

ORIGINAL ARTICLE

A Nominal Group Technique Consolidated Consensus for Developing Mobile Application Content on Leptospirosis

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Received: 04 September 2025 / Accepted: 24 November 2025

ABSTRAK

Teknik kumpulan nominal (NGT) digunakan untuk mengenal pasti dan mengutamakan konstruk dan item untuk membangunkan kandungan aplikasi mudah alih untuk meningkatkan pengetahuan, sikap dan amalan dalam kalangan pekerja pasar basah berkenaan leptospirosis. Satu sesi NGT selama 3 jam telah dijalankan dengan menggunakan platform hibrid yang melibatkan tujuh orang pakar (epidemiologi, informatik kesihatan dan kesihatan persekitaran) yang mengutamakan 18 konstruk dan 50 item bagi pembangunan kandungan aplikasi tersebut. Sesi hibrid ini melibatkan lima orang pakar secara bersemuka dan dua orang pakar secara dalam talian melalui platform Google Meet (Google LLC, Mountain View, CA, USA). Proses NGT tersebut terdiri daripada empat langkah berstruktur: (i) pakar secara bebas dan senyap mendokumentasikan respons mereka terhadap soalan rangsangan; (ii) setiap pakar menyumbangkan satu idea apabila ditanyakan soalan dan setiap respons direkodkan; (iii) pakar membincangkan setiap idea untuk menjelaskan maksudnya dan mengenal pasti idea yang paling penting; dan (iv) pakar menyusun keutamaan mereka (pilihan), mengundi setiap idea dan membincangkan pola pengundian. Syor-syor daripada pakar tersebut telah mengenal pasti empat konstruk utama dan 10 item penting yang selaras dengan komponen-komponen dalam model kepercayaan kesihatan (HBM). Konstruk pertama penting untuk mendirikan maklumat asas dan meningkatkan kesedaran tentang leptospirosis serta merangkumi komponen HBM, iaitu keterukan tanggapan dan kerentanan penyakit. Konstruk kedua selaras dengan komponen risiko tanggapan dan efikasi sendiri, dengan memberi tumpuan kepada cara pemindahan langsung dan tidak langsung serta memupuk kesedaran tentang bagaimana tingkah laku rutin boleh meningkatkan risiko jangkitan. Konstruk ketiga menekankan kepentingan penggunaan peralatan perlindungan diri ketika mengendalikan bahan-bahan yang berkemungkinan tercemar. Konstruk keempat menyenaraikan fasiliti kesihatan awam dan swasta serta menjelaskan halangan-halangan tanggapan dengan memudahkan proses mendapatkan khidmat kesihatan. Kajian ini telah mengenal pasti dan mengutamakan kandungan aplikasi mudah alih untuk mencegah leptospirosis berdasarkan pandangan pakar untuk memastikan maklumat yang menyeluruh, relevan dan bersesuaian dengan keperluan pengguna.

Kata kunci: Kandungan aplikasi mudah alih; leptospirosis; teknik kumpulan nominal

ABSTRACT

The nominal group technique (NGT) was used to identify and prioritise the constructs and items for developing mobile application content to improve wet market workers' knowledge, attitudes and practices regarding leptospirosis. A hybrid-platform 3-hour NGT session was conducted, where seven experts (epidemiology, health informatics, environmental health) prioritised 18 constructs and 50 items to develop the content. The hybrid session involved five experts who participated in person, while two experts participated remotely via the Google Meet platform. The NGT consisted of four structured steps: (i) the experts independently and silently documented their responses to a stimulus question; (ii) each expert contributed an idea when asked a question, and the response was recorded; (iii) the experts discussed each idea to clarify its meaning and identified the most critical ideas; and (iv) the experts ranked their preferences (optional), voted on the ideas, and discussed the voting pattern. The experts' recommendations identified four key constructs and 10 essential items which aligned with health belief model (HBM) components. Construct 1 is essential to establish fundamental information and awareness regarding leptospirosis and addresses the perceived severity and susceptibility HBM components. Construct 2 aligns with perceived risk and self-efficacy and focuses on the direct and indirect transmission routes and fosters awareness of how routine behaviors may increase infection risk. Construct 3 emphasises the importance of using personal protective equipment when handling potentially contaminated materials. Construct 4 lists public and private health facilities and addresses perceived barriers by simplifying the medical care-seeking process. This study identified and prioritised mobile application content for leptospirosis prevention based on experts' opinions to ensure comprehensive, relevant and user-appropriate information.

