



Enabling self-management of pollen allergies: a pre-season questionnaire evaluating the perceived benefit of providing local pollen information

Danielle E. Medek · Marko Simunovic · Bircan Erbas · Constance H. Katelaris ·
Edwin R. Lampugnani · Alfredo Huete · Paul J. Beggs · Janet M. Davies

Received: 15 January 2019 / Accepted: 12 July 2019
© Springer Nature B.V. 2019

Abstract The Australian AusPollen Partnership provides respiratory allergy patients with accurate, relevant and localised pollen information via smart-phone Apps. This study aims to evaluate public perceptions of need and benefit of providing local pollen information. Individuals aged 18 years and older were contacted through AusPollen Smartphone Apps (Brisbane, Sydney, Canberra and Melbourne), Australian Society for Clinical Immunology and Allergy, Asthma Australia and social media. A pilot

questionnaire was developed in consultation with partner organisations, including select questions drawn from the National Young People and Asthma Survey. The questionnaire consisted of four sections: participant demographics, allergic rhinitis and asthma symptoms, symptom management and App utility. One hundred and twenty-seven people completed the survey, of whom 53% had access to local pollen information. Most (97%) participants without access to local pollen information indicated that they wanted

D. E. Medek
School of Culture, History and Language, The Australian
National University, Canberra, Australia

M. Simunovic · J. M. Davies
School of Biomedical Science, Institute of Health and
Biomedical Innovation, Queensland University of
Technology, South Brisbane, Australia

B. Erbas
School of Psychology and Public Health, La Trobe
University, Melbourne, Australia

C. H. Katelaris
Immunology/Allergy Unit, Department of Medicine,
Campbelltown Hospital and Western Sydney University,
Campbelltown, Australia

E. R. Lampugnani
School of BioSciences, The University of Melbourne,
Melbourne, Australia

A. Huete
School of Life Sciences, Faculty of Science, University of
Technology Sydney, Sydney, Australia

P. J. Beggs
Department of Environmental Sciences, Faculty of
Science and Engineering, Macquarie University, Sydney,
Australia

J. M. Davies
Office of Research, Metro North Hospital and Health
Service, Herston, Australia

D. E. Medek (✉)
Department of Medicine, North Shore Hospital, 124
Shakespeare Rd, Takapuna 0622, New Zealand
e-mail: Danielle.Medek@anu.edu.au

such a service. Pollen information was most commonly perceived by participants to be useful for prevention and avoidance as well as preparation and planning. This preliminary study identified a public demand for local pollen information. Users identified practical ways in which pollen information assisted them. Publicised pollen concentrations and forecasts have the potential to improve awareness of allergy triggers and empower patient self-management, reducing symptoms and burden of disease.

Keywords Allergic rhinitis · Asthma · Forecast · Pollen · App · Symptom management

1 Introduction

Grass pollen exposure is a major predictor of seasonal allergic rhinitis (hay fever) in Australia and globally. Approximately 16% of Australians self-report allergic rhinitis (AR) (AIHW 2011), with affected individuals having over three times the risk of the general population for developing asthma (Guerra et al. 2002). During peak pollen times, asthma exacerbations requiring hospital admissions increase (Tobías et al. 2003). Furthermore, during springtime thunderstorms, allergic rhinitis sufferers with asthma who are sensitised to grass pollen are at risk of severe asthma exacerbations, with associated high healthcare burden, morbidity and mortality (Venables et al. 1997; Thien et al. 2018). During and after days of high pollen concentrations, as symptoms develop, allergy sufferers' quality of life deteriorates (Kiotseridis et al. 2013).

