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PUSHING CHRONIC CARE MODEL FORWARD IN ABU DHABI BY IDENTIFYING PRIORITIES AND BARRIERS: A MODIFIED DELPHI TECHNIQUE

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ABSTRACT

Objectives This study aimed to elucidate the top five key priorities and barriers for chronic care in the health system of Abu Dhabi, United Arab Emirates.

Design A modified Delphi study was performed to reach consensus on priority areas and barriers for the development of the Chronic Care Model in the health system of Abu Dhabi. Individual wireless audience response devices (keypads) linked to a computer were used to reduce from 28 priorities and 20 barriers to the top five on 3 rounds, in 3 consecutive days.

Setting Chronic care services for patients with diabetes, cardiovascular diseases, and cancer, in both private and publicly funded healthcare services in the emirate of Abu Dhabi.

Participants A purposive sample of twenty health systems' experts was chosen. They were healthcare workers from the public and private sector, working in the delivery of care for patients with diabetes, cardiovascular diseases, and cancer.

Results The 'overall organizational leadership in chronic illness care' was ranked as the most important priority to address (26.3%) and 'patient compliance' was ranked as the most important barrier (36.8%) for the development of the Chronic Care Model.

Conclusions This study has identified the current priorities and barriers to improving chronic care within Abu Dhabi's healthcare system. Our paper addresses the UAE's 2021 Agenda aims and findings can help inform strategic changes required to achieve this mission.

Strengths and limitations of this study:

- The use of the modified Delphi technique to reach consensus on the health system in Abu Dhabi is a novelty, as far as we know.
- The use of the wireless computer-linked keypads ensured participant privacy and confidentiality during the consensus exercise.
- The purposive sample of twenty healthcare experts was chosen to try to represent the healthcare workers population providing daily care to chronic patients, majority of female nurses. Although, this sample is not representative and the results can not be generalized.

- The United Arab Emirates has a very international population, as well as the healthcare workers, which turns the health system of Abu Dhabi unique and internationally well positioned.

INTRODUCTION

The Chronic Care Model (CCM) is a comprehensive model which integrates six elements to facilitate the delivery of high-quality care. Each element has its own strategic and developmental concepts to enhance the health outcomes of populations with chronic illness. This model was designed to help primary health care (PHC) practices improve health outcomes by changing the routine of care delivery and to convert chronically ill patients from reactive to proactive in managing their own diseases[1]. The CCM is a holistic combination of the six elements combined to foster quality improvement in the following areas: health system, community, self-management support, decision support, delivery system design and clinical information systems. Increasing evidence has shown that changes in, at least, four of the six categories of the CCM led to clear advances in health outcomes[2]. Although some interventions have focused solely on one or two specific components and led to improvements in the development of the CCM[2,3].This model has been mostly applied to patients with diabetes, congestive heart failure, and chronic obstructive pulmonary disease with evidence in the United States of America and Australia showing that the patients benefited from healthcare adjustments guided by the CCM[1,4,5]. The Improvement Chronic Illness Care at the MacColl Center for Health Care Innovation, which designed the CCM, also developed assessment tools such as the Assessment of Chronic Illness Care (ACIC) to be completed by healthcare workers and the Patient Assessment of Chronic Illness Care (PACIC) to be completed by patients. A previous study (currently under review) conducted by our research group in the emirate of Abu Dhabi used the ACIC to understand the perception of healthcare workers on the development of the CCM in the delivery of chronic care to patients with diabetes, cardiovascular diseases, and cancer. The study found that Abu Dhabi's health system has a reasonably good support for chronic illness care. It was a mixed method study, comprising a quantitative and a qualitative part. The participants scored the subcomponents of the CCM completing the ACIC and were asked about the subcomponents (priorities) of the CCM through a semi-structured interview guide based on the ACIC. The barriers of the present study emerged from this previous one.

A modified Delphi technique was performed to identify and rank the top 5 priorities and barriers from an initial list of 28 priority areas and 20 barriers. The present study represents the first consensus exercise using a modified Delphi technique to identify the top five priorities and barriers for chronic care in the health system of Abu Dhabi, UAE.

Purpose and rationale

One of the key strategic goals of the UAE Vision 2021 National Agenda is to achieve a world-class healthcare system. The main rationale for this study was the need to conduct the first consensus exercise with key stakeholders to understand the role of the CCM in Abu Dhabi's healthcare system. The primary aim was to use a modified Delphi technique to identify and subsequently rank the priorities and barriers of the CCM in Abu Dhabi's healthcare system, UAE, in order to achieve a full support for chronic illnesses. Utilizing a health policy prioritization approach to strengthen the health services requires proper and focused policymaking. Therefore, the modified Delphi technique sought to elucidate the five most significant priorities and barriers identified by participants that can be used to facilitate policy-making and health care reform in Abu Dhabi, UAE.

Prevention of bias

To maximize privacy and confidentiality, all participants were provided with an individual keypad ((Keepad Interactive, NSW, Australia) to electronically log their responses. The software is extremely efficient in terms of avoiding missing data, as the number of people who answered each question appears at the corner of the slideshow. The polling results for each question can be shown in real-time to the participants; however, in this study the participants did not receive any feedback until they were presented with the reduced list of priorities and barriers at the start of the subsequent round. The researchers conducting the modified Delphi technique did not have any conflicts of interest, so there was no need for an independent research team to coordinate the study.

REPORTING

Expert panel

A purposive sample of 20 health systems' experts on the Abu Dhabi emirate health system was used to perform the modified Delphi technique. The inclusion criteria to be considered as a health systems' expert was: speak and understand English, work in the public or private sector of the healthcare system in Abu Dhabi, work in the same facility for more than one year and work in the delivery of care to patients with diabetes, cardiovascular or cancer. The participants were invited to attend three brief meetings to complete the three interactive rounds of the modified Delphi technique.

The majority of the participants were females (70%), nurses (37.5%), working in the public sector (93.3%) and in the Eastern Region of Al Ain (81.3%). The average years of experience were 14.8±13.7 years and the mean working time in the same facility was 6.3±3.3 years.

Description of the methods

The modified Delphi method itself starts with a series of questionnaires used to identify a list of topics. Through an interactive process of nominal scoring, they are reduced until a pre-specified number of topics remain to be ranked in order of priority, and finishes when consensus has been established at a sufficient level[6,7]. This technique supports health policy decision-making and has been used previously to reach expert consensus on definitions, guidelines, and strategies for occupational health, elderly care, rural health, palliative care, primary health care, migrant health, diabetes, and medical professionalism (10-19). This paper follows the recently published Guidelines to Conduct and REport Delphi Studies (CREDES)[8].

Study researchers prepared tables with the priorities and barriers to be provided for the participants on arrival. They also performed a pilot test of the modified Delphi technique to ensure the correct configuration and set-up of the wireless voting system through the PowerPoint presentation using the TurningPoint software, which has specific configurations for the type of question to be addressed and works as an interface with the wireless keypads. The participants used these individual computer-linked electronic keypads to vote and rank the priorities and barriers. The information provided from each wireless keypad was automatically logged on the computer system and the results (i.e. frequency and percentage) were provided immediately. After each round, the researchers analyzed the results to prepare the reduced list of tables and the PowerPoint presentation for the next round of the modified Delphi study.

Procedure and definition of consensus

Three brief meetings were conducted to execute the three selection rounds and achieve consensus through this technique. Each of the three rounds was conducted in three separate consecutive days where the priorities and barriers were voted to reach the “top five” by the end of the third meeting. At the start of each meeting, two colored sheets with the priorities and barriers on a table with a *Likert scale* (yellow for priorities and blue for barriers) were delivered for the participants on arrival. The participants were asked to use the colored sheets to score the priorities and barriers according to the provided *Likert scale* ‘not very relevant’, ‘relevant’ or

'very relevant'. Once all the participants had completed the *Likert scale* on the paper, wireless keypads were distributed and oral instructions about how to use them were given in order to record their answers. At the end of the first round, the researchers reviewed the results of each priority subcomponent and barrier that were voted 'very relevant', 'relevant' or 'not very relevant', according to participants' previous handwriting choices (on the given colored paper). The priorities and barriers that were considered 'very relevant' by at least 30% of the participants were selected for the next round. In this case, from the 28 priorities, there was a reduced to 16 and from the 20 barriers to 14. During the second round, the participants were asked to repeat the process and identify the five most relevant priorities and barriers by marking them as 'very relevant'. The five priorities and barriers with the highest percentage of participants ranking them as 'very relevant' were selected to be ranked in the third round. Three of the priority subcomponents: 'Improvement strategy for chronic illness care', 'evidence-based guidelines' and 'patient treatment plans' received the same proportion of votes. As a result of this tie, seven priorities were selected for the final rank (Figure 1).

WHAT ARE THE TOP FIVE PRIORITY AREAS TO INTERVENE?

Table 1 shows that the 26.3% of expert participants selected the 'overall organizational leadership in chronic illness care' as the most important priority subcomponent of the CCM to address. The two subcomponents 'continuity of care' and 'effective behavior change interventions and peer-support' were voted as the second priority by 21.1% of the participants leading to a tie in the priority rank. The 'evidence-based guidelines' was voted as the third most important priority by 15.8% of the participants. The subcomponent 'improvement strategy for chronic illness care' was voted as the fourth most important priority by 10.5% and the subcomponent 'provider education for chronic illness care' was voted as the fifth by 5.3% of the participants.

Table 1: Round 3 results: top five priorities subcomponents of the CCM.

Rank	Percentage	Priorities
1	26.3%	Overall Organizational Leadership in Chronic Illness Care
2	21.1%	Continuity of care
2	21.1%	Effective behavior change interventions and peer support
3	15.8%	Evidence-based guidelines

4	10.5%	Improvement strategy for chronic illness care
5	5.3%	Provider education for chronic illness care

WHAT ARE THE TOP FIVE BARRIERS TO THE DEVELOPMENT OF THE CCM?