Keywords: Leptospirosis; mobile application content; nominal group technique

INTRODUCTION

Leptospirosis, also known as Weil's disease, is recognised by the World Health Organisation (WHO) as a neglected tropical illness with a large global health burden. Southeast Asia recorded the second-highest incidence after Oceania since 2015, with an estimated 1.03 million cases and 58,900 fatalities annually. Hence, leptospirosis is the most common cause of zoonotic disease and mortality, with most of its burden occurring in tropical regions and the poorest countries. However, these statistics might be underestimated, given the dearth of current information from many countries. The public health issue of leptospirosis is deteriorating in most tropical developing nations. The disease is endemic in South and Southeast Asia, and several outbreaks occur after natural disasters (Chadsuthi et al. 2022).

Leptospirosis is present worldwide; however, it is primarily endemic in regions with humid subtropical and tropical climates. It is estimated

that leptospirosis affects more than 500,000 people annually worldwide. Leptospirosis spreads rapidly, especially after a heavy rainy season or flooding. Most North and South American countries have recorded cases, where leptospirosis outbreaks were reported in Brazil, Guyana, Nicaragua and other Latin American countries. Severe symptoms and high mortality exceeding 10% have been observed in most complex cases. The exact number of human cases is unknown due to underdiagnosis or misdiagnosis, and flare-ups may be associated with tropical cyclones and floods [Pan American Health Organisation (PAHO) n.d.].

Malaysia is prone to leptospirosis endemicity given its geographic proximity to the equator and the significant rainfall in the region, especially during the monsoon season. Local data has stated that there were 30.2 leptospirosis cases per 100,000 people in 2015, a significant increase from 1.03 cases per 100,000 people in 2004. Furthermore, the age-standardised incidence rate

of leptospirosis in Malaysia was 13.15 per 100,000 people in 2012 and 15.87 per 100,000 people in 2013. Based on these incidence rates, Malaysia is among the top 20 countries globally with the highest incidence of leptospirosis (Pappas et al. 2008). In 2010, the Ministry of Health (MOH), Malaysia published recommendations for diagnosing and treating leptospirosis, with improved access to the microscopic agglutination test (Fann et al. 2020). In 2015, Selangor state, Malaysia, reported a total leptospirosis mortality rate of 48% (Nozmi et al. 2018).

Previous studies have documented the risk of leptospirosis exposure at market areas (Rahman et al. 2018a; Rahman et al. 2018b; Samsudin et al. 2020). Open food markets are known as wet markets, where workers sell dried processed foods, fresh meat, seafood, fruits and vegetables. Wet market workers are susceptible to leptospirosis due to their exposure to contaminated work settings. Rodents are the primary source of human leptospirosis, and their infection is facilitated by humid circumstances and an abundance of food.

Most urban and rural communities continue to demonstrate low knowledge, attitudes and practices (KAP) regarding leptospirosis (Nozmi et al. 2018). Specifically, vital aspects, such as awareness of the disease, transmission modes, symptoms and complications are poorly understood, highlighting the need for different approaches to update public knowledge, awareness, and self-efficiency regarding leptospirosis.

KAP are significant factors in motivating constructive behaviour (Larson et al. 2002). Unfortunately, KAP research in Malaysia on understanding leptospirosis incidence in both urban and rural populations is challenging (Nozmi et al. 2018). Accordingly, this article describes a method was used to develop a mobile application to educate the community on leptospirosis, which may substitute the current methods of information dissemination. Additionally, this application enlightened the community on leptospirosis and its prevention (Ghazaei 2018).

This study explored experts' views and recommendations on developing the mobile application content and validated the constructs and items proposed by the experts.

MATERIALS AND METHODS

The primary research methodology in this study was the nominal group technique (NGT). This study included seven public health, family medicine and environmental health experts to prioritise 18 constructs and 50 items for developing mobile application content as an intervention to enhance wet market workers' KAP regarding leptospirosis. The 3-hour NGT session was conducted on a hybrid platform (a physical platform and a Google Meet platform (Google LLC, Mountain View, CA, USA). During the hybrid session, five experts participated in person, while two experts participated remotely via the Google Meet platform. The experts and researchers used the NGT to conduct a brainstorming session to synthesise ideas and solutions. Upon concluding the session, the researchers used the NGT to perform a concise calculation by using NGT-PLUS software. The results were used to address the research objectives. The data collection for the NGT process was conducted from 21-07-2023 to 1-09-2023.

