

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [info.bmjopen@bmj.com](mailto:info.bmjopen@bmj.com)

# BMJ Open

## Scientific, professional and experiential validation of the Model of Preventive Behaviours at Work: a modified Delphi study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-035606
Article Type:	Protocol
Date Submitted by the Author:	08-Nov-2019
Complete List of Authors:	Lecours, Alexandra; Universite Laval Faculte de medecine, Réadaptation
Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, REHABILITATION MEDICINE, PUBLIC HEALTH

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3 1 **Abstract**

4 2 **Objective.** The objective of this article is to describe the study protocol that will be used to validate  
5 the Model of Preventive Behaviours at Work.

6 3  
7 4 **Design.** This Delphi study proposes seven systematic steps to conduct a scientifically rigorous  
8 validation study based on scientific and professional experts' opinion. A focus group to collect  
9 workers' opinion about the model has also been included in the protocol.

10 5  
11 6  
12 7 **Setting.** International occupational health settings

13 8 **Participants.** Thirty experts (scientists and professionals) will be selected regarding their  
14 experience (e.g. at least five years of experience) and expertise (e.g. having published at least one  
15 article as the first author in the last three years) towards workers' health or organizational  
16 behaviours. The study will also include eight full-time workers having at least five years of  
17 experience.

18 9  
19 10 **Outcome measures.** Quantitative data will be analyzed to calculate the percentage of experts'  
20 agreement on four content validity indicators (i.e. comprehensiveness, representativeness,  
21 relevance, clarity). Qualitative data will be considered in the content validity analysis.

22 11  
23 12 **Results.** No results available yet.

24 13  
25 14 **Conclusions.** The validation using scientific, professional and experiential knowledge is innovative  
26 and timely. The inclusion of a focus group with workers will enhance knowledge users'  
27 acceptability of the model and will open the door to further steps of validation, such as statistical  
28 and predictive validation.

29 15  
30 16  
31 17  
32 18  
33 19  
34 20  
35 21  
36 22 Key words: Delphi study, occupational health, conceptual model  
37 23  
38 24  
39 25  
40 26  
41 27  
42 28  
43 29  
44 30  
45 31  
46 32  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 33 **Strengths and limitations of this study**  
4

- 5 34 • This study protocol integrates seven systematic steps to validate a new conceptual model.  
6 The detailed description of each research step easily allows for replication.  
7 35  
8 36 • This protocol proposes a validation including scientific, professional and experiential  
9 knowledge, which is innovative and timely.  
10 37  
11 38 • An entire research step is dedicated to the involvement of the public, this maximizing the  
12 relevance of the study results.  
13 39  
14 40 • The proposed research design doesn't permit obtaining a statistical validation of the  
15 Model of Preventive Behaviours at Work. Further studies are required to go beyond the  
16 descriptive value of the model.  
17 41  
18 42  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

## 43 INTRODUCTION.

44 The number of people in employment is growing in industrialized societies. For example, the  
45 Canadian labour force grew from 15.8 to 20.2 million workers between 2000 and 2019, which  
46 represents an increase of near than 28 %<sup>1</sup>. Recognized as a determinant of health<sup>2,3</sup>, work may  
47 have positive effects on the health and well-being of people, as it may contribute to financial  
48 health, social recognition or protection against declining skills<sup>4</sup>. When a workplace health injury  
49 occurs, whether it is an accident, a physical illness or a transient mental disorder, the negative  
50 consequences are harmful not only for workers and families, but also for work organizations, by  
51 reducing performance and productivity<sup>5</sup>. The societal impacts are also impressive with an  
52 estimated amount of over \$ 250 billion in the US to cover annual costs related to workplace health  
53 injuries<sup>6</sup>.

54 It is then important to focus on the determinants of workplace prevention. The literature suggests  
55 that factors related to healthcare services, compensation systems, work organizations, as well as  
56 to workers themselves would influence the prevention of workplace health injuries<sup>7-9</sup>.  
57 Considering workers-related factors, the preventive behaviours they may adopt would play an  
58 important role in workplace health and safety<sup>10-13</sup>. Indeed, the influence of these behaviours on  
59 the risk of workplace health injuries has been demonstrated in several studies conducted with  
60 various workers' populations<sup>10 14 15</sup>.

61 A conceptual framework to understand the preventive behaviours workers may adopt has been  
62 developed in the last years<sup>16</sup>. The Model of Preventive Behaviours at Work defines the behaviours  
63 workers may adopt to preserve their own health, their colleagues', thus contributing to the overall  
64 organizational health. The Figure 1 presents the Model of Preventive Behaviours at Work<sup>16</sup>.

65  
66 Insert figure 1 here

67 **Figure 1.** Model of Preventive Behaviours at Work (adapted from Lecours, 2019)<sup>16</sup>

68  
69 The Model presents six major preventive behaviours, which are 1) *adopting a reflective practice*  
70 (e.g. analyzing work situations, identifying risks, and taking decisions about one's health); 2)  
71 *complying with rules and procedures* (e.g. respecting work-related procedures or wearing  
72 personal protective equipment), 3) *participating, involving and taking initiatives for prevention*  
73 (e.g. involving in health and safety committees or seeking help from available resources), 4) *caring*

74 *about others* (e.g. team working or listening to each other), 5) *communicating* (e.g. expressing  
75 one's needs or limits) and 6) *adopting a healthy lifestyle* (e.g. having a restful sleep or exercising).  
76 The Model of Preventive Behaviours at Work presents a systemic and multifactorial view of  
77 preventive behaviours. These behaviours are largely influenced by contextual factors related to  
78 the workers themselves, the occupation of work or the environment. These contextual factors  
79 have an impact on the ability of workers to engage in preventive behaviours at work. Thus, in  
80 addition to being interested in the concrete behaviours, the model focuses on the factors  
81 upstream of the manifestation of a behaviour, on the context in which workers adopt behaviours.  
82 The model also considers the consequences following the manifestation of behaviours. These  
83 consequences are generally positive for the workers themselves (e.g. health and well-being) as  
84 well as for the organization (e.g. work climate). This model was developed after conducting three  
85 theoretical<sup>17</sup> and empirical<sup>18-20</sup> studies. The development process of the model is detailed  
86 elsewhere<sup>16</sup>. To increase its scientific validity and to maximize its use in professional settings in  
87 order to foster workers' health and well-being, the next step is to validate the model with  
88 scientific and professional experts, as well as with workers. Literature offers a large spectrum of  
89 conceptual model validation study designs. Over the years, the Delphi technique has been used  
90 in various validation studies, but most of the published articles focused on results, while validation  
91 protocols remain more or less detailed, making difficult replicating studies. Furthermore, authors  
92 have criticized the lack of clear guidelines in the current writing surrounding the use of the Delphi  
93 technique, which may lead to a lack of scientific rigour<sup>21 22</sup>. To fill these gaps, the aim of this article  
94 is to describe the study protocol that will be used to validate the Model of Preventive Behaviours  
95 at Work.

## 97 **METHOD AND ANALYSIS.**

### 98 **Design**

99 Created in the middle of the 18<sup>th</sup> century<sup>23</sup> and used in health sciences since the 70s<sup>24</sup>, the Delphi  
100 technique is recognized as an efficient way to structure communication processes allowing  
101 individuals to work on a complex subject<sup>25</sup>, which is the case of the Model of Preventive  
102 Behaviours at Work. Since this model is emerging, a first step of validation with experts will make  
103 it possible to appreciate its acceptability<sup>22</sup> from the scientific community and its applicability from  
104 the knowledge users, which are professionals and workers. The main advantage of the Delphi  
105 technique is that communications take place remotely, allowing the recruitment of experts from

106 all over the planet <sup>21 26</sup>. Disadvantages noted in the scientific literature relate to the lack of  
 107 consensus on the definition of an expert and on how to statute about the consensus's adoption  
 108 <sup>26-28</sup>. The limited implication of knowledge users in Delphi studies is also a weak point of the actual  
 109 method <sup>22</sup>. The method can also take a considerable amount of time from the participants, which  
 110 can discourage them from getting involved <sup>21 29 30</sup>. Finally, many variants of the original method  
 111 have been used in published studies <sup>22</sup>, but lack of justification for the changes made and lack of  
 112 details in protocols contribute to creating ambiguities in the guidelines to follow <sup>21 22</sup>. Our wish in  
 113 drafting this protocol is to bring clarity to these elements of the study design.

### 114 115 Procedure and analysis

116 The Delphi technique will be used to obtain consensus from scientific, professional and  
 117 experiential experts on content validity indicators, which are: 1) *comprehensiveness* of the model  
 118 structure, 2) *representativeness* to the content domain, 3) *relevance* of the model components  
 119 and 4) *clarity* of the model components and links. These indicators were recommended according  
 120 to writing on content validity <sup>31-34</sup>. The study design proposes seven systematic steps to conduct  
 121 a scientifically rigorous validation study (see table 1). The expected duration of the study is 12  
 122 months, beginning in the winter 2020.

123  
124 Table 1. Systematic steps of the study design

<b>Step 1</b>	Elaborate selection criteria for scientific and professional experts
<b>Step 2</b>	Make scientific and professional experts list
<b>Step 3</b>	Contact scientific and professional experts
<b>Step 4</b>	Administrate questionnaires
<b>Step 5</b>	Synthesize answers
<b>Step 6</b>	Consult experiential experts
<b>Step 7</b>	Final analysis and publication


 Round of consultation

125  
126 *Elaborate selection criteria for scientific and professional experts.*

127 The quality of a study using the Delphi technique mainly rests on the choice of experts <sup>22 30 35</sup>.  
 128 Indeed, since the opinion of these will serve to generate the results of the study, their selection  
 129 must be judicious. Currently, there is no recognized definition of “who is an expert” and no  
 130 universal criteria for structuring the choice of experts <sup>26-28</sup>. The researcher's judgment is solicited



1  
2  
3 131 to determine criteria that will enable him / her to select the people most likely to contribute to  
4  
5 132 meeting the research objective <sup>21 28 30</sup>.

6  
7 133 As we believe that scientists and professionals can both contribute to our research objective of  
8  
9 134 validating the Model of Preventive Behaviours at Work, we have established a list of criteria to be  
10  
11 135 used to select experts based on information available in scientific literature.

12 136 Scientists.

13 137 Expertise seems to be the main criteria to select scientists <sup>30</sup>. For the success of a Delphi study,  
14  
15 138 experts must have a thorough knowledge of the subject <sup>36</sup>. For the current study, scientists with  
16  
17 139 expertise in the field of workers' health or organizational behaviours will be targeted. Accordingly,  
18  
19 140 it will be possible to select experts in various disciplines such as industrial psychology, ergonomics,  
20  
21 141 occupational therapy, occupational medicine or human resource management because the  
22  
23 142 Model of Preventive Behaviours at Work was developed according to that literature <sup>16</sup>.

24 143 To select scientists, the evaluation of the relevance of their published scientific papers related to  
25  
26 144 the subject of our study will be used. This systematic selection method is cited in many  
27  
28 145 manuscripts <sup>28 37 38</sup>. A scientist will be identified to be part of the panel of experts if he / she has  
29  
30 146 published at least one relevant article as the first author in the last three years <sup>39</sup>.

31 147 Professionals.

32 148 Since the Model of Preventive Behaviours at Work is expected to be used in practical settings, we  
33  
34 149 chose to include professionals in the validation process. Although some authors do not  
35  
36 150 recommend including the participation of professionals for emerging concept validation <sup>40</sup>,  
37  
38 151 literature in the field of health mostly recommends including professionals in the panel of experts  
39  
40 152 <sup>41 27 42 43</sup>.

41 153 Work experience in the field of study seems to be the criterion most often used to select  
42  
43 154 professionals <sup>36 42</sup>. For our study, a variety of professionals (i.e. ergonomists, industrial  
44  
45 155 psychologists, occupational therapists, occupational physicians or human resources managers)  
46  
47 156 will be recruited if they have at least five years of experience in relation with workers.

48 157  
49 158 *Make scientific and professional experts list*

50 159 To recruited scientists based on their published articles, the following scholarly journals will be  
51  
52 160 consulted: a) Work, b) Journal of Occupational and Organizational Psychology, and c) Safety  
53  
54 161 Science. Numbers in the last three years will be considered. These journals are targeted because  
55  
56 162 of their readership profile, the number of scientists contributing to it, and the topics that are

1  
2  
3 163 relevant to our research project <sup>40</sup>. The journal numbers published in the last three years will be  
4  
5 164 consulted one by one. The articles that seem to have a link with the subject of study according to  
6  
7 165 their title and keywords will be retained. The abstract of these articles will then be read to confirm  
8  
9 166 the author's relevance to the research project. If needed, the ResearchGate and personal pages  
10  
11 167 of scientists will be consulted to deepen the analysis and make sure of their potential contribution  
12  
13 168 to this validation study.

14 169 Recruitment of professionals will be done in two stages. First, participants meeting the inclusion  
15  
16 170 criteria will be identified in the author's network. Subsequently, the snowball method will be used  
17  
18 171 to expand the pool of experts following recommendations of the participants.

19 172 An Excel table will be constructed to gather relevant information about potential experts, such as  
20  
21 173 level of training, area of expertise, affiliation, email address and country <sup>35</sup>.

22 174 The number of experts to recruit is not established in the actual literature <sup>30 41</sup>. Even if some Delphi  
23  
24 175 study were conducted with more than 1500 participants <sup>29</sup>, they mainly include 10 to 20  
25  
26 176 participants <sup>30 44</sup>. The size of the group has an importance on the stability of the results. Indeed,  
27  
28 177 with a smaller group, an expert has a greater influence on the result since his / her opinion  
29  
30 178 occupies a larger proportion of the consensus <sup>41</sup>. On the other hand, it is more complex and costly  
31  
32 179 to consult with a large number of experts <sup>21 30</sup>.

33 180 For our study, we plan to recruit 30 experts, 15 scientists and 15 professionals. Considering the  
34  
35 181 attrition of participants during the study, this number seems adequate.

### 36 182

#### 37 183 *Contact scientific and professional experts*

38 184 After having made a list of potential experts to recruit for the consultation, it is time to invite  
39  
40 185 them. Nowadays, email seems to be the most frequent way to contact experts. Authors suggest  
41  
42 186 sending a detailed letter to invite experts <sup>21 26 27 35 42 45</sup>. The letter will contain the following  
43  
44 187 information: presentation of the researcher responsible of the study, description of the study,  
45  
46 188 reasons for the selection of the expert, procedures to be followed to participate to the  
47  
48 189 consultation, estimation of the time required, expectations of the expert (including the  
49  
50 190 importance of participating in all the rounds of the consultation), promise of anonymity, and  
51  
52 191 participation recognition <sup>21 26 27 35 42 45</sup>.

