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EDUCATION

Evaluation of the efficacy of a web-based work-related asthma educational tool

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Abstract

Background: Work-related asthma (WRA) has been estimated to account for 15–20% of adult asthma cases. Studies have indicated that a substantial number of asthma patients have inadequate knowledge of work-related effects on their disease, which may contribute to suboptimal asthma control. A Canadian web-based educational tool on WRA was developed to address this knowledge gap in the population. **Objective:** To evaluate the effectiveness of this web-based tool. **Methods:** Participants were recruited prior to a routine visit at a tertiary care asthma clinic in Toronto. A brief WRA knowledge questionnaire was developed and administered immediately before and after using of the web-based educational tool, and one year later. **Results:** The study sample ($N = 34$) was mostly female (68%) with a mean age of 50.7 (SD, 17.2). Participants demonstrated significant improvement in questionnaire scores following interaction with the tool. The mean score increased from 76% (SEM = 2.1) to 84% (SEM = 1.7) ($p = 0.001$). On average, scores improved on 12 of the 13 questionnaire items. A 1-year follow-up of a sample of 19 participants demonstrated a slight reduction in mean scores, from 86% (SEM = 1.9) to 84% (SEM = 1.9), but still demonstrated a trend towards a higher score than the baseline (78%; SEM = 2.9; $p = 0.08$). **Conclusions:** Our findings suggest that the educational tool has a positive effect on WRA knowledge, and that knowledge may be retained long-term. Future studies are needed in non-tertiary care clinic populations which may possess less baseline knowledge of WRA.

Keywords

Prevention, work-related asthma, education, knowledge, website, tertiary clinic

History

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Introduction

Asthma is a chronic and debilitating respiratory condition that affects approximately 8.5% of Canada's population [1]. Prevalence rates have been gradually increasing, particularly in Ontario, with a prevalence of 13.3% in 2005 compared to 8.5% in 1996 [2]. Approximately 15–20% of asthma cases are associated with workplace exposures [3]. Work-related asthma (WRA) is comprised of occupational asthma (OA) and work-exacerbated asthma (WEA). In general, OA is established when asthma is new-onset and induced by workplace stimuli, and WEA occurs when pre-existing asthma is aggravated by workplace stimuli [4, 5]. WRA is associated with adverse effects in socioeconomic status, psychosocial outcomes, and overall quality of life [6, 7].

A substantial number of asthma patients have inadequate knowledge of their illness, which can contribute to asthma exacerbations, poor disease management, and a lack of personal preventative strategies [8]. A study [9] reported

that only 7.5% of patients examined had good knowledge of asthma, but 90% possessed a positive attitude regarding their illness and 85.3% had good self-efficacy (i.e. ability to control one's behavior and environment) [9]. Correspondingly, patients with a positive attitude and strong self-efficacy may be more receptive to asthma management programs that could potentially enhance their health outcomes.

Individuals diagnosed with asthma should be aware of work exposures that can exacerbate their illness. However, gaps exist in WRA knowledge among asthma patients, and this may contribute to suboptimal asthma outcomes. In a population of young adults with asthma aged 16–22, 65% indicated that asthma was not a significant factor in their career plans, 43% were unable to identify specific occupations that may exacerbate asthma symptoms, and only 54% acknowledged the need to use appropriate protective equipment in exposure-prone workplaces [10]. This demonstrates that WRA and its effects are under-recognized among asthma patients. Accordingly, enhanced knowledge of WRA may lead to improved asthma management and possible prevention of work-related worsening.

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Previously, a general web-based patient-oriented asthma program resulted in improvements in patients' perceptions of interactions with their physicians and in their self-efficacy for disease self-management: physicians also indicated that the tool had strong potential to improve patient care [11].

Recognizing that the Internet is a common patient resource for health-information, that gaps in patients' knowledge of WRA are large and impactful, and that no validated, web-based WRA educational tool existed, we previously employed an iterative, patient-centered design process to develop a web-based WRA education program intended for young adults [12]. This tool features patient-oriented information regarding the definition of WRA, workplace triggers, preventative measures, and mechanisms for workers' compensation. In the present study, we sought to measure baseline knowledge of WRA among asthma patients in a tertiary care clinic and the impact of this tool on this population's knowledge of WRA.

Methods

Ethics

The study protocol was approved by the University Health Network Research Ethics Board in Toronto, Ontario.

Participant recruitment

Participants were recruited from The Asthma and Airway Centre, a University of Toronto-affiliated tertiary care center, from June to September 2014. Patients are referred to this center both by respiratory specialists and general practitioners, and a dedicated respiratory therapist provides patients with asthma education. Participants were recruited prior to or after a scheduled medical visit. We included patients over the age of 16 with a physician diagnosis of asthma, who could read and write in English.