Content Development

The mobile application content was developed based on the health belief model (HBM). The content development involved the following stages: (i) reviewing the literature on leptospirosis, signs and symptoms, complications, transmission modes, treatment, prevention and control and the functions of mobile health intervention and education applications; and (ii) identifying content pertinent to the intended users by using this evidence-based information as key guiding principles.

For example, it may be challenging for participants to express their opinions regarding the features of a user-friendly mobile application if they are unfamiliar with the features of such

an application. The NGT was implemented to explore the following components: (i) What information do the target users need?; (ii) How can the self-explanatory aspect of the content be ensured?; and (iii) What characteristics are required for a user-friendly mobile application?

Research Samples

There was disagreement regarding the ideal sample size when using the NGT in research. Some researchers had stated that the NGT can be conducted with a single cohort or a large group (Dobbie et al. 2004; Lomax & McLeman 1984), but a large group can also be divided into small groups to facilitate efficient communication depending on the needs of the study. Table 1 presented the sample sizes used for NGT in previous research.

In this study, seven experts were selected to participate in the NGT procedure based on the references in Table 1. Table 2 listed the participating experts, who were selected based on their experience and expertise.

Expert Criteria

Booker and McNamara (2004) stated that experts were informed individuals who had obtained their degree of competence through a combination of classroom learning, real-world application and independent study. Mustapha

and Darusalam (2017) and Nikolopoulos (2004) stated that specialists are recognised as such when their peers and superiors acknowledge their expertise and competency in light of their education, training and experience. Cantrill et al. (1996) stated that an expert is an individual who has proven to be highly knowledgeable in a particular field or subject. The expert panel was comprised of epidemiology, health informatics, and environmental health specialists, which was deemed sufficient as these domains represented the core knowledge areas necessary to validate health-related mobile application content for leptospirosis prevention.

Nominal Group Technique

The NGT is a systematic process that reveals the views shared by a group on a certain topic. Delbecq et al. (1975) described the NGT as a “participation approach for social planning scenarios” (Kennedy & Clinton 2009). Social planning is defined as a form of exploratory research involving interdisciplinary specialists, citizen engagement and proposal assessment. Numerous studies involving groups, including empirical social scientific research, have used the NGT. Furthermore, the NGT has been used occasionally in educational research (Lomax & McLeman 1984; O’Neil & Jackson 1983). Nevertheless, most NGT usage has been in

TABLE 1: Nominal group technique sampling

Reference	Sample
Delbecq and Van de Ven (1971)	5–9 experts/participants
Horton (1980)	7–10 experts/participants
Harvey and Holmes (2012)	6–12 experts/participants
Mustapha et al. (2022)	7–10 experts/participants
Carney et al. (1996)	Minimum of 6 experts/participants

TABLE 2: List of experts

Expert	Total Number of Experts	Field of Expertise	Institution
Public health physician	4	Epidemiology	Ministry of Health Malaysia
Family medicine physician	2	Health informatics	Ministry of Health Malaysia
Environmental health officer	1	Environmental health	Ministry of Health Malaysia

health-related research in the social sciences. Additionally, the NGT approach aids in exploring solutions to issues, setting priorities and identifying an issue. Table 3 presented the main NGT steps.

Data Analysis

The data obtained were entered into NGT-PLUS software. After the experts had discussed all items, the voting was conducted directly in the open. After the experts had responded to each item, the data were analysed using NGT-PLUS software (Figure 1 & 2). The NGT-PLUS software facilitated electronic voting, automatically calculated consensus percentages and generated item rankings, enabling a transparent and efficient analysis of expert input.

Ethics Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki and received ethical approval from the Universiti Kebangsaan Malaysia (UKM) Research Ethics Committee (Project Code: UKM PPI/111/8/JEP-2023-069). As the study did not involve data, patients or facilities under the jurisdiction of the MOH, approval from the MOH Medical



FIGURE 1: NGT-PLUS analysis software

Research and Ethics Committee (MREC) was not required. However, the study was registered with the National Medical Research Register (NMRR) under the identifier NMRR-ID-23-01054-DVX. Prior to participation, all respondents provided written informed consent.