#### 53 192

#### 54 193 *Administrate questionnaires*

55  
56  
57  
58  
59  
60

1  
2  
3 194 The first questionnaire allows experts to express their opinion on the subject to study <sup>22</sup>. The  
4  
5 195 purpose of this first questionnaire is often to provide an overview of the experts' opinion on the  
6  
7 196 subject of study and then to determine the elements to be studied in the subsequent  
8  
9 197 questionnaires. Basic open-ended questions are required to cover the entire subject <sup>27 41 46</sup>. Since  
10  
11 198 these open-ended questions are likely to generate a great deal of information <sup>46</sup>, it is suggested  
12  
13 199 to limit the number of questions in this first questionnaire <sup>22 23</sup>. For example, the first  
14  
15 200 questionnaire of our consultation will contain four large questions about the indicators of content  
16  
17 201 validity (i.e. comprehensiveness, representativeness, relevance, clarity) in relation with the Model  
18  
19 202 of Preventive Behaviours at Work and its components. As suggested in the literature, we will also  
20  
21 203 add a fifth question to permit experts to freely add information they find relevant about the  
22  
23 204 subject <sup>22</sup>. In order to ensure questionnaire clarity, a pretest will be done with four experts (two  
24  
25 205 scientists and two professionals), as suggested by many authors who published about the Delphi  
26  
27 206 technique <sup>21 27 29 47</sup>. The qualitative data gathered with this first questionnaire will be analyzed with  
28  
29 207 a content analysis strategy using the QDA Miner software. This will permit to determine the  
30  
31 208 content of the subsequent consultation tours.

32  
33 209 The second questionnaire (and the following, if applicable) will first summarize the opinions found  
34  
35 210 in the previous questionnaire <sup>30 45</sup>. After that, the idea is to document experts' opinion on more  
36  
37 211 specific elements, generally with closed questions <sup>27</sup>. The opinion will often be documented using  
38  
39 212 Likert type scales, with the aim to obtain a consensus of experts <sup>30 45</sup>. For example, elements  
40  
41 213 related to the four content validity indicators that emerged from the analysis of the first  
42  
43 214 questionnaire will be assessed by experts on a 4-point Likert scale (e.g. Clarity : 1- this element is  
44  
45 215 not clear, 2- this element needs major revisions to be clear, 3- this element needs minor revisions  
46  
47 216 to be clear, 4- this element is clear). The iteration process and the return on the information  
48  
49 217 offered to the experts will allow them to reconsider their opinion in the light of that of the others,  
50  
51 218 thus convince toward a consensus. The anonymity provided by the method facilitates this process  
52  
53 219 <sup>48</sup>. The quantitative data gathered with the administration of the second questionnaire, and the  
54  
55 220 following, will be analyzed with descriptive statistics, using the SPSS software.

56  
57 221 Nowadays, web questionnaires are preferred to postal ones <sup>22</sup>. We will also follow this tendency  
58  
59 222 in our study.

223

224 *Synthesize answers*

1  
2  
3 225 This research step comprises the crucial moment of the determination of the consensus of experts  
4  
5 226 about the different components of the Model of Preventive Behaviours at Work. Paradoxically,  
6  
7 227 literature doesn't offer a consensus about the definition of the consensus <sup>21 26 29 41 47</sup>. The  
8  
9 228 consensus, which is the agreement between the experts, may be defined in different ways, such  
10  
11 229 as a measure of central tendency of experts' quantitative responses, the stability in experts'  
12  
13 230 responses between the rounds of consultation, or a subjective measure of general opinion <sup>49</sup>.  
14  
15 231 Given the lack of a clear rule on the definition of consensus, it is important for researchers to  
16  
17 232 define this agreement in an operational manner before starting the consultation <sup>22 50</sup>. The chosen  
18  
19 233 definition of the consensus is to impact on the number of required tours to obtain this agreement  
20  
21 234 between the experts.  
22  
23 235 Using a percentage of agreement would be the most common way to rule on consensus <sup>29</sup>.  
24  
25 236 However, the percentage to be reached to obtain a consensus varies considerably across studies,  
26  
27 237 ranging from 51% to 100% <sup>21 26 29 30</sup>. A 100% consensus may be impossible to achieve, and often  
28  
29 238 not necessary <sup>26</sup>. Although aiming to reach a high percentage of agreement permits to ensure the  
30  
31 239 agreement between the experts, it may result in the need to add several consultation rounds. To  
32  
33 240 have a sufficiently discriminating percentage without excessively lengthening the time of  
34  
35 241 realization of the study, we will set it at 80%. We will use the following rules to monitor consensus:  
36  
37 242 a) if 80 % of experts give an element the rating of 4 on the 4-point Likert scale, we consider that  
38  
39 243 a consensus was obtained on this element and it will be kept in the Model; b) if 80 % of experts  
40  
41 244 give an element the rating of 1 on the 4-point Likert scale, we consider that a consensus was  
42  
43 245 obtained on this element and it will be removed from the Model; c) for elements having mostly  
44  
45 246 been rated 2 or 3 on the 4-point Likert scale, modification will be made according to experts'  
46  
47 247 opinion and these elements will be submitted to the following round of consultation.  
48  
49 248  
50  
51 249

250 *Insert figure 2 here*

251 Figure 2. Description of rounds of consultation

252 Literature suggests two or three rounds are needed to reach the consensus <sup>26</sup>. We a priori plan to  
253 realize three rounds, as shown in figure 2. We will give experts two weeks to answer a  
254 questionnaire, as suggested by others <sup>30 51-53</sup>. The total time to complete the collection of data can  
255 therefore be spread out over a few weeks depending on the number of rounds to be made.  
256

1  
2  
3 257 *Consult experiential experts*

4  
5 258 A last consultation step will be conducted with experiential experts, namely workers in our study.

6  
7 259 This panel of experts will comprise people that have been working full-time since at least five

8  
9 260 years. While not common in Delphi studies, this decision to include people having experienced a

10  
11 261 condition has been suggested by other authors having conducted health-related studies<sup>29 54 55 56</sup>

12  
13 262 and is timely in this era of research favouring the involvement of stakeholders.

14  
15 263 The consultation will take the form of a focus group<sup>57</sup>. Results of the scientific and professional

16  
17 264 experts consultation will be presented to eight workers. Each of them will then bring a unique

18  
19 265 expertise that will enrich the perspectives of analysis of the topic. The purpose of the consultation

20  
21 266 is to verify the applicability of the results obtained, the relevance with the current work context

22  
23 267 as well as the face validity with the population. This consultation step will also provide nuances

24  
25 268 to the data collected based on users' experience. Study results will be improved.

26  
27 269

28  
29 270 *Final analysis and publication*

30  
31 271 Once the analysis of all the collected data and the consensus reached, a summary of the results

32  
33 272 will be transmitted to each expert who took part in the study, namely the scientists, the

34  
35 273 professionals and the workers. The experts will be free to comment on these findings, which may

36  
37 274 help to enhance reflection about the validity of the Model of Preventive Behaviours at Work.

38  
39 275 Findings will be shared with various stakeholders involved in workers' health. Findings will also be

40  
41 276 disseminated in workshops, peer-reviewed journals and conferences.

42  
43 277

44  
45 278 **PATIENT AND PUBLIC INVOLVEMENT.**

46  
47 279 To support co-production of knowledge, this study proposes to actively involve various

48  
49 280 stakeholders in the different steps. In fact, professional experts' opinion will be gathered by

50  
51 281 questionnaire to confirm or improve the model. As these persons will be likely to use the model

52  
53 282 in their clinical practice, building the study around their opinion will improve the relevance of the

54  
55 283 model and increase the likelihood that it will be used to guide interventions about preventive

56  
57 284 behaviours at work. Stakeholders will also be involved in the recruitment of participants using the

58  
59 285 snowball method. The protocol also proposes to add an innovative and timely step to the

60  
286 validation process using the Delphi technique. In fact, the consultation step with experiential

287 experts, namely workers in this study, will allow including the perceptions and experiences of the

288 public in the interpretation of results. This will also be a first occasion to start disseminating  
289 findings. Following that, diverse activities will take place to transfer knowledge.

290

## 291 ETHICS.

292 Approval of the research ethics board of the Centre intégré universitaire de santé et de services  
293 sociaux de la Capitale Nationale has been obtained (project 2020-1919).

294

## 295 CONCLUSION.

296 The Delphi study proposed in this protocol will enable to validate an emerging conceptual model  
297 in the field of workers' health. The validation using scientific, professional and experiential  
298 knowledge is innovative and timely. The inclusion of a focus group with workers will enhance  
299 knowledge users' acceptability of the model and will open the door to further steps of validation,  
300 such as statistical and predictive validation. Finally, this detailed seven-step systematic validation  
301 protocol, including a consultation with experiential experts, will contribute to the advancement  
302 of knowledge in the methodological field of conceptual model validation with experts.

303

## 304 REFERENCES

- 305 1. Canada S. Labour force characteristics by province, monthly, seasonally adjusted 2019  
306 [Available from:  
307 <https://www150.statcan.gc.ca/t1/tbl1/fr/cv.action?pid=1410028703#timeframe>.
- 308 2. OMS. Charte d'Ottawa pour la promotion de la santé. In: Ministère de la santé nationale et du  
309 bien être social, ed. Ottawa, 1986.
- 310 3. Wilcock AA, Hocking C. An occupational perspective of health. 3 ed. Thorofare, NJ, USA: SLACK  
311 Incorporated 2015.
- 312 4. Bosma H, Van Boxtel M, Ponds R, et al. Education and age-related cognitive decline: the  
313 contribution of mental workload. *Educational gerontology* 2003;29(2):165-73.
- 314 5. Demerouti E, Bakker AB, Halbesleben JRB. Productive and counterproductive job crafting: a  
315 daily diary study. *Journal of Occupational Health Psychology* 2015;20(4):457-69. doi:  
316 10.1037/a0039002
- 317 6. Leigh JP. Economic burden of occupational injury and illness in the United States. *Milbank*  
318 *Quarterly* 2011;89(4):728-72. doi: 10.1111/j.1468-0009.2011.00648.x
- 319 7. Robichaud M-M. Retour au travail à la suite d'une lésion professionnelle : perspective des  
320 intervenants en réadaptation du système d'indemnisation public. Université Laval, 2016.
- 321 8. Durand M-J, Loisel P, Hong QN, et al. Helping clinicians in work disability prevention: the work  
322 disability diagnosis interview. *Journal of Occupational Rehabilitation* 2002;12(3):191-204.
- 323 9. Loisel P, Durand M-J, Berthelette D, et al. Disability prevention. *Disease Management and*  
324 *Health Outcomes* 2001;9(7):351-60.
- 325 10. Roy M, Cadieux J, Forter L, et al. Validation d'un outil d'autodiagnostic et d'un modèle de  
326 progression de la mesure en santé et sécurité du travail. Montréal: IRSST, 2008:28.



- 327 11. Akselsson R, Jacobsson A, Bötjesson M, et al. Efficient and effective learning for safety from  
328 incidents. *Work* 2012;41:3216-22.
- 329 12. Simard M, Marchand A. The behaviour of first-line supervisors in accident prevention and  
330 effectiveness in occupational safety. *Safety Science* 1994;17(3):169-85. doi:  
331 10.1016/0925-7535(94)90010-8
- 332 13. Cossette R. Le comportement sécuritaire, un modèle qui pourrait rallier deux écoles de  
333 pensée. *Travail et Santé* 2013;29(1):6-9.
- 334 14. Roy M, Desmarais L, Cadieux J. Améliorer la performance en SST : les résultats vs les  
335 prédicteurs. *Pistes* 2005;7(2):En ligne.
- 336 15. Johnson SE. The predictive validity of safety climate. *Journal of Safety Research*  
337 2007;38(5):511-21. doi: 10.1016/j.jsr.2007.07.001
- 338 16. Lecours A. Using an occupational perspective to understand behaviours fostering the  
339 prevention of work-related health problems: A proposed conceptual model. *Journal of*  
340 *Occupational Science* 2019;Online First:1-14. doi: 10.1080/14427591.2019.1600575
- 341 17. Lecours A, Therriault P-Y. Preventive behavior at work - A concept analysis. *Scandinavian*  
342 *Journal of Occupational Therapy* 2017;24(4):1-10. doi: 10.1080/11038128.2016.1242649
- 343 18. Lecours A, Therriault P-Y. Habilitier les travailleurs à la prévention : description des pratiques  
344 des ergothérapeutes visant la mise en place des antécédents du comportement préventif  
345 au travail. *Revue francophone de recherche en ergothérapie* 2019;5(1):59-79.
- 346 19. Lecours A, Therriault P-Y. Development of preventive behavior at work : description of  
347 occupational therapists' practice. *Work* 2018;61(3):477-88. doi: 10.3233/WOR-182811
- 348 20. Lecours A, St-Hilaire F, Daneau P. How to move toward an integrated prevention approach in  
349 mental health at work? Promoting workers' commitment through concrete actions.  
350 manuscrit inédit
- 351 21. Vernon W. The Delphi technique: A review. *International Journal of Therapy & Rehabilitation*  
352 (*INT J THER REHABIL*), Feb 2009 2009
- 353 22. Tremblay-Boudreault V, Dionne CE. L'approche Delphi. Application dans la conception d'un  
354 outil clinique en réadaptation au travail en santé mentale. In: Corbière M, Larivière N, eds.  
355 Méthodes qualitatives, quantitatives et mixtes. Québec: Presses de l'Université du  
356 Québec 2014:283-303.
- 357 23. Couper MR. The Delphi technique: characteristics and sequence model. *ANS Advances in*  
358 *nursing science* 1984;7(1):72-77.
- 359 24. Powell C. The Delphi technique: myths and realities. *Journal of advanced nursing*  
360 2003;41(4):376-82.
- 361 25. Linstone HA, Turoff M. The delphi method: Addison-Wesley Reading, MA 1975.
- 362 26. Pherson S, Reese C, Wendler MC. Methodology update : Delphi Studies. *Nursing Research*  
363 2018;67(5)
- 364 27. Hohmann E, Cote MP, Brand JC. Research pearls : Expert consensus based evidence using the  
365 delphi method. *Arthroscopy : The Journal of Arthroscopic and Related Surgery*  
366 2018;34(12):3278-82.
- 367 28. Baker J, Lovell K, Harris N. How expert are the experts? An exploration of the concept of  
368 'expert' within Delphi panel techniques. *Nurse Researcher* 2006;14(1)
- 369 29. Powell C. The Delphi technique : myths and realities. *Journal of Advanced Nursing*  
370 2003;41(4):376-82.
- 371 30. Hsu C-C, Sanford BA. The Delphi Technique : Making sense of consensus. *Practical Assessment,*  
372 *Research & Evaluation* 2007;12(10)
- 373 31. Grant JS, Davis LL. Selection and use of content experts for instrument development. *Research*  
374 *in nursing & health* 1997;20(3):269-74.

