ORIGINAL ARTICLE

Effectiveness of User Guide for Occupational Asthma Web Application (OAKKU) Developed through Participatory Action Research

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Background: Work-related asthma (WRA) is often undiagnosed and underreported. The occupational asthma web application (OAKKU) has been created to assist in identifying asthmagens to find and manage WRA. However, it has language limitations and lacks a user guide.

Objective: To develop an effective OAKKU web application user guide using participatory action research (PAR).

Materials and Methods: The design of the present study was PAR. The study was conducted in two loops of PAR at two asthma clinics, with the eight participation of physicians, nurses, nurse assistants, and pharmacists. Data was collected through group meetings, brainstorming sessions, situational analysis, and real-time observation during work. Data analysis was carried out using content analysis and mean.

Results: The results revealed challenges as the followings. Physicians lacked awareness due to the effectiveness of current treatments and difficulties in accessing information on asthmagens, coupled with limited time for searching. Although the OAKKU web application was developed and implemented, language barriers and complex search functions posed usability issues. To address these challenges, user guides were developed, and the OAKKU web application was translated into Thai, while search functionalities were simplified. Experimental results demonstrated high effectiveness, as evidenced by a usability test score of 4.88 out of 5 for ease of understanding and satisfaction. Additionally, the OAKKU web application significantly reduced search time.

Conclusion: The OAKKU web application user guide, developed through PAR, significantly enhanced the OAKKU web application. These included improvements to incorporate Thai language supports and simplifies the search process, resulting in more effective searches.

Keywords: Work-related asthma; Occupational asthma; Asthmagens; Web application; Diagnosis of asthma

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Asthma is characterized by chronic airway inflammation. Respiratory symptoms such as wheezing, shortness of breath, chest tightness, and cough, are typically observed[1]. Globally, approximately 360 million people suffer from asthma. Among adult-onset asthma cases, about 15% to 25% are work-related asthma (WRA)[2-5]. In a study conducted by the Global Burden of Disease (GBD) 2016 Occupational Chronic Respiratory Risk Factors Collaborators, the mortality rate attributed to occupational asthma (OA) was 37,600 individuals per year. The resultant consequential loss of disability-adjusted life years (DALY) totals 2.3 million years within Asia, Oceania, Africa[6], and Thailand. In 2014, Wortong et al. interviewed 105 asthma patients in an asthma clinic of a university hospital and reported that 87.6% had symptoms after starting their jobs[7]. In 2018, Jongkumchok et al. studied the proportion of WRA in 523 patients in an asthma clinic and found that 16.3% had WRA[8].

WRA is preventable[9] and frequently undiagnosed or underreported[10]. Early diagnosis can significantly reduce the impact and severity[3]. However, on average, it takes four years from the appearance of the first symptom to reach a diagnosis[10]. Studies, including those by Poonai et al., revealed that a significant reason for this delay was physician

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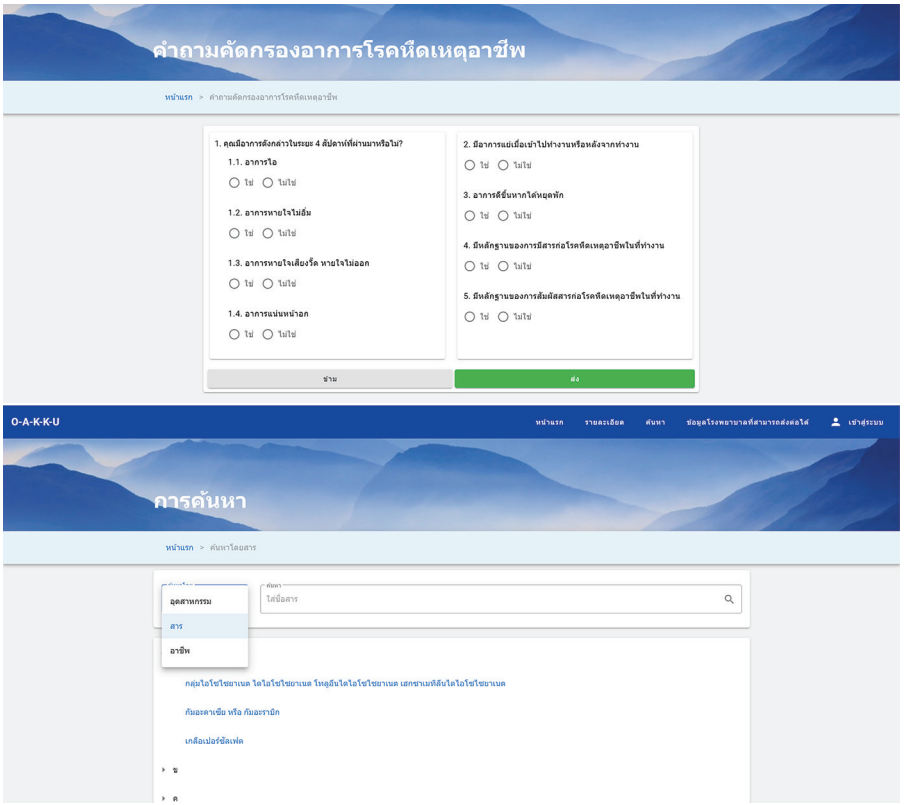

