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

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Abstract

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

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

Setting. International occupational health settings

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

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

Results. No results available yet.

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

Key words: Delphi study, occupational health, conceptual model

Strengths and limitations of this study

- This study protocol integrates seven systematic steps to validate a new conceptual model. The detailed description of each research step easily allows for replication.
- This protocol proposes a validation including scientific, professional and experiential knowledge, which is innovative and timely.
- An entire research step is dedicated to the involvement of the public, this maximizing the relevance of the study results.
- The proposed research design doesn't permit obtaining a statistical validation of the Model of Preventive Behaviours at Work. Further studies are required to go beyond the descriptive value of the model.

INTRODUCTION.

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

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

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

Insert figure 1 here

Figure 1. Model of Preventive Behaviours at Work (adapted from Lecours, 2019)[16]

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

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

METHOD AND ANALYSIS.

Design

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

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

Procedure and analysis

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

Table 1. Systematic steps of the study design

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

Round of consultation

Elaborate selection criteria for scientific and professional experts.

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

to determine criteria that will enable him / her to select the people most likely to contribute to meeting the research objective [21 28 30].

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

Scientists.

Expertise seems to be the main criteria to select scientists [30]. For the success of a Delphi study, experts must have a thorough knowledge of the subject [36]. For the current study, scientists with expertise in the field of workers' health or organizational behaviours will be targeted. Accordingly, it will be possible to select experts in various disciplines such as industrial psychology, ergonomics, occupational therapy, occupational medicine or human resource management because the Model of Preventive Behaviours at Work was developed according to that literature [16].

To select scientists, the evaluation of the relevance of their published scientific papers related to the subject of our study will be used. This systematic selection method is cited in many manuscripts [28 37 38]. A scientist will be identified to be part of the panel of experts if he / she has published at least one relevant article as the first author in the last three years [39].

Professionals.

Since the Model of Preventive Behaviours at Work is expected to be used in practical settings, we chose to include professionals in the validation process. Although some authors do not recommend including the participation of professionals for emerging concept validation [40], literature in the field of health mostly recommends including professionals in the panel of experts [41 27 42 43].

Work experience in the field of study seems to be the criterion most often used to select professionals [36 42]. For our study, a variety of professionals (i.e. ergonomists, industrial psychologists, occupational therapists, occupational physicians or human resources managers) will be recruited if they have at least five years of experience in relation with workers.

Make scientific and professional experts list

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

relevant to our research project [40]. The journal numbers published in the last three years will be consulted one by one. The articles that seem to have a link with the subject of study according to their title and keywords will be retained. The abstract of these articles will then be read to confirm the author's relevance to the research project. If needed, the ResearchGate and personal pages of scientists will be consulted to deepen the analysis and make sure of their potential contribution to this validation study.

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

An Excel table will be constructed to gather relevant information about potential experts, such as level of training, area of expertise, affiliation, email address and country [35].

The number of experts to recruit is not established in the actual literature [30 41]. Even if some Delphi study were conducted with more than 1500 participants [29], they mainly include 10 to 20 participants [30 44]. The size of the group has an importance on the stability of the results. Indeed, with a smaller group, an expert has a greater influence on the result since his / her opinion occupies a larger proportion of the consensus [41]. On the other hand, it is more complex and costly to consult with a large number of experts [21 30].

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

Contact scientific and professional experts

After having made a list of potential experts to recruit for the consultation, it is time to invite them. Nowadays, email seems to be the most frequent way to contact experts. Authors suggest sending a detailed letter to invite experts [21 26 27 35 42 45]. The letter will contain the following information: presentation of the researcher responsible of the study, description of the study, reasons for the selection of the expert, procedures to be followed to participate to the consultation, estimation of the time required, expectations of the expert (including the importance of participating in all the rounds of the consultation), promise of anonymity, and participation recognition [21 26 27 35 42 45].

