

# GRAND CHALLENGES IN CHRONIC NON-COMMUNICABLE DISEASES

## ONLINE SUPPLEMENTARY MATERIAL

### METHODOLOGY

#### About the Delphi Method

The Delphi method is a structured and systematized process that uses a series of sequential questionnaires interspersed with controlled opinion feedback from a panel of anonymous experts. This is done in order to collect and distil knowledge to build reliable group consensus<sup>1</sup> on a specific issue. It is most useful in answering one specific, single-dimensional question. The Delphi is suitable to investigate and surface underlying assumptions or information leading to differing judgments and to obtain knowledge which can generate a consensus among a group of experts. It also serves to correlate informed judgments on a topic that spans a wide range of disciplines<sup>2</sup>.

The objective of most Delphi applications is the reliable and creative exploration of ideas or the production of suitable information for decision making. It allows for the combination of the testimony of a number of experts into useful statements and recognizes human judgement as a legitimate and useful input into the consensus process. This method is a powerful tool for making the best use of often less than perfect information.

The Delphi is based on well-researched principles and provides forecasts that are more accurate than those from unstructured groups<sup>3</sup>. It is a widely accepted tool, especially in forecasting, and has been used successfully for thousands of studies in areas varying from technology forecasting to drug abuse. Since the 1950s several biomedical researchers have used the Delphi method, particularly in regards to public health issues (such as policies for drug use reduction and prevention of AIDS/HIV) and education areas<sup>4,5,6</sup>. We ourselves have used this method successfully in previous studies<sup>7,8,9</sup>.

The basic premise is that an empirical generalization can be judged useful and possibly actionable if there is sufficient, widespread agreement from a representative group of experts. Members of the Delphi panel responding to the questionnaires should be well informed in the appropriate area.<sup>10</sup> However, a high degree of expertise is not always necessary.<sup>11,12</sup> It is also

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<sup>1</sup> Although there are Delphi techniques that are not designed primarily to seek consensus

<sup>2</sup> Hasson F, Keeney S. & McKenna H (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing* 32, 1008-1015

Jones J. & Hunter D (1995). Consensus methods for medical and health services research. *British Medical Journal* 311: 376-380.

Martin BR (1995). Foresight in science and technology. *Technology Analysis & Strategic Management* 7, 139-168.

Powell C (2003). The Delphi technique: Myths and realities. *Journal of Advanced Nursing* 41, 376-382.

<sup>3</sup> Rowe G & Wright G (2001). Expert opinions in forecasting. Role of the Delphi technique. In Armstrong JS (Ed.): *Principles of forecasting: A handbook of researchers and practitioners* Boston: Kluwer Academic Publishers, p125-144.

<sup>4</sup> Adler M & Ziglio E (1996). *Gazing into the oracle*. Jessica Kingsley Publishers: Bristol, PA.

<sup>5</sup> Cornish E (1977). *The study of the future*. World Future Society: Washington, D.C.

<sup>6</sup> Basu S & Schroeder RG (1977). Incorporating judgments in sales forecasts: application of the Delphi method at American Hoist and Derrick. *Interfaces* 7: 18-27.

<sup>7</sup> Daar AS, Thorsteinsdottir H, Martin DK, Smith AC, Nast S, et al. (2002) Top ten biotechnologies for improving health in developing countries. *Nat Genet* 32: 229-232.

<sup>8</sup> Salamanca-Buentello F, Persad DL, Court EB, Martin DK, Daar AS, et al. (2005). Nanotechnology and the developing world. *PLoS Med* 2: e97.

<sup>9</sup> Greenwood HL, Singer PA, Downey GP, Martin DK, Thorsteinsdóttir H, et al. (2006). Regenerative medicine and the developing world. *PLoS Med* 3: e381

<sup>10</sup> Hanson WH & Ramani N (1988). Technology forecasting: a hydroelectric company experience. *Technology Management Publication*, 1: 266-270.

