse”, “indicator” and “competency” stand out, and that have been used to define models of nursing practice.

An example of implementation of the Delphi method in Mexico is the study carried out by Huerta-Iga et al.¹⁶, in which six experts in the management of gastroesophageal reflux disease evaluated endoscopic treatment vs. surgical treatment and subsequently wrote a series of statements that were anonymously evaluated by a panel of participating physicians, who classified

them at different levels, with those that complied with any of the following answers being accepted: “A: totally agree”, “B: agree with minor reservations” or “C: agree with major reservations”. Statements with more than 75% “disagree” were removed, while those with at least 75% A, B or C underwent a second voting round, with pertinent changes being made. The level of agreement of each accepted statement was established, whereby recommendations for the treatment of gastroesophageal reflux disease were defined¹⁶.

Another example of implementation of the method is that described by Bell et al.¹⁷, who carried out a consensus with members of the Colorectal Surgery Association of Australia and New Zealand to evaluate the open, laparoscopic, robotic and minimally-invasive transanal surgery techniques, depending on the characteristics of both patient and tumor. The conclusions were that all techniques are useful for the treatment of colorectal cancer, but that surgical management of each case has to be individualized in order to obtain the best results. The study specifies in which cases is each technique recommended according to the opinion of surgeons specialized in the subject.

Several studies related to the COVID-19 pandemic have been published, the focus of which is aimed at generating international recommendations and consensus on the management of infection and treatment of the disease¹⁸.

Of course, in addition to the Delphi method, other alternative methods should be considered, with fewer advantages, but which can be used according to the expected results: focus groups¹⁹, shortlist voting, virtual meetings for open discussion, brainstorming, etc. Among other less common methods, but that can be effective, are the process of analytical hierarchy²⁰ and those based on analytical prediction computational algorithms^{20,21}.

Procedure

Since its initial description, the Delphi method was defined by three characteristics: anonymity, controlled feedback, and statistical response group.

The Delphi method must have a logical order according to the goals to be attained. The problem to be analyzed must be clearly defined in order to generate the precise instruments to be used in the survey with the experts. The creation of these instruments is a preliminary step that can be carried out with the same method²². For example, the RAND Corporation carried

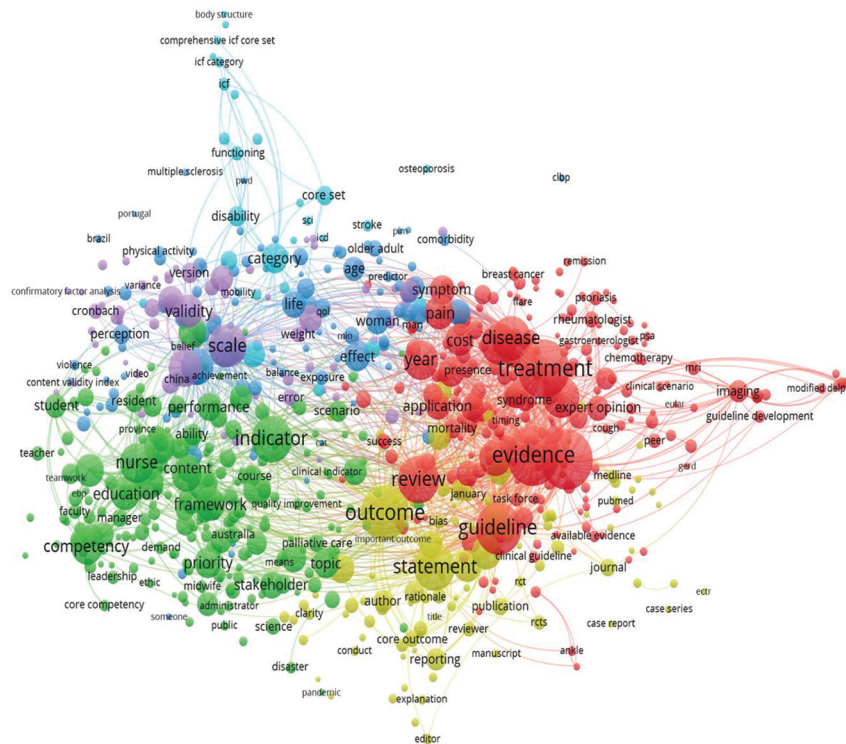


Figure 1. Main terms associated with the Delphi method. The map shows different clusters with the main terms that have at least 50 occurrences in the title and abstract of the 10,000 most recent records retrieved from PubMed until August 11, 2020.

out a rapid initial process to define the relevant questions during the COVID-19 pandemic for reaching an initial agreement that resulted in an instrument with precise questions in order for administrative staff, doctors, nurses and other health workers at hospitals to be able to analyze the degree at which the supplies for patient care, number of ventilators, physical space, trained health personnel, supervisors and emergency physicians can be factors with limitations for maintaining operational efficiency at hospitals.