- 1  
2  
3 375 32. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported?  
4 376 Critique and recommendations. *Research in nursing & health* 2006;29(5):489-97.  
5 377 33. Lynn MR. Determination and quantification of content validity. *Nursing research* 1986  
6 378 34. Rubio DM, Berg-Weger M, Tebb SS, et al. Objectifying content validity: Conducting a content  
7 379 validity study in social work research. *Social work research* 2003;27(2):94-104.  
8 380 35. Ekionea J-PB, Bernard P, Plaisent M. Consensus par la méthode Delphi sur les concepts clés  
9 381 des capacités organisationnelles spécifiques de la gestion des connaissances. *Recherche*  
10 382 *Qualitatives* 2011;29(3):168-92.  
11 383 36. Ford TE. A national Delphi study examining the feasibility of universal access to health and  
12 384 medical care in the United States. University of La Verne, 2002.  
13 385 37. Zerem E. The ranking of scientists based on scientific publications assessment. 2017;Journal  
14 386 of Biomedical Informatics(75):107-09.  
15 387 38. Steurer J. The Delphi method: an efficient procedure to generate knowledge. *Skeletal*  
16 388 *Radiology* 2011;40(8):959-61. doi: 10.1007/s00256-011-1145-z  
17 389 39. Graham B, Regehr G, Wright J. Delphi as a method to establish consensus for diagnostic  
18 390 criteria. *Journal of Clinical Epidemiology* 2003;56(12):1150-56.  
19 391 40. Ekionea JB, Bernard P, Plaisent M. Consensus par la méthode Delphi sur les concepts clés des  
20 392 capacités organisationnelles spécifiques de la gestion des connaissances. *Recherches*  
21 393 *qualitatives* 2011;29(3):168-92.  
22 394 41. Jorm AF. Using the Delphi expert consensus method in mental health research. *Australian &*  
23 395 *New Zealand Journal of Psychiatry (AUST NZ J PSYCHIATRY)* 2015  
24 396 42. Dari TH. Development and Validation of Community-Based Participatory Research (CBPR)  
25 397 Competencies: A Delphi Study [Dissertation]. University of Toledo, 2017.  
26 398 43. Wendimagegn NF, Bezuidenhout M. The integrated health service model: the approach to  
27 399 restrain the vicious cycle to chronic diseases. *BMC Health Services Research (BMC HEALTH*  
28 400 *SERV RES)* 2019;19(1) doi: [http://dx.doi.org.acces.bibl.ulaval.ca/10.1186/s12913-019-](http://dx.doi.org/acces.bibl.ulaval.ca/10.1186/s12913-019-4179-x)  
29 401 [4179-x](http://dx.doi.org/acces.bibl.ulaval.ca/10.1186/s12913-019-4179-x)  
30 402 44. Hara Y. Brain plasticity and rehabilitation in stroke patients. *Journal of Nippon Medical School*  
31 403 *= Nippon Ika Daigaku zasshi* 2015;82(1):4-13. doi: 10.1272/jnms.82.4 [published Online  
32 404 First: 2015/03/24]  
33 405 45. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *Journal*  
34 406 *of Advanced Nursing* 2000;32(4):1008-15.  
35 407 46. Cwalina AM. Organizational Practices Leading to a Positive Safety Culture : A Delphi Approach  
36 408 [Dissertation]. Nova Southeastern University, 2013.  
37 409 47. Tremblay-Boudreault V, Dionne CE. L'approche Delphi : Application dans la conception d'un  
38 410 outil clinique en réadaptation au travail en santé mentale. In: Corbière M, Larivière N, eds.  
39 411 Méthodes qualitatives, quantitatives et mixtes: Les presses de l'Université de Québec  
40 412 2000.  
41 413 48. Jones J, Hunter D. Consensus methods for medical and health services research. *BMJ: British*  
42 414 *Medical Journal* 1995;311(7001):376.  
43 415 49. Holey EA, Feeley JL, Dixon J, et al. An exploration of the use of simple statistics to measure  
44 416 consensus and stability in Delphi studies. *BMC medical research methodology*  
45 417 2007;7(1):52.  
46 418 50. Keeney S, Hasson F, McKenna H. Consulting the oracle: ten lessons from using the Delphi  
47 419 technique in nursing research. *Journal of advanced nursing* 2006;53(2):205-12.  
48 420 51. Cole ZD, Donohoe HM, Stelfson MI. Internet-based Delphi research : Case based discussion.  
49 421 *Environmental Management* 2013;51(3):511-23.



- 1  
2  
3 422 52. Coleen E. HealthLiteracy competencies for registered nurses : An e-Delphi study. *The Journal*  
4 423 *of Continuing Education in Nursing* 2016;47(12):558-65.  
5 424 53. Harper MG, Asselin M, Kurtz AC, et al. Research Priorities for nursing professional  
6 425 development : A modified e-Delphi study. *Journal for Nurses in Staff Development*  
7 426 2012;28(3)  
8 427 54. Lakeman R. Mental health recovery competencies for mental health workers : a Delphi study.  
9 428 *Journal of Mental Health* 2010;19(1):62-74.  
10 429 55. Green H, Smith E, Poole R, et al. A Delphi study of the subjective 'rush experience :  
11 430 understanding the perspective of the injecting drug user to enhance quality of drug  
12 431 intervention. *Journal of Substance Use* 2009;14(5):295-305.  
13 432 56. Arblaster K, Mackenzie L, Matthews L, et al. Learning from consumers : An eDelphi study of  
14 433 Australian mental health consumers priorities for recovery-oriented curricula. *Australian*  
15 434 *Occupational Therapy Journal* 2018;65(6):586-97.  
16 435 57. Desrosiers J, Larivière N. Le groupe de discussion focalisé. In: Corbière M, Larivière N, eds.  
17 436 Méthodes qualitatives, quantitatives et mixtes. Québec: Presses de l'Université du  
18 437 Québec 2014:257-81.  
19  
20  
21 438  
22  
23 439  
24  
25 440  
26  
27 441  
28 442  
29  
30 443  
31 444  
32  
33 445  
34  
35 446  
36  
37 447  
38 448  
39  
40 449  
41  
42 450  
43  
44 451  
45 452  
46  
47 453  
48 454  
49  
50 455  
51  
52 456  
53  
54 457  
55 458  
56  
57  
58  
59  
60

1  
2  
3 459

4  
5 460 **AUTHOR'S CONTRIBUTIONS**

6 461 AL drafted the manuscript, made the required revisions and approved the final version of the  
7  
8 462 manuscript.  
9

10 463  
11 464 **FUNDING**

12  
13 465 This work was supported by the first author's *Fonds d'établissement de jeune chercheur* from the  
14 466 Center for Interdisciplinary Research in Rehabilitation and Social Integration.  
15  
16 467

17  
18 468 **COMPETING INTEREST STATEMENT**

19  
20 469 None declared.  
21

22 470  
23 471 **DATA AVAILABILITY STATEMENT**

24  
25 472 No additional data available  
26

27 473  
28 474 **Word count (max 4000):** 3,370 words (excluding abstract and references)  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

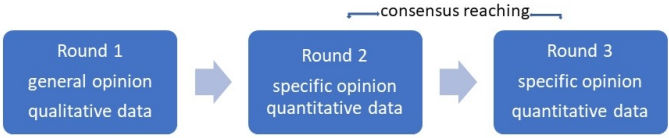


Figure 2. Description of rounds of consultation  
338x190mm (96 x 96 DPI)

# BMJ Open

## Scientific, professional and experiential validation of the Model of Preventive Behaviours at Work: Protocol of a modified Delphi study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-035606.R1
Article Type:	Protocol
Date Submitted by the Author:	12-Jun-2020
Complete List of Authors:	Lecours, Alexandra; Universite Laval Faculte de medecine, Réadaptation
<b>Primary Subject Heading</b>:	Occupational and environmental medicine
Secondary Subject Heading:	Research methods
Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, REHABILITATION MEDICINE, PUBLIC HEALTH

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1 **Title:** Scientific, professional and experiential validation of the Model of Preventive  
2 Behaviours at Work: Protocol of a modified Delphi study

3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
To submit to: BMJ Open

**Authors:** Lecours, Alexandra <sup>1,2</sup>

1. Département de réadaptation, Université Laval, Québec, Québec, Canada
2. Center for Interdisciplinary Research in Rehabilitation and Social Integration, Québec, Québec, Canada

Authors' email :

AL : [Alexandra.Lecours@fmed.ulaval.ca](mailto:Alexandra.Lecours@fmed.ulaval.ca) - CORRESPONDING AUTHOR

Université Laval

Pavillon Ferdinand Vandry

Département de réadaptation

1050 Avenue de la Médecine

Québec (Qc) G1V 0A6

Canada

1-418-656-2131 # 407422

**Thanks:** The author thanks Guylain Breton, research trainee, for his help with the literature search.

**Key words:** Delphi study, occupational health, occupational safety, occupational well-being, conceptual model

**Word count (max 4000):** 3, 987 words (excluding abstract and references)

1  
2  
3 **32 Abstract**

4 **33 Introduction.** To offer an in-depth understanding of preventive behaviours, those complex  
5 behaviours considered as levers to foster work prevention, recent theoretical and empirical  
6 studies permitted to develop the Model of Preventive Behaviours at Work. The next step  
7 is to validate the Model with researchers, professionals, and workers. This article aims to  
8 describe the study protocol that will be used to validate the Model of Preventive Behaviours  
9 at Work.

10 **39 Methods and Analysis.** This Delphi study proposes seven systematic steps to conduct a  
11 scientifically rigorous validation study based on scientific and professional experts'  
12 opinion. A focus group to collect workers' opinion about the Model has also been included  
13 in the protocol. Thirty experts (researchers and professionals) will be selected regarding  
14 their experience (e.g. at least five years of experience) and expertise (e.g. having published  
15 at least one article as the first author in the last three years) towards workers' health or  
16 organizational behaviours. Workers will be recruited to have a diversity in terms of age,  
17 gender and working conditions. Quantitative data will be analyzed to calculate the  
18 percentage of experts' agreement on four content validity indicators (i.e.  
19 comprehensiveness, representativeness, relevance, clarity). Qualitative data will be  
20 examined through a thematic analysis strategy.

21 **50 Ethics and dissemination.** Approval of the research ethics board of the Centre intégré  
22 universitaire de santé et de services sociaux de la Capitale Nationale has been obtained.  
23 Findings will be shared with various stakeholders inclusive of researchers, professionals,  
24 and workers. Findings will be disseminated in workshops, peer-reviewed journals and  
25 conferences.

26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62

### 63 **Strengths and limitations of this study**

- 64 • This study protocol integrates seven systematic steps to validate a new conceptual  
65 model.
- 66 • The detailed description of each research step easily allows for replication.
- 67 • This protocol proposes a validation including scientific, professional and  
68 experiential knowledge, which is innovative and timely.
- 69 • An entire research step is dedicated to the involvement of the public, this  
70 maximizing the relevance of the study results.
- 71 • The proposed research design doesn't permit obtaining a statistical validation of the  
72 Model of Preventive Behaviours at Work; further studies are required.



## 73 INTRODUCTION.

74 The number of people in employment is growing in industrialized societies. For example,  
75 the Canadian labour force grew from 15.8 to 20.2 million workers between 2000 and 2019,  
76 which represents an increase of near than 28% <sup>1</sup>. Recognized as a determinant of health <sup>2</sup>  
77 <sup>3</sup>, work may have positive effects on the health, safety and well-being of people, as it may  
78 contribute to financial health, social recognition or protection against declining skills <sup>4</sup>.  
79 When a work-related health problem occurs, whether it is an accident, a physical illness or  
80 a transient mental disorder, the negative consequences are harmful not only for workers  
81 and families, but also for work organizations, by reducing performance and productivity <sup>5</sup>.  
82 The societal impacts are also impressive with an estimated amount of over \$ 250 billion in  
83 the US to cover annual costs related to work-related health problems <sup>6</sup>.  
84 It is then important to focus on the determinants of workers' health, safety, and well-being.  
85 The literature suggests that factors related to healthcare services, compensation systems,  
86 work organizations, as well as to workers themselves would influence the prevention of  
87 the occurrence, relapse, and prolonged disability related to work-related health problems <sup>7-</sup>  
88 <sup>9</sup>. Considering worker-related factors, the preventive behaviours they may adopt would  
89 play an important role in workplace health, safety, and well-being <sup>10-13</sup>. Indeed, the  
90 influence of these behaviours on the risk of work-related health problems has been  
91 demonstrated in several studies conducted with various workers' populations <sup>10 14 15</sup>.  
92 Considered as levers to promote workers' health, safety and well-being, these preventive  
93 behaviours are complex, and literature lacks a concrete definition of them <sup>16</sup>. To offer an  
94 in-depth understanding of preventive behaviours, recent theoretical and empirical studies  
95 have permitted proposing the Model of Preventive Behaviours at Work. This Model defines  
96 the behaviours workers may adopt to foster their own health, safety and well-being, and  
97 their colleagues'. The Figure 1 presents the Model of Preventive Behaviours at Work <sup>16</sup>.

98

99

Insert figure 1 here

100 **Figure 1.** Model of Preventive Behaviours at Work (adapted from Lecours, 2020)<sup>16</sup>

101

102 The Model shows six major preventive behaviours, which are 1) *adopting a reflective*  
103 *practice* (e.g. analyzing work situations, identifying risks, and taking decisions about one's

1  
2  
3 104 health); 2) *complying with rules and procedures* (e.g. respecting work-related procedures  
4 or wearing personal protective equipment), 3) *participating, involving and taking*  
5 *initiatives for prevention* (e.g. involving in health and safety committees or seeking help  
6 from available resources), 4) *caring about others* (e.g. team working or listening to each  
7 other), 5) *communicating* (e.g. expressing one's needs or limits) and 6) *adopting a healthy*  
8 *lifestyle* (e.g. having lifestyle balance or exercising).  
9

10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
110 The Model of Preventive Behaviours at Work presents a systemic and multifactorial view  
111 of preventive behaviours. These behaviours are largely influenced by contextual factors  
112 related to workers themselves, occupation of work or environment. These contextual  
113 factors have an impact on the ability of workers to engage in preventive behaviours. Thus,  
114 in addition to being interested in the concrete behaviours, the Model focuses on the factors  
115 upstream of the manifestation of a behaviour, on the context in which workers adopt  
116 behaviours. The Model also considers the consequences following the manifestation of  
117 behaviours. These consequences are generally positive for workers themselves (e.g. health,  
118 safety and well-being) as well as for the organization (e.g. work climate). The three-way  
119 arrow in the centre of the Model reflects the dynamic interaction and multiple influences  
120 between 1) contextual factors, 2) workers' engagement in preventive behaviours, 3) and  
121 outcomes. This Model was developed after conducting three theoretical<sup>17</sup> and empirical  
122<sup>18-20</sup> studies. The development process of the Model is detailed elsewhere<sup>16</sup>.

123 Regarding occupational health, several of the current models focus only on one aspect of  
124 the health of workers, whether physical<sup>e.g.17</sup> or mental<sup>e.g. 21</sup>. In accordance with the vision  
125 of health proposed by the World Health Organization<sup>22</sup>, the Model of Preventive  
126 Behaviours at Work suggests a holistic vision of the health of workers, inclusive of the  
127 physical, mental and social aspects. This holistic understanding of health reflects in  
128 contextual factors, preventive behaviours and outcomes. In addition, the focus of the Model  
129 rests on the engagement of workers in preventive behaviour at work. This angle is  
130 innovative since most of the current models focus on the actions the organization may have  
131 on workers' health<sup>e.g.23</sup>, giving them a mostly passive role. Since the management of  
132 occupational health, safety and well-being must be shared by everyone involved in an  
133 organization<sup>24-27</sup>, this Model helps to better explain the active role workers may have.  
134 Designed to be applicable to the reality of workers, regardless of the nature of their work

1  
2  
3 135 or health, this Model can also help to understand the factors that influence workers'  
4 136 engagement in preventive behaviours and the resulting effects on health, safety and well-  
5 137 being.