<sup>11</sup> Armstrong JS (1978). *Long-range forecasting*. New York: John Wiley & Sons.

not necessary to work with large groups. Evidence shows that under ideal circumstances, groups as small as four people can perform well.<sup>13</sup>

The judgment of groups of experts is considerably more reliable than the judgment of single individuals, since a group possesses at least as much knowledge as the least knowledgeable of its members. The Delphi also harnesses the power of controlled feedback, as panellists expect to receive feedback from their colleagues in the panel and have their responses serve as feedback for others. It is an ideal methodological choice when distilling the knowledge of geographically dispersed individuals. Although labour intensive and time consuming, the Delphi is relatively easier to implement than other group techniques, especially those requiring face-to-face meetings repeatedly or over an extended period. It enables researchers to assemble more people than in a regular group.

The Delphi also adds structure to the process and prevents negative aspects of group interaction arising from social, psychological, and political factors. These are typical of group meetings and can bias the results. Thus, the Delphi is the method of choice when disagreements between individuals are likely to be severe or politically unpalatable, since it decreases motive conflicts, personality clashes, and power games. Individual experts may have biases and face-to-face group meetings are often beset with the tendency to "follow the leader" and reluctance to abandon previously stated opinions.<sup>14,15</sup> The Delphi allows panel members to express opinions and judgments privately, giving them an opportunity to change their opinions and judgments without losing face in the eyes of the rest of the panel. Anonymity is a crucial feature of the Delphi method, since it provides an equal chance for each panel member to present and react to ideas unbiased by the identities of other participants. The opinion of each panellist carries the same weight and is given equal importance, thus eliminating potential subject bias. Anonymity also prevents social pressures like the domination of the results by powerful or dogmatic individuals, the biasing effects of personality traits or seniority, and other inappropriate criteria. Therefore, all opinions are considered on merit alone.

In summary, the Delphi method is an exercise in group communication and consensus building among a panel of geographically dispersed experts. It allows participants to deal systematically with a complex problem or task; and it is characterized by anonymity, controlled feedback, and statistical response.

## **Theoretical Limitations of the Delphi Method**

First, our study may be limited by bias in the selection of participants. There is an inherent bias in the selection of the panellists since those who are willing to participate in a Delphi may be more likely to be affected directly by the outcome of the process. They are also more likely to join and remain involved in the study. Furthermore, people who are most involved in the study of chronic non-communicable diseases are also, logically, the most knowledgeable about the field. Despite our best efforts we were unable to recruit more than 30% women

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<sup>12</sup> Welty G (1972). Problems of selecting experts for Delphi exercises. *Academy of Management Journal* 15: 123.

<sup>13</sup> Brockhoff K. (1975). The performance of forecasting groups in computer dialogue and face to face discussions. In: Linstone H & Turoff M. (Eds.), *The Delphi method: techniques and applications*, Addison-Wesley, London.

<sup>14</sup> Gatewood RD & Gatewood EJ (1983). The use of expert data in human resource planning: Guidelines from strategic forecasting. *Human Resource Planning* 5: 83-94.

<sup>15</sup> Fowles J (1978). *Handbook of futures research*. Greenwood Press: Connecticut.

among the panellists. This may well represent the true proportion of female experts at present. Also, since English was a second language to a few panellists, there may have been some difficulties with communication between panellists. However, as the vast majority are familiar with English, it is unlikely that this has affected the results significantly. The experts in our study may not have been familiar with issues outside their main research focus (e.g., an expert in the molecular biology of cancer may not have been familiar with the nuances of public health policy). The experts in the panel may not be experienced as forecasters, mainly due to their overspecialization in their particular field of interest. The results do not appear to support these arguments. The findings address what are commonly considered to be key issues in global public health. Finally, the panellists belong to an intellectual elite that may be unaware or dismissive of the real needs of most of the population of their respective nations. In theory, it is possible, although unlikely, that a different group of participants would have identified a completely different set of challenges.

Second, our study may be limited by social desirability bias. A panellist may have chosen the most “politically correct” challenges instead of those thought to be most relevant. It is also impossible to ascertain whether individuals responded honestly or according to their perception of what the researcher expected. However, we proceeded with the assumption that the participants’ responses reflected what they purported to reflect, and have encountered no contradictory evidence.

Third, our study may be limited by the selection of study method. The Delphi has been criticized because it might, if performed poorly, force consensus by creating a pressure for predictions to converge. Panellists may be persuaded to conform rather than express true disagreement. However, when we reviewed other extant methods and the possibility of their efficient implementation, we decided that the Delphi was the most appropriate method here.

