

**The Work Productivity and Activity Impairment Allergic Specific (WPAI-AS) Questionnaire Using Mobile Technology: The MASK Study**

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Uncontrolled allergic and nonallergic rhinitis have a major impact on work productivity and absenteeism [1]. The Work Productivity and Activity Impairment Allergic Specific Questionnaire (WPAI-AS) has been used in many studies [2-7]. Impaired work productivity assessed using the WPAI-AS has been associated with the severity of allergic rhinitis (AR) [7]. Using mobile technology-based visual analog scales, we previously found that work productivity was impaired in moderate/severe AR [8].

MASK-rhinitis (MACVIA-ARIA Sentinel Network for allergic rhinitis) is a patient-centered information and communications technology system [9] based on a mobile phone app (Allergy Diary). Users are asked to complete a short demographic questionnaire and the WPAI-AS to provide baseline characteristics of their disease. The Allergy Diary has been launched in 21 countries.

In order to better assess the loss of work productivity in AR, we tested the WPAI-AS using the Allergy Diary.

A cross-sectional study was carried out in all consecutive users of the Allergy Diary (12 636) who completed the WPAI-AS from June 1, 2016 to July 31, 2017. The Allergy Diary has been described elsewhere [8,10]. The app collects information on AR symptoms experienced (nasal and ocular), disease type (intermittent/persistent), how symptoms impact users' lives, and type(s) of AR treatment used. The system has been deployed in 21 countries and in 16 languages (translated and back-translated, culturally adapted, and legally compliant). The data are anonymized, except for geographic data, which are never totally anonymous. Independent Review Board approval was not needed.

The electronic form of the WPAI-AS Questionnaire was applied in the 7 available languages (ie, English, French, German, Italian, Polish, Portuguese, and Spanish) [8,10] according to the package obtained from Reilly Associates ([www.reillyassociates.net/WPAI\\_General.html](http://www.reillyassociates.net/WPAI_General.html)). The outcomes used were the percentages of impairment due to allergy for daily activities (Q9: degree allergy affected regular activities) or work productivity (Q4: degree allergy affected productivity while working).

Since the results were not normally distributed for Q4 and Q9 (Shapiro-Wilk test), values were expressed as median (IQR), and nonparametric tests were used.

Of the 12 636 registered users, 1017 completed Q9 and 698 Q4 (Table online). There were 629 women (61%) and 405 men (39%), with a mean age of 26 (16) years. The number of users per country was distributed as follows:

– Austria	7
– Australia	6
– Brazil	198
– Canada	3
– France	126
– Germany	96
– Italy	126
– Mexico	85
– Poland	43
– Portugal	294
– Spain	66
– Switzerland	89
– UK	73

Similar WPAI-AS percentages of impairment were found for Q4 (N=698; median, 20 [4-50]) and for Q9 (N=1017; median, 17 [3-45]).

There was a highly significant correlation between the 2 questions. For a Q4 percentage of impairment of over 50%, all but 1 user reported no impairment in work productivity. In users with Q4  $\geq 50$ , 18% had a Q9 < 50.

Analysis of data from this pilot ICT-based care system for AR revealed that the level of work impairment is highly correlated with the degree that allergy affected regular activities using the 2 validated questions of the WPAI-AS on global and work impairment.

The strengths and limitations of this study are those of mobile technology, which have been discussed at length elsewhere [8,10]. A key limitation was the lack of patient characterization, which is impossible using an app. However, every observational study we have performed using the Allergy Diary has confirmed the potential to identify users with severe disease. It is likely that mobile technology will become a very important tool in our understanding and management of AR.

The WPAI-AS scores observed in the study are lower than those reported in patients selected by physicians [2-7]. This is because many users have mild rhinitis, whereas in clinical trials or in patients selected by physicians, AR is usually more severe.

The results of the study are in line with those of 2 previous studies using the same app. All 3 studies used different but complementary tools. In the first study, a global question was asked at baseline (“How do my symptoms affect my school or work?”) [10], and it was found that impairment was associated with troublesome symptoms, ocular symptoms, and nasal obstruction. In the second study, the result of the visual analog scale was correlated with global allergy symptoms (N=5678 days;  $\rho=0.82$ ), rhinitis ( $\rho=0.80$ ), ocular symptoms ( $\rho=0.70$ ), and asthma ( $\rho=0.56$ ). In this third study, there was a highly significant correlation between the WPAI-AS questions Q4 (degree allergy affected productivity while working) and Q9 (degree allergy affected regular activities). Together, the findings from these studies indicate that 3 different tools used in a large number of countries and languages with cultural differences give very similar results. There is a very strong correlation between the severity of rhinitis and work productivity. However, as found in the 3 studies, some work impairment is also found in users with milder rhinitis symptoms.

Work productivity is a major problem in rhinitis patients. Those with severe symptoms almost always have some work impairment, although work impairment is not restricted to moderate and severe disease.

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#### Conflicts of Interest

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The remaining authors declare that they have no conflicts of interest.

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