6  
7  
8 138 To increase its scientific validity, to maximize its use in professional settings, and  
9 139 ultimately to foster workers' health, safety and well-being, the next step is to validate the  
10 140 Model. Literature offers a large spectrum of conceptual model validation study designs.  
11  
12 141 Over the years, the Delphi technique has been used in various validation studies, but most  
13 142 of the published articles focused on results, while validation protocols remain more or less  
14  
15 143 detailed, making difficult replicating studies. Furthermore, authors have criticized the lack  
16 144 of clear guidelines in the current writing surrounding the use of the Delphi technique, which  
17 145 may lead to a lack of scientific rigour<sup>28 29</sup>. To fill these gaps, the aim of this article is to  
18 146 describe the study protocol that will be used to validate the Model of Preventive Behaviours  
19 147 at Work.

20  
21  
22  
23  
24  
25  
26 148

## 27 149 **METHOD AND ANALYSIS.**

### 28 29 150 **Design**

30  
31 151 Created in the middle of the 18<sup>th</sup> century<sup>30</sup> and used in health sciences since the 70s<sup>31</sup>, the  
32 152 Delphi technique is recognized as an efficient way to structure communication processes  
33 153 allowing individuals to work on a complex subject<sup>32</sup>, which is the case of the Model of  
34 154 Preventive Behaviours at Work. Since this Model is emerging, a first step of validation  
35  
36 155 with experts will make it possible to appreciate its acceptability<sup>29</sup> from the scientific  
37 156 community and its applicability from the knowledge users, which are professionals and  
38 157 workers. The main advantage of the Delphi technique is that communications take place  
39 158 remotely, allowing the recruitment of experts from all over the planet<sup>28 33</sup>. Disadvantages  
40 159 noted in the scientific literature relate to the lack of consensus on the definition of an expert  
41 160 and on how to rule on the consensus's adoption<sup>33-35</sup>. The limited implication of knowledge  
42 161 users in Delphi studies is also a weak point of the actual method<sup>29</sup>. The method can also  
43 162 take a considerable amount of time from the participants, which can discourage them from  
44 163 getting involved<sup>28 36 37</sup>. Finally, many variants of the original method have been used in  
45 164 published studies<sup>29</sup>, but lack of justification for the changes made and lack of details in  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

165 protocols contribute to creating ambiguities in the guidelines to follow<sup>28 29</sup>. Our wish in  
 166 drafting this protocol is to bring clarity to these elements of the study design.

### 168 **Procedure and analysis**

169 The Delphi technique will be used to obtain consensus from scientific, professional and  
 170 experiential experts on content validity indicators, which are: 1) *comprehensiveness* of the  
 171 model structure, 2) *representativeness* to the content domain, 3) *relevance* of the model  
 172 components and 4) *clarity* of the model components and links. These indicators were  
 173 recommended according to writing on content validity<sup>38-41</sup>. The study design proposes  
 174 seven systematic steps to conduct a scientifically rigorous validation study (see table 1).  
 175 The expected duration of the study is 12 months, beginning in the summer 2020.

177 Table 1. Systematic steps of the study design

<b>Step 1</b>	Elaborate selection criteria for scientific and professional experts
<b>Step 2</b>	Make scientific and professional experts list
<b>Step 3</b>	Contact scientific and professional experts
<b>Step 4</b>	Administrate questionnaires
<b>Step 5</b>	Synthesize answers
<b>Step 6</b>	Consult experiential experts
<b>Step 7</b>	Final analysis and publication

178  
 179 To validate the Model according to a) scientific, b) professional and c) experiential  
 180 expertise, participants from the following three categories will be recruited a) researchers,  
 181 b) professionals, and c) workers. The boundaries between these expertises are however  
 182 permeable; the experts will be invited to give their opinion on the various indicators  
 183 according to their overall expertise. For example, even if professionals are recruited on the  
 184 basis of their technical and specialized experience with workers, it is also possible that  
 185 scientific or experiential knowledge influence their contribution. It is hoped that this  
 186 validation study will be carried out using rich and diversified expertise.

187

1  
2  
3 188 *Elaborate selection criteria for scientific and professional experts.*

4  
5 189 The quality of a study using the Delphi technique mainly rests on the choice of experts <sup>29</sup>  
6 190 <sup>37 42</sup>. Indeed, since the opinion of these will serve to generate the results of the study, their  
7  
8 191 selection must be judicious. Currently, there is no recognized definition of “who is an  
9  
10 192 expert” and no universal criteria for structuring the choice of experts <sup>33-35</sup>. The researcher's  
11  
12 193 judgment is solicited to determine criteria that will enable her / him to select the people  
13  
14 194 most likely to contribute to meeting the research objective <sup>28 35 37</sup>.

15 195 The first steps of the protocol imply to select researchers and professionals. A list of  
16  
17 196 inclusion criteria was established based on information available in scientific literature.

18  
19 197 Researchers.

20 198 Expertise seems to be the main criteria to select researchers <sup>37</sup>. For the success of a Delphi  
21  
22 199 study, experts must have a thorough knowledge of the subject <sup>43</sup>. For the current study,  
23  
24 200 researchers with expertise in the field of workers' health or organizational behaviours will  
25  
26 201 be targeted. It will be possible to select experts in various disciplines such as industrial  
27  
28 202 psychology, ergonomics, occupational therapy, occupational medicine or human resource  
29  
30 203 management because the Model of Preventive Behaviours at Work was developed  
31  
32 204 according to that literature <sup>16</sup>.

33 205 To select researchers, the evaluation of the relevance of their published scientific papers  
34  
35 206 related to the subject of our study will be used. This systematic selection method is cited  
36  
37 207 in many manuscripts <sup>35 44 45</sup>. A researcher will be identified to be part of the panel of experts  
38  
39 208 if she / he has published at least one relevant article, as the first author, in the last three  
40  
41 209 years <sup>46</sup>. This published article should specifically concern prevention at work.

42 210 Professionals.

43 211 Since the Model of Preventive Behaviours at Work is expected to be used in practical  
44  
45 212 settings, we chose to include professionals in the validation process. Although some  
46  
47 213 authors do not recommend including the participation of professionals for emerging  
48  
49 214 concept validation <sup>42</sup>, literature in the field of health mostly recommends including  
50  
51 215 professionals in the panel of experts <sup>47 34 48 49</sup>.

52 216 Work experience in the field of study seems to be the criterion most often used to select  
53  
54 217 professionals <sup>43 48</sup>. For our study, a variety of professionals (i.e. ergonomists, industrial  
55  
56 218 psychologists, occupational therapists, occupational physicians or human resources

219 managers) will be recruited if they have at least five years of experience in relation with  
220 workers.

221

222 *Make scientific and professional experts list*

223 To recruit researchers based on their published articles, the following scholarly journals  
224 will be consulted: a) Work, b) Journal of Occupational and Organizational Psychology,  
225 and c) Safety Science. These journals are targeted because of their readership profile, the  
226 number of researchers contributing to it, and the topics that are relevant to our research  
227 project <sup>42</sup>. Indeed, these journals have a wide vision of the thematic of work and include  
228 articles from various disciplines and fields of research. The journal numbers published in  
229 the last three years will be consulted one by one. The articles that seem to have a link with  
230 the subject of study according to their title and keywords will be retained. The abstract of  
231 these articles will then be read to confirm the author's relevance to the research project. If  
232 needed, the ResearchGate and personal web pages of researchers will be consulted to  
233 deepen the analysis and make sure of their potential contribution to this validation study.  
234 For feasibility reasons, only three journals will be extensively screened. However, each of  
235 the experts identified in this first screening step will be invited to suggest other potential  
236 experts during the first contact. If those suggested experts meet the inclusion criteria, they  
237 will be added to the list of potential experts. This second selection step using the snowball  
238 method will allow identifying experts who can contribute validating the Model, even if  
239 they have not published articles in the targeted journals.

240 Recruitment of professionals will be done in two stages. First, participants meeting the  
241 inclusion criteria will be identified in the author's network. Subsequently, the snowball  
242 method will be used to expand the pool of experts.

243 Particular attention will be paid to recruiting experts of different ages, genders, work  
244 environments and geographic origins. An Excel table will be constructed to gather relevant  
245 information about potential experts, such as the level of training, area of expertise,  
246 affiliation, email address and country <sup>42</sup>.

247 The number of experts to recruit is not established in the actual literature <sup>37 47</sup>. Even if some  
248 Delphi study were conducted with more than 1500 participants <sup>36</sup>, they mainly include 10  
249 to 20 participants <sup>37 50</sup>. The size of the group has an importance for the stability of the



250 results. Indeed, with a smaller group, an expert has a greater influence on the result since  
251 her / his opinion occupies a larger proportion of the consensus<sup>47</sup>. On the other hand, it is  
252 more complex and costly to consult with a large number of experts<sup>28 37</sup>.

253 For our study, we plan to recruit 30 experts: 15 researchers and 15 professionals.  
254 Considering the attrition of participants during the study, this number seems adequate.

255

### 256 *Contact scientific and professional experts*

257 After having made a list of potential experts to recruit for the consultation, it is time to  
258 invite them. Nowadays, email seems to be the most frequent way to contact experts.  
259 Authors suggest sending a detailed message to invite experts<sup>28 33 34 42 48 51</sup>. The message  
260 will contain the following information: presentation of the researcher responsible of the  
261 study, description of the study, reasons for the selection of the expert, procedures to be  
262 followed to participate to the consultation, estimation of the time required, expectations  
263 regarding the expert (including the importance of participating in all the rounds of the  
264 consultation), promise of anonymity, and participation recognition<sup>28 33 34 42 48 51</sup>.

265

### 266 *Administrate questionnaires*

267 The first questionnaire allows experts to express their opinion on the subject to study<sup>29</sup>.  
268 The purpose of this first questionnaire is often to provide an overview of the experts'  
269 opinion on the subject of study and then to determine the elements to be studied in the  
270 subsequent questionnaires. Basic open-ended questions are required to cover the entire  
271 subject<sup>34 47 52</sup>. Since these open-ended questions are likely to generate a great deal of  
272 information<sup>52</sup>, it is suggested to limit the number of questions in this first questionnaire<sup>29</sup>  
273<sup>30</sup>. For example, the first questionnaire of our consultation will contain four large questions  
274 about the indicators of content validity (i.e. comprehensiveness, representativeness,  
275 relevance, clarity) in relation with the Model of Preventive Behaviours at Work and its  
276 components. As suggested in the literature, we will also add a fifth question to permit  
277 experts to freely add information they find relevant about the subject<sup>29</sup>. In order to ensure  
278 the questionnaire clarity, a pretest will be done with four experts (two researchers and two  
279 professionals), as suggested by many authors who published about the Delphi technique<sup>28</sup>  
280<sup>34 36 53</sup>. The qualitative data gathered with this first questionnaire will be analyzed with a

1  
2  
3 281 thematic analysis strategy using the QDA Miner software. This will permit to determine  
4 282 the content of the subsequent consultation rounds.

5 283 The second questionnaire (and the following, if applicable) will first summarize the  
6 284 opinions found in the previous questionnaire <sup>37 51</sup>. After that, the idea is to document  
7 285 experts' opinion on more specific elements, generally with closed questions <sup>34</sup>. The opinion  
8 286 will often be documented using Likert type scales, with the aim to obtain a consensus of  
9 287 experts <sup>37 51</sup>. For example, elements related to the four content validity indicators that  
10 288 emerged from the analysis of the first questionnaire will be assessed by experts on a 4-  
11 289 point Likert scale (e.g. Clarity : 1- this element is not clear, 2- this element needs major  
12 290 revisions to be clear, 3- this element needs minor revisions to be clear, 4- this element is  
13 291 clear). The iteration process and the return on the information offered to the experts will  
14 292 allow them to reconsider their opinion in the light of that of the others, thus convince  
15 293 toward a consensus. The anonymity provided by the method facilitates this process <sup>54</sup>. The  
16 294 quantitative data gathered with the administration of the second questionnaire, and the  
17 295 following, will be analyzed with descriptive statistics, using the SPSS software.

18 296 Nowadays, web questionnaires are preferred to postal ones <sup>29</sup>. We will also follow this  
19 297 tendency in our study.

20 298

### 21 299 *Synthesize answers*

22 300 This research step comprises the crucial moment of the determination of the consensus of  
23 301 experts about the different components of the Model of Preventive Behaviours at Work.  
24 302 Paradoxically, literature doesn't offer a consensus about the definition of the consensus <sup>28</sup>  
25 303 <sup>33 36 47 53</sup>. The consensus, which is the agreement between the experts, may be defined in  
26 304 different ways, such as a measure of central tendency of experts' quantitative responses,  
27 305 the stability in experts' responses between the rounds of consultation, or a subjective  
28 306 measure of general opinion <sup>55</sup>. Given the lack of a clear rule on the definition of consensus,  
29 307 it is important for researchers conducting a Delphi study to define this agreement in an  
30 308 operational manner before starting the consultation <sup>29 56</sup>. The chosen definition of the  
31 309 consensus is to impact on the number of required rounds to obtain this agreement between  
32 310 the experts.



1  
2  
3 311 Using a percentage of agreement would be the most common way to rule on consensus<sup>36</sup>.  
4  
5 312 However, the percentage to be reached to obtain a consensus varies considerably across  
6  
7 313 studies, ranging from 51% to 100%<sup>28 33 36 37</sup>. A 100% consensus may be impossible to  
8  
9 314 achieve, and often not necessary<sup>33</sup>. Although aiming to reach a high percentage of  
10  
11 315 agreement permits to ensure the agreement between the experts, it may result in the need  
12  
13 316 to add several consultation rounds. To have a sufficiently discriminating percentage  
14  
15 317 without excessively lengthening the time of realization of the study, we will set it at 80%.  
16  
17 318 We will use the following rules to monitor consensus: a) if 80 % of experts give an element  
18  
19 319 the rating of 4 on the 4-point Likert scale, we consider that a consensus was obtained on  
20  
21 320 this element and it will be kept in the Model; b) if 80 % of experts give an element the  
22  
23 321 rating of 1 on the 4-point Likert scale, we consider that a consensus was obtained on this  
24  
25 322 element and it will be removed from the Model; c) for elements having mostly been rated  
26  
27 323 2 or 3 on the 4-point Likert scale, modification will be made according to experts' opinion  
28  
29 324 and these elements will be submitted to the following round of consultation.  
30  
31 325

32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
*Insert figure 2 here*

317 Figure 2. Description of rounds of consultation

328  
329 Literature suggests two or three rounds are needed to reach the consensus<sup>33</sup>. We a priori  
330 plan to realize three rounds, as shown in figure 2. We will give experts two weeks to answer  
331 a questionnaire, as suggested by others<sup>37 57-59</sup>. The total time to complete the collection of  
332 data can therefore be spread out over a few weeks depending on the number of rounds to  
333 be made.  
334

#### 335 *Consult experiential experts*

336 A last consultation step will be conducted with experiential experts, namely workers in this  
337 study. While not common in Delphi studies, this decision to include people having  
338 experienced a condition has been suggested by other authors who had conducted health-  
339 related studies<sup>36 60 61 62</sup>. This permits to favour the involvement of a variety of stakeholders.