It should be noted that the existence of a consensus does not imply that the “correct” answer, opinion or judgment has been found. Theoretically, the consensus may only be a diluted version of the best opinions and lead to bland, trite statements that represented the lowest common denominator. The results do not indicate that this is the case. Among the Executive Committee and Scientific Board are people with experience and expertise. On the whole they found the top 20 list to resonate with their views and the needs of the real world. To some extent this is reflected by the closeness with which the better worded and refined final list adhered to the original.

## **How We Carried Out the Study**

### **Inclusion criteria**

Based on our previous experience in the Grand Challenges in Global Health (GCGH)<sup>16</sup> initiative ([www.gcgh.org](http://www.gcgh.org)) we established an Executive Committee (EC) to supervise this study

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<sup>16</sup> Varmus H, Klausner R, Zerhouni E, Acharya T, Daar AS, Singer PA. (2003). Grand Challenges in Global Health. *Science* 302: 398-9.

and make major decisions, and a Scientific Board (SB)<sup>17</sup>. Some of members of the SB are also members of the SB GCGH.

We aimed to bring together a heterogeneous group of experts to increase the reliability of the results. It has been shown that heterogeneous groups, characterized by panellists with widely different personalities, backgrounds and perspectives, lead to a wider range of alternatives and thus to higher quality results than homogeneous groups. Thus, a conscious effort was made to balance the panel with respect to gender, knowledge areas, and geographic distribution. Since the quality of the opinions, of the response to feedback, and, ultimately, of the Delphi results depend on the extent of the knowledge of each panellist, we sought to include experts with appropriate domains of knowledge. The members of our Delphi panel reflected current knowledge and perceptions in areas related to chronic non-communicable diseases.

The selection of the panellists involved non-probability sampling techniques. The participants were not selected randomly. We used purposive and criterion sampling, selecting them according to the nature of our study question. Purposive and criterion sampling assumes that a researcher's knowledge about a population can be used to select the individuals to be included in the study. We selected the panellists based on a review of the literature and major reports (e.g. The 2005 World Health Organization Report on chronic diseases<sup>18</sup>), our knowledge of the field, previous contacts, and recommendations of experts, interested individuals, and institutions.

To arrive at the 20 Grand Challenges in Chronic Non-Communicable Diseases, we conducted a three round Delphi study, preceded by consultation among members of the EC and SB to determine the most appropriate terminology and definitions, and to help identify potential stakeholders, sectors, and panel members.

## Definitions

We used the following definitions:

Of a Grand Challenge:

***A specific critical barrier that if removed would help to solve an important health problem. The intervention(s) it could lead to might be innovative and, if successfully implemented, will have a high likelihood of impact and feasibility.***

Of chronic non-communicable diseases:

***Diseases or conditions that occur in, or are known to affect, individuals over an extensive period of time and for which there are no known causative agents that are transmitted from one affected individual to another. For the purpose of this study the***

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<sup>17</sup> There were minor changes in composition of the Executive Committee and Scientific Board as the study progressed.

<sup>18</sup> World Health Organization (2005). Preventing chronic diseases: a vital investment. Available at [http://www.who.int/chp/chronic\\_disease\\_report/full\\_report.pdf](http://www.who.int/chp/chronic_disease_report/full_report.pdf)

**major focus is on cardiovascular diseases, type 2 diabetes, chronic respiratory diseases and certain cancers. Commonly known risk factors for these include lack of exercise, improper diet and smoking.**

## **The Three Delphi rounds**

The study began in June 2006 and was completed in October 2007. Based upon previous experience and on the existing literature, we decided that three Delphi rounds, using email, faxes and phone calls, would be sufficient to elicit response stability from the answers of the panellists.

### **Round I**

The first Delphi round consisted of an unstructured, open-ended, question that provided the panellists with an opportunity to generate ideas and to identify important issues. Open-ended questions are recognized to increase the richness of the data collected. We drafted an initial panel of 190 experts. Our sample size was based upon our previous experience, the purpose of the project, the design, and the time frame for data collection.

We asked the panellists to answer the following question:

***What do you think are the Grand Challenges in Chronic Non-Communicable Diseases?***

We pilot-tested the definitions and the question with a small group of experts in order to identify wording difficulties and to improve clarity.