Figure 1. Example of OAKKU.

Link of OAKKU: https://asthma-project.web.app/

failure to explore the link between patient jobs and symptoms[11]. Manuchet found that only about a quarter of patients had their occupational history fully recorded, and less than half had their occupation noted[12]. Thus, there is a gap in the diagnosis and reporting of WRA, particularly among primary care practitioners and specialists[3]. In primary care, there is a significant lack of knowledge regarding asthma management and diagnosis[13]. Specialists often miss screening for WRA and neglect to ask whether asthma symptoms are work-related[14,15]. Specialists tend to diagnose WRA only when triggered by an agent with which they are familiar[14,16]. Parhar et al. surveyed specialists, revealing that the two main challenges in diagnosing WRA are the physician's limited knowledge about workplace factors and the time-consuming nature of linking various potential causes of WRA to the workplace. Therefore, enhancing education and awareness among specialists regarding the possible causes of OA could be beneficial[16].

A questionnaire is the current tool that aids physicians in diagnosing WRA. This typically includes questions about whether symptoms worsen at work and improve when away from it. Questionnaires have been developed in many countries to aid in diagnosis, such as the WRA Screening Questionnaire (long-version) [WRASQ(L)] and the Occupational Asthma Screening Questionnaire-11 items (OASQ-11)[17,18]. However, the effectiveness of these tools is limited by under-reporting. This often occurs because, during initial medical evaluations, there is a lack of focus on identifying asthmagens in the workplace or in specific occupations that could cause asthma. Another resource for healthcare workers is a web application designed to provide information about asthmagens. Sangjumrus et al.[19] developed an application named "O-A-K-K-U", which compiles data from systematic reviews into an accessible online platform. This application assists in diagnosing asthma by offering a questionnaire about symptoms, their relationship with the workplace, and detailed information about various asthmagens categorized by occupation (Figure 1). Users can input specific occupations or substances into the OAKKU web application to obtain relevant information for identifying and managing WRA. Knowing the

asthmagens present in the workplace can assist in diagnosis[14]. However, testing revealed issues, such as challenges in searching for information and the time-consuming nature of the process, mainly when dealing with unfamiliar asthmagens. Additionally, there are language barriers, as the application does not yet support Thai, and no user guide is available[19].

The present study aimed to develop an effective OAKKU web application user guide using participatory action research (PAR).

Materials and Methods

Research design

A participatory action research was conduct.

Site/Setting

Loop 1 was conducted at the Easy Asthma Clinic at Srinagarind Hospital, Khon Kaen University, which is a specialized clinic within a large hospital. It featured chest physicians specialized in treating asthma and could also diagnose OA. This clinic had a history of involvement in experimental trials and had significantly contributed to the development of the OAKKU web application.

Loop 2 was conducted at the Easy Asthma Clinic, Srinagarind Hospital at Khon Kaen University, and the Occupational Lung Clinic at Maharat Nakhon Ratchasima Hospital. These were clinics that provided treatment by chest physicians for lung diseases related to occupational exposure and could also diagnose OA.