Administrate questionnaires

The first questionnaire allows experts to express their opinion on the subject to study [22]. The purpose of this first questionnaire is often to provide an overview of the experts' opinion on the subject of study and then to determine the elements to be studied in the subsequent questionnaires. Basic open-ended questions are required to cover the entire subject [27 41 46]. Since these open-ended questions are likely to generate a great deal of information [46], it is suggested to limit the number of questions in this first questionnaire [22 23]. For example, the first questionnaire of our consultation will contain four large questions about the indicators of content validity (i.e. comprehensiveness, representativeness, relevance, clarity) in relation with the Model of Preventive Behaviours at Work and its components. As suggested in the literature, we will also add a fifth question to permit experts to freely add information they find relevant about the subject [22]. In order to ensure questionnaire clarity, a pretest will be done with four experts (two scientists and two professionals), as suggested by many authors who published about the Delphi technique [21 27 29 47]. The qualitative data gathered with this first questionnaire will be analyzed with a content analysis strategy using the QDA Miner software. This will permit to determine the content of the subsequent consultation tours.

The second questionnaire (and the following, if applicable) will first summarize the opinions found in the previous questionnaire [30 45]. After that, the idea is to document experts' opinion on more specific elements, generally with closed questions [27]. The opinion will often be documented using Likert type scales, with the aim to obtain a consensus of experts [30 45]. For example, elements related to the four content validity indicators that emerged from the analysis of the first questionnaire will be assessed by experts on a 4-point Likert scale (e.g. Clarity : 1- this element is not clear, 2- this element needs major revisions to be clear, 3- this element needs minor revisions to be clear, 4- this element is clear). The iteration process and the return on the information offered to the experts will allow them to reconsider their opinion in the light of that of the others, thus convince toward a consensus. The anonymity provided by the method facilitates this process [48]. The quantitative data gathered with the administration of the second questionnaire, and the following, will be analyzed with descriptive statistics, using the SPSS software.

Nowadays, web questionnaires are preferred to postal ones [22]. We will also follow this tendency in our study.

Synthesize answers

This research step comprises the crucial moment of the determination of the consensus of experts about the different components of the Model of Preventive Behaviours at Work. Paradoxically, literature doesn't offer a consensus about the definition of the consensus [21 26 29 41 47]. The consensus, which is the agreement between the experts, may be defined in different ways, such as a measure of central tendency of experts' quantitative responses, the stability in experts' responses between the rounds of consultation, or a subjective measure of general opinion [49]. Given the lack of a clear rule on the definition of consensus, it is important for researchers to define this agreement in an operational manner before starting the consultation [22 50]. The chosen definition of the consensus is to impact on the number of required tours to obtain this agreement between the experts.

Using a percentage of agreement would be the most common way to rule on consensus [29]. However, the percentage to be reached to obtain a consensus varies considerably across studies, ranging from 51% to 100% [21 26 29 30]. A 100% consensus may be impossible to achieve, and often not necessary [26]. Although aiming to reach a high percentage of agreement permits to ensure the agreement between the experts, it may result in the need to add several consultation rounds. To have a sufficiently discriminating percentage without excessively lengthening the time of realization of the study, we will set it at 80%. We will use the following rules to monitor consensus: a) if 80 % of experts give an element the rating of 4 on the 4-point Likert scale, we consider that a consensus was obtained on this element and it will be kept in the Model; b) if 80 % of experts give an element the rating of 1 on the 4-point Likert scale, we consider that a consensus was obtained on this element and it will be removed from the Model; c) for elements having mostly been rated 2 or 3 on the 4-point Likert scale, modification will be made according to experts' opinion and these elements will be submitted to the following round of consultation.

Insert figure 2 here

Figure 2. Description of rounds of consultation

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

Consult experiential experts

A last consultation step will be conducted with experiential experts, namely workers in our study. This panel of experts will comprise people that have been working full-time since at least five years. While not common in Delphi studies, this decision to include people having experienced a condition has been suggested by other authors having conducted health-related studies [29 54 55 56] and is timely in this era of research favouring the involvement of stakeholders.

The consultation will take the form of a focus group [57]. Results of the scientific and professional experts consultation will be presented to eight workers. Each of them will then bring a unique expertise that will enrich the perspectives of analysis of the topic. The purpose of the consultation is to verify the applicability of the results obtained, the relevance with the current work context as well as the face validity with the population. This consultation step will also provide nuances to the data collected based on users' experience. Study results will be improved.

Final analysis and publication

Once the analysis of all the collected data and the consensus reached, a summary of the results will be transmitted to each expert who took part in the study, namely the scientists, the professionals and the workers. The experts will be free to comment on these findings, which may help to enhance reflection about the validity of the Model of Preventive Behaviours at Work. Findings will be shared with various stakeholders involved in workers' health. Findings will also be disseminated in workshops, peer-reviewed journals and conferences.