We wanted to know:

- Were the definitions used comprehensive and sound enough? Were they clear?
- What did the experts piloted think of the question that the panellists would be asked to answer? Was it clear? Was it self-explanatory?
- If the experts piloted were asked that question, and with our definitions in mind, how would they respond?
- Did the experts have any comments or suggestions regarding the question, the definitions, or the study?

The first round was the sent to all 190 initial panellists. We received 129 responses in which we identified a total of 1854 ideas for what might constitute a grand challenge. There was significant overlap in the responses. We analyzed, organized, and collated the answers from the first round according to common themes and generated a list of 109 distinct and generally non-overlapping, mutually exclusive, and exhausting categories. We identified a level granularity of the issues that was resonant with the aims of the study and was likely to lead to actionable results.

### **Round II**

The second and third rounds were more specific than round I, since they sought the panellists' quantitative judgments. For Round II, rather than send the list of 109 categories

obtained from Round I to only the 129 Round I respondents (as we had done in our previous Delphi studies), we sent it to all the 190 original panellists. This was a deliberate choice: as we moved closer to consensus we wanted to include as many panellists as possible. This is a methodological refinement that has also been used by others<sup>19,20,21,22</sup>. We asked them to identify and rank their top 30 Grand Challenges, and to provide comments on their choices. It has been shown that accuracy increases over rounds when both statistical information and reasons are included as feedback. With reasons, panellists are less inclined to change their responses, but when they do change, the responses tend to be more accurate. We listed the 109 categories alphabetically under a few subheadings to prevent position bias. We received 122 responses in Round 2. From the data, including the comments, we generated a preliminary consensus list of the top 30 Grand Challenges.

### Round III

In Round 3 panellists were asked to consolidate their consensus. We sent the draft list of the top 30 Grand Challenges, listed from the highest to the lowest ranked, to the initial 190 invitees. We asked them to accept the ranking as provided, or re-rank their top 30 choices. We received 123 responses in this final round. The final list from the Delphi study was generated from a statistical analysis of the rankings made by these 123 panellists at the end of Round III.

From the final ranked 30 choices, the EC decided to focus on the top 20 Grand Challenges in Chronic Non-Communicable Diseases<sup>23</sup>:

1. Raise political awareness of chronic non-communicable diseases in order to increase prioritization within budgets by increasing and sharing evidence of the negative economic, social and public health impacts of chronic non-communicable diseases
2. Reform medical/professional training, medical practice and health care systems away from medicalization and treatment and more towards prevention
3. Study and address the impact of macroeconomic policies on health with a view to improving the prevention and management of chronic non-communicable diseases
4. Reduce the cost and increase the availability and access to healthy food choices such as fruits, vegetables, etc.
5. Implement and evaluate programs and policies that take into account environmental and cultural factors that will make behaviour modification more successful

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<sup>19</sup> Atkinson NL & Gold RS (2001). Online research to guide knowledge management planning. *Health Education Research* 16:747-763.

<sup>20</sup> Elnicki DM, Lescisin DA & Case S (2002). Improving the National Board of Medical Examiners Internal Medicine Subject Exam for use in clerkship evaluation. *J Gen Intern Med* 17:435-440.

<sup>21</sup> Mayfield CA, Wingenbach GJ & Chalmers DR (2005). Assessing stakeholder needs: Delphi meets the internet. *J Extension*. Available at <http://www.joe.org/joe/2005june/iw1.shtml>

<sup>22</sup> Froehlich TJ, Begthol C, Buckland M, Davis C, Debons A, Dragulanescu N, Harmon G, Kraft D, Menou M & Zins C (2005). Knowledge map of information science: A report on a Delphi study. ASIST 2005 Annual Meeting Wiki. Available at [http://www.ils.unc.edu/asist2005/wiki/index.php?title=Knowledge\\_Map\\_of\\_Information\\_Science:\\_A\\_Report\\_on\\_a\\_Delphi\\_Study](http://www.ils.unc.edu/asist2005/wiki/index.php?title=Knowledge_Map_of_Information_Science:_A_Report_on_a_Delphi_Study)

<sup>23</sup> Because we incorporated comments from the panellists even in the third round, there is some duplication of ideas in some of the grand challenges