1  
2  
3 340 The consultation will take the form of a focus group <sup>63</sup>. The purpose of the consultation  
4 341 will be to verify the applicability of the results obtained, the relevance with the current  
5 342 work context, and the face validity of the Model.

6  
7  
8 343 Groups of eight workers will be formed. This number of participants per group is large  
9 344 enough to get rich discussions <sup>63</sup> and small enough to let all participants express themselves  
10 345 <sup>64</sup>. Participants will be recruited to have a diversity in terms of ages, genders and working  
11 346 conditions (e.g. type of work, full-time vs. part-time, etc.). In a two-hour discussion, results  
12 347 of the consultation with scientific and professional experts will be exposed to workers.  
13 348 Different indicators will be discussed, such as facilitators and obstacles for the usability of  
14 349 the Model or relevance of its components to the reality of workers. The group facilitation  
15 350 guide will be developed for the purpose of this study and validated by a pre-test with two  
16 351 people having the same characteristics as the participants. . The number of groups to be  
17 352 conducted will be defined throughout the study until data reveals a redundancy in the  
18 353 meaning of the ideas shared by the participants <sup>65</sup>. It is estimated that two or three groups  
19 354 will be required to reach data saturation <sup>66</sup>. After fully transcribing the data and importing  
20 355 it into the QDA Miner software, a thematic analysis strategy in four stages will be followed  
21 356 <sup>67</sup>: 1) repeated readings of the data corpus to develop a feeling of immersion; 2) initial  
22 357 coding (descriptive codes "in vivo" will be assigned to the meaning units found in the  
23 358 corpus); 3) conception of a code tree (the codes [micro level] will be grouped into  
24 359 categories [meso level] and / or themes [macro level]); 4) finalization of the code tree by  
25 360 going back and forth between the raw data and the general structure to clarify and interpret  
26 361 the data while respecting the experience of the participants. To ensure scientific rigour, the  
27 362 thematic analysis process will be carried out by two people and the inter-judge agreement  
28 363 will be periodically checked. This last consultation step will provide nuances to the study  
29 364 results.

### 365 366 *Final analysis and publication*

367 Once the analysis of all collected data and the consensus reached, a summary of the results  
368 will be transmitted to each expert who took part in the study, namely the researchers, the  
369 professionals and the workers. The experts will be free to comment on these findings,

1  
2  
3 370 which may help to enhance reflection about the validity of the Model of Preventive  
4 371 Behaviours at Work.

5  
6 372

### 7 373 **Patient and public involvement**

8  
9 374 To support co-production of knowledge, this study proposes to actively involve various  
10 375 stakeholders in the different steps. In fact, professional experts' opinion will be gathered  
11 376 by questionnaire to confirm or improve the Model. As these persons will be likely to use  
12 377 the Model in their practice, building the study around their opinion will improve the  
13 378 relevance of the Model and increase the likelihood that it will be used to guide interventions  
14 379 about preventive behaviours at work. Stakeholders will also be involved in the recruitment  
15 380 of participants using the snowball method. The protocol also proposes to add an innovative  
16 381 and timely step to the validation process using the Delphi technique. In fact, the  
17 382 consultation step with experiential experts, namely workers in this study, will allow  
18 383 including the perceptions and experiences of the public in the interpretation of results.

19 384

### 20 385 **ETHICS AND DISSEMINATION.**

21 386 Approval of the research ethics board of the Centre intégré universitaire de santé et de  
22 387 services sociaux de la Capitale Nationale has been obtained (project 2020-1919). The  
23 388 preponderant involvement of various stakeholders throughout the study will offer the  
24 389 possibility of start disseminating results during conducting the study. Following that,  
25 390 diverse activities will take place to transfer knowledge. For examples, scientific papers will  
26 391 be published and conferences held to share results with researchers. Workshops will be  
27 392 organized with professionals. Popular science conferences are also planned to disseminate  
28 393 the results of the study to the general public.

29 394

### 30 395 **REFERENCES**

- 31 396 1. Statistics Canada. Labour force characteristics by province, monthly, seasonally adjusted  
32 397 2019 [Available from:  
33 398 <https://www150.statcan.gc.ca/t1/tb11/fr/cv.action?pid=1410028703#timeframe>.  
34 399 2. OMS. Charte d'Ottawa pour la promotion de la santé. Ottawa, 1986.  
35 400 3. Wilcock AA, Hocking C. An occupational perspective of health. 3 ed. Thorofare, NJ,  
36 401 USA: SLACK Incorporated 2015.

- 402 4. Bosma H, Van Boxtel M, Ponds R, et al. Education and age-related cognitive decline:  
403 the contribution of mental workload. *Educational gerontology* 2003;29(2):165-73.
- 404 5. Demerouti E, Bakker AB, Halbesleben JRB. Productive and counterproductive job  
405 crafting: A daily diary study. *Journal of Occupational Health Psychology*  
406 2015;20(4):457-69. doi: 10.1037/a0039002
- 407 6. Leigh JP. Economic burden of occupational injury and illness in the United States.  
408 *Milbank Quarterly* 2011;89(4):728-72. doi: 10.1111/j.1468-0009.2011.00648.x
- 409 7. Robichaud M-M. Retour au travail à la suite d'une lésion professionnelle : perspective  
410 des intervenants en réadaptation du système d'indemnisation public. Université  
411 Laval, 2016.
- 412 8. Durand M-J, Loisel P, Hong QN, et al. Helping clinicians in work disability prevention:  
413 the work disability diagnosis interview. *Journal of Occupational Rehabilitation*  
414 2002;12(3):191-204.
- 415 9. Loisel P, Durand M-J, Berthelette D, et al. Disability prevention. *Disease Management*  
416 *and Health Outcomes* 2001;9(7):351-60.
- 417 10. Roy M, Cadieux J, Forter L, et al. Validation d'un outil d'autodiagnostic et d'un modèle  
418 de progression de la mesure en santé et sécurité du travail. Montréal: IRSST,  
419 2008:28.
- 420 11. Akselsson R, Jacobsson A, Bötjesson M, et al. Efficient and effective learning for safety  
421 from incidents. *Work* 2012;41:3216-22.
- 422 12. Simard M, Marchand A. The behaviour of first-line supervisors in accident prevention  
423 and effectiveness in occupational safety. *Safety Science* 1994;17(3):169-85. doi:  
424 10.1016/0925-7535(94)90010-8
- 425 13. Cossette R. Le comportement sécuritaire, un modèle qui pourrait rallier deux écoles de  
426 pensée. *Travail et Santé* 2013;29(1):6-9.
- 427 14. Roy M, Desmarais L, Cadieux J. Améliorer la performance en SST : les résultats vs les  
428 prédicteurs. *Pistes* 2005;7(2):On line.
- 429 15. Johnson SE. The predictive validity of safety climate. *Journal of Safety Research*  
430 2007;38(5):511-21. doi: 10.1016/j.jsr.2007.07.001
- 431 16. Lecours A. Using an occupational perspective to understand behaviours fostering the  
432 prevention of work-related health problems: A proposed conceptual model. *Journal*  
433 *of Occupational Science* 2020;27(2):222-35. doi:  
434 10.1080/14427591.2019.1600575
- 435 17. Lecours A, Therriault P-Y. Preventive behavior at work - A concept analysis.  
436 *Scandinavian Journal of Occupational Therapy* 2017;24(4):1-10. doi:  
437 10.1080/11038128.2016.1242649
- 438 18. Lecours A, Therriault P-Y. Habilitier les travailleurs à la prévention : description des  
439 pratiques des ergothérapeutes visant la mise en place des antécédents du  
440 comportement préventif au travail. *Revue francophone de recherche en*  
441 *ergothérapie* 2019;5(1):59-79. doi: 10.13096/rfre.v5n1.97
- 442 19. Lecours A, Therriault P-Y. Development of preventive behavior at work : description  
443 of occupational therapists' practice. *Work* 2018;61(3):477-88. doi:  
444 <http://dx.doi.org/10.3233/WOR-182811>
- 445 20. Lecours A, St-Hilaire F, Daneau P. How to move toward an integrated prevention  
446 approach in mental health at work? Promoting workers' commitment through  
447 concrete actions. accepted

- 1  
2  
3 448 21. Demerouti E, Bakker AB, Nachreiner F, et al. The job demands-resources model of  
4 449 burnout. *Journal of Applied psychology* 2001;86(3):499.  
5 450 22. OMS, ed. Préambule à la Constitution Conférence internationale sur la Santé; 1946;  
6 451 New York.  
7 452 23. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *Journal of*  
8 453 *Occupational Health Psychology* 1996;1(1):27.  
9 454 24. Lowe GS. Creating healthy organizations: How vibrant workplaces inspire employees  
10 455 to achieve sustainable success: University of Toronto Press 2010.  
11 456 25. Shain M, Kramer DM. Health promotion in the workplace: framing the concept  
12 457 reviewing the evidence *Occupational and Environmental Medicine*  
13 458 2004;61(7):643. doi: 10.1136/oem.2004.013193  
14 459 26. OMS. Plan d'action mondiale pour la santé des travailleurs 2008-2017. In: Soixantième  
15 460 assemblée mondiale de la santé, ed., 2007:12.  
16 461 27. Éditeur officiel du Québec. Loi sur la santé et la sécurité du travail. In: Gouvernement  
17 462 du Québec, ed. Québec, 2017.  
18 463 28. Vernon W. The Delphi technique: A review. *International Journal of Therapy &*  
19 464 *Rehabilitation* 2009;Feb 2009  
20 465 29. Tremblay-Boudreault V, Dionne CE. L'approche Delphi. Application dans la  
21 466 conception d'un outil clinique en réadaptation au travail en santé mentale. In:  
22 467 Corbière M, Larivière N, eds. Méthodes qualitatives, quantitatives et mixtes.  
23 468 Québec: Presses de l'Université du Québec 2014:283-303.  
24 469 30. Couper MR. The Delphi technique: characteristics and sequence model. *Advances in*  
25 470 *Nursing Science* 1984;7(1):72-77.  
26 471 31. Powell C. The Delphi technique: myths and realities. *Journal of Advanced Nursing*  
27 472 2003;41(4):376-82.  
28 473 32. Linstone HA, Turoff M. The Delphi method: Addison-Wesley Reading, MA 1975.  
29 474 33. Pherson S, Reese C, Wendler MC. Methodology update : Delphi Studies. *Nursing*  
30 475 *Research* 2018;67(5)  
31 476 34. Hohmann E, Cote MP, Brand JC. Research pearls : Expert consensus based evidence  
32 477 using the delphi method. *Arthroscopy : The Journal of Arthroscopic and Related*  
33 478 *Surgery* 2018;34(12):3278-82.  
34 479 35. Baker J, Lovell K, Harris N. How expert are the experts? An exploration of the concept  
35 480 of 'expert' within Delphi panel techniques. *Nurse Researcher* 2006;14(1)  
36 481 36. Powell C. The Delphi technique : myths and realities. *Journal of Advanced Nursing*  
37 482 2003;41(4):376-82.  
38 483 37. Hsu C-C, Sanford BA. The Delphi technique : Making sense of consensus. *Practical*  
39 484 *Assessment, Research & Evaluation* 2007;12(10)  
40 485 38. Grant JS, Davis LL. Selection and use of content experts for instrument development.  
41 486 *Research in nursing & health* 1997;20(3):269-74.  
42 487 39. Polit DF, Beck CT. The content validity index: are you sure you know what's being  
43 488 reported? Critique and recommendations. *Research in Nursing & Health*  
44 489 2006;29(5):489-97.  
45 490 40. Lynn MR. Determination and quantification of content validity. *Nursing Research*  
46 491 1986



- 1  
2  
3 492 41. Rubio DM, Berg-Weger M, Tebb SS, et al. Objectifying content validity: Conducting  
4 493 a content validity study in social work research. *Social Work Research*  
5 494 2003;27(2):94-104.
- 6 495 42. Ekionea J-PB, Bernard P, Plaisent M. Consensus par la méthode Delphi sur les concepts  
7 496 clés des capacités organisationnelles spécifiques de la gestion des connaissances.  
8 497 *Recherche Qualitatives* 2011;29(3):168-92.
- 9 498 43. Ford TE. A national Delphi study examining the feasibility of universal access to health  
10 499 and medical care in the United States. University of La Verne, 2002.
- 11 500 44. Zerem E. The ranking of scientists based on scientific publications assessment.  
12 501 2017;Journal of Biomedical Informatics(75):107-09.
- 13 502 45. Steurer J. The Delphi method: an efficient procedure to generate knowledge. *Skeletal*  
14 503 *Radiology* 2011;40(8):959-61. doi: 10.1007/s00256-011-1145-z
- 15 504 46. Graham B, Regehr G, Wright J. Delphi as a method to establish consensus for  
16 505 diagnostic criteria. *Journal of Clinical Epidemiology* 2003;56(12):1150-56.
- 17 506 47. Jorm AF. Using the Delphi expert consensus method in mental health research.  
18 507 *Australian & New Zealand Journal of Psychiatry* 2015
- 19 508 48. H. Dari T. Development and validation of community-based participatory research  
20 509 competencies: A Delphi study [Dissertation]. University of Toledo, 2017.
- 21 510 49. Wendimagegn NF, Bezuidenhout M. The integrated health service model: the approach  
22 511 to restrain the vicious cycle to chronic diseases. *BMC Health Services Research*  
23 512 (*BMC HEALTH SERV RES*) 2019;19(1) doi:  
24 513 <http://dx.doi.org.acces.bibl.ulaval.ca/10.1186/s12913-019-4179-x>
- 25 514 50. Hara Y. Brain plasticity and rehabilitation in stroke patients. *Journal of Nippon Medical*  
26 515 *School* 2015;82(1):4-13. doi: 10.1272/jnms.82.4 [published Online First:  
27 516 2015/03/24]
- 28 517 51. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique.  
29 518 *Journal of Advanced Nursing* 2000;32(4):1008-15.
- 30 519 52. Cwalina AM. Organizational Practices Leading to a Positive Safety Culture : A Delphi  
31 520 Approach [Dissertation]. Nova Southeastern University, 2013.
- 32 521 53. Tremblay-Boudreault V, Dionne CE. L'approche Delphi : Application dans la  
33 522 conception d'un outil clinique en réadaptation au travail en santé mentale. In:  
34 523 Corbière M, Larivière N, eds. Méthodes qualitatives, quantitatives et mixtes: Les  
35 524 presses de l'Université de Québec 2000.
- 36 525 54. Jones J, Hunter D. Consensus methods for medical and health services research. *British*  
37 526 *Medical Journal* 1995;311(7001):376.
- 38 527 55. Holey EA, Feeley JL, Dixon J, et al. An exploration of the use of simple statistics to  
39 528 measure consensus and stability in Delphi studies. *BMC medical research*  
40 529 *methodology* 2007;7(1):52.
- 41 530 56. Keeney S, Hasson F, McKenna H. Consulting the oracle: ten lessons from using the  
42 531 Delphi technique in nursing research. *Journal of Advanced Nursing*  
43 532 2006;53(2):205-12.
- 44 533 57. Cole ZD, Donohoe HM, Stelfson MI. Internet-based Delphi research : Case based  
45 534 discussion. *Environmental Management* 2013;51(3):511-23.
- 46 535 58. Coleen E. HealthLiteracy competencies for registered nurses : An e-Delphi study. *The*  
47 536 *Journal of Continuing Education in Nursing* 2016;47(12):558-65.

