Development and Validation of a Thai Questionnaire for Occupational Asthmagens Identification in Clinical Settings

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Abstract

Background: Work-related asthma (WRA), including occupational asthma and work-exacerbated asthma, accounts for a substantial proportion of adult asthma cases. Although workplace surveillance aims to promote early detection, most cases are identified in clinical settings after symptom onset. Early recognition of occupational asthmagens/irritants in clinical practice is therefore essential. However, existing screening tools may inadequately capture specific occupational exposures, and workers often have difficulty identifying asthmagens/irritants.

Objective: 1) To develop a Thai questionnaire for occupational asthmagens/irritants identification in clinical settings. 2) To examine the content and face validity of the developed questionnaire.

Materials and Methods: This descriptive study included a literature review and review of existing resources, including the Occupational Asthma Web Application or OAKKU database of known asthmagens/irritants, to identify allergenic and irritant agents. A Thai version questionnaire was developed using occupation- and task-based exposure descriptions rather than chemical names alone. Content and face validity were assessed by six experts using item-level content validity index (I-CVI) and scale-level content validity index based on the average method (S-CVI/Ave). Pretesting was conducted among 30 adult patients with new-onset or worsening asthma and a history of occupational exposure from two tertiary hospitals in Thailand. Participants completed both the newly developed questionnaire and the existing Medical Surveillance of Occupational Asthma Questionnaire (MSOAQ) routinely used in the occupational medicine clinic at Srinagarind Hospital, and the identified exposures from the two instruments were compared.

Results: The final developed questionnaire comprised three sections: confirmation of asthma diagnosis, identification of asthmagen/irritant exposure, and screening for the likelihood of WRA. After two rounds of expert review, all items met predefined content validity criteria (I-CVI ≥0.83 and S-CVI/Ave ≥0.90). Face validity supported clarity and clinical applicability. During pretesting, task-based descriptions and practical examples facilitated greater recognition of asthmagen/irritant exposures compared with name-based items in the MSOAQ.

Conclusion: The developed questionnaire demonstrated good validity and improved identification of occupational asthmagens/irritants, supporting its use as a screening tool in clinical settings.

Keywords: Work-related asthma; Asthmagens; Questionnaire; Validation; Clinical settings

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Asthma is a chronic inflammatory airway disease and remains a significant global health burden. Approximately 25% of asthma cases are related to workplace exposure, collectively referred to as work-related asthma (WRA)[1], which includes occupational asthma (OA) and work-exacerbated asthma (WEA). OA is classified into 2 types, which are sensitizer-

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What is already known about this topic?

Questionnaires are useful tools for identifying potential occupational asthmagens and for screening WRA. However, they have limited sensitivity for detecting WRA when used as part of routine workplace medical surveillance. Previous evidence suggests that screening conducted in a clinical setting is more effective in detecting WRA than surveillance programs implemented solely in the workplace. In addition, asthmagens included in existing questionnaires are often difficult for workers to interpret, making accurate identification of relevant occupational exposures challenging.

What does this study add?

This study shows that incorporating activity-based descriptions, clear explanations, and practical examples of asthmagens improves respondents' understanding and facilitates more accurate identification of occupational exposures. The developed questionnaire helps clinicians recognize potential work-related causes of asthma, supporting earlier detection of WRA and more timely intervention. It may be particularly useful in clinical settings in developing countries, where workers often have limited knowledge of specific workplace asthmagens.

induced asthma and irritant-induced asthma[1-4]. There are many asthma-causing agents in the occupational and industrial processes. Some occupations can expose a worker to many asthmagens/irritants, while some agents are involved in many occupations[1,4,5].

The diagnosis of WRA enables avoidance or reduction of exposure to symptom-worsening sensitizers or irritants, supports appropriate asthma management, helps prevent disease among workers in similar settings, facilitates identification of additional cases, and improves access to compensation[1,6]. WRA is diagnosed based on occupational history and supportive investigations, with history taking on work exposure and symptom–work relationships being the crucial first step[1,7,8]. A questionnaire is a useful tool to assess the occupational and medical history of the patients and may be helpful for screening WRA[9]. However, some questionnaires do not ask about the specific exposure agents in the workplace, and some patients also cannot identify the agents.