'Patient compliance' was voted as the most important barrier to the development of the CCM by 36.8% of the participants. 'Lack of standardized processes/procedures' was voted as the second barrier by 31.6% of the participants, 'differences between insurances' was voted as the third barrier by 15.8% of the participants, 'lack of regional plans and standardizing guidelines between facilities' was voted to be the fourth barrier by 10.5% of the participants and 'lack of monitoring' was voted as the fifth barrier by 5.3% of the participants (Table 2).

Table 2: Round 3 results: top five barriers of the CCM.

Rank	Percentage	Barriers
1	36.8%	Patient compliance
2	31.6%	Lack of standardized processes/procedures
3	15.8%	Differences between insurances
4	10.5%	Lack of regional plans standardizing guidelines between facilities
5	5.3%	Lack of monitoring

DISCUSSION

Among the six elements of the CCM that enclose the 28 subcomponents that the expert participants voted and ranked, the element "health system" was present twice in the subcomponents 'overall organizational leadership in chronic illness care' and 'improvement strategy for chronic illness care', while the elements "delivery system design", "self-management", and "decision support" appeared once linked to the other subcomponents. The elements "clinical system design" and "community" were not represented in the final priorities.

The 'overall organizational leadership in chronic illness care' was the subcomponent ranked as the most important priority to address, relating to health system organization and different leadership models. According to Lapão and colleagues (2017), the development of a healthcare organization is directly proportional to the leadership process, the professional's management ability, the incentives and the resources available[9]. The aim of any health system is to have higher awareness and more proactive participation of the managers. In order to provide the right environment to approach the managers and the health professionals exploring the dynamics of

the relationships is crucial. Especially between leadership values, culture, capabilities and the organizational context, supporting a high level of self, team and organizational awareness[9–11]. A study in Iran used the Delphi technique to facilitate designing an excellence and quality model for a primary health care training center[12]. The study authors also found that leadership was the component with most sub-criteria. Another Delphi study in South Africa (2013), identified governance and leadership as the most important priority and the fifth-ranked challenge to intervene in care provision in rural areas[13]. One should recognize that although "leadership" is now a clearer concept its operationalization is still not mature, which can explain some of the difficulties acknowledged by health organizations[14]. This first subcomponent ('overall organizational leadership in chronic illness care') is linked with the fourth priority 'improvement strategy for chronic illness care'. This 'improvement strategy for chronic illness care' is a core base of the CCM, addressing the need for the healthcare system reorganization to face the growing problem of chronic diseases. The development of the CCM advocates organizational changes in health delivery to a patient-centered model where, for example, the patient has a proactive role managing their own disease (e.g. through access to their personal health data), all the providers are able to see patients information in their workstations and agree to follow the same guidelines and treatments with patients agreement[1]. This example and suggestion of an 'improvement strategy for chronic illness care' integrate four of the six elements of the CCM (delivery system design, clinical information system, decision support, and self-management). Further analysis should be conducted to design an appropriate improvement strategy for each healthcare services center. 'Continuity of care' was ranked as the second most important priority and it shows the perception of the experts for the need of a change in the delivery system design. In the Abu Dhabi health system, a patient is not allocated to a specific family medicine physician; rather, the family medicine physician working at the chronic care clinics, often does not follow the same patient every time the patient reaches the system which causes a lack of continuity of care from the perspective of the doctor-patient relation. 'Effective behavior change interventions and peer support' was also ranked as the second most important priority. In the United Kingdom, Spain or in Portugal, there is a general practitioner, or family medicine doctor, attributed to each person according to the residency area who acts as the first line of contact between the patient and the health system[15–17]. This allows the doctor to know their patient's history (and families), establish a relationship with them and to promote behavior changes that

are in the base of the prevention of the chronic diseases[16]. Implementing a similar general practitioner/family medicine physician model in Abu Dhabi may improve the continuity of care and enhance the effectiveness of behavior change interventions.

'Evidence-based guidelines' was considered the third most important priority to improve the care of chronic diseases in Abu Dhabi, however, the UAE was a pioneer using evidence-based medicine, the concept was introduced in 1998[18]. One of the reasons for this subcomponent to be ranked as a priority might be the multinational origin of the healthcare workers, who tend to follow the guidelines of the country where they are from and/or trained. For example, physicians from North America may follow the North American guidelines related to a specific chronic disease. A previous study concluded that the diagnosis and management of type 2 diabetes differed substantially between the United States of America, United Kingdon, and Germany[19]. Despite this issue, the competent health authority should have the mission to regulate and develop the healthcare sector and the individuals working within the health systems[20]. "Evidence-based guidelines" is also related to electronic health records and decision-support systems that might help health professionals improve their performance, in terms of better decisions and time.

'Patient compliance' was identified by the participants as the most important barrier. A study conducted in the Netherlands (2012) with the aim of understanding the development and coordination of disease management programs, also reported that patient involvement in their own care as a barrier to implementing the CCM[21]. From the literature, it is known that one way to address patient compliance is through patient education and participation[22,23]. The patient needs to be able to understand that they can have a proactive role in the management of their own disease if they are provided with self-management support sessions (the "how to comply").

A 'lack of standardized processes/procedures' was considered to be the second most relevant barrier and there is a need to integrate the delivery of care with the clinical systems for all professionals working in the health system. Also, this barrier seems to be related to the third one: 'differences between insurances'. Although health insurance is mandatory in the emirate of Abu Dhabi, there are different insurance packages depending on the type of employment and residence visa. These different insurance packages provide access to different coverage and

access to services. For example, diabetes education or lactation consultations are not available for patients with the lower health insurances, which makes the delivery of care not standardized for the healthcare workers, as they are not able to provide the same procedure to all the patients. The 'differences between insurances' was also considered a barrier by Haggstrom and colleagues (2012) when they assessed the CCM implementation for cancer screening in community centers in the United States of America[24]. The 'lack of regional plans standardizing the guidelines between the facilities' was considered to be the fourth barrier. Similarly to other models, like the Portuguese or the Saudi Arabian health system[9,25], the Abu Dhabi's publicly funded health system seems to have a centralized organizational model[26] where all the facilities with the same level of care follow the same instructions: decisions tend to be centered in the administration of a whole group. The decentralized model is when the facilities have some degree of autonomy, as for example, in Rio de Janeiro, Brazil[9]. In this case, further work inside the organization, engaging top managers, and healthcare workers are needed to understand why the same level of care following the same directions is not provided in all facilities. The barrier ranked as the fifth most important barrier was 'lack of monitoring'. This barrier is linked to the 'lack of standardized processes/procedures' and shows that the healthcare workers and clinical directors feel the need for monitoring and feedback of their performance, interventions or implemented measures. There is also the need to examine the effectiveness and efficiency of the different communication channels, both horizontally and vertically, within an organization. Hroscikoski and colleagues (2006) also in the United States of America, reported barriers related to the 'lack of monitoring' when they implemented the CCM in a group of 18 clinics: insufficient time to measure the change, lack of measures to assess change, and a lack of specific details and desired care changes[27].

This paper addresses one of the UAE's Vision 2021 agenda aims which is to achieve a world-class healthcare system. It is hoped that our findings of the priorities and barriers of the CCM implementation in the Abu Dhabi health system will contribute to the continuous improvement of the quality of healthcare delivery both for the patient and healthcare workers. In addition, the UAE can serve as an example for other high income and/or rapidly developing countries facing the same challenges within their health system.

Strengths: The wireless computer-linked keypads ensured participant privacy and confidentiality during the modified Delphi technique and this should have minimized response bias. In addition, completing the study over three consecutive days, as opposed to weeks and months required with a postal or email methodology, resulted in a 95% response rate and a low attrition rate. Overall, our methodology using wireless handheld keypads enabled a rapid consensus process to effectively identify priorities and barriers for the CCM in Abu Dhabi's health system. There are at least three previous studies that have used a Delphi technique in the UAE to reach consensus on occupational health (10), elderly care (15), and medical professionalism [28–30]; however, our study is the first to use a modified Delphi technique to elucidate the priorities and barriers of the CCM in Abu Dhabi's healthcare system.

Limitations: One of the limitations of this modified Delphi technique is the requirement for the participants to be physically present, which can introduce a selection bias if the attendance reduces significantly during the rounds[30]. However, the response rate in this study was 95%, as from day one to the end of the study only one participant was absent, round 2 and 3 had 19 participants instead of 20. Another limitation is the inability to generalize our results to the health systems operating in other emirates in the UAE, but that was not the purpose of this study.

Adequacy of conclusions

The modified Delphi technique achieved the aim of identifying the priorities and barriers of the CCM in Abu Dhabi's healthcare system; specifically, 'Overall Organizational Leadership in Chronic Illness Care' was ranked as the top priority and 'Patient Compliance' as the most important barrier. This study represents an important step in the process of understanding the key barriers and priority areas for intervention to maximize the development of the CCM in the health system of Abu Dhabi.

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Data sharing statement No additional data available.

Reporting guidelines Conducting and REporting DElphi Studies – CREDES.