- 537 59. Harper MG, Asselin M, Kurtz AC, et al. Research Priorities for nursing professional  
538 development : A modified e-Delphi study. *Journal for Nurses in Staff Development*  
539 2012;28(3)
- 540 60. Lakeman R. Mental health recovery competencies for mental health workers : a Delphi  
541 study. *Journal of Mental Health* 2010;19(1):62-74.
- 542 61. Green H, Smith E, Poole R, et al. A Delphi study of the subjective 'rush experience' :  
543 understanding the perspective of the injecting drug user to enhance quality of drug  
544 intervention. *Journal of Substance Use* 2009;14(5):295-305.
- 545 62. Arblaster K, Mackenzie L, Matthews L, et al. Learning from consumers : An eDelphi  
546 study of Australian mental health consumers priorities for recovery-oriented  
547 curricula. *Australian Occupational Therapy Journal* 2018;65(6):586-97.
- 548 63. Desrosiers J, Larivière N. Le groupe de discussion focalisé. In: Corbière M, Larivières  
549 N, eds. Méthodes qualitatives, quantitatives et mixtes. Québec: Presses de  
550 l'Université du Québec 2014:257-81.
- 551 64. Onwuegbuzie AJ, Dickinson WB, Leech NL, et al. A qualitative framework for  
552 collecting and analyzing data in focus group research. *International Journal of*  
553 *Qualitative Methods* 2009;8(3):1-21.
- 554 65. Barbour R. Doing focus groups: Sage 2008.
- 555 66. Guest G, Namey E, McKenna K. How many focus groups are enough? Building an  
556 evidence base for nonprobability sample sizes. *Field methods* 2017;29(1):3-22.
- 557 67. Paillé P, Mucchielli A. L'analyse qualitative en sciences humaines et sociales.  
558 Quatrième édition ed. Paris: Armand Colin 2016.

559

## 560 AUTHOR'S CONTRIBUTIONS

561 AL drafted the manuscript, made the required revisions and approved the final version of  
562 the manuscript.

563

## 564 FUNDING

565 This work was supported by the first author's *Fonds d'établissement de jeune chercheur*  
566 from the Center for Interdisciplinary Research in Rehabilitation and Social Integration.

567

## 568 COMPETING INTEREST STATEMENT

569 None declared.

570

## 571 DATA AVAILABILITY STATEMENT

572 No additional data available

573

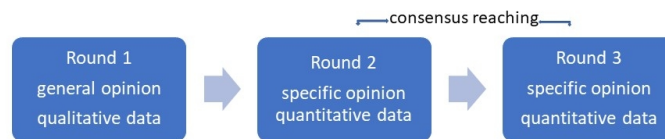


Figure 2. Description of rounds of consultation

338x190mm (96 x 96 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



# BMJ Open

## Scientific, professional and experiential validation of the Model of Preventive Behaviours at Work: Protocol of a modified Delphi study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-035606.R2
Article Type:	Protocol
Date Submitted by the Author:	01-Aug-2020
Complete List of Authors:	Lecours, Alexandra; Universite Laval Faculte de medecine, Réadaptation
<b>Primary Subject Heading</b>:	Occupational and environmental medicine
Secondary Subject Heading:	Research methods
Keywords:	OCCUPATIONAL & INDUSTRIAL MEDICINE, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, REHABILITATION MEDICINE, PUBLIC HEALTH

SCHOLARONE™  
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1 **Title:** Scientific, professional and experiential validation of the Model of Preventive  
2 Behaviours at Work: Protocol of a modified Delphi study

3  
4 To submit to: BMJ Open

5  
6 **Authors:** Lecours, Alexandra<sup>1,2</sup>

- 7 1. Département de réadaptation, Université Laval, Québec, Québec, Canada
- 8 2. Center for Interdisciplinary Research in Rehabilitation and Social Integration,  
9 Québec, Québec, Canada

10 Authors' email :

11 AL : [Alexandra.Lecours@fmed.ulaval.ca](mailto:Alexandra.Lecours@fmed.ulaval.ca) - CORRESPONDING AUTHOR

12 Université Laval

13 Pavillon Ferdinand Vandry

14 Département de réadaptation

15 1050 Avenue de la Médecine

16 Québec (Qc) G1V 0A6

17 Canada

18 1-418-656-2131 # 407422

19  
20 **Thanks:** The author thanks Guylain Breton, research trainee, for his help with the literature  
21 search.

22 **Funding:** This work was supported Fonds d'établissement de jeune chercheur from the  
23 Center for Interdisciplinary Research in Rehabilitation and Social Integration (IS120195)

24 **Key words:** Delphi study, occupational health, occupational safety, occupational well-  
25 being, conceptual model

26 **Word count (max 4000):** 3, 980 words (excluding abstract and references)

27  
28  
29  
30  
31

1  
2  
3 324  
5 336  
7 34 **Abstract**

8 35 **Introduction.** To offer an in-depth understanding of preventive behaviours, those complex  
9 36 behaviours considered as levers to foster work prevention, recent theoretical and empirical  
10 37 studies permitted to develop the Model of Preventive Behaviours at Work. The next step  
11 38 is to validate the Model with researchers, professionals, and workers. This article aims to  
12 39 describe the study protocol that will be used to validate the Model of Preventive Behaviours  
13 40 at Work.

14 41 **Methods and Analysis.** This Delphi study proposes seven systematic steps to conduct a  
15 42 scientifically rigorous validation study based on scientific and professional experts'  
16 43 opinion. A focus group to collect workers' opinion about the Model has also been included  
17 44 in the protocol. Thirty experts (researchers and professionals) will be selected regarding  
18 45 their experience (e.g. at least five years of experience) and expertise (e.g. having published  
19 46 at least one article as the first author in the last three years) towards workers' health or  
20 47 organizational behaviours. Workers will be recruited to have a diversity in terms of age,  
21 48 gender and working conditions. Quantitative data will be analyzed to calculate the  
22 49 percentage of experts' agreement on four content validity indicators (i.e.  
23 50 comprehensiveness, representativeness, relevance, clarity). Qualitative data will be  
24 51 examined through a thematic analysis strategy.

25 52 **Ethics and dissemination.** Approval of the research ethics board of the Centre intégré  
26 53 universitaire de santé et de services sociaux de la Capitale Nationale has been obtained.  
27 54 Findings will be shared with various stakeholders inclusive of researchers, professionals,  
28 55 and workers. Findings will be disseminated in workshops, peer-reviewed journals and  
29 56 conferences.

30 57

31 58

32 59

33 60

34 61

35 62

1  
2  
3 634  
5 646 **Strengths and limitations of this study**7  
8 66 • The proposed method includes scientific, professional and experiential knowledge,  
9 67 which is innovative and timely.10 68 • An entire research step is dedicated to the involvement of the public, this  
11 69 maximizing the relevance of the study results.12 70 • The proposed research design doesn't permit obtaining a statistical validation of the  
13 71 Model of Preventive Behaviours at Work; further studies are required.

## 72 INTRODUCTION.

73 The number of people in employment is growing in industrialized societies. For example,  
74 the Canadian labour force grew from 15.8 to 20.2 million workers between 2000 and 2019,  
75 which represents an increase of near than 28% <sup>1</sup>. Recognized as a determinant of health <sup>2</sup>  
76 <sup>3</sup>, work may have positive effects on the health, safety and well-being of people, as it may  
77 contribute to financial health, social recognition or protection against declining skills <sup>4</sup>.  
78 When a work-related health problem occurs, whether it is an accident, a physical illness or  
79 a transient mental disorder, the negative consequences are harmful not only for workers  
80 and families, but also for work organizations, by reducing performance and productivity <sup>5</sup>.  
81 The societal impacts are also impressive with an estimated amount of over \$ 250 billion in  
82 the US to cover annual costs related to work-related health problems <sup>6</sup>.  
83 It is then important to focus on the determinants of workers' health, safety, and well-being.  
84 The literature suggests that factors related to healthcare services, compensation systems,  
85 work organizations, as well as to workers themselves would influence the prevention of  
86 the occurrence, relapse, and prolonged disability related to work-related health problems <sup>7-</sup>  
87 <sup>9</sup>. Considering worker-related factors, the preventive behaviours they may adopt would  
88 play an important role in workplace health, safety, and well-being <sup>10-13</sup>. Indeed, the  
89 influence of these behaviours on the risk of work-related health problems has been  
90 demonstrated in several studies conducted with various workers' populations <sup>10 14 15</sup>.  
91 Considered as levers to promote workers' health, safety and well-being, these preventive  
92 behaviours are complex, and literature lacks a concrete definition of them <sup>16</sup>. To offer an  
93 in-depth understanding of preventive behaviours, recent theoretical and empirical studies  
94 have permitted proposing the Model of Preventive Behaviours at Work<sup>16</sup>. This Model  
95 defines the behaviours workers may adopt to foster their own health, safety and well-being,  
96 and their colleagues'.

97 The Model shows six major preventive behaviours, which are 1) *adopting a reflective*  
98 *practice* (e.g. analyzing work situations, identifying risks, and taking decisions about one's  
99 health); 2) *complying with rules and procedures* (e.g. respecting work-related procedures  
100 or wearing personal protective equipment), 3) *participating, involving and taking*  
101 *initiatives for prevention* (e.g. involving in health and safety committees or seeking help  
102 from available resources), 4) *caring about others* (e.g. team working or listening to each

1  
2  
3 103 other), 5) *communicating* (e.g. expressing one's needs or limits) and 6) *adopting a healthy*  
4 104 *lifestyle* (e.g. having lifestyle balance or exercising).

5  
6 105 The Model of Preventive Behaviours at Work presents a systemic and multifactorial view  
7 106 of preventive behaviours. These behaviours are largely influenced by contextual factors  
8 107 related to workers themselves, occupation of work or environment. These contextual  
9 108 factors have an impact on the ability of workers to engage in preventive behaviours. Thus,  
10 109 in addition to being interested in the concrete behaviours, the Model focuses on the factors  
11 110 upstream of the manifestation of a behaviour, on the context in which workers adopt  
12 111 behaviours. The Model also considers the consequences following the manifestation of  
13 112 behaviours. These consequences are generally positive for workers themselves (e.g. health,  
14 113 safety and well-being) as well as for the organization (e.g. work climate). The Model  
15 114 reflects the dynamic interaction and multiple influences between 1) contextual factors, 2)  
16 115 workers' engagement in preventive behaviours, 3) and outcomes. This Model was  
17 116 developed after conducting three theoretical<sup>17</sup> and empirical<sup>18-20</sup> studies. The development  
18 117 process and visual representation of the Model are detailed elsewhere<sup>16</sup>.

19 118 Regarding occupational health, several of the current models focus only on one aspect of  
20 119 the health of workers, whether physical<sup>e.g.17</sup> or mental<sup>e.g. 21</sup>. In accordance with the vision  
21 120 of health proposed by the World Health Organization<sup>22</sup>, the Model of Preventive  
22 121 Behaviours at Work suggests a holistic vision of the health of workers, inclusive of the  
23 122 physical, mental and social aspects. This holistic understanding of health reflects in  
24 123 contextual factors, preventive behaviours and outcomes. In addition, the focus of the Model  
25 124 rests on the engagement of workers in preventive behaviour at work. This angle is  
26 125 innovative since most of the current models focus on the actions the organization may have  
27 126 on workers' health<sup>e.g.23</sup>, giving them a mostly passive role. Since the management of  
28 127 occupational health, safety and well-being must be shared by everyone involved in an  
29 128 organization<sup>24-27</sup>, this Model helps to better explain the active role workers may have.  
30 129 Designed to be applicable to the reality of workers, regardless of the nature of their work  
31 130 or health, this Model can also help to understand the factors that influence workers'  
32 131 engagement in preventive behaviours and the resulting effects on health, safety and well-  
33 132 being.



1  
2  
3 133 To increase its scientific validity, to maximize its use in professional settings, and  
4 134 ultimately to foster workers' health, safety and well-being, the next step is to validate the  
5 135 Model. Literature offers a large spectrum of conceptual model validation study designs.  
6  
7 136 Over the years, the Delphi technique has been used in various validation studies, but most  
8  
9 137 of the published articles focused on results, while validation protocols remain more or less  
10  
11 138 detailed, making difficult replicating studies. Furthermore, authors have criticized the lack  
12  
13 139 of clear guidelines in the current writing surrounding the use of the Delphi technique, which  
14  
15 140 may lead to a lack of scientific rigour <sup>28 29</sup>. To fill these gaps, the aim of this article is to  
16  
17 141 describe the study protocol that will be used to validate the Model of Preventive Behaviours  
18  
19 142 at Work.

20 143

## 21 144 **METHOD AND ANALYSIS.**

### 22 145 **Design**

23  
24  
25 146 Created in the middle of the 18<sup>th</sup> century <sup>30</sup> and used in health sciences since the 70s <sup>31</sup>, the  
26  
27 147 Delphi technique is recognized as an efficient way to structure communication processes  
28  
29 148 allowing individuals to work on a complex subject <sup>32</sup>, which is the case of the Model of  
30  
31 149 Preventive Behaviours at Work. Since this Model is emerging, a first step of validation  
32  
33 150 with experts will make it possible to appreciate its acceptability <sup>29</sup> from the scientific  
34  
35 151 community and its applicability from the knowledge users, which are professionals and  
36  
37 152 workers. The main advantage of the Delphi technique is that communications take place  
38  
39 153 remotely, allowing the recruitment of experts from all over the planet <sup>28 33</sup>. Disadvantages  
40  
41 154 noted in the scientific literature relate to the lack of consensus on the definition of an expert  
42  
43 155 and on how to rule on the consensus's adoption <sup>33-35</sup>. The limited implication of knowledge  
44  
45 156 users in Delphi studies is also a weak point of the actual method <sup>29</sup>. The method can also  
46  
47 157 take a considerable amount of time from the participants, which can discourage them from  
48  
49 158 getting involved <sup>28 36 37</sup>. Finally, many variants of the original method have been used in  
50  
51 159 published studies <sup>29</sup>, but lack of justification for the changes made and lack of details in  
52  
53 160 protocols contribute to creating ambiguities in the guidelines to follow <sup>28 29</sup>. Our wish in  
54  
55 161 drafting this protocol is to bring clarity to these elements of the study design.

56 162

### 57 163 **Procedure and analysis**

164 The Delphi technique will be used to obtain consensus from scientific, professional and  
 165 experiential experts on content validity indicators, which are: 1) *comprehensiveness* of the  
 166 model structure, 2) *representativeness* to the content domain, 3) *relevance* of the model  
 167 components and 4) *clarity* of the model components and links. These indicators were  
 168 recommended according to writing on content validity<sup>38-41</sup>. The study design proposes  
 169 seven systematic steps to conduct a scientifically rigorous validation study (see table 1).  
 170 The expected duration of the study is 12 months, beginning in the summer 2020.