Methodology

This process was performed in two loops of PAR. Each loop comprised four steps (Figure 2).

Loop 1: The purpose of this loop was to engage stakeholders in planning, implementing, observing, and reflecting on the use of the OAKKU web application in the clinical setting.

Step 1 (Planning) involved identifying issues related to the use of the OAKKU web application in the clinic and devising a plan, which included drafting a user guide. Preparation engaged medical professionals, comprising a chest physician, a nurse, a nursing assistant, and a pharmacist, who organized meetings with all parties involved. Problem analysis was conducted through situation analysis by group discussions held to analyze the situation and problems encountered in diagnosing WRA. These discussions identified clinics that agreed to participate and recognized the significance of the issue. They also compiled points for inclusion in the user guide.

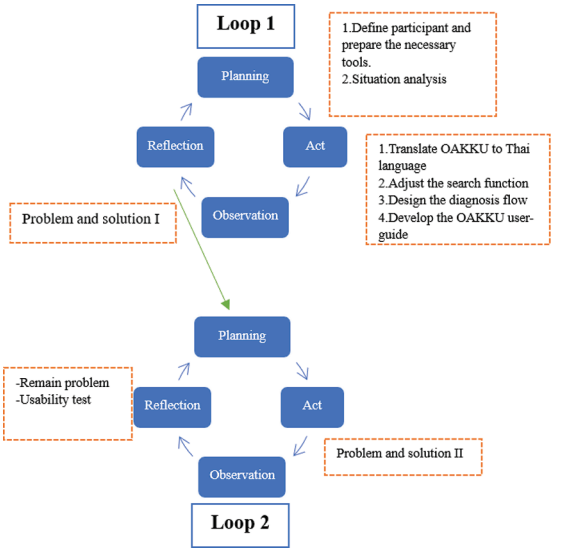

Figure 2. Overview of the studied PAR process.

Brainstorming sessions were applied as techniques. The planning step was conducted initially at the start of the research project and revisited three times, with each session occurring one week apart. Each meeting lasted for 30 to 60 minutes in this loop. In each meeting, everyone participated, including a researcher who acted as the moderator.

Step 2 (Action/Implementation) involved putting the plan formulated in Step 1 into action. The user guide was implemented according to the devised plan, specifying the method of implementation and responsible individuals. Techniques such as training sessions, pilot testing, and feedback mechanisms were employed during the implementation phase. The duration of implementation lasted two months, with activities conducted once a week, totaling seven sessions. Participants included healthcare professionals responsible for using the OAKKU web application in the clinical setting, as well as researchers overseeing the process.

Step 3 (Observe) involved collecting data and evaluating the effectiveness of the user guide in conjunction with the OAKKU web application, with a focus on identifying areas needing improvement. Techniques such as surveys, interviews, and observations were used to gather feedback, and evaluation criteria were applied to assess the user guide's usability. Observation was ongoing throughout the implementation phase, which was every time the services were provided at the clinic. The time required for observation lasted two months, with activities conducted once a week, totaling seven

sessions. Healthcare professionals responsible for using the OAKKU web application in the clinical setting, along with researchers overseeing the process, participated in this step.

Step 4 (Reflection) involved using the insights gained from the observation phase to refine and improve the user guide. Reflective sessions, focus groups, and collaborative discussions were used to review feedback and make necessary adjustments to the user guide. Reflection occurred following the observation phase and continued iteratively throughout the research project. The time required for reflection depended on the extent of changes needed and the complexity of the feedback received, involving four meetings over two months. Healthcare professionals responsible for using the OAKKU web application in the clinical setting, along with researchers overseeing the process, participated in this step.