Delayed diagnosis of WRA and continued workplace exposure are associated with increased symptom severity, poorer asthma control, higher morbidity, greater healthcare costs, and productivity loss[10,11]. Although workplace medical surveillance may facilitate early detection, most WRA cases remain underdiagnosed and are more often identified in clinical settings. Previous studies reported low detection rates of WRA through workplace surveillance. For example, in the motor vehicle repair industry in the United Kingdom, only 9 cases were identified over a three-year period (mean incidence rate 0.79 per 1,000 workers) based on health surveillance records from 1995 to 2000[12]. Similarly, a retrospective study in Finland reported that only 11 cases (18%) were detected through workplace surveillance, compared with 49 cases (82%) identified in healthcare settings[13]. Underdiagnosis may result from limited awareness and screening, under-reporting by workers and healthcare professionals, failure to assess work-relatedness of symptoms, fear of job loss, and inadequate workplace pathways for diagnostic confirmation[12,14]. In addition, workers may have difficulty identifying workplace asthmagens/irritants, and spirometry in medical surveillance has shown limited benefit in asymptomatic individuals[3,13].

Clinical settings serve as a critical point for the early identification of WRA, with more cases detected in clinical practice than through workplace surveillance. However, it remains under-recognized due to the absence of systematic occupational exposure assessment. Although the Occupational Asthma Web Application or OAKKU—a web-based tool developed at Khon Kaen University to provide information on occupational asthmagens/irritants and to screen for WRA—has been applied in clinical settings, its utility remains limited due to incomplete asthmagens/irritants data input[15]. An OA identification questionnaire may therefore be essential for the early detection of WRA in clinical settings. This study aimed to develop a Thai questionnaire for OA identification in clinical settings and to examine its content and face validity.

Materials and Methods

This research was a descriptive study. Previous studies and existing resources, including the OAKKU database, were reviewed to identify occupational asthmagens/irritants across various industries[1,4,15-17]. Both asthmagens and irritants were identified, including flour in bakery work, plant- and animal-derived allergens in agriculture, latex and disinfectants in healthcare, and isocyanates in occupations such as automotive work, carpentry, insulation installation, and the use of adhesives or spray paints. The Thai version questionnaire was developed by grouping items by occupation and specifying relevant asthmagens. Exposures were framed as recognizable work activities, and explanatory descriptions were provided for asthmatics with technical chemical names to enhance comprehension and accurate reporting. The questionnaire comprised three sections: confirmation of asthma diagnosis, identification of asthmagen/irritant exposure, and likelihood of WRA.

Part 1: Confirmation of asthma diagnosis. This section obtained patient-reported information on physician-diagnosed asthma, including duration since diagnosis, methods used for diagnosis, age at symptom onset, symptoms prior to diagnosis, current asthma treatment, and current asthma status.

Part 2: Identification of asthmagens/irritants and exposure activities. This section constituted the core component of the questionnaire. It included questions on main occupation, secondary occupation or hobbies, occupational hazards, and specific exposure characteristics of asthmagens/irritants. To facilitate accurate identification of occupational exposures, the questionnaire incorporated task-based and industry-specific screening questions focusing on concrete work activities known to generate airborne allergens or irritants. Presenting asthmagens in relation to familiar tasks and job processes helped participants more easily recall and recognize substances to which they had been exposed. In addition, descriptions of asthmagens characteristics and the inclusion of practical examples

of relevant substances enhanced comprehension and further supported participants in identifying potential exposures.