PATIENT AND PUBLIC INVOLVEMENT.

To support co-production of knowledge, this study proposes to actively involve various stakeholders in the different steps. In fact, professional experts' opinion will be gathered by questionnaire to confirm or improve the model. As these persons will be likely to use the model in their clinical practice, building the study around their opinion will improve the relevance of the model and increase the likelihood that it will be used to guide interventions about preventive behaviours at work. Stakeholders will also be involved in the recruitment of participants using the snowball method. The protocol also proposes to add an innovative and timely step to the validation process using the Delphi technique. In fact, the consultation step with experiential experts, namely workers in this study, will allow including the perceptions and experiences of the

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

ETHICS.

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

CONCLUSION.

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

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AUTHOR'S CONTRIBUTIONS

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

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Figure 2. Description of rounds of consultation

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Abstract

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

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

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

Strengths and limitations of this study

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

INTRODUCTION.

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

It is then important to focus on the determinants of workers' health, safety, and well-being. The literature suggests that factors related to healthcare services, compensation systems, work organizations, as well as to workers themselves would influence the prevention of the occurrence, relapse, and prolonged disability related to work-related health problems [7-9]. Considering worker-related factors, the preventive behaviours they may adopt would play an important role in workplace health, safety, and well-being [10-13]. Indeed, the influence of these behaviours on the risk of work-related health problems has been demonstrated in several studies conducted with various workers' populations [10 14 15]. Considered as levers to promote workers' health, safety and well-being, these preventive behaviours are complex, and literature lacks a concrete definition of them [16]. To offer an in-depth understanding of preventive behaviours, recent theoretical and empirical studies have permitted proposing the Model of Preventive Behaviours at Work. This Model defines the behaviours workers may adopt to foster their own health, safety and well-being, and their colleagues'. The Figure 1 presents the Model of Preventive Behaviours at Work [16].

Insert figure 1 here

Figure 1. Model of Preventive Behaviours at Work (adapted from Lecours, 2020)[16]

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

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

The Model of Preventive Behaviours at Work presents a systemic and multifactorial view of preventive behaviours. These behaviours are largely influenced by contextual factors related to workers themselves, occupation of work or environment. These contextual factors have an impact on the ability of workers to engage in preventive behaviours. Thus, in addition to being interested in the concrete behaviours, the Model focuses on the factors upstream of the manifestation of a behaviour, on the context in which workers adopt behaviours. The Model also considers the consequences following the manifestation of behaviours. These consequences are generally positive for workers themselves (e.g. health, safety and well-being) as well as for the organization (e.g. work climate). The three-way arrow in the centre of the Model reflects the dynamic interaction and multiple influences between 1) contextual factors, 2) workers' engagement in preventive behaviours, 3) and outcomes. This Model was developed after conducting three theoretical [17] and empirical [18-20] studies. The development process of the Model is detailed elsewhere [16].

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

or health, this Model can also help to understand the factors that influence workers' engagement in preventive behaviours and the resulting effects on health, safety and well-being.

To increase its scientific validity, to maximize its use in professional settings, and ultimately to foster workers' health, safety and well-being, the next step is to validate the Model. Literature offers a large spectrum of conceptual model validation study designs. Over the years, the Delphi technique has been used in various validation studies, but most of the published articles focused on results, while validation protocols remain more or less detailed, making difficult replicating studies. Furthermore, authors have criticized the lack of clear guidelines in the current writing surrounding the use of the Delphi technique, which may lead to a lack of scientific rigour [28 29]. To fill these gaps, the aim of this article is to describe the study protocol that will be used to validate the Model of Preventive Behaviours at Work.

METHOD AND ANALYSIS.