While members of the public are using pollen information communicated via Apps provided by our AusPollen project as well as other services locally (Johnston et al. 2018) and internationally (Berger et al. 2013), the public benefit arising from provision of pollen information is rarely investigated. The AusPollen Partnership Project (<https://auspollen.com.au/>) is establishing a standardised pollen monitoring network to provide the general public with accurate and localised pollen observations, forecasts and alerts for major Australian cities via smartphone Apps and online. This study aims to evaluate public perceptions of need and benefit of providing local pollen information. We hypothesised that access to pollen information would help empower self-management of

patients with allergic rhinitis. To survey the user-perceived benefit of this pollen information, a pilot questionnaire was undertaken at the time of establishing a standardised pollen monitoring program for Brisbane, Sydney, Canberra and Melbourne.

2 Methods

2.1 The questionnaire

The questionnaire was developed in consultation with partner organisations, with select questions (demographic, screening, health service use and information access) drawn from the Australian National Young People and Asthma Survey (Blanchard et al. 2014). The questionnaire contained four sections: participant demographics (age, gender and postcode), allergic rhinitis and asthma symptoms (timing, severity, and presence of itch, sneezing, rhinorrhoea, blocked nose and difficulty breathing), symptom management (use of medications and immunotherapy, and an open-answered question on how symptoms are managed) and open-answered questions on App utility. Participants with access to pollen information were asked, "On a scale of 1 to 5, how much do you think access to pollen levels and forecast information could help you manage your symptoms?" Then, "In what ways do you think the pollen count is useful to you?" Participants without access to pollen information were asked, "Would you want to access a local pollen count and forecast information?" And "Why would you want to access a local pollen count and forecast information?"

2.2 Circulation of the questionnaire

The study was approved by the South Western Sydney Local Health District Human Research Ethics Committee (HREC/16/LPOOL/306, with approved amendments). Adults 18 years and older were invited to participate through Asthma Australia and the Australasian Society of Clinical Immunology and Allergy email lists and social media (Facebook). Questionnaire responses were collected from 8 September 2016 to 24 July 2017, which includes the Australian spring to autumn, capturing the pollen season variability in Australia (Beggs et al. 2015). Pollen information was provided by AusPollen Apps and online for Melbourne, Sydney and Canberra; 1 October to 31

December 2016, and Brisbane; 1 November 2016 to 18 May 2017.

2.3 Statistical analysis

Only questionnaires completed and submitted by participants living in Australia at the time of the survey, and questionnaires in which the question regarding access to pollen information was answered, were included in the analysis.

Statistical analysis was performed using R (Version 3.2.4 2016-03-10), including crude odds ratios (OR) and Chi-squared tests of quantitative data. Descriptive statistics such as counts and proportions were used to describe qualitative data. A thematic analysis was performed on responses to the two open questions. Responses were organised into preliminary themes, chosen by classifying the most common words used in responses, and refined by iterative processes during analysis of the data.

3 Results

3.1 Participant characteristics

A total of $n = 127$ completed and submitted questionnaires were included in the analysis. Participant demographic information is summarised in Table 1.

The majority of participants were older (> 55 years, 35%) and female (76%). Eighty per cent of participants reported hay fever diagnosed by a medical professional. Fifty-five per cent reported a formal diagnosis of asthma. Forty-six per cent reported diagnoses of both. The highest prevalence of hay fever and asthma was in the 26–35 years age group (91%, $n = 11$ and 66%, $n = 8$ of 12 participants in this age range, respectively). Most ($n = 77$, 61%) participants derived information about hay fever from their doctor, with the Internet being the second most used resource ($n = 49$, 36%).

Fifty per cent of participants had access to local pollen information. Age and gender distributions, and formal diagnoses of asthma or hay fever did not statistically differ between participants who had access to pollen information, and those who did not (see supplemental data).