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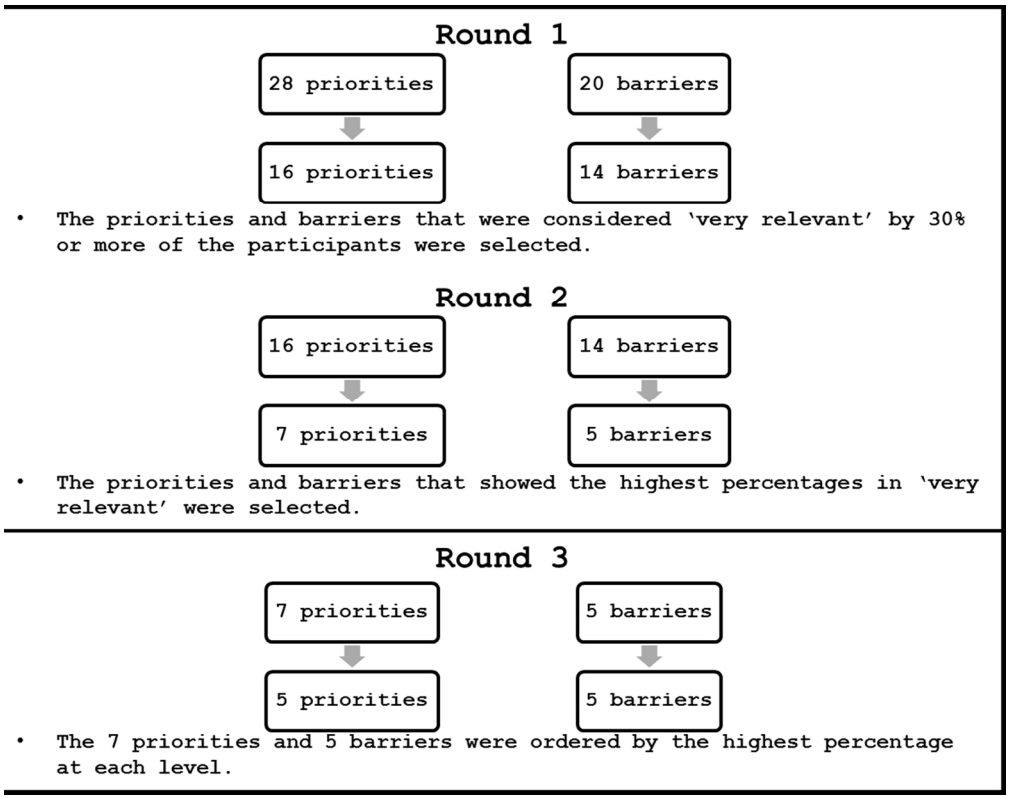
FIGURES

Figure 1: Delphi technique rounds procedure.



Delphi technique rounds procedure

199x157mm (150 x 150 DPI)

Box 3. Recommendations for the Conducting and REporting of DElphi Studies (CREDES)[1].

Rationale for the choice of the Delphi technique

1. *Justification.* The choice of the Delphi technique as a method of systematically collating expert consultation and building consensus needs to be well justified. When selecting the method to answer a particular research question, it is important to keep in mind its constructivist nature

Planning and design

2. *Planning and process.* The Delphi technique is a flexible method and can be adjusted to the respective research aims and purposes. Any modifications should be justified by a rationale and be applied systematically and rigorously
3. *Definition of consensus.* Unless not reasonable due to the explorative nature of the study, an a priori criterion for consensus should be defined. This includes a clear and transparent guide for action on (a) how to proceed with certain items or topics in the next survey round, (b) the required threshold to terminate the Delphi process and (c) procedures to be followed when consensus is (not) reached after one or more iterations

Study conduct

4. *Informational input.* All material provided to the expert panel at the outset of the project and throughout the Delphi process should be carefully reviewed and piloted in advance in order to examine the effect on experts' judgements and to prevent bias
5. *Prevention of bias.* Researchers need to take measures to avoid directly or indirectly influencing the experts' judgements. If one or more members of the research team have a conflict of interest, entrusting an independent researcher with the main coordination of the Delphi study is advisable
6. *Interpretation and processing of results.* Consensus does not necessarily imply the 'correct' answer or judgement; (non)consensus and stable disagreement provide informative insights and highlight differences in perspectives concerning the topic in question
7. *External validation.* It is recommended to have the final draft of the resulting guidance on best practice in palliative care reviewed and approved by an external board or authority before publication and dissemination

Reporting

8. *Purpose and rationale.* The purpose of the study should be clearly defined and demonstrate the appropriateness of the use of the Delphi technique as a method to achieve the research aim. A rationale for the choice of the Delphi technique as the most suitable method needs to be provided. **Page 5**
9. *Expert panel.* Criteria for the selection of experts and transparent information on recruitment of the expert panel, socio- demographic details including information on expertise regarding the topic in question, (non)response and response rates over the ongoing iterations should be reported **Page 5**
10. *Description of the methods.* The methods employed need to be comprehensible; this includes information on preparatory steps (How was available evidence on the topic in question synthesised?), piloting of material and survey instruments, design of the survey instrument(s), the number and design of survey rounds, methods of data analysis, processing and synthesis of experts' responses to inform the subsequent survey round and methodological decisions taken by the research team throughout the process **Page 6**
11. *Procedure.* Flow chart to illustrate the stages of the Delphi process, including a preparatory phase, the actual 'Delphi rounds', interim steps of data processing and analysis, and concluding steps **Page 6**
12. *Definition and attainment of consensus.* It needs to be comprehensible to the reader how consensus was achieved throughout the process, including strategies to deal with non-consensus **Page 6**
13. *Results.* Reporting of results for each round separately is highly advisable in order to make the evolving of consensus over the rounds transparent. This includes figures showing the average group response, changes between rounds, as well as any modifications of the survey instrument such as deletion, addition or modification of survey items based on previous rounds **Page 7**
14. *Discussion of limitations.* Reporting should include a critical reflection of potential limitations and their impact of the resulting guidance **Page 8/11**
15. *Adequacy of conclusions.* The conclusions should adequately reflect the outcomes of the Delphi study with a view to the scope and applicability of the resulting practice guidance **Page 12**
16. *Publication and dissemination.* The resulting guidance on good practice in palliative care should be clearly identifiable from the publication, including recommendations for transfer into practice and implementation. If the publication does not allow for a detailed presentation of either the resulting practice guidance or the methodological features of the applied Delphi technique, or both, reference to a more detailed presentation elsewhere should be made (e.g. availability of the full guideline from the authors or online; publication of a separate paper reporting on methodological details and particularities of the process (e.g. persistent disagreement and controversy on certain issues)). A dissemination plan should include endorseent of the guidance by professional associations and health care authorities to facilitate implementation

*Consolidated criteria for reporting qualitative research
**Consolidated Standards of Reporting Trials

[1] Jünger S, Payne SA, Brine J, *et al.* Guidance on Conducting and Reporting Delphi Studies (CREDES) in palliative care: Recommendations based on a methodological systematic review. *Palliat Med* 2017;:26921631769068. doi:10.1177/0269216317690685

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PUSHING CHRONIC CARE FORWARD IN ABU DHABI BY IDENTIFYING PRIORITIES AND ADDRESSING BARRIERS: A MODIFIED DELPHI TECHNIQUE

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PUSHING CHRONIC CARE FORWARD IN ABU DHABI BY IDENTIFYING PRIORITIES AND ADDRESSING BARRIERS: A MODIFIED DELPHI TECHNIQUE

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ABSTRACT

Objectives This study aimed to elucidate the top five key priorities and barriers for chronic care in the health system of Abu Dhabi, United Arab Emirates (UAE).

Design A modified Delphi study was performed to reach consensus on priority areas and barriers for the development of the Chronic Care Model in the health system of Abu Dhabi. Individual wireless audience response devices (keypads) linked to a computer were used to reduce 28 priorities and 20 barriers to the top five during 3 iterative rounds over 3 consecutive days.

Setting Chronic care services for patients with diabetes, cardiovascular diseases, and cancer, in both private and publicly funded healthcare services in the emirate of Abu Dhabi.

Participants A purposive sample of twenty health systems' experts was recruited. They were healthcare workers from the public and private sector working in the delivery of care for patients with diabetes, cardiovascular diseases, and cancer.

Results The 'overall organizational leadership in chronic illness care' was ranked as the most important priority to address (26.3%) and 'patient compliance' was ranked as the most important barrier (36.8%) for the development of the Chronic Care Model.

Conclusions This study has identified the current priorities and barriers to improving chronic care within Abu Dhabi's healthcare system. Our paper addresses the UAE's 2021 Agenda of achieving a world-class healthcare system and findings may help inform strategic changes required to achieve this mission.

Strengths and limitations of this study:

- To our knowledge, this study is the first to use a modified Delphi technique to reach consensus on the health system in Abu Dhabi.
- Use of the wireless computer-linked keypads ensured participant privacy and confidentiality during the consensus exercise.
- A purposive sample of twenty healthcare experts was chosen to represent the healthcare workers population providing daily care to chronic patients. However, the sample was not a random sample; therefore, the results cannot be generalized.

INTRODUCTION

The Chronic Care Model (CCM) is a comprehensive model that integrates six elements to facilitate the delivery of high-quality care. Each element has its own strategic and developmental concepts to enhance the health outcomes of populations with chronic illness. This model was designed to help primary health care (PHC) practices improve health outcomes by changing the routine of care delivery and to convert chronically ill patients from reactive to proactive in managing their own diseases[1]. The CCM is a holistic combination of the six elements combined to foster quality improvement in the following areas: health system, community, self-management support, decision support, delivery system design and clinical information systems. Increasing evidence has shown that changes in at least four of the six categories of the CCM led to clear advances in health outcomes[2]. Some interventions have focused on one or two specific CCM components and these studies also showed improvements in the development of the CCM[2,3].This model has been mostly applied to patients with diabetes, congestive heart failure, and chronic obstructive pulmonary disease with evidence in the United States of America and Australia showing that the patients benefited from healthcare adjustments guided by the CCM[1,4,5].

A previous study (currently under review) conducted by our research group in the emirate of Abu Dhabi used the Assessment of Chronic Illness Care (ACIC) to understand the perception of healthcare workers on the development of the CCM in the delivery of chronic care to patients with diabetes, cardiovascular diseases, and cancer. The study found that Abu Dhabi's health system has reasonably good support for chronic illness care. It was a mixed method study, comprising a quantitative and a qualitative part. The study participants scored the subcomponents of the CCM completing the ACIC and were asked about the subcomponents (priorities) of the CCM through a semi-structured interview guide based on the ACIC. The priorities and barriers used in the present study emerged from earlier work conducted by our research group.