For example, participants involved in baking or beverage preparation were asked about exposure to airborne flour or dough dust, nut or egg powder, coffee roasting activities, and the use of natural rubber latex gloves. In the agriculture or livestock sector, questions addressed exposure to pollen or grain dust, straw or hay, contact with bees or silkworms, and exposure to animal hair, fur, or feces. For workers in the electronics industry, items assessed exposure to agents such as isocyanates in surface coatings or spray paints, polyurethane adhesives, and rosin-based soldering flux.

Similar activity-based questions were developed for other occupational groups to comprehensively capture asthmagen/irritant exposures across different industries. Occupational groups were classified into 12 categories, based on a review of common occupations associated with exposure to common asthmagens/irritants: baking or beverage preparation; cook or chef; agriculture or livestock farming; health worker; automobile manufacturing or vehicle repair; furniture maker or carpenter; electronics industry or soldering work; metal industry; cleaner; hairdresser; clerical work; and others.

Part 3: Likelihood of WRA. This section applied standardized screening questions commonly used in clinical and research settings to assess symptom worsening during work, particularly following exposure to asthmagens/irritants identified in Part 2, and symptom improvement during periods away from work. Information on occupational history obtained in Part 2 also provided a preliminary indication of exposure duration. This section was intended for initial screening to identify individuals who may require further investigation to confirm the diagnosis.

Content and face validity were evaluated by a purposive sample of six experts, including three occupational medicine physicians, two pulmonary and critical care physicians, and one industrial hygienist. The number of experts was determined based on methodological recommendations suggesting that content validation should involve a minimum of six and not more than ten experts[18]. Item relevance was rated using a four-point Likert scale. The item-level content validity index (I-CVI) and the scale-level content validity index based on the average method (S-CVI/Ave) were calculated. The I-CVI was defined as the proportion of experts rating an item as 3 or 4 (I-CVI = Nc/N), while the S-CVI/Ave was calculated as the mean of I-CVI values across items (ΣI-CVI/p).

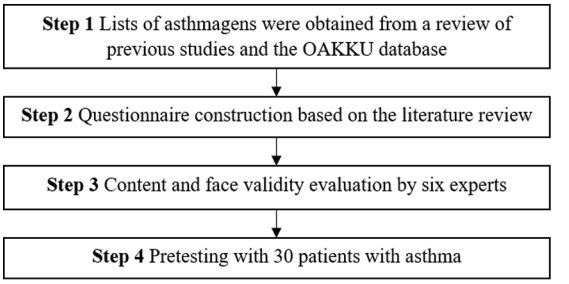

Figure 1. Flow diagram of the research methodology.

Items not meeting predefined criteria (I-CVI ≥0.83 and S-CVI/Ave ≥0.90) were revised based on expert feedback and reassessed[18,19]. Face validity focused on clarity, comprehensiveness, and appropriateness of wording. Experts were asked to evaluate the clarity of each item (clear vs. unclear) using a content and face validity assessment form. This step was conducted between June 2025 and September 2025.

Pretesting of the developed questionnaire was carried out among 30 adult patients aged 18-75 years who had new-onset or worsening asthma with a history of occupational exposure to asthmagens/irritants. Participants were recruited through purposive sampling from Srinagarind Hospital (20 patients) and Maharat Nakhon Ratchasima Hospital (10 patients). The number of participants for pretesting was determined based on methodological recommendations requiring a minimum of 30 participants[20]. The upper age limit was extended to 75 years to reflect the age distribution of asthma patients in the study settings, where patients are generally older and have a history of occupational exposure to asthmagens/irritants, and to ensure adequate recruitment of eligible participants, including those with possible delayed diagnosis related to previous occupational exposure. Participants completed both the existing Medical Surveillance of Occupational Asthma Questionnaire (MSOAQ), routinely used in the occupational medicine clinic at Srinagarind Hospital, and the developed questionnaire. Asthmagen/irritant exposures were self-reported by participants based on their own work tasks and activities, and the identified exposures were then compared. All data were anonymized, and medical records were used as supplementary information. This step was conducted between November 2025 and December 2025 (Figure 1).