3.2 Use of local pollen information

The group with access to local pollen information commonly rated its usefulness for symptom management at 5 out of 5 ($n = 35$, 50%). Responses to the open-answer questions were coded based on the themes of symptom management; prevention, preparedness and planning; medication decisions; allergen avoidance; symptom triggers; information and

Table 1 Demographics of respondents overall and for those with and without access to local pollen information

	All groups	Those with access	Those without access	OR with versus without access (CI)
Number	127	63	64	
Age in years				
> 55	44 (35%)	25 (40%)	19 (29%)	
36–55	63 (50%)	30 (48%)	33 (52%)	
18–35	20 (16%)	8 (13%)	12 (19%)	
Gender: female	93 (76%)	44 (73%)	49 (77%)	0.79 (0.34–1.79)
Seasonal AR diagnosis	98 (80%)	52 (85%)	46 (75%)	1.88 (0.75–4.71)
Asthma diagnosis	68 (55%)	35 (57%)	33 (53%)	1.18 (0.58–2.41)
AR severity rating				
1–2	22 (18%)	9 (15%)	13 (22%)	
3–4	62 (52%)	34 (56%)	28 (48%)	
5 (“severe”)	35 (29%)	18 (30%)	17 (29%)	

Seasonal AR = seasonal allergic rhinitis, or hay fever. “Diagnosis” refers to question, “Has a doctor or nurse ever told you that you have [... asthma/hay fever]” For odds ratios (OR), 95% confidence intervals are presented. For comparison of age distributions between those with and without access, Chi-squared = 5.6, $p = 0.23$

awareness; forecasts and alerts; and for family members. When asked how the pollen information was useful, the commonly reported responses were: allergen avoidance ($n = 25$, 40%), medication decisions ($n = 17$, 27%) and a more general discussion regarding prevention, preparedness and planning ($n = 17$, 27%) (Fig. 1). Of the participants without access to local pollen information, 89% indicated that they would want such a service. When asked why they wanted access, the most commonly reported responses aligned with the following themes: allergen avoidance ($n = 12$, 19%), for forecasting symptoms or pollen levels (“forecast, alerts”, $n = 8$, 12.5%) and medication decisions ($n = 8$, 12.5%). Participants both with and without access to pollen information also sought symptom confirmation, information, and improved awareness of pollen levels, and understanding of what was triggering their symptoms (Fig. 1). When asked for their preferred method to access pollen information

(smartphone App, Facebook, a website or other means), 85% preferred a smartphone App followed by 8.8 per cent preferring a website.

4 Discussion

Our findings indicate an appreciation and need for pollen information among adults with varying demographics. This is one of the few studies designed to explore the community perception of publicised pollen information. The questionnaire appeared to be a useful tool with open-answer questions to directly ask people why and how they use pollen information. Environmental awareness, preventative medication use and allergen avoidance activities for symptom management, and curiosity for knowledge were some of the reasons given to explain why such information is needed.