172 Table 1. Systematic steps of the study design

<b>Step 1</b>	Elaborate selection criteria for scientific and professional experts
<b>Step 2</b>	Make scientific and professional experts list
<b>Step 3</b>	Contact scientific and professional experts
<b>Step 4</b>	Administrate questionnaires
<b>Step 5</b>	Synthesize answers
<b>Step 6</b>	Consult experiential experts
<b>Step 7</b>	Final analysis and publication

173  
 174 To validate the Model according to a) scientific, b) professional and c) experiential  
 175 expertise, participants from the following three categories will be recruited a) researchers,  
 176 b) professionals, and c) workers. The boundaries between these expertises are however  
 177 permeable; the experts will be invited to give their opinion on the various indicators  
 178 according to their overall expertise. For example, even if professionals are recruited on the  
 179 basis of their technical and specialized experience with workers, it is also possible that  
 180 scientific or experiential knowledge influence their contribution. It is hoped that this  
 181 validation study will be carried out using rich and diversified expertise.

182  
 183 *Elaborate selection criteria for scientific and professional experts.*

184 The quality of a study using the Delphi technique mainly rests on the choice of experts<sup>29</sup>  
 185<sup>37 42</sup>. Indeed, since the opinion of these will serve to generate the results of the study, their  
 186 selection must be judicious. Currently, there is no recognized definition of “who is an

187 expert” and no universal criteria for structuring the choice of experts<sup>33-35</sup>. The researcher's  
188 judgment is solicited to determine criteria that will enable her / him to select the people  
189 most likely to contribute to meeting the research objective<sup>28 35 37</sup>.

190 The first steps of the protocol imply to select researchers and professionals. A list of  
191 inclusion criteria was established based on information available in scientific literature.

#### 192 Researchers.

193 Expertise seems to be the main criteria to select researchers<sup>37</sup>. For the success of a Delphi  
194 study, experts must have a thorough knowledge of the subject<sup>43</sup>. For the current study,  
195 researchers with expertise in the field of workers’ health or organizational behaviours will  
196 be targeted. It will be possible to select experts in various disciplines such as industrial  
197 psychology, ergonomics, occupational therapy, occupational medicine or human resource  
198 management because the Model of Preventive Behaviours at Work was developed  
199 according to that literature<sup>16</sup>.

200 To select researchers, the evaluation of the relevance of their published scientific papers  
201 related to the subject of our study will be used. This systematic selection method is cited  
202 in many manuscripts<sup>35 44 45</sup>. A researcher will be identified to be part of the panel of experts  
203 if she / he has published at least one relevant article, as the first author, in the last three  
204 years<sup>46</sup>. This published article should specifically concern prevention at work.

#### 205 Professionals.

206 Since the Model of Preventive Behaviours at Work is expected to be used in practical  
207 settings, we chose to include professionals in the validation process. Although some  
208 authors do not recommend including the participation of professionals for emerging  
209 concept validation<sup>42</sup>, literature in the field of health mostly recommends including  
210 professionals in the panel of experts<sup>47 34 48 49</sup>.

211 Work experience in the field of study seems to be the criterion most often used to select  
212 professionals<sup>43 48</sup>. For our study, a variety of professionals (i.e. ergonomists, industrial  
213 psychologists, occupational therapists, occupational physicians or human resources  
214 managers) will be recruited if they have at least five years of experience in relation with  
215 workers.

216

217 *Make scientific and professional experts list*

1  
2  
3 218 To recruit researchers based on their published articles, the following scholarly journals  
4 219 will be consulted: a) Work, b) Journal of Occupational and Organizational Psychology,  
5 220 and c) Safety Science. These journals are targeted because of their readership profile, the  
6  
7 221 number of researchers contributing to it, and the topics that are relevant to our research  
8  
9 222 project <sup>42</sup>. Indeed, these journals have a wide vision of the thematic of work and include  
10  
11 223 articles from various disciplines and fields of research. The journal numbers published in  
12  
13 224 the last three years will be consulted one by one. The articles that seem to have a link with  
14  
15 225 the subject of study according to their title and keywords will be retained. The abstract of  
16  
17 226 these articles will then be read to confirm the author's relevance to the research project. If  
18  
19 227 needed, the ResearchGate and personal web pages of researchers will be consulted to  
20  
21 228 deepen the analysis and make sure of their potential contribution to this validation study.  
22  
23 229 For feasibility reasons, only three journals will be extensively screened. However, each of  
24  
25 230 the experts identified in this first screening step will be invited to suggest other potential  
26  
27 231 experts during the first contact. If those suggested experts meet the inclusion criteria, they  
28  
29 232 will be added to the list of potential experts. This second selection step using the snowball  
30  
31 233 method will allow identifying experts who can contribute validating the Model, even if  
32  
33 234 they have not published articles in the targeted journals.

34 235 Recruitment of professionals will be done in two stages. First, participants meeting the  
35  
36 236 inclusion criteria will be identified in the author's network. Subsequently, the snowball  
37  
38 237 method will be used to expand the pool of experts.

39 238 Particular attention will be paid to recruiting experts of different ages, genders, work  
40  
41 239 environments and geographic origins. An Excel table will be constructed to gather relevant  
42  
43 240 information about potential experts, such as the level of training, area of expertise,  
44  
45 241 affiliation, email address and country <sup>42</sup>.

46 242 The number of experts to recruit is not established in the actual literature <sup>37 47</sup>. Even if some  
47  
48 243 Delphi study were conducted with more than 1500 participants <sup>36</sup>, they mainly include 10  
49  
50 244 to 20 participants <sup>37 50</sup>. The size of the group has an importance for the stability of the  
51  
52 245 results. Indeed, with a smaller group, an expert has a greater influence on the result since  
53  
54 246 her / his opinion occupies a larger proportion of the consensus <sup>47</sup>. On the other hand, it is  
55  
56 247 more complex and costly to consult with a large number of experts <sup>28 37</sup>.

248 For our study, we plan to recruit 30 experts: 15 researchers and 15 professionals.  
249 Considering the attrition of participants during the study, this number seems adequate.

250

### 251 *Contact scientific and professional experts*

252 After having made a list of potential experts to recruit for the consultation, it is time to  
253 invite them. Nowadays, email seems to be the most frequent way to contact experts.  
254 Authors suggest sending a detailed message to invite experts<sup>28 33 34 42 48 51</sup>. The message  
255 will contain the following information: presentation of the researcher responsible of the  
256 study, description of the study, reasons for the selection of the expert, procedures to be  
257 followed to participate to the consultation, estimation of the time required, expectations  
258 regarding the expert (including the importance of participating in all the rounds of the  
259 consultation), promise of anonymity, and participation recognition<sup>28 33 34 42 48 51</sup>.

260

### 261 *Administrate questionnaires*

262 The first questionnaire allows experts to express their opinion on the subject to study<sup>29</sup>.  
263 The purpose of this first questionnaire is often to provide an overview of the experts'  
264 opinion on the subject of study and then to determine the elements to be studied in the  
265 subsequent questionnaires. Basic open-ended questions are required to cover the entire  
266 subject<sup>34 47 52</sup>. Since these open-ended questions are likely to generate a great deal of  
267 information<sup>52</sup>, it is suggested to limit the number of questions in this first questionnaire<sup>29</sup>  
268<sup>30</sup>. For example, the first questionnaire of our consultation will contain four large questions  
269 about the indicators of content validity (i.e. comprehensiveness, representativeness,  
270 relevance, clarity) in relation with the Model of Preventive Behaviours at Work and its  
271 components. As suggested in the literature, we will also add a fifth question to permit  
272 experts to freely add information they find relevant about the subject<sup>29</sup>. In order to ensure  
273 the questionnaire clarity, a pretest will be done with four experts (two researchers and two  
274 professionals), as suggested by many authors who published about the Delphi technique<sup>28</sup>  
275<sup>34 36 53</sup>. The qualitative data gathered with this first questionnaire will be analyzed with a  
276 thematic analysis strategy using the QDA Miner software. This will permit to determine  
277 the content of the subsequent consultation rounds.

1  
2  
3 278 The second questionnaire (and the following, if applicable) will first summarize the  
4  
5 279 opinions found in the previous questionnaire <sup>37 51</sup>. After that, the idea is to document  
6  
7 280 experts' opinion on more specific elements, generally with closed questions <sup>34</sup>. The opinion  
8  
9 281 will often be documented using Likert type scales, with the aim to obtain a consensus of  
10  
11 282 experts <sup>37 51</sup>. For example, elements related to the four content validity indicators that  
12  
13 283 emerged from the analysis of the first questionnaire will be assessed by experts on a 4-  
14  
15 284 point Likert scale (e.g. Clarity : 1- this element is not clear, 2- this element needs major  
16  
17 285 revisions to be clear, 3- this element needs minor revisions to be clear, 4- this element is  
18  
19 286 clear). The iteration process and the return on the information offered to the experts will  
20  
21 287 allow them to reconsider their opinion in the light of that of the others, thus convince  
22  
23 288 toward a consensus. The anonymity provided by the method facilitates this process <sup>54</sup>. The  
24  
25 289 quantitative data gathered with the administration of the second questionnaire, and the  
26  
27 290 following, will be analyzed with descriptive statistics, using the SPSS software.  
28  
29 291 Nowadays, web questionnaires are preferred to postal ones <sup>29</sup>. We will also follow this  
30  
31 292 tendency in our study.

### 293 294 *Synthesize answers*

32  
33 295 This research step comprises the crucial moment of the determination of the consensus of  
34  
35 296 experts about the different components of the Model of Preventive Behaviours at Work.  
36  
37 297 Paradoxically, literature doesn't offer a consensus about the definition of the consensus <sup>28</sup>  
38  
39 298 <sup>33 36 47 53</sup>. The consensus, which is the agreement between the experts, may be defined in  
40  
41 299 different ways, such as a measure of central tendency of experts' quantitative responses,  
42  
43 300 the stability in experts' responses between the rounds of consultation, or a subjective  
44  
45 301 measure of general opinion <sup>55</sup>. Given the lack of a clear rule on the definition of consensus,  
46  
47 302 it is important for researchers conducting a Delphi study to define this agreement in an  
48  
49 303 operational manner before starting the consultation <sup>29 56</sup>. The chosen definition of the  
50  
51 304 consensus is to impact on the number of required rounds to obtain this agreement between  
52  
53 305 the experts.  
54  
55 306 Using a percentage of agreement would be the most common way to rule on consensus <sup>36</sup>.  
56  
57 307 However, the percentage to be reached to obtain a consensus varies considerably across  
58  
59 308 studies, ranging from 51% to 100% <sup>28 33 36 37</sup>. A 100% consensus may be impossible to



1  
2  
3 309 achieve, and often not necessary<sup>33</sup>. Although aiming to reach a high percentage of  
4 310 agreement permits to ensure the agreement between the experts, it may result in the need  
5 311 to add several consultation rounds. To have a sufficiently discriminating percentage  
6 312 without excessively lengthening the time of realization of the study, we will set it at 80%.  
7  
8 313 We will use the following rules to monitor consensus: a) if 80 % of experts give an element  
9 314 the rating of 4 on the 4-point Likert scale, we consider that a consensus was obtained on  
10 315 this element and it will be kept in the Model; b) if 80 % of experts give an element the  
11 316 rating of 1 on the 4-point Likert scale, we consider that a consensus was obtained on this  
12 317 element and it will be removed from the Model; c) for elements having mostly been rated  
13 318 2 or 3 on the 4-point Likert scale, modification will be made according to experts' opinion  
14 319 and these elements will be submitted to the following round of consultation.  
15  
16  
17  
18  
19  
20  
21  
22 320  
23

24 321 *Insert figure 2 here*

25 322 Figure 1. Description of rounds of consultation  
26  
27 323

28  
29 324 Literature suggests two or three rounds are needed to reach the consensus<sup>33</sup>. We a priori  
30 325 plan to realize three rounds, as shown in figure 1. We will give experts two weeks to answer  
31 326 a questionnaire, as suggested by others<sup>37 57-59</sup>. The total time to complete the collection of  
32 327 data can therefore be spread out over a few weeks depending on the number of rounds to  
33 328 be made.  
34  
35  
36  
37  
38 329

### 39 330 *Consult experiential experts*

40  
41 331 A last consultation step will be conducted with experiential experts, namely workers in this  
42 332 study. While not common in Delphi studies, this decision to include people having  
43 333 experienced a condition has been suggested by other authors who had conducted health-  
44 334 related studies<sup>36 60 61 62</sup>. This permits to favour the involvement of a variety of stakeholders.  
45 335 The consultation will take the form of a focus group<sup>63</sup>. The purpose of the consultation  
46 336 will be to verify the applicability of the results obtained, the relevance with the current  
47 337 work context, and the face validity of the Model.  
48  
49  
50  
51  
52

53 338 Groups of eight workers will be formed. This number of participants per group is large  
54 339 enough to get rich discussions<sup>63</sup> and small enough to let all participants express themselves  
55  
56  
57  
58  
59  
60



340 <sup>64</sup>. Participants will be recruited to have a diversity in terms of ages, genders and working  
341 conditions (e.g. type of work, full-time vs. part-time, etc.). In a two-hour discussion, results  
342 of the consultation with scientific and professional experts will be exposed to workers.  
343 Different indicators will be discussed, such as facilitators and obstacles for the usability of  
344 the Model or relevance of its components to the reality of workers. The group facilitation  
345 guide will be developed for the purpose of this study and validated by a pre-test with two  
346 people having the same characteristics as the participants. The number of groups to be  
347 conducted will be defined throughout the study until data reveals a redundancy in the  
348 meaning of the ideas shared by the participants <sup>65</sup>. It is estimated that two or three groups  
349 will be required to reach data saturation <sup>66</sup>. After fully transcribing the data and importing  
350 it into the QDA Miner software, a thematic analysis strategy in four stages will be followed  
351 <sup>67</sup>: 1) repeated readings of the data corpus to develop a feeling of immersion; 2) initial  
352 coding (descriptive codes "in vivo" will be assigned to the meaning units found in the  
353 corpus); 3) conception of a code tree (the codes [micro level] will be grouped into  
354 categories [meso level] and / or themes [macro level]); 4) finalization of the code tree by  
355 going back and forth between the raw data and the general structure to clarify and interpret  
356 the data while respecting the experience of the participants. To ensure scientific rigour, the  
357 thematic analysis process will be carried out by two people and the inter-judge agreement  
358 will be periodically checked. This last consultation step will provide nuances to the study  
359 results.

360

### 361 *Final analysis and publication*

362 Once the analysis of all collected data and the consensus reached, a summary of the results  
363 will be transmitted to each expert who took part in the study, namely the researchers, the  
364 professionals and the workers. The experts will be free to comment on these findings,  
365 which may help to enhance reflection about the validity of the Model of Preventive  
366 Behaviours at Work.

367

### 368 **Patient and public involvement**

369 To support co-production of knowledge, this study proposes to actively involve various  
370 stakeholders in the different steps. In fact, professional experts' opinion will be gathered

371 by questionnaire to confirm or improve the Model. As these persons will be likely to use  
372 the Model in their practice, building the study around their opinion will improve the  
373 relevance of the Model and increase the likelihood that it will be used to guide interventions  
374 about preventive behaviours at work. Stakeholders will also be involved in the recruitment  
375 of participants using the snowball method. The protocol also proposes to add an innovative  
376 and timely step to the validation process using the Delphi technique. In fact, the  
377 consultation step with experiential experts, namely workers in this study, will allow  
378 including the perceptions and experiences of the public in the interpretation of results.