Design

Created in the middle of the 18th century [30] and used in health sciences since the 70s [31], the Delphi technique is recognized as an efficient way to structure communication processes allowing individuals to work on a complex subject [32], which is the case of the Model of Preventive Behaviours at Work. Since this Model is emerging, a first step of validation with experts will make it possible to appreciate its acceptability [29] from the scientific community and its applicability from the knowledge users, which are professionals and workers. The main advantage of the Delphi technique is that communications take place remotely, allowing the recruitment of experts from all over the planet [28 33]. Disadvantages noted in the scientific literature relate to the lack of consensus on the definition of an expert and on how to rule on the consensus's adoption [33-35]. The limited implication of knowledge users in Delphi studies is also a weak point of the actual method [29]. The method can also take a considerable amount of time from the participants, which can discourage them from getting involved [28 36 37]. Finally, many variants of the original method have been used in published studies [29], but lack of justification for the changes made and lack of details in

protocols contribute to creating ambiguities in the guidelines to follow [28 29]. Our wish in drafting this protocol is to bring clarity to these elements of the study design.

Procedure and analysis

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

Table 1. Systematic steps of the study design

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

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

Elaborate selection criteria for scientific and professional experts.

The quality of a study using the Delphi technique mainly rests on the choice of experts [29] [37] [42]. Indeed, since the opinion of these will serve to generate the results of the study, their selection must be judicious. Currently, there is no recognized definition of "who is an expert" and no universal criteria for structuring the choice of experts [33-35]. The researcher's judgment is solicited to determine criteria that will enable her / him to select the people most likely to contribute to meeting the research objective [28] [35] [37].

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

Researchers.

Expertise seems to be the main criteria to select researchers [37]. For the success of a Delphi study, experts must have a thorough knowledge of the subject [43]. For the current study, researchers with expertise in the field of workers' health or organizational behaviours will be targeted. Il will be possible to select experts in various disciplines such as industrial psychology, ergonomics, occupational therapy, occupational medicine or human resource management because the Model of Preventive Behaviours at Work was developed according to that literature [16].

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

Professionals.

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

Work experience in the field of study seems to be the criterion most often used to select professionals [43] [48]. For our study, a variety of professionals (i.e. ergonomists, industrial psychologists, occupational therapists, occupational physicians or human resources

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

Make scientific and professional experts list

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

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

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

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

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

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

Contact scientific and professional experts

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

Administrate questionnaires

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

thematic analysis strategy using the QDA Miner software. This will permit to determine the content of the subsequent consultation rounds.

The second questionnaire (and the following, if applicable) will first summarize the opinions found in the previous questionnaire [37 51]. After that, the idea is to document experts' opinion on more specific elements, generally with closed questions [34]. The opinion will often be documented using Likert type scales, with the aim to obtain a consensus of experts [37 51]. For example, elements related to the four content validity indicators that emerged from the analysis of the first questionnaire will be assessed by experts on a 4-point Likert scale (e.g. Clarity : 1- this element is not clear, 2- this element needs major revisions to be clear, 3- this element needs minor revisions to be clear, 4- this element is clear). The iteration process and the return on the information offered to the experts will allow them to reconsider their opinion in the light of that of the others, thus convince toward a consensus. The anonymity provided by the method facilitates this process [54]. The quantitative data gathered with the administration of the second questionnaire, and the following, will be analyzed with descriptive statistics, using the SPSS software.

Nowadays, web questionnaires are preferred to postal ones [29]. We will also follow this tendency in our study.

Synthesize answers

This research step comprises the crucial moment of the determination of the consensus of experts about the different components of the Model of Preventive Behaviours at Work. Paradoxically, literature doesn't offer a consensus about the definition of the consensus [28 33 36 47 53]. The consensus, which is the agreement between the experts, may be defined in different ways, such as a measure of central tendency of experts' quantitative responses, the stability in experts' responses between the rounds of consultation, or a subjective measure of general opinion [55]. Given the lack of a clear rule on the definition of consensus, it is important for researchers conducting a Delphi study to define this agreement in an operational manner before starting the consultation [29 56]. The chosen definition of the consensus is to impact on the number of required rounds to obtain this agreement between the experts.

Using a percentage of agreement would be the most common way to rule on consensus [36]. However, the percentage to be reached to obtain a consensus varies considerably across studies, ranging from 51% to 100% [28 33 36 37]. A 100% consensus may be impossible to achieve, and often not necessary [33]. Although aiming to reach a high percentage of agreement permits to ensure the agreement between the experts, it may result in the need to add several consultation rounds. To have a sufficiently discriminating percentage without excessively lengthening the time of realization of the study, we will set it at 80%. We will use the following rules to monitor consensus: a) if 80 % of experts give an element the rating of 4 on the 4-point Likert scale, we consider that a consensus was obtained on this element and it will be kept in the Model; b) if 80 % of experts give an element the rating of 1 on the 4-point Likert scale, we consider that a consensus was obtained on this element and it will be removed from the Model; c) for elements having mostly been rated 2 or 3 on the 4-point Likert scale, modification will be made according to experts' opinion and these elements will be submitted to the following round of consultation.