RESULTS AND DISCUSSION

After the NGT session, the mobile application content was developed as an intervention to improve wet market workers' KAP regarding leptospirosis. During Step 3 of the NGT session,

TABLE 3: The main nominal group technique steps

Step	Description	Description
1	Brainstorming (silent synthesis of ideas in written form)	Participants independently and silently document their responses to a stimulus question.
2	Round-robin session	Each participant contributes one idea when asked a question, and the response is recorded on a large flipchart. The ideas are not debated. The completed sheets are taped to the wall for all to view. Meanwhile, the group facilitator continuously summons the participants until all ideas have been documented or a sufficient number of ideas has been obtained.
3	Idea discussion	The participants discuss each idea so that everyone sees and understands its meaning.
4	Voting	The participants identify the most critical ideas, rank their preferences (optional), vote on the flipchart, and discuss the voting pattern. This step encourages genuine findings and commitment to them by requiring anonymous voting in conjunction with the provisions outlined above.

Items / Elements	Voter1	Voter2	Voter3	Voter4	Voter5	Voter6	Voter7
Definition	3	3	3	3	3	3	3
Sign & Symptoms	3	3	3	3	3	3	3
Complication	3	3	2	2	3	2	3
Treatment & Health Seeking Behaviour	3	3	2	2	3	2	3
Prevention & Control	3	3	1	1	1	1	3

Items / Elements	Voter1	Voter2	Voter3	Voter4	Voter5	Voter6	Voter7	Total item score	Percenta
Definition	3	3	3	3	3	3	3	21	100.00

FIGURE 2: Data entry from expert voting

the experts discussed, merged and refined overlapping constructs and items. Through consensus, the initial 18 constructs and 50 items were thematically grouped into four main constructs comprising 10 essential items that best represented the HBM components. This refinement process ensured conceptual clarity and alignment with leptospirosis prevention behavior. The suggestions were compiled based on the experts' advice and opinions (Table 4).

Table 5 presented the total content development scores from the experts' perspectives. Briefly, the conclusions drawn demonstrated that all percentages of the tested constructs and items were at a level suitable for use. This conclusion was supported by previous research (Deslandes et al. 2010; Dobbie et al. 2004), in which percentages exceeding 70% were considered acceptable. Thus, all experts concurred that the major constructs

TABLE 4: Content development list

No.	Section	Description
1	Introduction - Definition - Signs and symptoms - Complication - Treatment and health-seeking behaviour	Essential to establish fundamental information and awareness regarding leptospirosis.
2	Epidemiology - Transmission modes - High-risk groups	Focuses on direct and indirect transmission routes, fosters awareness of how routine behaviours may increase the infection risk.
3	Prevention and control - Rodent control - Personal protective equipment (PPE) - Safe water and hygiene	Emphasises the significance of utilising PPE (gloves, boots, rodent control) when handling potentially contaminated materials. Encouraging daily hygiene in high-risk environments is a crucial behaviour modification approach.
4	Health facilities - List of hospitals and clinics (public and private)	Lists public and private health facilities where workers can seek diagnosis and treatment. Access to accurate and easily accessible information is essential for prompt intervention.

TABLE 5: Nominal group technique (NGT) analysis results (output from NGT-PLUS software)

Item/Element	Voter 1	Voter 2	Voter 3	Voter 4	Voter 5	Voter 6	Voter 7	Total Item Score	Percentage (%)	Rank Priority	Voter Consensus
Introduction	3	3	3	3	3	3	3	21	100.00	1	Suitable
Sign and symptoms	3	1	3	3	2	3	3	18	85.71	2	Suitable
Complication	3	1	3	3	2	2	3	17	80.95	3	Suitable
Treatment and health-seeking behaviors	3	1	3	1	2	3	3	16	76.19	4	Suitable
Transmission modes	3	3	3	3	2	1	3	18	85.71	2	Suitable
High-risk groups	3	3	3	3	1	2	3	18	85.71	2	Suitable
Rodent control	3	3	3	3	1	2	3	18	85.71	2	Suitable
PPE	3	3	3	3	2	1	3	18	85.71	2	Suitable
Safe water and hygiene	3	3	3	3	1	2	3	18	85.71	2	Suitable
List of health facilities (private and government)	3	3	3	3	3	1	1	17	80.95	3	Suitable

PPE: Personal protective equipment

and items in the developed mobile application were acceptable and usable. These results demonstrated that the experts achieved a strong consensus on the most critical content areas for inclusion in the mobile application, confirming the practicality of the NGT for rapid consensus building. In contrast to the Delphi method, which involved several rounds of expert reviews and meetings, the NGT yielded information rapidly.