Abu Dhabi is the largest emirate of the United Arab Emirates (UAE) in terms of territory and population. The UAE and emirate of Abu Dhabi have an unusual population pyramid, characterized by a young population and a disproportion of genders[6,7]. In Abu Dhabi, only 18.2% of the residents are UAE nationals and the majority (67.3%) are under the age of 30 years

[8]. Although the UAE has a young population compared to similar high-income/ developed countries, the UAE is facing the growing problem of chronic diseases related to lifestyles i.e. obesity, diabetes, cardiovascular diseases, and cancer. In 2016, the age-standardized prevalence of diabetes was 25.4% for UAE nationals and 15.2% for expats, and cardiovascular diseases accounted for 37.1% of all the deaths in the emirate[8]. The government of the UAE has set health targets through the UAE Vision 2021. One of the key strategic goals of the UAE Vision 2021 National Agenda is to achieve a world-class healthcare system. Specific to chronic diseases this will be achieved by decreasing the prevalence of obesity amongst children, the overall prevalence of diabetes, and the number of deaths from cardiovascular diseases [9]. All seven UAE emirates (Abu Dhabi, Dubai, Sharjah, Ajman, Umm al Quwain, Ras Al-Khaima, and Fujairah) are working towards achieving these. The UAE healthcare system is regulated at both Federal and Emirate level having multiple regulators and providers depending on the emirate[6]. For these reasons, our study in focused on only one emirate, Abu Dhabi, and we are used the CCM as a framework to improve chronic care. To our knowledge, our study is the first addressing the CCM in the emirate of Abu Dhabi.

A modified Delphi technique was performed to identify and rank the top 5 priorities and barriers from an initial list of 28 priority areas and 20 barriers. The present study represents the first consensus exercise using a modified Delphi technique to identify the top five priorities and barriers for chronic care in the health system of Abu Dhabi, UAE.

Purpose and rationale

The main rationale for this study was the need to conduct the first consensus exercise with key stakeholders to understand the role of the CCM in one of the UAE's largest emirates – Abu Dhabi. The primary aim was to use a modified Delphi technique to identify and subsequently rank the priorities and barriers of the CCM in Abu Dhabi's healthcare system, UAE. Utilizing a health policy prioritization approach to strengthening the health services requires proper and focused policymaking. Therefore, the modified Delphi technique sought to elucidate the five most significant priorities and barriers identified by participants that can be used to facilitate policy-making and health care reform in Abu Dhabi, UAE.

Prevention of bias

To maximize privacy and confidentiality, all participants were provided with an individual wireless keypad (Keepad Interactive, NSW, Australia) to electronically log their responses to each question and round of the Delphi study. Our study design maximizes response rates and minimizes missing data as the software displays the number of people who answered each question in the corner of the polling slide. The polling results for each question can be shown in real-time to the participants; however, in this study, the participants did not receive any feedback until they were presented with the reduced list of priorities and barriers at the start of the subsequent round. The researchers conducting the modified Delphi technique did not have any conflicts of interest; hence, there was no need for an independent research team to coordinate the study. This study was approved by the competent Ethical Committee and all the participants signed the informed consent to be part of the study.

REPORTING

Expert panel

A purposive sample of 20 health systems' experts on the Abu Dhabi emirate health system was recruited to perform the modified Delphi technique. These 20 participants were considered experts by their epistemic expertise, which was defined by Weinstein as "the capacity to provide strong justification for a range of propositions in a domain"[10]. The inclusion criteria to be considered as a health systems' expert was: work in the public or private sector of the healthcare system in Abu Dhabi; work in the same facility for more than one year; work in the delivery of care to patients with diabetes, cardiovascular or cancer; and speak and understand English,. The participants were invited to attend three brief meetings to complete the three interactive rounds of the modified Delphi technique.

The majority of the participants were females (70%), nurses (37.5%), working in the public sector (70%) and in the Al Ain (Eastern Region) of Abu Dhabi (81.3%). The average years of experience were 14.8±13.7 years and the mean working time in the same facility was 6.3±3.3 years.

Description of the methods

The modified Delphi method itself starts with a series of questionnaires used to identify a list of topics. Through an interactive process of nominal scoring, the topics are reduced until a pre-specified number of topics remain to be ranked in order of priority, and the process finishes when consensus has been established at a sufficient level[11,12]. This technique supports health policy decision-making and has been used previously to reach expert consensus on definitions, guidelines, and strategies for occupational health, elderly care, rural health, palliative care, primary health care, migrant health, diabetes, and medical professionalism (10-19). This paper follows the recently published Guidelines to Conduct and REport DElphi Studies (CREDES)[13].

Study researchers printed sheets of A4 paper with the priorities and barriers and these were provided to the participants on arrival. The research team also performed a pilot test of the Keepad computer software for the modified Delphi technique to ensure the correct configuration and set-up of the wireless voting system through the PowerPoint presentation. The Keepad software has specific configurations for the type of question to be addressed and works as an interface with the wireless keypads. The participants used these individual computer-linked electronic keypads to vote and rank the priorities and barriers. The information provided from each wireless keypad was automatically logged on the computer system and the results (i.e. frequency and percentage) were provided immediately to the researchers. After each round, the researchers analyzed the results to prepare the reduced list of tables and the PowerPoint presentation for the next round of the modified Delphi study.

Procedure and definition of consensus

Three brief meetings were conducted to execute the three selection rounds and achieve consensus through this technique. Each of the three rounds was conducted over three separate consecutive days where the priorities and barriers were voted to reach the "top five" by the end of the third meeting. At the start of each meeting, two colored sheets with the priorities and barriers on a table with a three-point *Likert scale* (yellow for priorities and blue for barriers) were given to the participants on arrival. The participants were asked to use the colored sheets to score the priorities and barriers according to the provided three-point *Likert scale* 'not very relevant', 'relevant' or 'very relevant'. Once all the participants had completed the *Likert scale* on the

paper, wireless keypads were distributed and oral instructions about how to use them were given in order to record their answers. At the end of the first round, the researchers reviewed the results of each priority subcomponent and barrier that were voted 'very relevant', 'relevant' or 'not very relevant', according to participants' previous handwriting choices (on the given colored paper). The priorities and barriers that were considered 'very relevant' by at least 30% of the participants were selected for the next round. In this case, 28 priorities were a reduced to 16 priorities, and 20 barriers were reduced to 14 barriers. During the second round, participants were asked to repeat the process and identify the five most relevant priorities and barriers by marking them as 'very relevant'. The five priorities and barriers with the highest percentage of participants ranking them as 'very relevant' were selected to be ranked in the third round. Three of the priority subcomponents: 'Improvement strategy for chronic illness care', 'evidence-based guidelines' and 'patient treatment plans' received the same proportion of votes. As a result of this tie, seven priorities were selected for the final ranking exercise in round three (Figure 1).

WHAT ARE THE TOP FIVE PRIORITY AREAS TO INTERVENE?

Table 1 shows that the 26.3% of expert participants selected the 'overall organizational leadership in chronic illness care' as the most important priority subcomponent of the CCM to address. The two subcomponents 'continuity of care' and 'effective behavior change interventions and peer-support' were voted as the second priority by 21.1% of the participants leading to a tie in the priority rank. The 'evidence-based guidelines' was voted as the third most important priority by 15.8% of the participants. The subcomponent 'improvement strategy for chronic illness care' was voted as the fourth most important priority by 10.5% and the subcomponent 'provider education for chronic illness care' was voted as the fifth by 5.3% of the participants.

Table 1: Round 3 results: top five priority subcomponents of the CCM.

Rank	Percentage	Priorities
1	26.3%	Overall Organizational Leadership in Chronic Illness Care
2	21.1%	Continuity of care
2	21.1%	Effective behavior change interventions and peer support
3	15.8%	Evidence-based guidelines
4	10.5%	Improvement strategy for chronic illness care

5	5.3%	Provider education for chronic illness care

WHAT ARE THE TOP FIVE BARRIERS TO THE DEVELOPMENT OF THE CCM?

'Patient compliance' was voted as the most important barrier to the development of the CCM by 36.8% of participants. 'Lack of standardized processes/procedures' was voted as the second most important barrier by 31.6% of the participants, 'differences between insurances' was voted as the third most important barrier by 15.8% of the participants, 'lack of regional plans and standardizing guidelines between facilities' was voted as the fourth most important barrier by 10.5% of the participants, and a 'lack of monitoring' was voted as the fifth most important barrier by 5.3% of the participants (Table 2).

Table 2: Round 3 results: top five barriers of the CCM.

Rank	Percentage	Barriers
1	36.8%	Patient compliance
2	31.6%	Lack of standardized processes/procedures
3	15.8%	Differences between insurances
4	10.5%	Lack of regional plans standardizing guidelines between facilities
5	5.3%	Lack of monitoring

DISCUSSION

Our study used a modified Delphi technique to reach consensus on the priorities and barriers for the development of the CCM within Abu Dhabi's health system. The CCM is composed of six elements with 28 subcomponents that the expert participants voted and ranked. The element "health system" was present twice during the Delphi process in the subcomponents 'overall organizational leadership in chronic illness care' and 'improvement strategy for chronic illness care', while the elements "delivery system design", "self-management", and "decision support" appeared once linked to the other subcomponents. The elements "clinical system design" and "community" were not represented in the final priorities.