The order of the Delphi process must be analyzed beforehand, considering the goals that are pursued. Since initial questions must be asked to reach a consensus, conducting a pilot test with available technological tools is suggested, as well as to evaluate the feasibility of easy-to-access and easy-to-operate tools, clearness of the question, accuracy of the answer and data collection.

Use of technological tools

Modern medical libraries use instruments to automatically evaluate and capture data that facilitate the development of projects. Software engineers have worked hand in hand with health area researchers in

the development of a series of computer programs that automatize the process of conducting, synthesizing and presenting surveys, polls, interceptions and reports²³. End-users access the software through a web browser and the Internet, maintaining, protecting and making the software, systems and support services available in an application service provider model²⁴.

There are different applications based on the use of the web to capture data on medical/clinical research and to create databases. These databases are developed considering surveys and data collection forms as tools to capture the research process. In general, these projects are safe databases, which store highly confidential information and are self-sufficient, and are used for normal data entry or for surveys that are repeated or collected at different times²⁵. In addition to collecting real-time data, they can be exported to statistical programs and other analytic software types.

Programs can be free –for the general public, the academic community, or non-profit organizations– or paid (Table 2). Many of them have free modules and other modules that include more options for a fee.

On the other hand, in this same context of the COVID-19 pandemic, the protocol for the management of patients who present with the disease and in addition have a surgical complication will be of practical importance. Table 3 offers an example of the questions in which iterations can be made.

Phases in a Delphi procedure

The sequence for schematizing possible phases in a Delphi procedure (Fig. 2) has sufficient flexibility and can be modified according to the researchers' own creativity.

Preparatory phase

SELECTION OF EXPERTS

The selection of experts can be defined according to inclusion criteria that involve: 1) outstanding academic or professional trajectory in their specific area; 2) proven academic interest in the area of their knowledge or issue in question; 3) experience in decision-making; and 4) participation in any program related to the issues to be analyzed²⁶. The experts' sample size is varied and depends on the extent of the study, although, in general, higher statistical accuracy is expected the larger the number of participants²⁷.

DETERMINATION OF OBJECTIVES AND PREPARATION OF THE QUESTIONNAIRE

The questions of the questionnaire have to be formulated as clearly as possible from the beginning and be referred to the proposed objectives. They must consider variables of interest and elements that may affect them. In principle, they may be exploratory or have more than one possible answer; initially, open-ended questions can be prepared and then be proposed with closed answers, for example, using a Likert or multiple-choice scale²⁸.

Consultation phase

PERFORMANCE OF THE CONSULTATION ROUND

A first round can be carried out, and a defined time is given to answer the survey, allowing experts to become familiar with the instrument. The number of questions is varied; there are surveys with only a few

Table 2. List of programs for the creation of online surveys

Survey software	Web
All our ideas	http://allourideas.org/
Crowd Signal	https://crowdsignal.com/
Encuesta	https://encuesta.com/
Eval&Go*	https://www.evalandgo.com/
Google Forms	https://www.google.com/forms/about/
LimeSurvey*	https://www.limesurvey.org/en/
QuestionPro	https://www.questionpro.com/es/
REDCap†	https://www.project-redcap.org/
SurveyMonkey*	https://www.surveymonkey.com/
SurveyPlanet	https://surveyplanet.com/
Survio	https://www.survio.com/es/
Zoho Survey*	https://www.zoho.com/survey/
SurveyAnyplace‡	https://surveyanyplace.com/
SurveyLegend‡	https://www.surveylegend.com/
TypeForm‡	https://www.typeform.com/

*Free versions have a limit of 10 questions per survey or data export restrictions.

†Available free of charge to non-profit organizations.

‡Use only for a fee.

Table 3. Example of questions in the hypothetical case of a management protocol for COVID-19-positive patients attending an emergency room. In this example, three iterative rounds are presented

First iteration:

Q1. Write down as many suggestions as you want to answer:
Which should the prevention measures be in a surgical room in the presence of emergency patients who have not been tested for COVID-19?

Second iteration:

Consider the answers obtained in Q1.

Q2. Rate this list of 10 preventive measures (which were obtained in the first round) for providing care to surgical patients in the emergency room. Use a score of 10 for the most important and 1 for the least important.