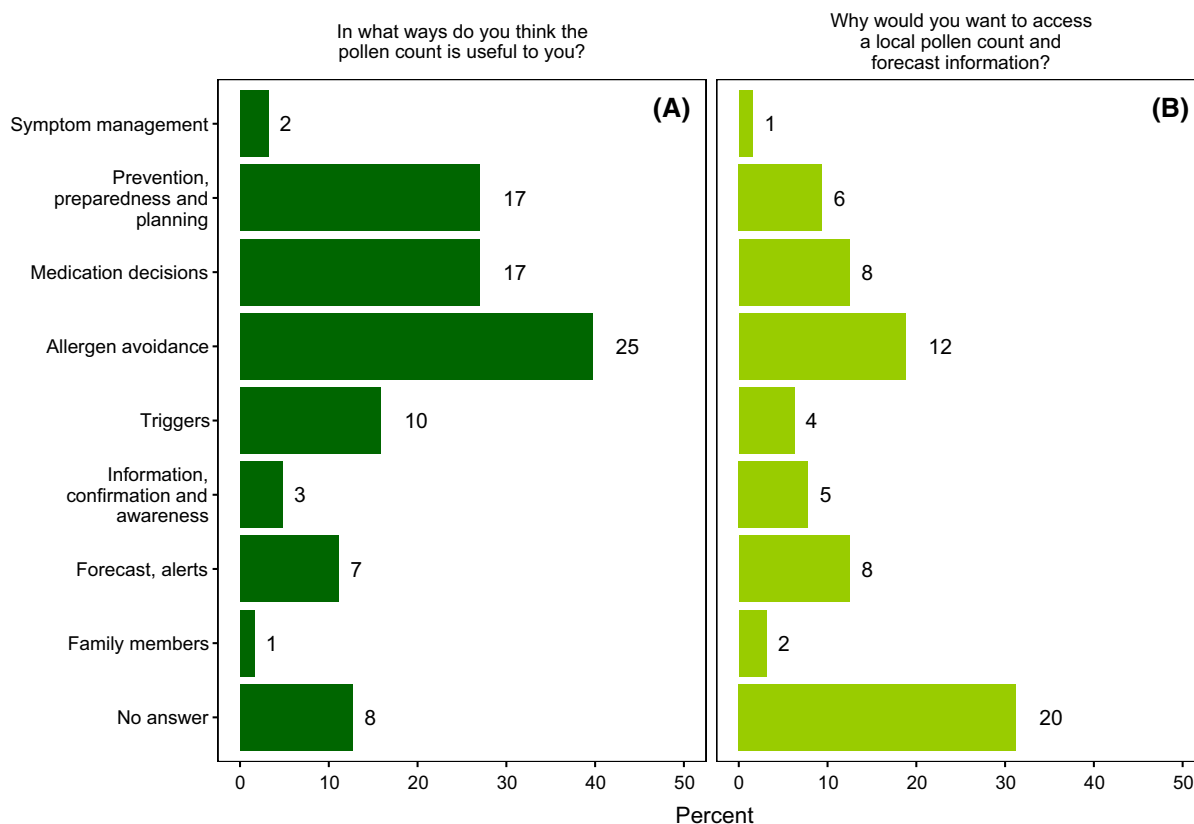


Fig. 1 Responses to open-ended questions evaluating the pollen concentration and forecast, for those with access (a) and for those without access (b). Numbers represent total

responses coded to each category, and bars represent per cent of total questionnaire respondents with access ($n = 63$) and without access ($n = 64$) to pollen information

Allergic rhinitis is often a self-managed condition, which places sufferers at risk of missing health information and best practice guidelines (Cvetkovski et al. 2018). However, allergy sufferers may seek pollen information online when symptomatic (Kmenta et al. 2016; Bousquet et al. 2018). Whereas Cvetkovski et al. (2018) used interviews of allergic rhinitis sufferers to focus discussion on medication use, in our questionnaire those who had access to pollen information discussed avoidance of triggers at a comparable frequency. This suggests that participants in our study were aware of environmental triggers for their symptoms that they could themselves modify or avoid. This echoes the recent findings of Johnston et al. (2018) who also found improved environmental awareness in pollen information consumers. Pollen information services appear to serve as a public health tool encompassing a broader sphere of allergic respiratory disease management than is currently available through general practice or pharmacy. With the public relying on pollen forecasts to make decisions about their daily activities, there is a responsibility for timely, accurate pollen information (Bastl et al. 2017).

One limitation of this study is that participants who did not want a pollen service may have chosen not to proceed with the questionnaire, thus skewing towards favourable responses. We have described the responses of those with and without access to pollen information without directly comparing the response of the two groups; question wording differed to fit the context of each group. Age-specific hay fever prevalence in our study was similar to that in other studies (Cazzoletti et al. 2015). However, the age group reporting the highest hay fever prevalence represented a minority of responders, while the majority were aged over 50 years, and female. Throughout the AusPollen Partnership Project (2016–2020), versions of the questionnaire are being distributed before and after the pollen season to capture a larger number and broader representation of participants.