The 'overall organizational leadership in chronic illness care' was the subcomponent ranked as the most important priority to address, relating to health system organization and different leadership models. According to Lapão and colleagues (2017), the development of a healthcare organization is directly proportional to the leadership process, the professional's management ability, the incentives and the resources available[14]. The term "leadership" is now a clearer

concept; however, its operationalization is still not mature and this may explain some of the difficulties acknowledged by health organizations[15]. The highest ranked subcomponent ('overall organizational leadership in chronic illness care') is linked with the fourth ranked priority 'improvement strategy for chronic illness care'. 'Improvement strategy for chronic illness care' addresses the need for the healthcare system reorganization to face the growing problem of chronic diseases. The development of the CCM advocates organizational changes in health delivery to a patient-centered model where the patient has a proactive role managing their own disease.. In the patient-centered model, all the providers are able to see patient information in their workstations and agree to follow the same guidelines and treatments with patient agreement[1]. This example integrates four of the six elements of the CCM (delivery system design, clinical information system, decision support, and self-management). 'Continuity of care' was ranked as the second most important priority and it shows the perception of the experts for the need to change the delivery system design. In the Abu Dhabi health system, a patient is not allocated to a specific family medicine physician; the family medicine physician working at the chronic care clinics often does not follow the same patient every time causing a lack of continuity of care from the perspective of the doctor-patient relationship. 'Effective behavior change interventions and peer support' was also ranked as the second most important priority. In the United Kingdom, Spain and Portugal, there is a general practitioner, or family medicine doctor, attributed to each person according to the residency area who acts as the first line of contact (or the 'gatekeeper') between the patient and the health system[16–18]. This allows the doctor to know their patient's history (and families), establish a relationship with them, and to promote behavior changes that are in the base of chronic disease prevention [17]. 'Evidence-based guidelines' was considered the third most important priority to improve the care of chronic diseases in Abu Dhabi; however, the UAE was a pioneer using evidence-based medicine, the concept was introduced in 1998[19]. One of the reasons for this subcomponent to be ranked as a priority might be the multinational origin of the healthcare workforce, who tend to follow the guidelines of the country where they are from and/or trained. For example, physicians from North America may follow the North American guidelines related to a specific chronic disease. 'Evidence-based guidelines' is also related to electronic health records and decision-support systems that might help health professionals improve their performance, in terms of better decisions and time management.

'Patient compliance' was identified by the participants as the most important barrier. A study conducted in the Netherlands (2012) with the aim of understanding the development and coordination of disease management programs, also reported that patient involvement in their own care as a barrier to implementing the CCM[20]. From the literature, it is known that one way to address patient compliance is through patient education and participation[21,22]. A 'lack of standardized processes/procedures' was considered to be the second most relevant barrier and there is a need to integrate the delivery of care with the clinical systems for all professionals working in the health system. Also, this barrier seems to be related to the third ranked barrier: 'differences between insurances'. Although health insurance is mandatory in the emirate of Abu Dhabi, there are different insurance packages depending on the type of employment, monthly income, and residence visa. These different insurance packages provide access to different coverage plans and services. For example, diabetes education or lactation consultations are not available for patients with the lower health insurance plan, which makes the delivery of care not standardized for the healthcare workers, as they are not able to provide the same procedure to all patients. The 'differences between insurances' was also considered a barrier by Haggstrom and colleagues (2012) when they assessed the CCM implementation for cancer screening in community centers in the United States of America[23]. The 'lack of regional plans standardizing the guidelines between the facilities' was considered to be the fourth barrier. Abu Dhabi's publicly funded health system seems to have a centralized organizational model where further work inside the organization to engage top managers, and healthcare workers is needed to understand why the same level of care following the same directions is not provided in all facilities. The barrier ranked as the fifth most important barrier was a 'lack of monitoring'. This barrier is linked to the 'lack of standardized processes/procedures' and shows that the healthcare workers and clinical directors feel the need for monitoring and feedback on their performance, interventions or implemented measures. This findings suggests that there is the need to examine the effectiveness and efficiency of the different communication channels, both horizontally and vertically, within an organization. Hroscikoski and colleagues (2006) in the United States of America, reported barriers related to the 'lack of monitoring' when they implemented the CCM in a group of 18 clinics: insufficient time to measure the change, lack of measures to assess change, and a lack of specific details and desired care changes[24].It is hoped that our findings on the priorities and barriers of the CCM implementation in the Abu Dhabi health system will

contribute to the continuous improvement of the quality of healthcare delivery both for the patient and healthcare workers. The UAE can serve as an example for other high income and/or rapidly developing countries. The leadership stability, the availability and proper allocation of the resources, and the long-term economic and social strategies allowed the implementation of successful healthcare strategies creating an international competitive health system. To improve the delivery of care to chronic patients in the emirate of Abu Dhabi the development of a healthcare strategy to achieve the UAE Vision 2021 is recommended. Based on the modified Delphi and the CCM premises it would be recommended that a strategy includes:

- ongoing training for middle and executive managers on standardized leadership and communication skills;
- designing an appropriate improvement strategy for each healthcare service center with the patient at the center of the care;
- implementing a general practitioner/family medicine physician model in healthcare centers in Abu Dhabi;
- ensuring the use of the evidence-based guidelines;
- increasing the number of health educators to provide all patients with self-management support sessions to help them understand their proactive role managing their own disease ("how to comply");
- healthcare facilities for types of insurances ensuring that healthcare workers can provide the highest level of standardized and quality care regardless of the patient's health insurance (this already happens is some cases);
- establishing a monitoring process for healthcare workers with integrated feedback linked to team and facilities objectives (it is already used in some facilities Abu Dhabi).

It is believed that these strategies can be applied to other health systems facing the same challenges of an ageing population coupled with high levels of lifestyle-related chronic diseases. Our findings also highlight some important concepts (continuity of care, differences between insurances) required to globally achieve universal health coverage.

Strengths: The wireless computer-linked keypads ensured participant privacy and confidentiality during the modified Delphi technique and this should have minimized response

bias. In addition, completing the study over three consecutive days, as opposed to weeks and months required with a postal or email methodology, resulted in a 95% response rate and a low attrition rate. Overall, our methodology using wireless handheld keypads enabled a rapid consensus process to effectively identify priorities and barriers for the CCM in Abu Dhabi's health system. There are at least three previous studies that have used a Delphi technique in the UAE to reach consensus on occupational health [25], elderly care [26], and medical professionalism [26–28]; however, our study is the first to use a modified Delphi technique to elucidate the priorities and barriers of the CCM in Abu Dhabi's healthcare system.

Limitations: One of the limitations of this modified Delphi technique is the requirement for the participants to be physically present, which can introduce a selection bias if the attendance reduces significantly during the rounds[28]. However, the response rate in this study was 95%, as from day one to the end of the study only one participant was absent, round 2 and 3 had 19 participants instead of 20. Another limitation is the inability to generalize our results to the health systems operating in other emirates in the UAE, but that was not the purpose of this study.

Adequacy of conclusions

The modified Delphi technique achieved the aim of identifying the priorities and barriers of the CCM in Abu Dhabi's healthcare system; specifically, 'Overall Organizational Leadership in Chronic Illness Care' was ranked as the top priority and 'Patient Compliance' as the most important barrier. This study represents an important step in the process of understanding the key barriers and priority areas for interventions to maximize the development of the CCM in the health system of Abu Dhabi emirate in the UAE.

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Reporting guidelines Conducting and REporting DElphi Studies – CREDES.

Data sharing No additional data available.

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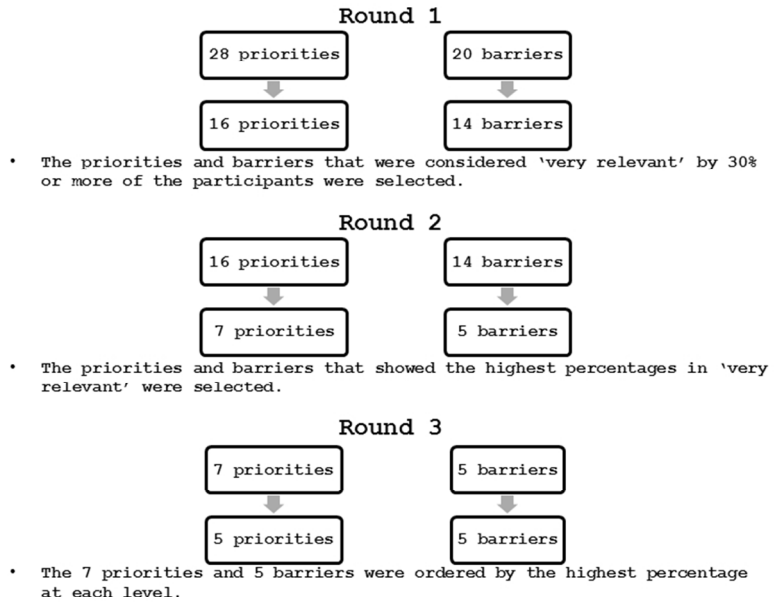
FIGURES

Figure 1: Delphi technique rounds procedure.



Delphi technique rounds procedure.

81x60mm (300 x 300 DPI)

Box 3. Recommendations for the Conducting and REporting of DElphi Studies (CREDES)[1].