Loop 2: The PAR process was repeated and built upon the insights and improvements made during Loop 1. Additionally, research activities were conducted in two clinics during Loop 2. The steps outlined in Loop 1 were revisited, and any necessary adjustments were made based on the reflections from the previous loop with a researcher acting as the moderator and responsible for collecting, analyzing data, and addressing issues that arose during the process. This iterative approach allowed for continuous refinement and enhancement of the user guide and its implementation in the clinic. In the Reflection phase of Loop 2, a focus group discussion was conducted to discuss and summarize the problems and solutions identified during the previous phase. Effectiveness was assessed using a usability test, and the duration of program usage. The usability test involved a questionnaire divided into five categories, ease of understanding, accuracy of information, speed of finding information, memorability, satisfaction, and ease of use. Additionally, the average duration of OAKKU usage before and after using the user guide was compared.

Data collection

Primary data were collected through group meetings, where notes and observations were recorded. In Loop 1, information and procedures for diagnosing OA were documented, along with problems and solutions related to diagnosing this condition using the OAKKU web application. This process also identified essential information points for the creation of the OAKKU user guide. In Loop 2, data on usability testing, usage duration, and operational issues were collected.

Data analysis

The data were then analyzed using content analysis, the usability tests were analyzed, and the duration required to use the OAKKU web application was calculated using the mean.

Ethical approval

The present research was approved by the Human Research Ethics Committee of Khon Kaen University on November 02, 2022, reference number HE651474.

Results

The results section focused on two findings: the development processes and outcome.

Processes

1. Problem identification and planning

From the situation analysis, a key issue identified in the diagnosis of OA in the clinic during the planning Step 1 of Loop 1 was that physicians still lack awareness in diagnosing OA. This was attributed to the current effective management of asthma that might obscure the importance of diagnosing the condition. Furthermore, gathering information about asthmagens in the workplace remains challenging, and there are no clear guidelines on how to manage a patient's work environment once OA is diagnosed. Nurses also seem to overlook the importance of OA diagnosis.

During a brainstorming session to identify issues with the use of the OAKKU in the hospital, physicians mentioned that their heavy workload left them less time to use the OAKKU web application. Additionally, all participants noted language barriers as the application is in English, making it difficult to use. Searching within the program also proved to be challenging (Table 1).

2. Data gather information

From the focus group discussion, participants expressed a need to develop OA diagnosis using the OAKKU web application as an aid. According to the physician, OAKKU's users should ideally be nurses, nurse assistants, or pharmacists, and researchers should be available to provide training and be stationed at clinics to assist with the usage of the tool and troubleshoot any issues during the process. It was also suggested that guidelines for managing patients suspected of having OA should be written.

Table 1. The problems related to the diagnosis of occupational asthma and the usage of the OAKKU web application

Participants	The problems with work-related diagnosis	The problems with the utilization of the OAKKU web application
Comments of physician	1. Physicians still lacked awareness in diagnosing work-related asthma because current treatments for asthma using inhalers are quite effective, and knowing the asthma-inducing substances may not change the treatment plan, which leads physicians to underestimate the importance of diagnosing the condition. 2. It remained difficult to gather information about asthmagens in the workplace. 3. There were no clear guidelines on how to manage a patient's work environment once work-related asthma is diagnosed.	1. Due to the heavy workload of physicians, they lacked time to use the OAKKU web application. 2. There were still difficulties in using the OAKKU web application. Basic training should be provided beforehand, and language barriers, particularly the absence of Thai language support, remained a problem.
Comments of nurse	There was still a lack of recognition regarding the importance of diagnosis. Once diagnosed, there was still no guidance on how to proceed.	1. Language remained a problem as it is in English, making it difficult to understand. 2. Searching within the OAKKU web application is still challenging because it requires familiarity with the profession, and multiple attempts using different job titles are often needed to find relevant information.
Comments of nurse-aid	No comments.	1. Searching using the OAKKU web application remained difficult to understand, and the English language made it challenging to comprehend certain aspects. 2. Language and job search issues persisted as the program still cannot easily search by job titles.
Comments of pharmacist	The main triggers often included dust, smoke, and burning activities in patients' daily lives, which came from work-related activities.	1. Utilizing the OAKKU web application remained somewhat challenging. 2. Language and job search issues persisted as the program still cannot easily search by job titles.