Insert figure 2 here

Figure 2. Description of rounds of consultation

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

Consult experiential experts

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

The consultation will take the form of a focus group [63]. The purpose of the consultation will be to verify the applicability of the results obtained, the relevance with the current work context, and the face validity of the Model.

Groups of eight workers will be formed. This number of participants per group is large enough to get rich discussions [63] and small enough to let all participants express themselves [64]. Participants will be recruited to have a diversity in terms of ages, genders and working conditions (e.g. type of work, full-time vs. part-time, etc.). In a two-hour discussion, results of the consultation with scientific and professional experts will be exposed to workers. Different indicators will be discussed, such as facilitators and obstacles for the usability of the Model or relevance of its components to the reality of workers. The group facilitation guide will be developed for the purpose of this study and validated by a pre-test with two people having the same characteristics as the participants. . The number of groups to be conducted will be defined throughout the study until data reveals a redundancy in the meaning of the ideas shared by the participants [65]. It is estimated that two or three groups will be required to reach data saturation [66]. After fully transcribing the data and importing it into the QDA Miner software, a thematic analysis strategy in four stages will be followed [67]: 1) repeated readings of the data corpus to develop a feeling of immersion; 2) initial coding (descriptive codes "in vivo" will be assigned to the meaning units found in the corpus); 3) conception of a code tree (the codes [micro level] will be grouped into categories [meso level] and / or themes [macro level]); 4) finalization of the code tree by going back and forth between the raw data and the general structure to clarify and interpret the data while respecting the experience of the participants. To ensure scientific rigour, the thematic analysis process will be carried out by two people and the inter-judge agreement will be periodically checked. This last consultation step will provide nuances to the study results.

Final analysis and publication

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

which may help to enhance reflection about the validity of the Model of Preventive Behaviours at Work.

Patient and public involvement

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

ETHICS AND DISSEMINATION.

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

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

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None declared.

DATA AVAILABILITY STATEMENT

No additional data available

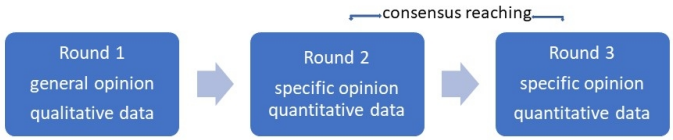

Figure 2. Description of rounds of consultation

338x190mm (96 x 96 DPI)

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

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Abstract

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

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

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

Strengths and limitations of this study

- The proposed method includes scientific, professional and experiential knowledge, which is innovative and timely.
- An entire research step is dedicated to the involvement of the public, this maximizing the relevance of the study results.
- The proposed research design doesn't permit obtaining a statistical validation of the Model of Preventive Behaviours at Work; further studies are required.

INTRODUCTION.

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

It is then important to focus on the determinants of workers' health, safety, and well-being. The literature suggests that factors related to healthcare services, compensation systems, work organizations, as well as to workers themselves would influence the prevention of the occurrence, relapse, and prolonged disability related to work-related health problems [7-9]. Considering worker-related factors, the preventive behaviours they may adopt would play an important role in workplace health, safety, and well-being [10-13]. Indeed, the influence of these behaviours on the risk of work-related health problems has been demonstrated in several studies conducted with various workers' populations [10 14 15]. Considered as levers to promote workers' health, safety and well-being, these preventive behaviours are complex, and literature lacks a concrete definition of them [16]. To offer an in-depth understanding of preventive behaviours, recent theoretical and empirical studies have permitted proposing the Model of Preventive Behaviours at Work[16]. This Model defines the behaviours workers may adopt to foster their own health, safety and well-being, and their colleagues'.