Limitations and Recommendations

This study aimed to enhance wet market workers' KAP regarding leptospirosis by focusing on experts' opinions in designing mobile application content as an intervention. One limitation of this study was that the NGT session involved a small group of experts. The results were based on the consensus of a focused panel of seven experts which was suitable for NGT, but may not have captured the full diversity of perspectives from broader expert populations. Additionally, this study included only experts familiar with

the researcher and working within the MOH, Malaysia. This study gathered expert consensus to develop the mobile application content. Future research should validate and refine this expert-derived content with end users, such as wet market workers, to ensure its practicality and usability. Future studies should therefore include a more diverse expert pool, including international and academic contributors.

CONCLUSION

The study used the NGT to identify and prioritise mobile application content for leptospirosis intervention based on expert opinions to ensure comprehensive and relevant information. The NGT is promising for facilitating the systematic determination of mobile application content development. This technique is less time-consuming and aids in collecting precise and accurate perspectives given that the responding experts are not influenced. Thus, the approach that can be used with the NGT to address

research concerns is easily identified. The strength of the NGT is its capacity to generate and prioritise ideas, and it includes various persuasive elements. Furthermore, the NGT needs minimal advance planning by either the researcher or the experts, rendering it an effective method in a busy professional environment with ever-increasing time constraints.

Four key constructs critical to the effectiveness of the mobile application in enhancing wet market workers' KAP regarding leptospirosis were involved, which were designed to address immediate knowledge gaps and to promote sustained behaviour change. Construct 1 focuses on foundational knowledge and awareness, ensuring that users have essential information on leptospirosis, including its symptoms and risks. This construct increases awareness of leptospirosis severity and susceptibility, laying the groundwork for behaviour change by fostering urgency and responsibility. Construct 2 emphasises transmission routes and risk awareness, and encourages users to identify and modify high-risk behaviours. This construct will educate users about direct and indirect leptospirosis transmission, and enhance their ability to adopt preventive practices. Construct 3 addresses personal protective equipment use and rodent control, integrating practical, actionable strategies to reduce exposure. The mobile application will encourage these routines to develop protective behaviors that can be sustained effortlessly, ensuring that precautions become a component of daily routines. Construct 4 lists public and private healthcare facilities to ensure that users can seek prompt diagnosis and treatment. This construct addresses care barriers and encourages a proactive approach to health management, highlighting the need for early intervention. Integrating these elements into a single platform facilitates the long-term durability of behaviour change by combining motivation, instruction and feasible solutions.

This study successfully utilised the NGT to identify and prioritise content for a mobile application designed to improve the KAP regarding leptospirosis among wet market workers. The

process yielded four main constructs and 10 critical content items aligned with the HBM. The NGT was a rapid and systematic approach to achieving expert consensus, providing a solid foundation for subsequent content validation and user testing. Future studies will extend this work by assessing the usability and effectiveness of the developed content among end users to ensure its long-term influence.

Author contributions: Conceptualisation: MNM, ZMI, RH, RI; Data curation: MNM, ZMI, RM, RAR; Formal analysis: MNM, ZMI, RM; Study investigation: MNM, ZMI, RH, RI, RAR; Methodology: MNM, ZMI, RH, RI; Writing-original draft: MNM, ZMI; Writing-review & editing: MNM, ZMI, RH, RI. All authors have approved the final manuscript.

Funding: This research received the Fundamental Research Grant (JEP-2023-069) under Faculty of Medicine, UKM.

Acknowledgement: The authors expressed their sincere thanks to Ampang Jaya Municipal Council for the permission and cooperation granted during the study. The authors also thank the participants and the people directly and indirectly involved in this study. Lastly, the authors thank the Department of Public Health Medicine, Faculty of Medicine, UKM and the MOH, Malaysia for their approval and support.

Conflict of interest: The authors declare no conflicts of interest.

Ethics statement and consent to participate: The study was performed in accordance with the Declaration of Helsinki and was approved by the UKMs Research and Ethics Committee (project code: UKM PPI/111/8/JEP-2023-069) and the Malaysian MOH's Medical Research and Ethics Committee (NMRR-ID-23-01054-DVX). Written informed consent for participation in this study was provided by the respondent prior to the survey.

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