While only 80% of questionnaire respondents cited a diagnosis of seasonal allergic rhinitis by a health professional, this does not capture those who are symptomatic but never formally diagnosed. Other participants may include those who seek information to assist them in providing care to others. Subsequent questionnaires for future research have been worded to explore more deeply the reason why people seek pollen information.

The AusPollen Partnership has established standardised pollen monitoring at four sites and developed a smartphone App that communicates pollen forecasts in these cities. The data from this pilot study indicated that pollen information appears to be valuable to users in the day-to-day management of symptoms during peak pollen periods, and may also play a part in mitigating large-scale events such as epidemic thunderstorm asthma. Access to local pollen information has potential to enhance self-management of respiratory allergy by allergen avoidance and improved symptom prevention and management.

Acknowledgements Authors wish to thank other members of the AusPollen team, including chief investigators Dr Elizabeth Ebert (Bureau of Meteorology), Assoc. Prof. Edward J Newbigin (The University of Melbourne), Dr Jeremy Silver (The University of Melbourne), Dr Riëks van Klinken (Commonwealth Scientific and Industrial Research Organisation) and Prof. Simon Haberle (The Australian National University). We thank partner organisations Australasian Society of Clinical Immunology and Allergy and Asthma Australia for assisting with distribution of the Questionnaire. The AusPollen Partnership Project was funded by the National Health and Medical Research Council GNT1116107 with co-sponsorship from Asthma Australia and Stallergenes Australia, and in-kind contributions from the Australasian Society of Clinical Immunology and Allergy, the Bureau of Meteorology, Commonwealth Scientific and Industrial Research Organisation and Meteorology Switzerland.

Funding This study was funded by the Australian National Health and Medical Research Council (NHMRC) (GNT1116107) with co-sponsorship from Asthma Australia and Stallergenes Australia, and in-kind contributions from the Australasian Society of Clinical Immunology and Allergy, the Bureau of Meteorology, Commonwealth Scientific and Industrial Research Organisation and Meteorology Switzerland.

Compliance with ethical standards

Conflict of interest JMD declares that QUT owns patents and patent applications (AU2008/316301; US PTO 14/311944; PCT/AU2015/050348; PCT/AU2014/000630/WO2014_201499) for which she is a named inventor. JMD leads the NHMRC AusPollen Partnership Project (GNT 1116107) with matching cash and in kind co-sponsorship from the Australasian Society of Clinical Immunology and Allergy, Asthma Australia, Bureau of Meteorology (BOM), Commonwealth Scientific and Industrial Research Organisation, Stallergenes Australia and Meteorology Switzerland. She is an investigator of the BOM's Victorian Thunderstorm Asthma Pollen Surveillance Project and has received grants from the NHMRC, Australian Research Council (DP170101630; DP190100376), National Foundation for Medical Research Innovation, the Allergy and Immunology Foundation of Australasia, Asthma Australia, Queensland University of

Technology and contracted research grant from Stallergenes (France), in-kind provision of materials from Thermo Fisher (Sweden) and services from Sullivan Nicolaides Pathology (QLD, Australia). JMD's institute has received Honorarium payments and travel expenses for education sessions and conference presentations from Stallergenes Australia, GlaxoSmithKline, Wymedical, and Meda Pharmaceuticals. PJB is a Chief Investigator on an Australian Research Council Discovery Project Grant (DP170101630) and an NHMRC Partnership Project Grant (APP1116107) and has been contracted by BOM (2017–2020) and the NSW Office of Environment and Heritage (2018–2019). Other authors declare no conflicts of interest.

Ethical approval This study involving human participants was performed in accordance with the Australian Guidelines for Responsible Conduct of Research including the 1964 Helsinki declaration. The study was approved by the SWSLHD Human Research Ethics Committee (HREC/16/LPOOL/306).

Informed consent Informed consent was obtained from all participants.