6. Reduce smoking and its negative health consequences by using all known effective measures that might include legislating aggressive increases in prices via taxes, providing information on the effects of smoking, prohibiting public advertisements aimed at both adults and youth, introducing smoke-free legislation, restricting sales (e.g. in vending machines and to minors), providing treatment programs for tobacco addiction, and allocating substantial resources to implement the Framework Convention on Tobacco Control
7. Allocate appropriate resources to health care systems based on burden of disease and undertake reforms to address chronic non-communicable diseases that include primary, secondary and tertiary prevention; adopt evaluated and proven long-term strategies for affordable screening, control and rehabilitation; increase access to medications/vaccines; and provide at least minimal care for conditions such as diabetes, hypertension and hyperlipidemia; and crucially, increase quality of managerial leadership
8. Invest in, increase access to, and promote the use of space and facilities for exercise/physical activity for all
9. Make industry/business a key stakeholder/partner to combat chronic non-communicable diseases and increase the positive role it could play by fostering corporate social responsibility and making the case for “doing well by doing good”
10. Invest in obtaining context-specific and other applicable evidence to build and sustain balanced, integrated health care delivery systems that address non-communicable diseases
11. Educate and encourage the media to focus on chronic non-communicable diseases with the aim of providing widespread, sustained, accurate, and non-sensational coverage
12. Develop comprehensive multi-level national and international policies for addressing chronic non-communicable diseases, including regulatory and fiscal restraints on consumption of alcohol, tobacco and unhealthy foods, by building upon existing effective policies and evidence. This might include consideration of an international instrument that will promote the country-by-country banning of processed food advertising to children
13. Legislate tough environmental protection laws which include measures to reduce pollutants such as lead, arsenic and other toxic elements that increase chronic non-communicable diseases
14. Use clear and consistent messages and effective education and public engagement methods, including the use of information technologies and marketing tools, to promote healthy lifestyle and consumption choices, including providing information on the risks of drugs, alcohol, tobacco and unhealthy foods
15. Empower community resources such as faith based organizations, voluntary health organizations, champions and dedicated personnel to improve action against chronic non-communicable diseases, especially in developing countries

16. Study and address the link between urbanization, its short- and long-term consequences (e.g. poor urban planning, congestion, stress, pollution, reduction in open spaces, etc.) and the adoption of poor lifestyle choices
17. Develop a code of responsible conduct for the food and beverage industry which might include: commitments to developing healthier products; provision of improved food labelling to include specific calorie, nutrient and fat/cholesterol content; promotion of healthy lifestyles and consumption choices in their marketing; and addressing the health consequences of their activities
18. Develop standardized research and evaluation tools; develop, institute and evaluate surveillance systems for chronic non-communicable diseases; and fund detailed epidemiological studies that include gathering group-specific morbidity and mortality data
19. Study and address how poverty and its consequences impact lifestyle choices and increase risk factors for non-communicable diseases; and, in turn, how chronic non-communicable diseases affect economic output and productivity
20. Create a screening system for chronic non-communicable diseases whereby inexpensive tests are used to screen large numbers of people and then more expensive tests are utilized on those at highest risk

Following completion of the Delphi process, all the members of the Executive Committee and the majority of members of the Scientific Board met in October 2007 in London (face to face or by telephone), or participated immediately afterwards to review the data from the Delphi and apply their own judgment to reach agreement on the following issues:

- Grouping the top 20 grand challenges from the Delphi panel into 6 Goals. The 20 challenges fell naturally under these Goals. Grouping them into 6 Goals of related issues meant the top 20 list no longer had the original rankings
- Refining and finalizing the wording of the Grand Challenges in Chronic Non-Communicable Diseases
- Generating a list of specific research needed to address the goals.

Below we have included the gender, geographical, and sector distribution of the 155 panellists (out of the original 190), who responded to at least one round of the study.

<b>GENDER (%)</b>	
Male	70
Female	30

<b>GEOGRAPHICAL DISTRIBUTION (%)</b>	
<b>Country / Region</b>	<b>%</b>
Europe (not including the UK)	19
USA	15
Africa	12
Canada	11
South/South-East Asia	11
UK	8
Eastern Mediterranean	8
Western Pacific	7
Americas (not including the US and Canada)	6
Oceania	3

<b>SECTOR (%)</b>	
Academia	48
Civil Society Organizations or Voluntary Health Organizations	19
Government	15
Private Sector	8
World Health Organization	8
Other	2