Rationale for the choice of the Delphi technique

1. *Justification.* The choice of the Delphi technique as a method of systematically collating expert consultation and building consensus needs to be well justified. When selecting the method to answer a particular research question, it is important to keep in mind its constructivist nature

Planning and design

2. *Planning and process.* The Delphi technique is a flexible method and can be adjusted to the respective research aims and purposes. Any modifications should be justified by a rationale and be applied systematically and rigorously
3. *Definition of consensus.* Unless not reasonable due to the explorative nature of the study, an a priori criterion for consensus should be defined. This includes a clear and transparent guide for action on (a) how to proceed with certain items or topics in the next survey round, (b) the required threshold to terminate the Delphi process and (c) procedures to be followed when consensus is (not) reached after one or more iterations

Study conduct

4. *Informational input.* All material provided to the expert panel at the outset of the project and throughout the Delphi process should be carefully reviewed and piloted in advance in order to examine the effect on experts' judgements and to prevent bias
5. *Prevention of bias.* Researchers need to take measures to avoid directly or indirectly influencing the experts' judgements. If one or more members of the research team have a conflict of interest, entrusting an independent researcher with the main coordination of the Delphi study is advisable
6. *Interpretation and processing of results.* Consensus does not necessarily imply the 'correct' answer or judgement; (non)consensus and stable disagreement provide informative insights and highlight differences in perspectives concerning the topic in question
7. *External validation.* It is recommended to have the final draft of the resulting guidance on best practice in palliative care reviewed and approved by an external board or authority before publication and dissemination

Reporting

8. *Purpose and rationale.* The purpose of the study should be clearly defined and demonstrate the appropriateness of the use of the Delphi technique as a method to achieve the research aim. A rationale for the choice of the Delphi technique as the most suitable method needs to be provided. **Page 5**
9. *Expert panel.* Criteria for the selection of experts and transparent information on recruitment of the expert panel, socio- demographic details including information on expertise regarding the topic in question, (non)response and response rates over the ongoing iterations should be reported **Page 5**
10. *Description of the methods.* The methods employed need to be comprehensible; this includes information on preparatory steps (How was available evidence on the topic in question synthesised?), piloting of material and survey instruments, design of the survey instrument(s), the number and design of survey rounds, methods of data analysis, processing and synthesis of experts' responses to inform the subsequent survey round and methodological decisions taken by the research team throughout the process **Page 6**
11. *Procedure.* Flow chart to illustrate the stages of the Delphi process, including a preparatory phase, the actual 'Delphi rounds', interim steps of data processing and analysis, and concluding steps **Page 6**
12. *Definition and attainment of consensus.* It needs to be comprehensible to the reader how consensus was achieved throughout the process, including strategies to deal with non-consensus **Page 6**
13. *Results.* Reporting of results for each round separately is highly advisable in order to make the evolving of consensus over the rounds transparent. This includes figures showing the average group response, changes between rounds, as well as any modifications of the survey instrument such as deletion, addition or modification of survey items based on previous rounds **Page 7**
14. *Discussion of limitations.* Reporting should include a critical reflection of potential limitations and their impact of the resulting guidance **Page 8/11**
15. *Adequacy of conclusions.* The conclusions should adequately reflect the outcomes of the Delphi study with a view to the scope and applicability of the resulting practice guidance **Page 12**
16. *Publication and dissemination.* The resulting guidance on good practice in palliative care should be clearly identifiable from the publication, including recommendations for transfer into practice and implementation. If the publication does not allow for a detailed presentation of either the resulting practice guidance or the methodological features of the applied Delphi technique, or both, reference to a more detailed presentation elsewhere should be made (e.g. availability of the full guideline from the authors or online; publication of a separate paper reporting on methodological details and particularities of the process (e.g. persistent disagreement and controversy on certain issues)). A dissemination plan should include endorseent of the guidance by professional associations and health care authorities to facilitate implementation

*Consolidated criteria for reporting qualitative research
**Consolidated Standards of Reporting Trials

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PUSHING CHRONIC CARE FORWARD IN ABU DHABI BY IDENTIFYING PRIORITIES AND ADDRESSING BARRIERS: A MODIFIED DELPHI TECHNIQUE

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PUSHING CHRONIC CARE FORWARD IN ABU DHABI BY IDENTIFYING PRIORITIES AND ADDRESSING BARRIERS: A MODIFIED DELPHI TECHNIQUE

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ABSTRACT

Objectives This study aimed to elucidate the top five key priorities and barriers for chronic care in the health system of Abu Dhabi, United Arab Emirates (UAE).

Design A modified Delphi study was performed to reach consensus on priority areas and barriers for the development of the Chronic Care Model in the health system of Abu Dhabi. Individual wireless audience response devices (keypads) linked to a computer were used to reduce 28 priorities and 20 barriers to the top five during 3 iterative rounds over 3 consecutive days.

Setting Chronic care services for patients with diabetes, cardiovascular diseases, and cancer, in both private and publicly funded healthcare services in the emirate of Abu Dhabi.

Participants A purposive sample of twenty health systems' experts was recruited. They were frontline healthcare workers from the public and private sector working in the delivery of care for patients with diabetes, cardiovascular diseases, and cancer.

Results The 'overall organizational leadership in chronic illness care' was ranked as the most important priority to address (26.3%) and 'patient compliance' was ranked as the most important barrier (36.8%) for the development of the Chronic Care Model.

Conclusions This study has identified the current priorities and barriers to improving chronic care within Abu Dhabi's healthcare system. Our paper addresses the UAE's 2021 Agenda of achieving a world-class healthcare system and findings may help inform strategic changes required to achieve this mission.

Strengths and limitations of this study:

- To our knowledge, this study is the first to use a modified Delphi technique to reach consensus on the health system in Abu Dhabi.
- Use of the wireless computer-linked keypads ensured participant privacy and confidentiality during the consensus exercise.
- A purposive sample of twenty frontline healthcare experts was chosen to represent the healthcare workers population providing daily care to chronic patients. However, the sample was not a random sample; therefore, the results cannot be generalized.

INTRODUCTION

The Chronic Care Model (CCM) is a comprehensive model that integrates six elements to facilitate the delivery of high-quality care. Each element has its own strategic and developmental concepts to enhance the health outcomes of populations with chronic illness. This model was designed to help primary health care (PHC) practices improve health outcomes by changing the routine of care delivery and to convert chronically ill patients from reactive to proactive in managing their own diseases[1]. The CCM is a holistic combination of the six elements combined to foster quality improvement in the following areas: health system, community, self-management support, decision support, delivery system design and clinical information systems. Increasing evidence has shown that changes in at least four of the six categories of the CCM led to clear advances in health outcomes[2]. Some interventions have focused on one or two specific CCM components and these studies also showed improvements in the development of the CCM[2,3].This model has been mostly applied to patients with diabetes, congestive heart failure, and chronic obstructive pulmonary disease with evidence in the United States of America and Australia showing that the patients benefited from healthcare adjustments guided by the CCM[1,4,5].

A previous study (currently under review) conducted by our research group in the emirate of Abu Dhabi used the Assessment of Chronic Illness Care (ACIC) to understand the perception of healthcare workers on the development of the CCM in the delivery of chronic care to patients with diabetes, cardiovascular diseases, and cancer. The study found that Abu Dhabi's health system has reasonably good support for chronic illness care. It was a mixed-methods study, comprising a quantitative and a qualitative part. The study participants scored the subcomponents of the CCM completing the ACIC and were asked about the subcomponents (priorities) of the CCM through a semi-structured interview guide based on the ACIC. The priorities and barriers used in the present study emerged from earlier work conducted by our research group.

Abu Dhabi is the largest emirate of the United Arab Emirates (UAE) in terms of territory and population. The UAE and emirate of Abu Dhabi have an unusual population pyramid, characterized by a young population and an imbalance in the sex ratio with approximately four times as many males as females [6,7]. This disproportion of sex within the general population is

due to the mass recruitment of expatriate males employed in the industrial and construction sector. However, there is an equal sex ratio between UAE nationals [6]. In Abu Dhabi, only 18.2% of the residents are UAE nationals and the majority (67.3%) are under the age of 30 years [8]. Although the UAE has a young population compared to similar high-income/developed countries, the UAE is facing the growing problem of chronic diseases related to lifestyles i.e. obesity, diabetes, cardiovascular diseases, and cancer. In 2016, the age-standardized prevalence of diabetes was 25.4% for UAE nationals and 15.2% for expats, and cardiovascular diseases accounted for 37.1% of all the deaths in the emirate[8]. The UAE government has set health targets through the UAE Vision 2021. One of the key strategic goals of the UAE Vision 2021 National Agenda is to achieve a world-class healthcare system. Specific to chronic diseases this will be achieved by decreasing the prevalence of obesity amongst children, the overall prevalence of diabetes, and the number of deaths from cardiovascular diseases [9]. All seven UAE emirates (Abu Dhabi, Dubai, Sharjah, Ajman, Umm al Quwain, Ras Al-Khaima, and Fujairah) are working towards achieving these goals. The UAE healthcare system is regulated at both Federal and Emirate level having multiple regulators and providers depending on the emirate[6]. For these reasons, our study is focused on only one emirate, Abu Dhabi, and we used the CCM as a framework to improve chronic care. To our knowledge, this study is the first addressing the CCM in the emirate of Abu Dhabi and this framework may be useful to help the UAE achieve a world class health system as one of the key strategic goals of the UAE Vision 2021 National Agenda.

A modified Delphi technique was performed to identify and rank the top 5 priorities and barriers from an initial list of 28 priority areas and 20 barriers. The present study represents the first consensus exercise using a modified Delphi technique to identify the top five priorities and barriers for chronic care in the health system of Abu Dhabi, UAE.

Purpose and rationale

The main rationale for this study was the need to conduct the first consensus exercise with key stakeholders to understand the role of the CCM in o UAE's largest emirate – Abu Dhabi. The primary aim was to use a modified Delphi technique to identify and subsequently rank the priorities and barriers of the CCM in Abu Dhabi's healthcare system, UAE. Utilizing a health policy prioritization approach to strengthening the health services requires proper and focused

policymaking. Therefore, the modified Delphi technique sought to elucidate the five most significant priorities and barriers identified by participants that can be used to facilitate policy-making and health care reform in Abu Dhabi, UAE.

Prevention of bias

To maximize privacy and confidentiality, all participants were provided with an individual wireless keypad (Keepad Interactive, NSW, Australia) to electronically log their responses to each question and round of the Delphi study. Our study design maximizes response rates and minimizes missing data as the software displays the number of people who answered each question in the corner of the polling slide. The polling results for each question can be shown in real-time to the participants; however, in this study, the participants did not receive any feedback until they were presented with the reduced list of priorities and barriers at the start of the subsequent round. The researchers conducting the modified Delphi technique did not have any conflicts of interest; hence, there was no need for an independent research team to coordinate the study. This study was approved by the competent Ethical Committee and all the participants signed the informed consent to be part of the study.