If physicians could have access to information about asthmagens, it would benefit their ability to advise on avoiding exposure to these substances. Nurses mentioned that access to disease information through the OAKKU web application has enhanced their understanding. Nurse assistants felt that they could assist nurses in using the OAKKU web application, while pharmacists suggested that there should be a manual with illustrations. All research participants agreed that the software should be translated into Thai and modified for easier search functionality.

3. User guide of the OAKKU web application development and implementation

The problem of using the system without a manual was highlighted by nurses, who noted the complexity involved in reaching the input field for substance or job title search. Navigating through general information pages and answering pre-screening questions for symptom assessment and job relevance were cumbersome. Consequently, it was deemed essential to provide program information detailing its benefits, access channels, and step-by-step usage instructions, from accessing the program to substance searching and data exportation upon finding substances. Drawing from gathered requirements and additional source[20] the manual should encompass various aspects, including introduction, assessment, components, how to use, frequently asked questions (FAQ), and contact information.

In Step 2, testing was conducted by measuring the time taken for usage, aiming for comparison after the availability of the OAKKU user guide. Regarding the use of OAKKU user guide (in this step, the OAKKU web application had not yet been modified), nurses and nurse assistants commented that operational details were still incomplete, lacking accompanying images for each step that could facilitate direct implementation. This led to additional time consumption for trial and error. Moreover, certain aspects, such as the explanation of the search process, remained challenging to understand, further increasing comprehension time. Concerning the OAKKU web application, difficulties persisted in the search process, particularly in initiating searches based on substance names or job titles. Researchers' assistance was required, especially for unfamiliar substance names or professions.

4. Making changes to the OAKKU user guide (Loop 2)

The final feedback from the users, nurses, and nurse assistants in the present research was as follows: The nurses suggested that videos explaining how to use the OAKKU web application should be included as they are easier to understand and clearly demonstrate the operational steps. The nurse assistants commented that although the OAKKU user guide was already easy to understand, they still felt that considerable effort was required to

Table 2. Components of the OAKKU user guide

Component	Operational Details	Detail
1. Introduction	1. What is the OAKKU web application? 2. How is it beneficial to use? 3. Who is it suitable for?	It includes the OAKKU web application introduction. The appropriate users for the OAKKU web application are nurses or clinical nursing assistants, and the benefit is that they can easily access information on allergenic substances
2. Devices that can access the OAKKU web application	1. Device 2. Link URL	The information introduction includes tools for use, suitable for computers or accessible via mobile phones and tablets, requiring an internet connection, and can be accessed through the link: https://asthma-project.web.app/
3. Components of the OAKKU web application	1. Language selection 2. General information about work-related asthma 3. Screening for symptoms of asthma and its relation to work 4. Searching by using profession, substances, and industry 5. Hospitals capable of referrals 6. Exporting information as a PDF file	The OAKKU web application components include a language selection option for Thai or English, screening questions, data search using occupation names, substance names, or industry group names, data export, and hospitals that can be referred to for diagnosis
4. How to use	1. Registration for use 2. Language selection for use 3. Initiating a search for asthmagens and professions 4. Exporting and saving data 5. Information on hospitals capable of referrals	The OAKKU user guide includes step-by-step instructions for each component, accompanied by illustrations for each step, to make it easy to follow the guide
5. Media that assists in usage	Video guide for usage	There are videos available that provide step-by-step instructions in Thai for each step, which can be accessed through link: https://youtu.be/ykN0VwLnR_4
6. Work guidelines	Example of a workflow diagram	An example of a flow chart for the guideline on how to implement the OAKKU web application in clinics, which can be adapted to suit the context of each clinic
7. Frequently asked questions (FAQ)	Frequently asked questions	Includes tools for use, reliability of information, issues in searching, and procedures to follow if a patient is suspected of having work-related asthma
8. Contact information	Contact channels for the OAKKU web application developer	Contact channels for the OAKKU web application developer

use the OAKKU web application. The physicians opined that the OAKKU web application was easy to use from their perspective and could be implemented.