Group answers:

Calculate the means and standard deviations of the two preceding rounds.

Q3. According to the presented scores, do you want to modify your previous scoring? This is completely optional.

and others can have a hundred covering different thematic areas, depending on the complexity and exhaustiveness of the study^{29,30}.

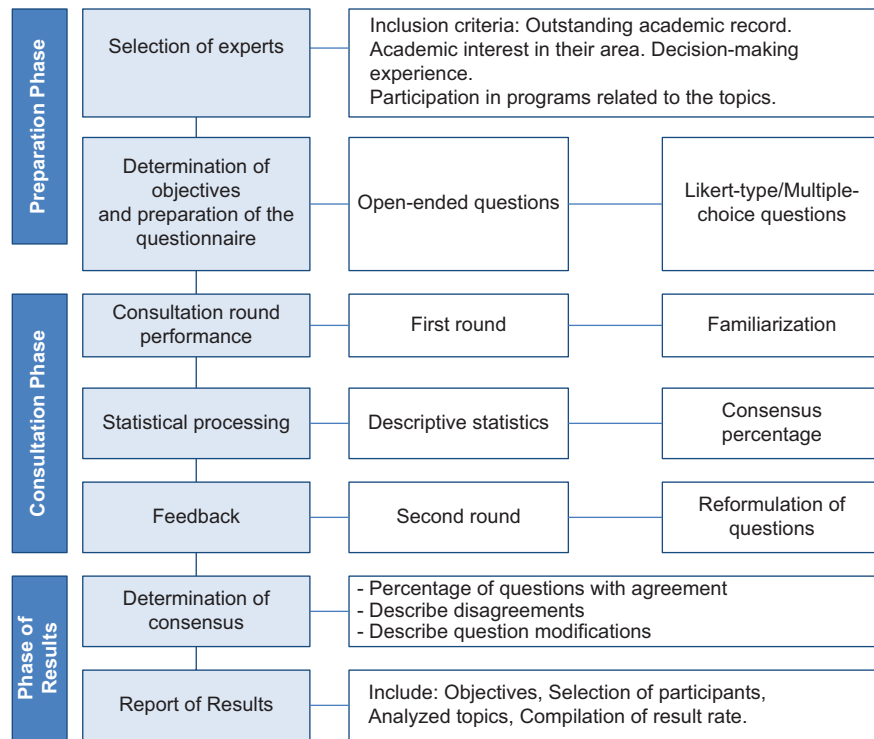


Figure 2. Schematic procedure of Delphi method main phases.

The flexibility and openness of the questions in this phase, as well as the diversity of the experts' knowledge according to their specialties and trajectories, allow to incorporate the variables of interest and explore associated factors in order to have an exhaustive approach to the problem.

STATISTICAL PROCESSING OF THE ROUND RESULTS

Closed- or open-ended questions can be statistically analyzed. In general, descriptive statistics are used, in which the results can be expressed as percentages in order for participants to be able clearly see whether or not there is consensus in the answers. A percentage of consensus can be previously defined, for example, that agreements are to be higher than 75%, and the way how questions with missing answers will be processed must be defined from the beginning. Scores for items can also be stipulated, and based on them obtain central tendency measures, and subsequently apply parametric or non-parametric analysis techniques in order to identify trends for the answers²⁶.

FEEDBACK ON ANSWER PROCESSING RESULTS

The research team can reformulate the questions of the questionnaire to carry out a second round (and

more rounds according to the protocol), but trying to ask closed-ended questions in those in which no prior consensus exists and that could gradually be specified as rounds go by. In previous section, we mentioned that a consensus criterion must be previously defined with closed-ended questions in the case of those with no clear consensus. In our experience, there is a learning curve in which, generally, at the beginning, the way the answers should be prioritized is not understood, and thus it is advisable for one more round additional to those previously contemplated to be carried out. When prioritizing alternatives is necessary, it can be done by calculating the percentage of those that are among the first three or five priorities^{31,32}.

Phase of results

CONSENSUS DETERMINATION

The phase of results can start with the results of the first round. For example, the calculation of the percentage of panelists who agreed at each one of the rounds can be presented. In addition, the topics and questions in which there was disagreement and the way in which they were modified should be described.

In subsequent rounds, it can be explained which questions of the first round were repeated, in which was it necessary for prioritization to be carried out again and the percentages obtained according to the topics of interest, as well as precisions or reformulations of questions.