REPORTING

Expert panel

A purposive sample of 20 frontline health systems' experts on the Abu Dhabi emirate health system was recruited to perform the modified Delphi technique. These 20 participants were considered experts by their epistemic expertise, which was defined by Weinstein as "the capacity to provide strong justification for a range of propositions in a domain"[10]. The inclusion criteria to be considered as a health systems' expert was: work in the public or private sector of the healthcare system in Abu Dhabi; work in the same facility for more than one year; work in the delivery of care to patients with diabetes, cardiovascular or cancer; and speak and understand English, The participants were invited to attend three brief meetings to complete the three interactive rounds of the modified Delphi technique.

The majority of the participants were females (70%), nurses (37.5%), working in the public sector (70%) and in the Al Ain (Eastern Region) of Abu Dhabi (81.3%). The average years of

experience were 14.8±13.7 years and the mean working time in the same facility was 6.3±3.3 years.

Description of the methods

The modified Delphi method itself starts with a series of questionnaires used to identify a list of topics. Through an interactive process of nominal scoring, the topics are reduced until a pre-specified number of topics remain to be ranked in order of priority, and the process finishes when consensus has been established at a sufficient level [11,12]. This technique supports health policy decision-making and has been used previously to reach expert consensus on definitions, guidelines, and strategies for occupational health, elderly care, rural health, palliative care, primary health care, migrant health, diabetes, and medical professionalism (10-19). This paper follows the recently published Guidelines to Conduct and REport DElphi Studies (CREDES)[13].

Study researchers printed sheets of A4 paper with the priorities and barriers and these were provided to the participants on arrival. The research team also performed a pilot test of the Keepad computer software for the modified Delphi technique to ensure the correct configuration and set-up of the wireless voting system through the PowerPoint presentation. The Keepad software has specific configurations for the type of question to be addressed and works as an interface with the wireless keypads. The participants used these individual computer-linked electronic keypads to vote and rank the priorities and barriers. The information provided from each wireless keypad was automatically logged on the computer system and the results (i.e. frequency and percentage) were provided immediately to the researchers. After each round, the researchers analyzed the results to prepare the reduced list of tables and the PowerPoint presentation for the next round of the modified Delphi study.

Patient and Public Involvement Patients and/or public were not involved.

Procedure and definition of consensus

Three brief meetings were conducted to execute the three selection rounds and achieve consensus through this technique. Each of the three rounds was conducted over three separate consecutive days where the priorities and barriers were voted to reach the “top five” by the end of the third meeting. At the start of each meeting, two colored sheets with the priorities and

barriers on a table with a three-point *Likert scale* (yellow for priorities and blue for barriers) were given to the participants on arrival. The participants were asked to use the colored sheets to score the priorities and barriers according to the provided three-point *Likert scale* 'not very relevant', 'relevant' or 'very relevant'. Once all the participants had completed the *Likert scale* on the paper, wireless keypads were distributed and oral instructions about how to use them were given in order to record their answers. At the end of the first round, the researchers reviewed the results of each priority subcomponent and barrier that were voted 'very relevant', 'relevant' or 'not very relevant', according to participants' previous handwriting choices (on the given colored paper). The priorities and barriers that were considered 'very relevant' by at least 30% of the participants were selected for the next round. In this case, 28 priorities were a reduced to 16 priorities, and 20 barriers were reduced to 14 barriers. During the second round, participants were asked to repeat the process and identify the five most relevant priorities and barriers by marking them as 'very relevant'. The five priorities and barriers with the highest percentage of participants ranking them as 'very relevant' were selected to be ranked in the third round. Three of the priority subcomponents: 'Improvement strategy for chronic illness care', 'evidence-based guidelines' and 'patient treatment plans' received the same proportion of votes. As a result of this tie, seven priorities were selected for the final ranking exercise in round three (Figure 1).

WHAT ARE THE TOP FIVE PRIORITY AREAS TO INTERVENE?

Table 1 shows that the 26.3% of expert participants selected the 'overall organizational leadership in chronic illness care' as the most important priority subcomponent of the CCM to address. The two subcomponents 'continuity of care' and 'effective behavior change interventions and peer-support' were voted as the second priority by 21.1% of the participants leading to a tie in the priority rank. The 'evidence-based guidelines' was voted as the third most important priority by 15.8% of the participants. The subcomponent 'improvement strategy for chronic illness care' was voted as the fourth most important priority by 10.5% and the subcomponent 'provider education for chronic illness care' was voted as the fifth by 5.3% of the participants.

Table 1: Round 3 results: top five priority subcomponents of the CCM.

Rank	Percentage	Priorities

1	26.3%	Overall Organizational Leadership in Chronic Illness Care
2	21.1%	Continuity of care
2	21.1%	Effective behavior change interventions and peer support
3	15.8%	Evidence-based guidelines
4	10.5%	Improvement strategy for chronic illness care
5	5.3%	Provider education for chronic illness care

WHAT ARE THE TOP FIVE BARRIERS TO THE DEVELOPMENT OF THE CCM?

'Patient compliance' was voted as the most important barrier to the development of the CCM by 36.8% of participants. 'Lack of standardized processes/procedures' was voted as the second most important barrier by 31.6% of the participants, 'differences between insurances' was voted as the third most important barrier by 15.8% of the participants, 'lack of regional plans and standardizing guidelines between facilities' was voted as the fourth most important barrier by 10.5% of the participants, and a 'lack of monitoring' was voted as the fifth most important barrier by 5.3% of the participants (Table 2).

Table 2: Round 3 results: top five barriers of the CCM.

Rank	Percentage	Barriers
1	36.8%	Patient compliance
2	31.6%	Lack of standardized processes/procedures
3	15.8%	Differences between insurances
4	10.5%	Lack of regional plans standardizing guidelines between facilities
5	5.3%	Lack of monitoring

DISCUSSION

Our study used a modified Delphi technique to reach consensus on the priorities and barriers for the development of the CCM within Abu Dhabi's health system. The CCM is composed of six elements with 28 subcomponents that the expert participants voted and ranked. The element "health system" was present twice during the Delphi process in the subcomponents 'overall organizational leadership in chronic illness care' and 'improvement strategy for chronic illness care', while the elements "delivery system design", "self-management", and "decision support" appeared once linked to the other subcomponents. The elements "clinical system design" and "community" were not represented in the final priorities.

The 'overall organizational leadership in chronic illness care' was the subcomponent ranked as the most important priority to address, relating to health system organization and different leadership models. According to Lapão and colleagues (2017), the development of a healthcare organization is directly proportional to the leadership process, the professional's management ability, the incentives and the resources available[14]. The term "leadership" is now a clearer concept; however, its operationalization is still not mature and this may explain some of the difficulties acknowledged by health organizations[15]. The highest ranked subcomponent ('overall organizational leadership in chronic illness care') is linked with the fourth ranked priority 'improvement strategy for chronic illness care'. 'Improvement strategy for chronic illness care' addresses the need for the healthcare system reorganization to face the growing problem of chronic diseases. The development of the CCM advocates organizational changes in health delivery to a patient-centered model where the patient has a proactive role managing their own disease. In the patient-centered model, all the providers are able to see patient information in their workstations and agree to follow the same guidelines and treatments with patient agreement[1]. This example integrates four of the six elements of the CCM (delivery system design, clinical information system, decision support, and self-management). 'Continuity of care' was ranked as the second most important priority and it shows the perception of the experts for the need to change the delivery system design. In the Abu Dhabi health system, a patient is not allocated to a specific family medicine physician; the family medicine physician working at the chronic care clinics often does not follow the same patient every time causing a lack of continuity of care from the perspective of the doctor-patient relationship. 'Effective behavior change interventions and peer support' was also ranked as the second most important priority. In the United Kingdom, Spain and Portugal, there is a general practitioner, or family medicine doctor, attributed to each person according to the residency area who acts as the first line of contact (or the 'gatekeeper') between the patient and the health system[16–18]. This allows the doctor to know their patient's history (and families), establish a relationship with them, and to promote behavior changes that are in the base of chronic disease prevention [17]. 'Evidence-based guidelines' was considered the third most important priority to improve the care of chronic diseases in Abu Dhabi; however, the UAE was a pioneer using evidence-based medicine, the concept was introduced in 1998[19]. One of the reasons for this subcomponent to be ranked as a priority might be the multinational origin of the healthcare workforce, who tend to follow the

guidelines of the country where they are from and/or trained. For example, physicians from North America may follow the North American guidelines related to a specific chronic disease. 'Evidence-based guidelines' is also related to electronic health records and decision-support systems that might help health professionals improve their performance, in terms of better decisions and time management.