The corrective actions taken included adding detailed descriptions for every step with accompanying illustrations and adding videos demonstrating the usage in Thai language and providing access channels. However, there were still obstacles. Some users found it difficult to store paper manuals, and the videos needed to have comprehensive details for each step. Moreover, limitations in video production tools and expertise posed challenges in creating instructional videos. After the OAKKU web application was translated into Thai and simplifying the search process, nurses and nurse assistants commented that the Thai language made it much easier to read and understand OAKKU. This led to a greater understanding of OAKKU and significantly reduced usage time. They could also use only certain keywords in asthmagens names or job titles for searching.

Outcome

The present research provided valuable insights into enhancing the effectiveness of the OAKKU user guide and improving the management of healthcare professionals. The main outcomes were threefold, 1) the OAKKU user guide was developed, 2) the OAKKU web application was improved, and 3) a flowchart for managing suspected patients was developed.

1. The OAKKU user guide was developed to reference the data collected during the data-collection phase. It was possible to define the necessary topics, essential content, and user needs for the OAKKU user guide (Table 2).

An example of the OAKKU user guide created (in the Thai language) can be found at the following URL link: https://kku.world/p0d7a (Figure 3).

2. Improved the OAKKU web application by translating and enhancing the search functionality to make it easier. Through experimentation and identifying issues related to using OAKKU, it was found that there were problems with language when

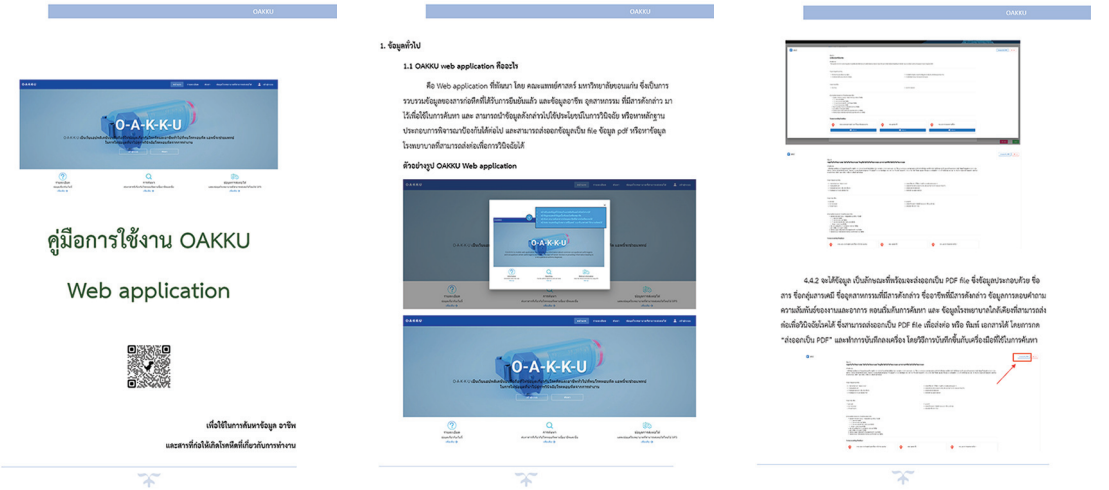

Figure 3. Example of the OAKKU user guide.

searching for asthmagens and difficulties in typing job names for searching. These issues were addressed through OAKKU enhancements to improve the user interface.

Adjusted OAKKU's usability and searchable information. Previously, the OAKKU web application was only available in English, the present research translated it to Thai. It then allowed searching in both English and Thai. Language experts translated the text, substances, job names, and OAKKU content from Thai to English. In the language translation process, converting occupation codes into Thai was necessary. Therefore, a transition from the International Standard Industrial Classification of All Economic Activities (ISIC) codes, which were in English, to the Thai Standard Industrial Classification (TSIC) codes was made. TSIC codes had slight modifications but retained the same meanings as the ISIC codes. This adaptation was beneficial because workplace asthmagens were categorized according to industry groups, which made searching easier. Users could choose the language in which they conducted their search. Enhanced the OAKKU web application's search capability to allow searchers to use specific keywords in job names or substance names without necessarily requiring the initial letters of the job name. Modified the OAKKU web application format to allow for adding and editing asthmagens, job names, and details later, with individual access permissions to the database (Table 3).