REPORT OF RESULTS

The report of results should be one of the goals in which the necessary and sufficient time is invested to allow a clear presentation in writing, with the support of the conclusions. Within the report, the objectives, the analyzed topics and the selection of participants (with inclusion and exclusion criteria) should be explained, as well as a compilation of the response rate³⁰.

A summary of the main topics and agreements obtained based on the previously established consensus criterion should be carried out, as well as a report of the main observed difficulties, either in the design of the questionnaire or for reaching an agreement between participants. Important elements incorporated to the instrument can also be reported based on the open answers initially provided by participants, and whether there were precisions added to the objective given this information³³.

Delphi method strengths

All scientific evidence, protocols, and medical practice habits require a critical review, and an emphasis should be placed on the methodology described in the studies in order to analyze their reproducibility. Readers must discern which of them achieve sufficient quality in order to influence clinical practice.

Since the adoption of the culture of evidence-based medicine, there are improvements in clinical practice and more weight in methodology and statistical management, but it is possible to fall into the trap of leaving aside the opinion of a group of experts: eminence-based medicine, with useful knowledge for clinical practice³⁴. The Delphi method can reinforce the principles of conscious and rigorous use of the best evidence for making decisions with regard to patient care³⁵. This way, it contributes to statistical and methodological interpretation of studies, bestowing clinical relevance characteristics based on the experience and contextual conditions that may influence the development or application of an intervention. Thus, well-conducted consensus becomes important for properly classifying

what we consider to be “evidence” and “clinical significance”.

The method can also be useful for conducting scientific research; in the first place, for achieving a greater understanding of a real problem, from different perspectives. This way, we would be accomplishing a better definition of the research question. In the second place, for reaching a level of agreement on topics of interest on which no conclusive information is available, which defines this technique as an organizational research tool³⁶. The potential for reaching a consensual scenario on how to conduct research in the country would allow a democratization of health services and an assertive use of the public treasury aimed at efficient research.

Limitations and potential dangers

Limitations of the Delphi method include the vagueness of the concept of “expert” who participates in the evaluation or answer to the formulated questions. The method requires the participation of experts in the subject, which is considered essential for the study to be validated. It is suggested that researchers should follow an objective criterion to select experts and accept their recommendations.

In the second place, lightly asking questions, or questions that are ambiguous or that simply do not respond to the goal being pursued should be avoided. Pressures due to deadlines or secondary interests from groups that can make a profit are a real possibility. To reduce this problem, people with ethics and genuine interest in looking for solutions should be invited to participate. The meetings for analyzing the results are important for points of view to be exchanged, information to be clarified, and for decisions that can modify the protocol to be made.

The virtue of the Delphi method lies in that it seeks consensus between participants, but this can also be a major problem. In several articles, the authors do not define when a consensus is reached or what will be done if it is not achieved. If a criterion for consensus has been defined, according to the literature, it can vary between > 50% and 100%, which also gives way to ambiguities regarding the level of agreement that is appropriate or reliable.

Finally, a fourth limitation is the lack of basic statistical analyses, with deficient techniques to summarize and present the answers of the coordinating group, which could impoverish the group vision. This becomes the subject of criticism for supporting the

reproducibility and validity of the results. Therefore, initial analyses should be as simple and straightforward as possible, and researchers should have access to the results during the process. The groups of experts and the coordination group should assume a reflective, flexible, but rigorous role that allows openness to a variety of opinions³⁶, and we even suggest that disagreement should be actively quantified and qualified.

Epilogue

Consensual meetings, whether face-to-face or remote, are necessary for solving problems during situations such as current pandemic. A sequel of confinement is the offer of a diversity of tools to maintain the flow of communication within and between institutions. Health personnel must take advantage of this new culture of social networks and technology to experiment and reflect on the largest possible number of clinical experiences and the broad diversity of contexts in which they can occur, socializing their knowledge and recognizing that those who receive their care are people to whom physical, but also mental and emotional well-being should be provided.

All these considerations also allow reflecting on the pros and cons the Delphi method can present with at each one of the dimensions of the medical area. Adapting the steps we propose according to the different specialties is recommended in order to increase the participation of those involved.

The method alone cannot provide the best answers. Space is required for a good participation. This will be achieved thanks to anonymity in order to freely express the perceived importance of each one of the proposed items. Particularly in times of pandemic, such as that currently caused by COVID-19, it is important to highlight the temporality of results –within the consensus statements or report of results–, since these must be periodically reevaluated according to the rapidness of new evidence emergence. In addition, organizers must have the best willingness to apply the consultations results, and maintain the highest ethics, transparency and willingness for improvements to be achieved in the short and medium term in order to solve serious problems in critical contexts.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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