### 380 ETHICS AND DISSEMINATION.

381 Approval of the research ethics board of the Centre intégré universitaire de santé et de  
382 services sociaux de la Capitale Nationale has been obtained (project 2020-1919). The  
383 preponderant involvement of various stakeholders throughout the study will offer the  
384 possibility of start disseminating results during conducting the study. Following that,  
385 diverse activities will take place to transfer knowledge. For examples, scientific papers will  
386 be published, and conferences held to share results with researchers. Workshops will be  
387 organized with professionals. Popular science conferences are also planned to disseminate  
388 the results of the study to the general public.

### 390 REFERENCES

- 391 1. Statistics Canada. Labour force characteristics by province, monthly, seasonally adjusted 2019  
392 [Available from:  
393 <https://www150.statcan.gc.ca/t1/tbl1/fr/cv.action?pid=1410028703#timeframe>.
- 394 2. OMS. Charte d'Ottawa pour la promotion de la santé. Ottawa, 1986.
- 395 3. Wilcock AA, Hocking C. An occupational perspective of health. 3 ed. Thorofare, NJ, USA: SLACK  
396 Incorporated 2015.
- 397 4. Bosma H, Van Boxtel M, Ponds R, et al. Education and age-related cognitive decline: the  
398 contribution of mental workload. *Educational gerontology* 2003;29(2):165-73.
- 399 5. Demerouti E, Bakker AB, Halbesleben JRB. Productive and counterproductive job crafting: A  
400 daily diary study. *Journal of Occupational Health Psychology* 2015;20(4):457-69. doi:  
401 10.1037/a0039002
- 402 6. Leigh JP. Economic burden of occupational injury and illness in the United States. *Milbank*  
403 *Quarterly* 2011;89(4):728-72. doi: 10.1111/j.1468-0009.2011.00648.x
- 404 7. Robichaud M-M. Retour au travail à la suite d'une lésion professionnelle : perspective des  
405 intervenants en réadaptation du système d'indemnisation public. Université Laval, 2016.
- 406 8. Durand M-J, Loisel P, Hong QN, et al. Helping clinicians in work disability prevention: the work  
407 disability diagnosis interview. *Journal of Occupational Rehabilitation* 2002;12(3):191-204.

- 1  
2  
3 408 9. Loisel P, Durand M-J, Berthelette D, et al. Disability prevention. *Disease Management and*  
4 409 *Health Outcomes* 2001;9(7):351-60.
- 5 410 10. Roy M, Cadieux J, Forter L, et al. Validation d'un outil d'autodiagnostic et d'un modèle de  
6 411 progression de la mesure en santé et sécurité du travail. Montréal: IRSST, 2008:28.
- 7 412 11. Akselsson R, Jacobsson A, Bötjesson M, et al. Efficient and effective learning for safety from  
8 413 incidents. *Work* 2012;41:3216-22.
- 9 414 12. Simard M, Marchand A. The behaviour of first-line supervisors in accident prevention and  
10 415 effectiveness in occupational safety. *Safety Science* 1994;17(3):169-85. doi:  
11 416 10.1016/0925-7535(94)90010-8
- 12 417 13. Cossette R. Le comportement sécuritaire, un modèle qui pourrait rallier deux écoles de  
13 418 pensée. *Travail et Santé* 2013;29(1):6-9.
- 14 419 14. Roy M, Desmarais L, Cadieux J. Améliorer la performance en SST : les résultats vs les  
15 420 prédicteurs. *Pistes* 2005;7(2):On line.
- 16 421 15. Johnson SE. The predictive validity of safety climate. *Journal of Safety Research*  
17 422 2007;38(5):511-21. doi: 10.1016/j.jsr.2007.07.001
- 18 423 16. Lecours A. Using an occupational perspective to understand behaviours fostering the  
19 424 prevention of work-related health problems: A proposed conceptual model. *Journal of*  
20 425 *Occupational Science* 2020;27(2):222-35. doi: 10.1080/14427591.2019.1600575
- 21 426 17. Lecours A, Therriault P-Y. Preventive behavior at work - A concept analysis. *Scandinavian*  
22 427 *Journal of Occupational Therapy* 2017;24(4):1-10. doi: 10.1080/11038128.2016.1242649
- 23 428 18. Lecours A, Therriault P-Y. Habilitier les travailleurs à la prévention : description des pratiques  
24 429 des ergothérapeutes visant la mise en place des antécédents du comportement préventif  
25 430 au travail. *Revue francophone de recherche en ergothérapie* 2019;5(1):59-79. doi:  
26 431 10.13096/rfre.v5n1.97
- 27 432 19. Lecours A, Therriault P-Y. Development of preventive behavior at work : description of  
28 433 occupational therapists' practice. *Work* 2018;61(3):477-88. doi:  
29 434 <http://dx.doi.org/10.3233/WOR-182811>
- 30 435 20. Lecours A, St-Hilaire F, Daneau P. How to move toward an integrated prevention approach in  
31 436 mental health at work? Promoting workers' commitment through concrete actions.  
32 437 accepted
- 33 438 21. Demerouti E, Bakker AB, Nachreiner F, et al. The job demands-resources model of burnout.  
34 439 *Journal of Applied psychology* 2001;86(3):499.
- 35 440 22. OMS, ed. Préambule à la Constitution Conférence internationale sur la Santé; 1946; New York.
- 36 441 23. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *Journal of Occupational*  
37 442 *Health Psychology* 1996;1(1):27.
- 38 443 24. Lowe GS. Creating healthy organizations: How vibrant workplaces inspire employees to  
39 444 achieve sustainable success: University of Toronto Press 2010.
- 40 445 25. Shain M, Kramer DM. Health promotion in the workplace: framing the concept reviewing the  
41 446 evidence *Occupational and Environmental Medicine* 2004;61(7):643. doi:  
42 447 10.1136/oem.2004.013193
- 43 448 26. OMS. Plan d'action mondiale pour la santé des travailleurs 2008-2017. In: Soixantième  
44 449 assemblée mondiale de la santé, ed., 2007:12.
- 45 450 27. Éditeur officiel du Québec. Loi sur la santé et la sécurité du travail. In: Gouvernement du  
46 451 Québec, ed. Québec, 2017.
- 47 452 28. Vernon W. The Delphi technique: A review. *International Journal of Therapy & Rehabilitation*  
48 453 2009;Feb 2009
- 49 454 29. Tremblay-Boudreault V, Dionne CE. L'approche Delphi. Application dans la conception d'un  
50 455 outil clinique en réadaptation au travail en santé mentale. In: Corbière M, Larivière N, eds.

- 1  
2  
3 456 Méthodes qualitatives, quantitatives et mixtes. Québec: Presses de l'Université du  
4 457 Québec 2014:283-303.
- 5 458 30. Couper MR. The Delphi technique: characteristics and sequence model. *Advances in Nursing*  
6 459 *Science* 1984;7(1):72-77.
- 7 460 31. Powell C. The Delphi technique: myths and realities. *Journal of Advanced Nursing*  
8 461 2003;41(4):376-82.
- 9 462 32. Linstone HA, Turoff M. The Delphi method: Addison-Wesley Reading, MA 1975.
- 10 463 33. Pherson S, Reese C, Wendler MC. Methodology update : Delphi Studies. *Nursing Research*  
11 464 2018;67(5)
- 12 465 34. Hohmann E, Cote MP, Brand JC. Research pearls : Expert consensus based evidence using the  
13 466 delphi method. *Arthroscopy : The Journal of Arthroscopic and Related Surgery*  
14 467 2018;34(12):3278-82.
- 15 468 35. Baker J, Lovell K, Harris N. How expert are the experts? An exploration of the concept of  
16 469 'expert' within Delphi panel techniques. *Nurse Researcher* 2006;14(1)
- 17 470 36. Powell C. The Delphi technique : myths and realities. *Journal of Advanced Nursing*  
18 471 2003;41(4):376-82.
- 19 472 37. Hsu C-C, Sanford BA. The Delphi technique : Making sense of consensus. *Practical Assessment,*  
20 473 *Research & Evaluation* 2007;12(10)
- 21 474 38. Grant JS, Davis LL. Selection and use of content experts for instrument development. *Research*  
22 475 *in nursing & health* 1997;20(3):269-74.
- 23 476 39. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported?  
24 477 Critique and recommendations. *Research in Nursing & Health* 2006;29(5):489-97.
- 25 478 40. Lynn MR. Determination and quantification of content validity. *Nursing Research* 1986
- 26 479 41. Rubio DM, Berg-Weger M, Tebb SS, et al. Objectifying content validity: Conducting a content  
27 480 validity study in social work research. *Social Work Research* 2003;27(2):94-104.
- 28 481 42. Ekionea J-PB, Bernard P, Plaisent M. Consensus par la méthode Delphi sur les concepts clés  
29 482 des capacités organisationnelles spécifiques de la gestion des connaissances. *Recherche*  
30 483 *Qualitatives* 2011;29(3):168-92.
- 31 484 43. Ford TE. A national Delphi study examining the feasibility of universal access to health and  
32 485 medical care in the United States. University of La Verne, 2002.
- 33 486 44. Zerem E. The ranking of scientists based on scientific publications assessment. 2017;Journal  
34 487 of Biomedical Informatics(75):107-09.
- 35 488 45. Steurer J. The Delphi method: an efficient procedure to generate knowledge. *Skeletal*  
36 489 *Radiology* 2011;40(8):959-61. doi: 10.1007/s00256-011-1145-z
- 37 490 46. Graham B, Regehr G, Wright J. Delphi as a method to establish consensus for diagnostic  
38 491 criteria. *Journal of Clinical Epidemiology* 2003;56(12):1150-56.
- 39 492 47. Jorm AF. Using the Delphi expert consensus method in mental health research. *Australian &*  
40 493 *New Zealand Journal of Psychiatry* 2015
- 41 494 48. H. Dari T. Development and validation of community-based participatory research  
42 495 competencies: A Delphi study [Dissertation]. University of Toledo, 2017.
- 43 496 49. Wendimagegn NF, Bezuidenhout M. The integrated health service model: the approach to  
44 497 restrain the vicious cycle to chronic diseases. *BMC Health Services Research (BMC HEALTH*  
45 498 *SERV RES)* 2019;19(1) doi: [http://dx.doi.org.acces.bibl.ulaval.ca/10.1186/s12913-019-](http://dx.doi.org.acces.bibl.ulaval.ca/10.1186/s12913-019-4179-x)  
46 499 [4179-x](http://dx.doi.org.acces.bibl.ulaval.ca/10.1186/s12913-019-4179-x)
- 47 500 50. Hara Y. Brain plasticity and rehabilitation in stroke patients. *Journal of Nippon Medical School*  
48 501 2015;82(1):4-13. doi: 10.1272/jnms.82.4 [published Online First: 2015/03/24]
- 49 502 51. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *Journal*  
50 503 *of Advanced Nursing* 2000;32(4):1008-15.

- 1  
2  
3 504 52. Cwalina AM. Organizational Practices Leading to a Positive Safety Culture : A Delphi Approach  
4 505 [Dissertation]. Nova Southeastern University, 2013.
- 5 506 53. Tremblay-Boudreault V, Dionne CE. L'approche Delphi : Application dans la conception d'un  
6 507 outil clinique en réadaptation au travail en santé mentale. In: Corbière M, Larivière N, eds.  
7 508 Méthodes qualitatives, quantitatives et mixtes: Les presses de l'Université de Québec  
8 509 2000.
- 9 510 54. Jones J, Hunter D. Consensus methods for medical and health services research. *British*  
10 511 *Medical Journal* 1995;311(7001):376.
- 11 512 55. Holey EA, Feeley JL, Dixon J, et al. An exploration of the use of simple statistics to measure  
12 513 consensus and stability in Delphi studies. *BMC medical research methodology*  
13 514 2007;7(1):52.
- 14 515 56. Keeney S, Hasson F, McKenna H. Consulting the oracle: ten lessons from using the Delphi  
15 516 technique in nursing research. *Journal of Advanced Nursing* 2006;53(2):205-12.
- 16 517 57. Cole ZD, Donohoe HM, Stellefson MI. Internet-based Delphi research : Case based discussion.  
17 518 *Environmental Management* 2013;51(3):511-23.
- 18 519 58. Coleen E. HealthLiteracy competencies for registered nurses : An e-Delphi study. *The Journal*  
19 520 *of Continuing Education in Nursing* 2016;47(12):558-65.
- 20 521 59. Harper MG, Asselin M, Kurtz AC, et al. Research Priorities for nursing professional  
21 522 development : A modified e-Delphi study. *Journal for Nurses in Staff Development*  
22 523 2012;28(3)
- 23 524 60. Lakeman R. Mental health recovery competencies for mental health workers : a Delphi study.  
24 525 *Journal of Mental Health* 2010;19(1):62-74.
- 25 526 61. Green H, Smith E, Poole R, et al. A Delphi study of the subjective 'rush experience :  
26 527 understanding the perspective of the injecting drug user to enhance quality of drug  
27 528 intervention. *Journal of Substance Use* 2009;14(5):295-305.
- 28 529 62. Arblaster K, Mackenzie L, Matthews L, et al. Learning from consumers : An eDelphi study of  
29 530 Australian mental health consumers priorities for recovery-oriented curricula. *Australian*  
30 531 *Occupational Therapy Journal* 2018;65(6):586-97.
- 31 532 63. Desrosiers J, Larivière N. Le groupe de discussion focalisé. In: Corbière M, Larivières N, eds.  
32 533 Méthodes qualitatives, quantitatives et mixtes. Québec: Presses de l'Université du  
33 534 Québec 2014:257-81.
- 34 535 64. Onwuegbuzie AJ, Dickinson WB, Leech NL, et al. A qualitative framework for collecting and  
35 536 analyzing data in focus group research. *International Journal of Qualitative Methods*  
36 537 2009;8(3):1-21.
- 37 538 65. Barbour R. Doing focus groups: Sage 2008.
- 38 539 66. Guest G, Namey E, McKenna K. How many focus groups are enough? Building an evidence  
39 540 base for nonprobability sample sizes. *Field methods* 2017;29(1):3-22.
- 40 541 67. Paillé P, Mucchielli A. L'analyse qualitative en sciences humaines et sociales. Quatrième  
41 542 édition ed. Paris: Armand Colin 2016.

543

## 544 AUTHOR'S CONTRIBUTIONS

545 AL drafted the manuscript, made the required revisions and approved the final version of  
546 the manuscript.

547



1  
2  
3 548 **FUNDING**

4  
5 549 This work was supported by the first author's *Fonds d'établissement de jeune chercheur*  
6  
7 550 from the Center for Interdisciplinary Research in Rehabilitation and Social Integration.

8  
9 551

10 552 **COMPETING INTEREST STATEMENT**

11  
12 553 None declared.

13  
14 554

15 555 **DATA AVAILABILITY STATEMENT**

16  
17 556 No additional data available

18  
19 557  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



Figure 1. Description of rounds of consultation

108x60mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60