Pre- and post-web questionnaire

Questionnaires (Appendix A) were distributed to participants before and after interactions with the educational tool. These pre- and post- questionnaires were identical, with 13 true or false questions on basic concepts related to WRA. This questionnaire was based on the questionnaire used in our earlier study [12], designed specifically to assess knowledge gains through the web-based tool. In order to ensure content validity of the questionnaire, questions were developed to probe common themes delivered by the web-based tool. In order to accommodate patients of varying educational levels, the questionnaire was designed with an average reading level below grade 8, (based on the following instruments: SMOG index, Automated Readability Index, Gunning-Fog Score and Flesch-Kincaid Grade Level).

Web-based work-related asthma educational tool [12]

The web-based tool can be found at the following URL: <http://wra.lung.ca/workrelatedasthma/>.

The web-based tool was designed and developed to address the perceived needs of asthma patients (primarily developed for young adults). The readability of the website is at a grade 8 level to accommodate patients of varied educational backgrounds.

The web-based tool offers important conceptual and procedural information on WRA (as detailed in the introduction). Patients reported several key topics where knowledge gains were most evident, which include: the two WRA subtypes, strategies to prevent or control WRA, mechanisms of workers' compensation, and occupational triggers.

Study protocol

After providing consent, patients started by providing sociodemographic information and responses to questions related to their asthma severity (types of medications used, emergency room visits, and the impact asthma has on the patient's everyday life), followed by completion of the baseline WRA questionnaire. After the completion of the baseline questionnaire, the web-based tool was introduced on a tablet device, and participants were given 30–40 minutes to navigate through it at their own pace, with no explicit directions. Finally, the post-questionnaire was administered. Approximately 1 year later, telephone calls were made to participants to request completion of a telephone version of the questionnaire.

Data analyses

IBM SPSS Statistics 20 was the statistical software used to analyze the data. We used descriptive statistics to organize dichotomous and nominal variables including sociodemographic and clinical characteristics of participants. A paired t-test was carried out to determine differences in pre- and post-questionnaires among participants.

Results

Participants

Thirty-four clinic patients agreed to participate in the study. Sixty-eight percent were female. There were no significant sociodemographic differences between males and females (Table 1).

Questionnaire performance

The mean baseline score was 0.76 (or 76%) out of a maximum score of 1. The score consisted of the mean of the 13 questionnaire items, with the allotment of 1 for a correct response and 0 for an incorrect response. Questions 11 and 13 had multiple sub-questions, which were summed to a maximum score of 1.

Questionnaire scores improved from 0.76 (SD = 0.12) to 0.84 (SD = 0.10) ($p = 0.001$) following interaction with the tool. The number of questionnaire items answered correctly increased by approximately 2.5 correct responses.

A 1-year follow-up was accomplished in a sample of 19 of the 34 participants. One of the initial participants declined the 1-year follow-up questionnaire and 14 could not be reached to complete this despite repeated phone call attempts. The 19 who participated showed retention of some knowledge gained from the web-based tool. Scores trended higher at 1 year, from a baseline of 0.78 (SD = 0.13), to a post-score of 0.86 (SD = 0.08) ($p = 0.04$), and a 1-year follow-up score of 0.84 (SD = 0.08) ($p = 0.09$). There were no age or gender-related effects identified for overall questionnaire performance.

Table 1. Characteristics of participants.

Patient Characteristics	Participants (N = 34) Mean $\pm$ SD (Percentage)
Male/Female	11/23
Age (years)	50.7 $\pm$ 17.2
Age Range (years)	22 – 83
Mean Time Since Asthma Diagnosis (years)	21.8 $\pm$ 16.9
Presently Working	23 (68%)
Employment by Industry:	(n = 23)
Health Care and Social Assistance	09 (39.1%)
Finance, Insurance, Real Estate, Rental, and Leasing	05 (21.7%)
Other Services	04 (17.3%)
Utilities	02 (8.7%)
Information, Culture, and Recreation	01 (4.3%)
Transportation and Warehousing	01 (4.3%)
Governmental (non-health-care)	01 (4.3%)
Mean Duration of Work (years) (n = 20)	13.3 $\pm$ 10.6
Presently in College/University	05 (15%)
Previously Visited an Emergency Room for Asthma	22 (65%)
Previously Admitted into a Hospital for Asthma	13 (38%)
Agreed or strongly agreed to the statement, “Asthma affects my daily life.”	19 (56%)
Agreed or strongly agreed to the statement, “It is important for people with asthma to use protective measures in the workplace if asthma triggers are present.”	24 (71%)
Agreed or strongly agreed to the statement, “Asthma has been an important factor in determining my choice of a future career.”	07 (21%)
Responded ‘Yes’ to the statement, “Have you had any discussions with your physician about asthma and how it might be affected by your career?”	10 (29%)