'Patient compliance' was identified by the participants as the most important barrier. A study conducted in the Netherlands (2012) with the aim of understanding the development and coordination of disease management programs, also reported that patient involvement in their own care as a barrier to implementing the CCM[20]. From the literature, it is known that one way to address patient compliance is through patient education and participation[21,22]. A 'lack of standardized processes/procedures' was considered to be the second most relevant barrier and there is a need to integrate the delivery of care with the clinical systems for all professionals working in the health system. Also, this barrier seems to be related to the third ranked barrier: 'differences between insurances'. Although health insurance is mandatory in the emirate of Abu Dhabi, there are different insurance packages depending on the type of employment, monthly income, and residence visa. These different insurance packages provide access to different coverage plans and services. For example, diabetes education or lactation consultations are not available for patients with the lower health insurance plan, which makes the delivery of care not standardized for the healthcare workers, as they are not able to provide the same procedure to all patients. The 'differences between insurances' was also considered a barrier by Haggstrom and colleagues (2012) when they assessed the CCM implementation for cancer screening in community centers in the United States of America[23]. The 'lack of regional plans standardizing the guidelines between the facilities' was considered to be the fourth barrier. Abu Dhabi's publicly funded health system seems to have a centralized organizational model where further work inside the organization to engage top managers, and healthcare workers is needed to understand why the same level of care following the same directions is not provided in all facilities. The barrier ranked as the fifth most important barrier was a 'lack of monitoring'. This barrier is linked to the 'lack of standardized processes/procedures' and shows that the healthcare workers and clinical directors feel the need for monitoring and feedback on their performance, interventions or implemented measures. These findings suggests that there is the need to examine the effectiveness and efficiency of the different communication channels, both horizontally and

vertically, within an organization. Hroscikoski and colleagues (2006) in the United States of America, reported barriers related to the 'lack of monitoring' when they implemented the CCM in a group of 18 clinics: insufficient time to measure the change, lack of measures to assess change, and a lack of specific details and desired care changes[24].It is hoped that our findings on the priorities and barriers of the CCM implementation in the Abu Dhabi health system will contribute to the continuous improvement of the quality of healthcare delivery both for the patient and healthcare workers. The UAE can serve as an example for other high income and/or rapidly developing countries. The leadership stability, the availability and proper allocation of the resources, and the long-term economic and social strategies allowed the implementation of successful healthcare strategies creating an international competitive health system. To improve the delivery of care to chronic patients in the emirate of Abu Dhabi the development of a healthcare strategy to achieve the UAE Vision 2021 is recommended. Based on the modified Delphi and the CCM premises it would be recommended that a strategy includes:

- ongoing training for middle and executive managers on standardized leadership and communication skills;
- designing an appropriate improvement strategy for each healthcare service center with the patient at the center of the care;
- implementing a general practitioner/family medicine physician model in healthcare centers in Abu Dhabi;
- ensuring the use of the evidence-based guidelines;
- increasing the number of health educators to provide all patients with self-management support sessions to help them understand their proactive role managing their own disease ("how to comply");
- healthcare facilities for types of insurances ensuring that healthcare workers can provide the highest level of standardized and quality care regardless of the patient's health insurance (this already happens is some cases);
- establishing a monitoring process for healthcare workers with integrated feedback linked to team and facilities objectives (it is already used in some facilities Abu Dhabi).

It is believed that these strategies can be applied to other health systems facing the same challenges of an ageing population coupled with high levels of lifestyle-related chronic diseases.

Our findings also highlight some important concepts (continuity of care, differences between insurances) required to globally achieve universal health coverage.

Strengths: The wireless computer-linked keypads ensured participant privacy and confidentiality during the modified Delphi technique and this should have minimized response bias. In addition, completing the study over three consecutive days, as opposed to weeks and months required with a postal or email methodology, resulted in a 95% response rate and a low attrition rate. Overall, our methodology using wireless handheld keypads enabled a rapid consensus process to effectively identify priorities and barriers for the CCM in Abu Dhabi's health system. There are at least three previous studies that have used a Delphi technique in the UAE to reach consensus on occupational health [25], elderly care [26], and medical professionalism [26–28]; however, our study is the first to use a modified Delphi technique to elucidate the priorities and barriers of the CCM in Abu Dhabi's healthcare system.

Limitations: One of the limitations of this modified Delphi technique is the requirement for the participants to be physically present, which can introduce a selection bias if the attendance reduces significantly during the rounds[28]. However, the response rate in this study was 95%, as from day one to the end of the study only one participant was absent, round 2 and 3 had 19 participants instead of 20. Our study specifically recruited expert frontline health care workers that delivered daily care to patients with chronic diseases. As such, the sample did not contain any executive healthcare leaders or policy makers and future studies may want to consider conducting a Delphi study focusing on this group. Another limitation is the inability to generalize our results to the health systems operating in other emirates in the UAE; however, this was not the purpose of this study.

Adequacy of conclusions

The modified Delphi technique achieved the aim of identifying the priorities and barriers of the CCM in Abu Dhabi's healthcare system; specifically, 'Overall Organizational Leadership in Chronic Illness Care' was ranked as the top priority and 'Patient Compliance' as the most important barrier. This study represents an important step in the process of understanding the key barriers and priority areas for interventions to maximize the development of the CCM in the health system of Abu Dhabi emirate in the UAE.

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Reporting guidelines Conducting and REporting DElphi Studies – CREDES.

Data sharing No additional data available.

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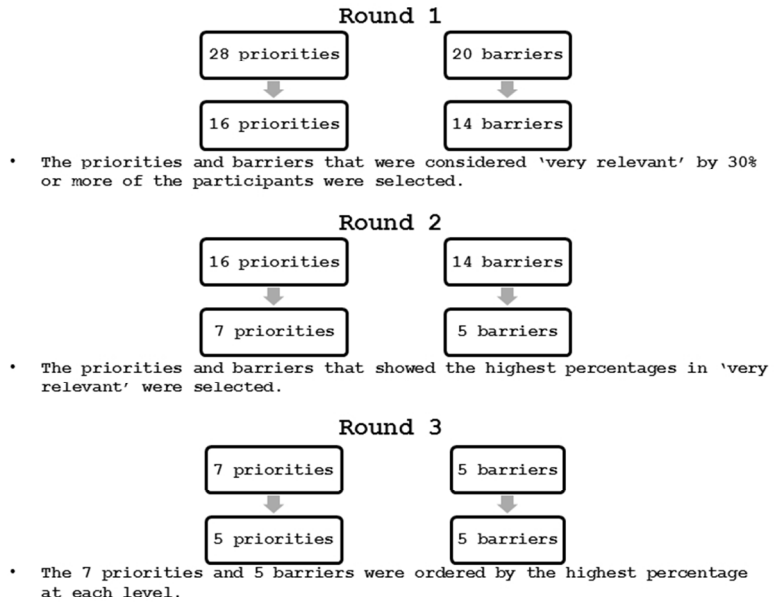
FIGURES

Figure 1: Delphi technique rounds procedure.



Delphi technique rounds procedure.

81x60mm (300 x 300 DPI)

Box 3. Recommendations for the Conducting and REporting of DElphi Studies (CREDES)[1].

Rationale for the choice of the Delphi technique

1. *Justification.* The choice of the Delphi technique as a method of systematically collating expert consultation and building consensus needs to be well justified. When selecting the method to answer a particular research question, it is important to keep in mind its constructivist nature

Planning and design

2. *Planning and process.* The Delphi technique is a flexible method and can be adjusted to the respective research aims and purposes. Any modifications should be justified by a rationale and be applied systematically and rigorously
3. *Definition of consensus.* Unless not reasonable due to the explorative nature of the study, an a priori criterion for consensus should be defined. This includes a clear and transparent guide for action on (a) how to proceed with certain items or topics in the next survey round, (b) the required threshold to terminate the Delphi process and (c) procedures to be followed when consensus is (not) reached after one or more iterations

Study conduct

4. *Informational input.* All material provided to the expert panel at the outset of the project and throughout the Delphi process should be carefully reviewed and piloted in advance in order to examine the effect on experts' judgements and to prevent bias
5. *Prevention of bias.* Researchers need to take measures to avoid directly or indirectly influencing the experts' judgements. If one or more members of the research team have a conflict of interest, entrusting an independent researcher with the main coordination of the Delphi study is advisable
6. *Interpretation and processing of results.* Consensus does not necessarily imply the 'correct' answer or judgement; (non)consensus and stable disagreement provide informative insights and highlight differences in perspectives concerning the topic in question
7. *External validation.* It is recommended to have the final draft of the resulting guidance on best practice in palliative care reviewed and approved by an external board or authority before publication and dissemination

Reporting

8. *Purpose and rationale.* The purpose of the study should be clearly defined and demonstrate the appropriateness of the use of the Delphi technique as a method to achieve the research aim. A rationale for the choice of the Delphi technique as the most suitable method needs to be provided. **Page 5**
9. *Expert panel.* Criteria for the selection of experts and transparent information on recruitment of the expert panel, socio- demographic details including information on expertise regarding the topic in question, (non)response and response rates over the ongoing iterations should be reported **Page 5**
10. *Description of the methods.* The methods employed need to be comprehensible; this includes information on preparatory steps (How was available evidence on the topic in question synthesised?), piloting of material and survey instruments, design of the survey instrument(s), the number and design of survey rounds, methods of data analysis, processing and synthesis of experts' responses to inform the subsequent survey round and methodological decisions taken by the research team throughout the process **Page 6**
11. *Procedure.* Flow chart to illustrate the stages of the Delphi process, including a preparatory phase, the actual 'Delphi rounds', interim steps of data processing and analysis, and concluding steps **Page 6**
12. *Definition and attainment of consensus.* It needs to be comprehensible to the reader how consensus was achieved throughout the process, including strategies to deal with non-consensus **Page 6**
13. *Results.* Reporting of results for each round separately is highly advisable in order to make the evolving of consensus over the rounds transparent. This includes figures showing the average group response, changes between rounds, as well as any modifications of the survey instrument such as deletion, addition or modification of survey items based on previous rounds **Page 7**
14. *Discussion of limitations.* Reporting should include a critical reflection of potential limitations and their impact of the resulting guidance **Page 8/11**
15. *Adequacy of conclusions.* The conclusions should adequately reflect the outcomes of the Delphi study with a view to the scope and applicability of the resulting practice guidance **Page 12**
16. *Publication and dissemination.* The resulting guidance on good practice in palliative care should be clearly identifiable from the publication, including recommendations for transfer into practice and implementation. If the publication does not allow for a detailed presentation of either the resulting practice guidance or the methodological features of the applied Delphi technique, or both, reference to a more detailed presentation elsewhere should be made (e.g. availability of the full guideline from the authors or online; publication of a separate paper reporting on methodological details and particularities of the process (e.g. persistent disagreement and controversy on certain issues)). A dissemination plan should include endorseent of the guidance by professional associations and health care authorities to facilitate implementation

*Consolidated criteria for reporting qualitative research
**Consolidated Standards of Reporting Trials

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