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## Work Productivity and Activity Impairment Allergic Specific (WPAI-AS) Questionnaire using Mobile Technology: The MASK study

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Uncontrolled allergic and non-allergic 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]. Work productivity impairment assessed using the WPAI-AS has been associated with allergic rhinitis (AR) severity [7]. We have found using mobile technology based visual analogue scales (VAS) that work productivity is impaired in moderate/severe AR [8].

MASK-rhinitis (MACVIA-ARIA Sentinel Network for allergic rhinitis) is an ICT system centred around the patient [9] using a mobile phone app (*Allergy Diary*). App users are asked to complete a short demographic questionnaire and WPAI-AS thus providing 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 from June 1, 2016 to July 31, 2017 in all consecutive users of the Allergy Diary (12,636) who filled in the WPAI-AS. The description of the Allergy Diary is reported in previous papers [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 geolocalized data that are never totally anonymous. An Independent Review Board approval was not needed.

The electronic form of the WPAI-AS Questionnaire was applied in the seven available languages (i.e. English, French, German, Italian, Polish, Portuguese and Spanish) (8, 10) according to the package obtained from Reilly and associates ([www.reillyassociates.net/WPAI\\_General.html](http://www.reillyassociates.net/WPAI_General.html)). 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) were the outcomes used.

Since the results were not normally distributed for Q4 and Q9 (Shapiro-Wilk test), medians and interquartile ranges, percentiles and non-parametric tests were used.

Of the 12,636 registered users, 1,017 filled in the WPAI-AS Q9 and 698 the Q4 (Table 1 online). There were 629 women (61%) and 405 men (39%), with a mean age of  $26 \pm 16$  years. The repartition of countries was:

- Austria 7 users
- 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 levels of WPAI-AS percentages of impairment were found for Q4 (N= 698, median and 25-75 percentiles: 20, 4-50) and for Q9 (N= 1,017; 17, 3-45).

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

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

The strengths and limitations of this study are those of mobile technology lengthily discussed previously [8,10]. A key limitation was that there was a 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 of the 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 two previous studies using the same App. These three studies used different, but complementary tools. In the first study, a global question was assessed at baseline ("How 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, VAS work was correlated with global allergy symptoms (N=5,678 days,  $Rho=0.82$ ), rhinitis ( $Rho=0.80$ ), eye symptoms ( $Rho=0.70$ ) and asthma ( $Rho=0.56$ ). In this third study, there is a highly significant correlation between the Q4 (degree allergy affected productivity while working) and Q9 (degree allergy affected regular activities) WPAI-AS questions. Together, the findings from these studies indicate that three 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 three studies, some work impairment is also found in users with milder rhinitis symptoms.

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

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