References

- Australian Institute of Health and Welfare. (2011). *Allergic rhinitis ('hay fever') in Australia*. Cat. no. ACM 23. Canberra: AIHW, <http://www.aihw.gov.au/publication-detail/?id=10737420595&tab=2>. Accessed July 2019.
- Bastl, K., Berger, M., Bergmann, K.-C., Kmenta, M., & Berger, U. (2017). The medical and scientific responsibility of pollen information services. *Wiener Klinische Wochenschrift*, 129(1–2), 70–74.
- Beggs, P. J., Katelaris, C. H., Medek, D., Johnston, F. H., Burton, P. K., Campbell, B., et al. (2015). Differences in grass pollen allergen exposure across Australia. *Australian and New Zealand Journal of Public Health*, 39(1), 51–55.
- Berger, U., Karatzas, K., Jaeger, S., Voukantsis, D., Sofiev, M., et al. (2013). Personalized pollen-related symptom-forecast information services for allergic rhinitis patients in Europe. *Allergy*, 68(8), 963–965.
- Blanchard, M., Morris, J., Birrell, E., Stephens-Reicher, J., Third, A., & Burns, J. (2014). *National Young People and Asthma Survey: Issues and opportunities in supporting the health and wellbeing of young Australians living with asthma*. Melbourne: Young and Well CRC.
- Bousquet, J., Agache, I., Berger, U., Bergmann, K.-C., Besancenot, J.-P., Bousquet, P. J., et al. (2018). Differences in reporting the ragweed pollen season using Google Trends across 15 countries. *International Archives of Allergy and Immunology*, 176(3–4), 181–188.
- Cazzoletti, L., Ferrari, M., Olivieri, M., Verlato, G., Antonicelli, L., Bono, R., et al. (2015). The gender, age and risk factor distribution differs in self-reported allergic and non-allergic rhinitis: A cross-sectional population-based study. *Allergy, Asthma & Clinical Immunology*, 11, 36.
- Cvetkovski, B., Kritikos, V., Yan, K., & Bosnic-Anticevich, S. (2018). Tell me about your hay fever: A qualitative investigation of allergic rhinitis management from the perspective of the patient. *NPJ Primary Care Respiratory Medicine*, 28, 3.
- Guerra, S., Sherrill, D. L., Martinez, F. D., & Barbee, R. A. (2002). Rhinitis as an independent risk factor for adult-onset asthma. *The Journal of Allergy and Clinical Immunology*, 109(3), 419–425.
- Johnston, F. H., Wheeler, A. J., Williamson, G. J., Campbell, S. L., Jones, P. J., Koolhof, I. S., et al. (2018). Using smartphone technology to reduce health impacts from atmospheric environmental hazards. *Environmental Research Letters*, 13(4), 044019.
- Kiotseridis, H., Cilio, C. M., Björner, L., Tunsäter, A., Jacobsson, H., & Dahl, Å. (2013). Grass pollen allergy in children and adolescents—symptoms, health related quality of life and the value of pollen prognosis. *Clinical and Translational Allergy*, 3, 19.
- Kmenta, M., Zetter, R., Berger, U., & Bastl, K. (2016). Pollen information consumption as an indicator of pollen allergy burden. *Wiener Klinische Wochenschrift*, 128(1–2), 59–67.
- Thien, F., Beggs, P. J., Csutoros, D., Darvall, J., Hew, M., Davies, J. M., et al. (2018). The Melbourne epidemic thunderstorm asthma event 2016: An investigation of environmental triggers, effect on health services, and patient risk factors. *The Lancet Planetary Health*, 2(6), e255–e263.
- Tobías, A., Galán, I., Banegas, J. R., & Aránguez, E. (2003). Short term effects of airborne pollen concentrations on asthma epidemic. *Thorax*, 58(8), 708–710.
- Venables, K. M., Allitt, U., Collier, C. G., Emberlin, J., Greig, J. B., Hardaker, P. J., et al. (1997). Thunderstorm-related asthma—The epidemic of 24/25 June 1994. *Clinical and Experimental Allergy*, 27(7), 725–736.