Results

The developed questionnaire comprised three parts: confirmation of asthma diagnosis, identification

of asthmagens exposure, and assessment of the likelihood of WRA, with a total of 26 items. The pretesting and validation process focused primarily on Part 2, as the main objective was to evaluate the ability of the instrument to facilitate identification of relevant asthmagen/irritant exposures.

Content validity of the developed questionnaire

Overall, the questionnaire demonstrated good content validity across all parts. In the first round of assessment, 25 of 26 items met the predefined acceptance criterion (I-CVI ≥0.83), with 12 items demonstrating excellent content validity (I-CVI=1.00) and 13 items demonstrating acceptable content validity (I-CVI=0.83). One item had an I-CVI of 0.67 and required revision. The overall S-CVI/Ave for the questionnaire was 0.90, indicating satisfactory content validity.

In Part 1, several items required minor revisions to improve clarity, such as refining wording, reordering items to better reflect disease chronology, and specifying whether symptoms referred to the current asthma episode. One item, which assessed asthma duration, was considered less reliable due to potential recall bias, and experts recommended revising it to focus on duration since diagnosis based on medical records rather than patient self-report.

In Part 2, which applied a task-based approach combined with explanations and practical examples of asthmagens/irritants, all items met the predefined content validity criterion, with I-CVI values ranging from 0.83 to 1.00. Several items achieved an I-CVI of 1.00, reflecting a high level of expert agreement. Expert feedback primarily involved targeted refinements, including distinguishing between current and past occupations, expanding the range of asthmagens/irritants options within certain items, broadening flour types in baking-related exposures, adding pesticide exposures in agricultural work, and incorporating natural rubber latex glove exposure in relevant occupations.

Part 3 demonstrated excellent content validity. Expert reviewers recommended clarifying the temporal relationship between occupational exposure and respiratory symptoms, as well as specifying the duration of time away from work required for symptom improvement. The item assessing asthma onset or worsening after starting work achieved acceptable content validity, with comments noting the potential latency period of OA.

Following revisions based on expert feedback, a physician-record section was added to document asthma diagnosis, diagnostic methods, and treatment information based on medical records. A second round of content validity assessment was then conducted. Items that had not met the predefined acceptance criterion in the first round were revised and re-evaluated. These revised items achieved I-CVI values of 1.00 in the second round, indicating full expert agreement after modification. The final questionnaire, therefore, demonstrated strong overall content validity.

Face validity of the developed questionnaire

Face validity was evaluated to assess the clarity, comprehensibility, and practical applicability of the questionnaire. Experts reviewed the wording, structure, and format of each item to ensure suitability for use in clinical settings. Overall, the questionnaire was considered clear and appropriate for the target population. Minor refinements were recommended to enhance readability and reduce potential misclassification, particularly regarding the timeframe of asthma treatment and the description of exposure characteristics. Based on this feedback, wording and formatting adjustments were made to improve clarity and ease of interpretation.

Pretesting: comparison of asthmagen/irritant exposures identified by the developed questionnaire and the MSOAQ

Overall, the results of the pretesting step of the study, which assessed the questionnaire among 30 participants, demonstrated that the researcher-developed questionnaire enabled participants to identify a broader range of asthmagen/irritant exposures compared with the MSOAQ routinely used in the occupational medicine clinic at Srinagarind Hospital (Table 1).

Specifically, eight asthmagens/irritants were reported using the developed questionnaire but were not selected in the MSOAQ. These included spices such as chili powder or curry powder; straw or hay; animal hair, fur, or feces; chlorhexidine disinfectants; formalin or formaldehyde; operating or sitting near a photocopier; natural rubber gloves (latex); and isocyanates. Notably, although participants frequently selected “lacquers” or “spray paints” in the MSOAQ, the term “isocyanates” was not selected when it was presented without additional clarification.