Individual questionnaire items

The differences in pre-score and post-score performance among the individual questionnaire items are depicted in Figure 1. Participants improved on all individual questionnaire items with the exception of item #10 from the pre- to post-questionnaire [“If workplace exposures worsen asthma then the effects usually lessen towards the end of the working week” (Answer: False)] with 26/34 (76%) participants answering it correctly on the pre-questionnaire, and 25/34 (74%) participants answering it correctly on the post-questionnaire. The

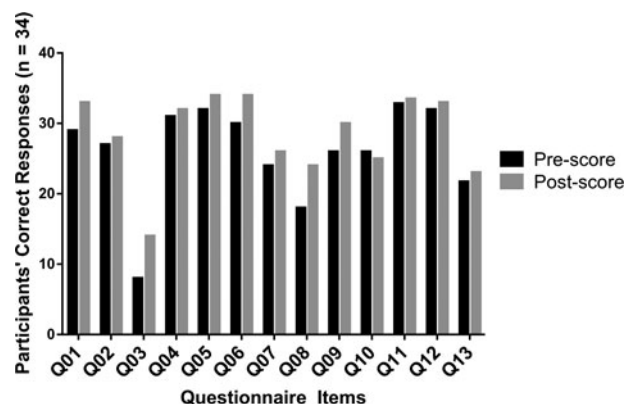


Figure 1. Correct responses of participants of individual pre- and post-questionnaire items.

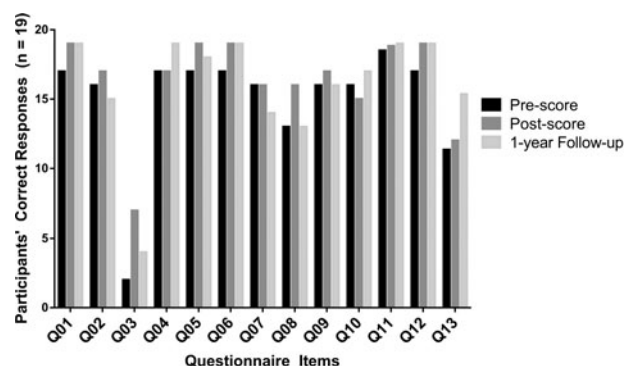


Figure 2. Correct responses of participants of individual pre-, post-questionnaire items, and 1-year follow-up items.

item which was most commonly answered incorrectly on both the pre- and post-questionnaires was item #3 (“People who develop work-exacerbated asthma must have a previous history of asthma (Answer: True)”), with 8/34 (24%) and 14/34 (41%) participants answering it correctly, respectively. The score patterns were similar among the 19 participants (Figure 2) who participated in the 1-year follow-up. On average, scores improved on all individual questionnaire items with the exception of #2 and #7 for the 1-year follow-up.

Discussion

We studied the effects of a brief interaction with a web-based educational tool for WRA and demonstrated significant short-term improvements in knowledge in patients of diverse ages, levels of education, and levels of asthma severity followed at a tertiary care asthma clinic.

Knowledge improvements were seen despite high baseline scores (which may be a reflection of the low level of difficulty of the questions and/or a high level of baseline knowledge among patients seen in a tertiary care clinic along with possible volunteer bias). Our tertiary care clinics (including one that has a focus on occupational lung disease), include patients with an established asthma diagnosis who are managed by a multi-disciplinary team employing educational, pharmacological and behavioral interventions (e.g., advising patients to avoid asthma triggers such as sensitizers) [13]. Study participants were not selected on the basis of a diagnosis of work-related asthma and only 4 had been evaluated in the occupational lung clinic, but it is likely that patients in this study were more informed and knowledgeable regarding asthma than those in an average primary care setting. Indeed, family physicians report that time constraints limit their ability to provide patient education, and admit to gaps in their own knowledge of WRA [14]. Given that there are no other readily available sources of information on WRA, this suggests that patients seen in the primary care setting would likely have lower baseline knowledge scores than those in our study. Accordingly, this questionnaire might have increased sensitivity in detecting knowledge changes in a less “specialized” population of patients such as those who participated in our previous study of young asthmatics and career plans [10].

Future studies should determine both baseline knowledge and corresponding effects of the intervention in these and other non-tertiary clinic populations to ascertain differences across

settings. Similarly, a larger future study should evaluate not only impact on knowledge, but also on behavioral intention with respect to work-related asthma prevention and management in working and pre-working-aged asthma patients. Given that our study allowed for only a brief and single interaction with the tool, future work should also evaluate usage and impact of real-world use of the tool over a period of weeks to months.