3. Developed a flowchart for managing suspected OA patients for use as a guideline in clinics to help solve the problem of the lack of a management approach for patients and facilitate referrals for diagnosis (Figure 4).

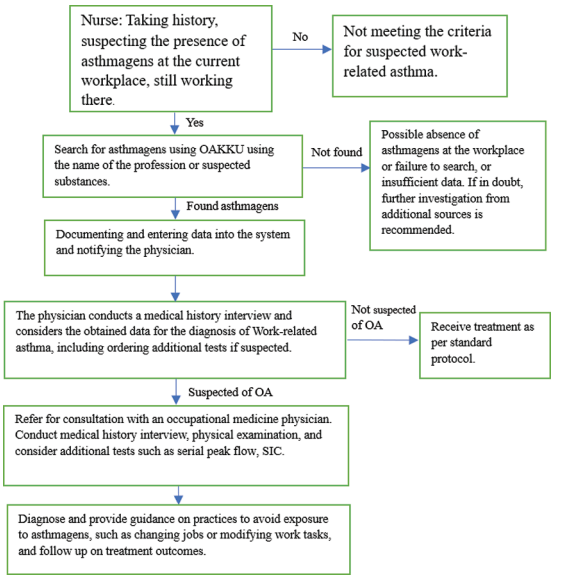

Figure 4. Flowchart diagram of using the OAKKU web application for clinical staff to diagnose occupational asthma.

It became possible to refine the OAKKU user guide and develop the OAKKU web application to be more suitable for usage, enabling access to OA-related information. Due to this, it led to significant benefits in reducing the time taken for diagnosing OA. This improvement could also lead to better treatment outcomes and help decrease healthcare expenses[14].

Table 3. Point of improvement of the OAKKU web application

Problems	Operational details	Outcomes of the modification
The language in the OAKKU web application was English, making it difficult for users to read and understand.	1. Proceeded with translating the data into Thai by a language expert. 2. Arranged the data in the Thai language format and incorporated it into the OAKKU web application, designed to allow the selection of language before usage.	It was possible to search by choosing whether to use the Thai or English language, and if Thai was selected, all information in the OAKKU web application could be used in Thai.
The data search still had limitations.	The task involved translating the names and codes of occupations from the International Standard Industrial Classification of All Economic Activities (ISIC) system into the Thai TSCI 2009 system. Most codes corresponded almost entirely, but specific industries had some discrepancies. These codes had been adjusted to align accordingly.	In the OAKKU web application, the names and codes of occupations, if searched in Thai, could be found using the CODE according to the TSCI standard, which was more suitable for use in Thailand.
The search system was still challenging to use because it required searching by the initial words of the occupation, substance, or industry only and did not allow for searches using partial words.	Improved the search system to be more user-friendly by enabling searches using parts of words.	It became much easier to search for names of substances, occupations, or industries by using any part of the word in the search.
The enhancement, addition, or amendment of the list of occupations or substances required hiring individuals skilled in programming, which was a limitation in future development.	Proceeded to add a function in the OAKKU web application to allow users to register as Admins, granting them the rights to access, add, and edit the list of occupations, substances, or industries, thereby facilitating easier development and improvement.	In the future, it would be possible to add, delete, edit, and update details about substances, occupations, and industries without the need to hire programmers.

Discussion

The research process involved several stages. Initially, challenges arose in scheduling meetings and recognizing the importance of occupational asthma diagnosis. However, scheduling meetings after work hours at the on-site clinic facilitated participant engagement and minimized logistical challenges. The data collection phase was impeded by the challenge of generating solutions. The diversity of professions among the research participants, particularly the reluctance of nursing assistants to offer their perspectives, hindered the generation of ideas. However, through open dialogue and active participant engagement, a collaborative environment was fostered, leading to increased idea sharing. Developing the OAKKU web application user guide was hindered by challenges, including users' unfamiliarity with the OAKKU web application and the absence of clear, step-by-step instructions. These factors significantly increased task completion times. Prior to improvements, OAKKU users, especially nurses and nursing assistants, often encountered difficulties with search functions and language barriers. However, the OAKKU user guide with step-by-step illustrations and instructional videos enhanced user understanding and inclination to use the OAKKU web application. Users could experiment based on video guidelines. Moreover, collaborative researchers provided valuable suggestions for improvements. It was recommended that expert-led training sessions precede actual usage. Subsequent refinements encountered challenges in creating comprehensive video tutorials and overcoming participant reluctance, particularly among nurses and nursing assistants due to diverse professional backgrounds. Initial solutions focused on gathering additional field data from real users. The OAKKU user guide, enhanced by instructional videos and expert training, significantly improved user experience. The present research actively engaged stakeholders as participants, aligned with PAR principles. The resulting OAKKU user guide and problem-solving guidelines demonstrated high usability and significantly reduced search times. While the usability test might have been influenced by recall bias, increased usage following the guide's introduction indicated its positive impact.