Furthermore, four additional asthmagens/irritants were identified through the developed questionnaire that were not included in the MSOAQ, namely icing sugar, cocoa powder, or baking powder; legume or egg powder; pesticides; and hair bleaching agents. In

Table 1. Comparison of the number of participants endorsing occupational asthmagens/irritants in the developed questionnaire and the MSOAQ

		Number of participants endorsing	
		Developed questionnaire	MSOAQ
Occupation-specific asthmagens			
1.	Baking or beverage preparation		
	Wheat flour, glutinous rice flour, corn flour, tapioca flour, bread flour, all-purpose flour, cake flour, or dough	1	1
	Legume powder, egg powder, or yeast powder	0	Not included
	Icing sugar, cocoa powder, or baking powder	1	Not included
	Roast raw coffee beans	0	Not included
2.	Cook or chef		
	Wheat flour, glutinous rice flour, corn flour, or tapioca flour	2	2
	Legume powder or egg powder	3	Not included
	Spices such as chili powder or curry powder	4	3
	Fish, shrimp, or crab	2	2
3.	Agriculture or livestock farming		
	Pollen from flowering plants or grain dust (e.g., wheat)	7	7
	Straw or hay	8	4
	Bees or silkworms (e.g., during beekeeping or silk production)	2	2
	Animal hair/fur or animal feces	7	6
	Pesticides	3	Not included
4.	Health worker		
	Chlorhexidine disinfectants	7	6
	Glutaraldehyde disinfectants such as Cidex	3	3
	Dental filling or coating materials, such as methyl methacrylate or resins	0	Not included
	Bone cement, such as polymethyl methacrylate	0	Not included
	Formalin or formaldehyde	4	2
5.	Automobile manufacturing or vehicle repair		
	Coolants or metalworking fluids (cutting fluids)	1	1
6.	Furniture maker or carpenter		
	Planing or sawing wood, such as redwood, teak, albizia, or rubberwood	1	1
7.	Electronics industry or in soldering work		
	Rosin-based soldering flux or flux (yellow liquid)	2	2
8.	Metal industry		
	Metal fumes or metal dust (e.g., nickel, chromium, cobalt, platinum) during welding, grinding, or polishing	1	1
9.	Cleaner		
	Cleaning agents, such as toilet cleaners, floor cleaners, or glass cleaners	2	2
10.	Hairdresser		
	Hair dyes (e.g., hair coloring products)	1	1
	Hair bleaching agents	1	Not included
11.	Office or clerical work		
	Operate a photocopier yourself or sit near a photocopier	8	7
	Operate a printer yourself or sit near a printer	8	8
12.	Others		
	Dust from banknotes	1	Not included
Asthmagens are reported across multiple occupations			
	Natural rubber gloves (latex)	12	0
	Isocyanates (e.g., in surface coatings, spray paints, or polyurethane adhesives)	4	0 (isocyanates) 4 (lacquers and spray paints)
	Adhesives or glue, such as polyurethane adhesives	4	4

MSOAQ=Medical Surveillance of Occupational Asthma Questionnaire
Not included: item not included in the MSOAQ

contrast, several asthmagens listed in the developed questionnaire were not reported by participants, as they had not been exposed to these substances. These included roasting raw coffee beans; dental filling or coating materials, such as methyl methacrylate or resins; and bone cement, including polymethyl methacrylate. For the remaining asthmagens/irritants, participants' responses in the developed questionnaire were generally consistent with those recorded in the MSOAQ. Additionally, one asthmagen/irritant—dust from banknotes—was spontaneously reported by a participant through the developed questionnaire but was not included in the MSOAQ.

A comparison of paired responses between the two instruments highlighted clear differences in endorsement for certain asthmagens/irritants. In particular, isocyanates and natural rubber gloves (latex) were more frequently identified using the developed questionnaire than the MSOAQ, suggesting improved recognition when familiar terms and task-based descriptions were used. The developed questionnaire can identify all asthmagens/irritants in all participants (30/30). In contrast, the MSOAQ can only identify all asthmagens/irritants in 9/30 (30%), with a significant difference ($p<0.001$).