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

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

The Model of Preventive Behaviours at Work presents a systemic and multifactorial view of preventive behaviours. These behaviours are largely influenced by contextual factors related to workers themselves, occupation of work or environment. These contextual factors have an impact on the ability of workers to engage in preventive behaviours. Thus, in addition to being interested in the concrete behaviours, the Model focuses on the factors upstream of the manifestation of a behaviour, on the context in which workers adopt behaviours. The Model also considers the consequences following the manifestation of behaviours. These consequences are generally positive for workers themselves (e.g. health, safety and well-being) as well as for the organization (e.g. work climate). The Model reflects the dynamic interaction and multiple influences between 1) contextual factors, 2) workers' engagement in preventive behaviours, 3) and outcomes. This Model was developed after conducting three theoretical [17] and empirical [18-20] studies. The development process and visual representation of the Model are detailed elsewhere [16].

Regarding occupational health, several of the current models focus only on one aspect of the health of workers, whether physical [e.g.17] or mental [e.g. 21]. In accordance with the vision of health proposed by the World Health Organization [22], the Model of Preventive Behaviours at Work suggests a holistic vision of the health of workers, inclusive of the physical, mental and social aspects. This holistic understanding of health reflects in contextual factors, preventive behaviours and outcomes. In addition, the focus of the Model rests on the engagement of workers in preventive behaviour at work. This angle is innovative since most of the current models focus on the actions the organization may have on workers' health [e.g.23], giving them a mostly passive role. Since the management of occupational health, safety and well-being must be shared by everyone involved in an organization [24-27], this Model helps to better explain the active role workers may have. Designed to be applicable to the reality of workers, regardless of the nature of their work or health, this Model can also help to understand the factors that influence workers' engagement in preventive behaviours and the resulting effects on health, safety and well-being.

To increase its scientific validity, to maximize its use in professional settings, and ultimately to foster workers' health, safety and well-being, the next step is to validate the Model. Literature offers a large spectrum of conceptual model validation study designs. Over the years, the Delphi technique has been used in various validation studies, but most of the published articles focused on results, while validation protocols remain more or less detailed, making difficult replicating studies. Furthermore, authors have criticized the lack of clear guidelines in the current writing surrounding the use of the Delphi technique, which may lead to a lack of scientific rigour [28 29]. To fill these gaps, the aim of this article is to describe the study protocol that will be used to validate the Model of Preventive Behaviours at Work.

METHOD AND ANALYSIS.

Design

Created in the middle of the 18th century [30] and used in health sciences since the 70s [31], the Delphi technique is recognized as an efficient way to structure communication processes allowing individuals to work on a complex subject [32], which is the case of the Model of Preventive Behaviours at Work. Since this Model is emerging, a first step of validation with experts will make it possible to appreciate its acceptability [29] from the scientific community and its applicability from the knowledge users, which are professionals and workers. The main advantage of the Delphi technique is that communications take place remotely, allowing the recruitment of experts from all over the planet [28 33]. Disadvantages noted in the scientific literature relate to the lack of consensus on the definition of an expert and on how to rule on the consensus's adoption [33-35]. The limited implication of knowledge users in Delphi studies is also a weak point of the actual method [29]. The method can also take a considerable amount of time from the participants, which can discourage them from getting involved [28 36 37]. Finally, many variants of the original method have been used in published studies [29], but lack of justification for the changes made and lack of details in protocols contribute to creating ambiguities in the guidelines to follow [28 29]. Our wish in drafting this protocol is to bring clarity to these elements of the study design.

Procedure and analysis

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

Table 1. Systematic steps of the study design

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

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

Elaborate selection criteria for scientific and professional experts.

The quality of a study using the Delphi technique mainly rests on the choice of experts [29 37 42]. Indeed, since the opinion of these will serve to generate the results of the study, their selection must be judicious. Currently, there is no recognized definition of "who is an

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

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

Researchers.

Expertise seems to be the main criteria to select researchers [37]. For the success of a Delphi study, experts must have a thorough knowledge of the subject [43]. For the current study, researchers with expertise in the field of workers' health or organizational behaviours will be targeted. Il will be possible to select experts in various disciplines such as industrial psychology, ergonomics, occupational therapy, occupational medicine or human resource management because the Model of Preventive Behaviours at Work was developed according to that literature [16].

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

Professionals.