The research process actively engaged end-users of the OAKKU web application, who also served as key stakeholders and implementers. Their involvement spanned all stages of the project, aligning with PAR principles[20-22]. This collaborative approach ensured the OAKKU user guide, and problem-solving guidelines were closely aligned with user needs and practical application.

The effectiveness of the OAKKU web application was evaluated through a usability test[24-26], which yielded high scores for ease of understanding and user satisfaction, averaging 4.88 out of a possible 5 points. This positive outcome is attributed to the users' involvement in the design process[21,23]. Furthermore, a significant reduction in search time was observed, with the average time decreasing from 3 minutes

and 5 seconds to 1 minute and 7 seconds per patient across a sample of 20 individuals. This comparison was conducted before and after the implementation of the user guide. However, it is important to note that the usability test might have been influenced by recall bias, as the same participants with prior OAKKU experience were involved. This could potentially have led to an underestimation of search times. Despite this limitation, a notable increase in OAKKU usage was observed following the introduction of the user guide, with an average of 10 to 20 uses per month.

Limitation

The user guide remains a document that needs to be read, which could be made more engaging by creating instructional videos covering all functionalities. This could significantly improve accessibility.

There are limitations in expanding the application to various healthcare settings with different contexts. For instance, physicians who can make diagnosis, systems in different locations, or tools such as computers and Internet accessibility, which are unsuitable for the OAKKU web application's use.

Recommendation

The implementation of the OAKKU web application to assist in the diagnosis of OA is suitable for use in asthma clinic settings in hospitals that can diagnose OA, often requiring the expertise of a chest physician and occupational medicine physician. The appropriate users of the program would be nurses, nurse assistants, or pharmacists, depending on the context of each area. If applied and familiarized, especially with asthmagens and occupations that may cause OA, this will lead to increased awareness and knowledge about the disease and potentially more diagnoses in the future[16].

After developing the OAKKU web application, it was discovered that the list of jobs in Thailand is still incomplete, and some asthmagens have yet to be identified. For more comprehensive coverage of Thai occupations, further development could include integrating the ISCO occupational system with the TSIC industrial codes and increasing the number of asthmagens by researching and adding them to OAKKU in the future. Testing of the device-specific tests, and user acceptance testing to better evaluate the suitability of the user guide is required. Additionally, further testing could be conducted to monitor and measure diagnostic outcomes to determine whether it can increase the diagnosis of OA.

Conclusion

A situation analysis revealed that both clinics still had issues with the diagnosis of OA, particularly in terms of disease awareness and the identification of asthmagens. The implementation of the OAKKU web application addressed these issues by facilitating the search for asthmagens and related occupational information. After its trial usage and the development of the OAKKU user guide, which was enhanced with Thai language support and a more straightforward search process, the OAKKU web application became much more user-friendly. A significant factor contributing to this improvement was the involvement of users in creating the user guide and enhancing the OAKKU web application, and all research participants were eager to solve the problem of diagnosing OA and cooperated well through the PAR process. Additionally, incorporating a video format into the OAKKU user guide proved beneficial, leading to faster searches and fewer errors. The high usability test score of 4.88 out of 5 for ease of understanding and satisfaction achieved after using the guide underscores these advancements. Finally, there was a significant reduction in the duration required for the OAKKU web application searches per patient.

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Conflicts of interest

The authors declare no conflicts of interest.

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