Among participants from the occupational lung clinic at Maharat Nakhon Ratchasima Hospital, three were confirmed as having WRA based on the OASYS score. However, some participants were not further investigated; therefore, WRA could not be definitively confirmed and was considered only as suspected in those cases.

Discussion

The questionnaire was developed based on the construct that WRA can be identified through structured assessment of asthma diagnosis, occupational asthmagen/irritant exposure, and work-related respiratory symptoms. Content validity confirmed that each section adequately captured its intended construct[19]. Most items achieved acceptable I-CVI values. One item in Part 1, on timing of asthma diagnosis, did not meet the threshold due to concerns about recall bias in self-reported data. Previous studies have demonstrated that self-reported health service utilization is susceptible to recall bias and may diverge from medical records[21]. Therefore, a physician-recorded section based on medical records was added to improve the reliability of diagnostic timing while preserving clinical relevance.

Part 2 constituted the core of the questionnaire and achieved full expert agreement for all items, supporting its content validity in identifying suspected occupational asthmagen/irritant exposure. The items systematically captured information on occupations, work processes, and task-specific exposures. By describing hazards in relation to real-world job activities rather than listing agent names alone, the questionnaire improved respondents' comprehension and reporting accuracy. This approach aligns with cognitive models of memory retrieval, in which structuring questions across related areas helps prompt recall by linking related information[22]. For example, one item asked cooks or chefs whether they came into contact with wheat flour, glutinous rice flour, corn flour, or tapioca flour in a dusty form during food preparation, using dichotomous response options (yes/no). This format situated the hazard within a familiar task and supported mental visualization of exposure circumstances. In the developed questionnaire, the response options were presented in their complete form to enhance clarity in the Thai language context. Prior research has recommended that dichotomous options be fully written to reduce ambiguity in languages such as Thai[23].

From a pathophysiological and epidemiological perspective, OA is influenced by the type of asthmagens/irritants, underscoring the importance of accurate agent identification. Job titles and task descriptions can be linked to job-exposure matrices to classify exposures, particularly when aligned with the job preceding symptom onset[24]. Even without quantitative data, this approach enables identification of occupational hazards and supports exposure–disease evaluation. As shown in Table 1, our study demonstrated that a well-designed questionnaire could operationalize this concept by identifying asthmagens/irritants through occupation- and task-based descriptions rather than requiring respondents to name specific agents—an approach that was especially relevant in the Thai context, where technical chemical names may be unfamiliar.

Part 3 of the questionnaire was designed as a screening component to assess the likelihood that asthma is work-related and demonstrated good content validity. This section included questions on symptom patterns, specifically worsening during workdays and improvement on days off, as indicators of work-relatedness. When responses suggest WRA, further investigation is required to confirm the diagnosis[1]. This questionnaire was developed primarily for use in clinical settings rather than for population-based medical surveillance. As previously reported, most cases of WRA are identified when patients present to healthcare facilities rather than through early detection

surveillance programs[13]. Screening for suspected cases in the clinical setting enables timely referral for confirmatory investigations and facilitates appropriate preventive and therapeutic interventions.

Following expert validation, the questionnaire was pretested to evaluate clarity, comprehension, and feasibility before clinical use. Participants responded to several asthmagen/irritant items in the developed questionnaire, but did not select corresponding items in the MSOAQ. This discrepancy may reflect the absence of initial prompts on occupation or specific work tasks, which could limit recall of exposures. In addition, listing agent names without contextual descriptions may have reduced understanding and confidence in identifying exposures. These findings are consistent with prior research showing that task-based questions improve exposure identification, particularly for silica[25]. However, unlike the typical task-based approach used in silica assessment, this study applied an agent-based approach before linking exposures to work tasks.