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

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

Make scientific and professional experts list

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

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

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

The number of experts to recruit is not established in the actual literature [37 47]. Even if some Delphi study were conducted with more than 1500 participants [36], they mainly include 10 to 20 participants [37 50]. The size of the group has an importance for the stability of the results. Indeed, with a smaller group, an expert has a greater influence on the result since her / his opinion occupies a larger proportion of the consensus [47]. On the other hand, it is more complex and costly to consult with a large number of experts [28 37].

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

Contact scientific and professional experts

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

Administrate questionnaires

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

The second questionnaire (and the following, if applicable) will first summarize the opinions found in the previous questionnaire [37 51]. After that, the idea is to document experts' opinion on more specific elements, generally with closed questions [34]. The opinion will often be documented using Likert type scales, with the aim to obtain a consensus of experts [37 51]. For example, elements related to the four content validity indicators that emerged from the analysis of the first questionnaire will be assessed by experts on a 4-point Likert scale (e.g. Clarity : 1- this element is not clear, 2- this element needs major revisions to be clear, 3- this element needs minor revisions to be clear, 4- this element is clear). The iteration process and the return on the information offered to the experts will allow them to reconsider their opinion in the light of that of the others, thus convince toward a consensus. The anonymity provided by the method facilitates this process [54]. The quantitative data gathered with the administration of the second questionnaire, and the following, will be analyzed with descriptive statistics, using the SPSS software.

Nowadays, web questionnaires are preferred to postal ones [29]. We will also follow this tendency in our study.

Synthesize answers

This research step comprises the crucial moment of the determination of the consensus of experts about the different components of the Model of Preventive Behaviours at Work. Paradoxically, literature doesn't offer a consensus about the definition of the consensus [28 33 36 47 53]. The consensus, which is the agreement between the experts, may be defined in different ways, such as a measure of central tendency of experts' quantitative responses, the stability in experts' responses between the rounds of consultation, or a subjective measure of general opinion [55]. Given the lack of a clear rule on the definition of consensus, it is important for researchers conducting a Delphi study to define this agreement in an operational manner before starting the consultation [29 56]. The chosen definition of the consensus is to impact on the number of required rounds to obtain this agreement between the experts.

Using a percentage of agreement would be the most common way to rule on consensus [36]. However, the percentage to be reached to obtain a consensus varies considerably across studies, ranging from 51% to 100% [28 33 36 37]. A 100% consensus may be impossible to

achieve, and often not necessary [33]. Although aiming to reach a high percentage of agreement permits to ensure the agreement between the experts, it may result in the need to add several consultation rounds. To have a sufficiently discriminating percentage without excessively lengthening the time of realization of the study, we will set it at 80%. We will use the following rules to monitor consensus: a) if 80 % of experts give an element the rating of 4 on the 4-point Likert scale, we consider that a consensus was obtained on this element and it will be kept in the Model; b) if 80 % of experts give an element the rating of 1 on the 4-point Likert scale, we consider that a consensus was obtained on this element and it will be removed from the Model; c) for elements having mostly been rated 2 or 3 on the 4-point Likert scale, modification will be made according to experts' opinion and these elements will be submitted to the following round of consultation.

Insert figure 2 here

Figure 1. Description of rounds of consultation

Literature suggests two or three rounds are needed to reach the consensus [33]. We a priori plan to realize three rounds, as shown in figure 1. We will give experts two weeks to answer a questionnaire, as suggested by others [37 57-59]. The total time to complete the collection of data can therefore be spread out over a few weeks depending on the number of rounds to be made.

Consult experiential experts

A last consultation step will be conducted with experiential experts, namely workers in this study. While not common in Delphi studies, this decision to include people having experienced a condition has been suggested by other authors who had conducted health-related studies [36 60 61 62]. This permits to favour the involvement of a variety of stakeholders. The consultation will take the form of a focus group [63]. The purpose of the consultation will be to verify the applicability of the results obtained, the relevance with the current work context, and the face validity of the Model.

Groups of eight workers will be formed. This number of participants per group is large enough to get rich discussions [63] and small enough to let all participants express themselves

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

Final analysis and publication

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

Patient and public involvement

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

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

ETHICS AND DISSEMINATION.

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

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AUTHOR'S CONTRIBUTIONS

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

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COMPETING INTEREST STATEMENT

None declared.

DATA AVAILABILITY STATEMENT

No additional data available

Figure 1. Description of rounds of consultation

108x60mm (300 x 300 DPI)