Our study also demonstrated that only a minority of participants had a discussion with their physician on the effect asthma could have on their career (29%) or considered asthma to be an important factor in their choice of a future career (21%). Discussion of potential work-related effects on asthma play an important role for preventive efforts and achieving optimal health outcomes. Key barriers for family physicians and pulmonologists in adequately educating patients on work-related effects include lack of expertise and testing facilities, inadequate knowledge of workers' compensation, time constraints, and a low volume of patients with occupational lung disease [14]. Our web-based educational tool is intended to address gaps in knowledge among patients and health-care professionals to ameliorate health outcomes.

A majority of participants (71%) agreed that it was important for those with asthma to use appropriate protective measures in the workplace if asthma triggers are present. We are pleased that most acknowledged the value of using protective measures when appropriate, as managing patients with WRA requires a multi-faceted approach, and appropriate respiratory protective equipment and avoidance of exposures is important in preventing future exacerbations.

There were a number of limitations in the present study. Firstly, the sample size was small, and a larger sample would allow greater confidence in outcome estimates. Next, this study examined knowledge gains through a single interaction with the web-based tool in a clinical setting, as opposed to the context of real world use. Also, as noted, the effects of the intervention are likely to be different in populations with different baseline levels of asthma and WRA knowledge, so our current conclusions are limited to patients in a tertiary care setting. Also, knowledge is a surrogate outcome to more clinically meaningful end-points such as behavioral intention, actual behavior change, and patient-level clinical outcomes, which will require measurement in future large-scale studies.

For future research, we hope to also assess if knowledge improvements among participants will be associated with any changes in behavioural outcomes (e.g., changes in self-management techniques or identification of occupational triggers). Furthermore, given that we only included patients that were fluent in English, and given the English-language nature of the website, our tool is being initially translated in to French and the study will require replication to determine its impact in culturally diverse populations. In addition, our questionnaire has not been formally validated against clinical outcomes. However, there are no such questionnaires for WRA knowledge currently available, this questionnaire was developed by work-related asthma and knowledge translation experts, and it was face-validated by both these experts and asthma patients [12].

It was also encouraging that participants improved on 12 of the 13 questionnaire items from the pre- to post- questionnaire and on 11 of the 13 items at the 1-year follow-up. This

suggests that increases in performance were broadly distributed across questionnaire items, and that in turn, that there was an adequate balance of emphasis, relevance, and understandability of the key concepts in the web-based tool. Finally, the web-based educational tool was designed to educate young adults and to aid them in navigating the workforce to prevent development of WRA, but this study assessed a primarily middle-aged population. However, the tool delivers applicable, accurate, and useful information on WRA, so it still had clinical suitability for the sample assessed (e.g., the tool describes self-management strategies that is applicable to those of any age).

The Internet is the medium that people are increasingly using to obtain health-related information. Approximately 80% of Canadian households are connected to the Internet, and 70% of Canadians search for health-related information on the web [15, 16]. In general, however, health-related information on the internet is often inaccurate and/or outdated. A review of 68 health information websites found that only 8.8% of asthma websites included accurate information based on the criteria employed by the National Heart, Blood, and Lung Institute (NHLBI) [17]. Despite this, a survey indicated that approximately 60% of patients who use the Internet to gather health-related information allowed it to impact their decision-making process for their illness [18]. This may indicate that a significant number of patients are modifying their health regimen based on potentially obsolete or incorrect information obtained from the Internet. Clearly, the Internet is a ubiquitous channel from which to access health information, but it is essential that the information being disseminated is accurate, up-to-date, and user-friendly for it to positively impact patient outcomes.

Conclusions

Our primary objective is for the web-based tool to deliver accurate and user-friendly information to the asthma population or those susceptible to developing work-related asthma. Our study demonstrated that the web-based tool enhances knowledge and that most knowledge gains are retained for at least one year. We hope that future studies will offer further insight as to the long-term effectiveness of this web-based tool, and its utility in a personal setting.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article. Joshua C. Lipszyc assisted in the development of the patient database, analyzed the data, and prepared the manuscript. Jack Scarborough collected the data and developed the patient database for the pre- and post- questionnaire scores. Simeon Gotzev collected the data and developed the patient database for 1-year follow-up. Susan M. Tarlo conceptualized the study, developed the evaluative questionnaire, provided ongoing guidance,

and reviewed the manuscript. Samir Gupta and Gary M. Liss assisted in the development of the web-based educational tool and reviewed the manuscript.

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