This pattern was illustrated in the case of isocyanates. Participants were unable to respond when only the technical term "isocyanate" was used, but identified exposure when practical examples such as lacquer or spray paints were provided. This suggested that workers recognized exposures more readily through familiar products than technical chemical names. Providing concrete examples, therefore, enhanced understanding and recall, consistent with evidence that examples improve response accuracy[26]. A similar pattern was observed for natural rubber latex: participants did not respond to a general item but readily identified exposure when "natural rubber/latex gloves" were specified. These findings were consistent with established survey design principles advocating clear, familiar language and avoidance of technical terms to reduce misunderstanding and non-response[27]. Overall, framing exposure questions using concrete examples rather than technical agent names improves both comprehension and recall.

Conversely, several asthmagen/irritant items captured in the developed questionnaire were not included in the MSOAQ. These items were easier for participants to understand because the questionnaire provided clear, occupation-based descriptions using simple, non-technical language, enabling accurate identification of exposures without difficulty. Nevertheless, important gaps remain in clinical practice. Occupational histories are often insufficiently detailed to establish links between workplace exposures and asthma symptoms, and under-recognition of WRA continues to be reported[3,28]. Previous recommendations have highlighted the importance of providing clinicians with structured information on common workplace exposure agents to support earlier recognition and management of WRA[29]. In this context, the developed questionnaire may enhance patients' ability to identify asthmagen/irritant exposures and support healthcare professionals in recognizing potential WRA during clinical assessment.

Limitation

This study has some limitations. First, there was unequal representation of experts across disciplines (three occupational medicine physicians, two pulmonary and critical care physicians, and one industrial hygienist). This reflected the emphasis on occupational medicine in diagnosing WRA and assessing WRA asthmagen/irritant exposures, while pulmonary physicians and the industrial hygienist contributed to clinical and occupational exposure aspects, respectively. Second, the questionnaire was developed and tested in a clinical setting; therefore, its validity and reliability have been established only for clinical application. Although the tool may be feasible for use in field or workplace settings, further validation is required to confirm its appropriateness and accuracy in those contexts.

Conclusion

The developed questionnaire demonstrated good validity and facilitated more effective identification of occupational asthmagens/irritants by framing exposures in terms of concrete work activities and exposure characteristics rather than relying solely on technical agent names. This approach improved respondents' ability to recognize relevant workplace hazards.

Recommendation

Usability testing is recommended to assess ease of use, clarity, feasibility, and user satisfaction among both clinicians and patients. Additional studies should be conducted to determine the diagnostic accuracy of the developed questionnaire, including its sensitivity and specificity for identifying WRA. Furthermore, the impact of routine implementation should be evaluated to determine whether use of the developed questionnaire leads to earlier recognition and increased identification of WRA cases.

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Authors' contribution

SK conceptualized and designed the study, conducted the literature review, developed the questionnaire, performed data collection and formal analysis, and drafted the manuscript. NC contributed to methodology design and questionnaire development, supervised the study, and critically revised the manuscript. CN contributed to methodology design and questionnaire development. TS assisted with participant recruitment during the data collection phase and contributed to manuscript review. WB assisted with participant recruitment during the data collection phase. All authors read and approved the final manuscript.

Clinical trial registration

Not applicable. This study is descriptive research focused on questionnaire development and validation, and does not involve any clinical interventions.

Conflict of interest

The authors declare no conflicts of interest.

Data availability statement

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Ethical approval and consent to participate

This study was reviewed and approved by Khon Kaen University Ethics Committee for Human Research (Reference No. HE671468) and the Maharaj Nakorn Ratchasima Hospital Institutional Review Board (Reference No. 68157). Informed consent was obtained from all participants involved in the study.

Use of artificial intelligence

During the preparation of this manuscript, the authors used ChatGPT (version GPT-4o) and Gemini (version 1.5 Flash) solely for English language editing, including grammar, vocabulary, syntax, and punctuation. These AI tools were not used to generate scientific content, analyze data, or influence the interpretation of results. The authors have reviewed and edited the output as needed and take full responsibility for the final content of the article.

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