

# Understanding the impact of migraine on work productivity using self-reported migraine diary data using the *Migraine-Buddy*® application in Europe

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## Introduction

- Migraine is defined as a type of moderate to severe headache that is typically unilateral, throbbing and worsened by physical activity. The headache occurs in association with symptoms such as nausea, vomiting, phonophobia (sensitivity to sound) and photophobia (sensitivity to light)<sup>1</sup>.
- Migraine is a disabling disorder affecting work participation (reduced productivity while at work and absenteeism) and associated with significant annual per patient indirect costs in the US and Europe<sup>2,3</sup>.
- Although there are a few studies describing the overall burden of migraine in Europe<sup>4-6</sup>, there are limited published studies on current real-world data of migraineurs who regularly report about the migraine itself, the symptoms and triggers, the impact on daily-life activities, personally, professionally and socially and how they cope with their migraine attacks.
- Migraine-Buddy*® is a free smartphone application used to collect self-reported migraine data. It is available in four languages (English, French, Japanese, and Spanish) for both Android (developed by Google) and iOS (developed by Apple) operating systems. Until today the application has been downloaded over 500,000 times in several countries across the world by users who log their migraine details into the application.
- Migraine-Buddy*® collects self-reported data from migraineurs such as the most common migraine triggers, symptoms, relief methods, migraine onset location and use of medication.

## Objective

- The purpose of the study was to evaluate the impact of migraine on work productivity as perceived by individuals suffering from migraine in the real world using a self-reported smartphone application called *Migraine-Buddy*®.

## Methods

- A total of 10,347, 11,301 and 6,504 migraine records were retrieved from CM, 8-14 EM and 4-7 EM individuals, respectively corresponding to a total of 16,815, 14,398, and 7,693 migraine days.
- A retrospective, cross-sectional analysis was conducted using self-reported data captured through *Migraine-Buddy*®. The most recent 28-days period of each user with >70% data completeness was defined as the observation period within a 13-month period from June 1, 2015 (first in) through July 3, 2016 (last out).
- Migraine records of individuals from 17 European countries including Great Britain, France, Spain, the Netherlands, Italy, Belgium, Norway, Sweden, Switzerland, Germany, Finland, Poland, Denmark, Portugal, Czech Republic, Hungary, and Slovakia, who were ≥18 years of age as of July 3, 2016 and had agreed to participate in the study, were included. Each migraine record describes a single migraine episode. Individuals who had used the *Migraine-Buddy*® for <2 consecutive weeks from the time of initial registration, recorded <4 migraines, and skipped the "impact on activity" question for all of the records in scope were excluded.
- Migraine-Buddy*® users were randomly selected and stratified by migraine frequency as chronic migraine (CM) (≥15 headache days/month), and episodic migraine (EM) with 4-7 migraine days/month (4-7 EM) and 8-14 migraine days/month (8-14 EM). Results are presented by subgroup and overall.
- Descriptive analysis was performed. Demographic variables (age, gender), migraine days per patient, work days missed, triggers, symptoms, medication usage and other information were summarized descriptively. Neither analyses of safety and effectiveness endpoints nor comparative effectiveness analyses were done.
- The study was conducted in accordance with the Guidelines for Good Pharmacoepidemiology Practices (GPP) of the International Society for Pharmacoepidemiology<sup>7</sup>, the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines<sup>8</sup>, and with the ethical principles laid down in the Declaration of Helsinki.

## Results

- A total of 10,347, 11,301 and 6,504 migraine records were retrieved from CM, 8-14 EM and 4-7 EM individuals, respectively corresponding to a total of 16,815, 14,398, and 7,693 migraine days.
- A total of 3,900 eligible migraineurs (n=900 CM, n=1500 8-14 EM and n=900 4-7 EM) were included with a total of 28,152 respective migraine records which were analyzed.
- The mean age of the study population reported (n=1950) was 35.4; 65% of the study population were female, 9% male and 26% not reported.
- Employed migraineurs were considered those who reported work either as the location of migraine onset or in 'affected activities' at least once. In total, 3,106 respondents were considered to be employed (80% of the overall study sample, see also **Table 1**).

**Table 1. Employment status of study sample by migraine frequency and overall.**

Number of *Migraine-Buddy*® users and % proportions in each category are shown

Employment status	CM (n=900)	8-14EM (n=1500)	4-7EM (n=1500)	Overall (n=3900)
Employed	730 (81%)	1237 (82%)	1139 (76%)	3106 (80%)
Unemployed	149 (17%)	239 (16%)	286 (19%)	674 (17%)
Unknown	21 (2%)	24 (2%)	75 (5%)	120 (3%)

CM, chronic migraine; EM, episodic migraine; respondents did not report their employment status directly

- Employed migraineurs reported a total of 31,322 migraine days overall across 23,050 *Migraine-Buddy*® records. A mean of 18.6, 9.6 and 5.1 migraine days in a 28-day period were reported by CM, 8-14 EM and 4-7 EM patients, respectively (**Table 2**).
- A mean of 4.4, 2.1 and 1.2 work days within the 28-day observation period were reported as missed by employed CM (n=730), 8-14 EM (n=1237) and 4-7 EM (n=1139) sufferers, respectively (**Table 2**). Overall, about 2.3 workdays were missed in a 28-day period by a migraine sufferer corresponding to 20% of the overall migraine days experienced.

**Table 2. Migraine days and missed days of work reported by *Migraine-Buddy*® users within a 28-day observation period**

	CM	8-14 EM	4-7 EM	Total
Employed users (n)	730	1,237	1,139	3,106
Migraine days recorded (total)	13,564	11,896	5,862	31,322
Migraine days (mean/person)	18.6	9.6	5.1	10.1
Work days missed (mean)	4.4	2.1	1.2	2.3
Estimated work days missed per year* (mean)	57.4	27.7	15.5	30.2

CM, chronic migraine; EM, episodic migraine

\*Calculated based on the mean missed work days reported in a 28-day period and extrapolated for the total calendar year of 365 days

- The most commonly reported potential triggers of absenteeism-related migraines were psychological (38%), sleep (34%), nutrition (25%), environment (25%) and/or menstruation (23%) among others (**Table 3**). Results did not differ by migraine frequency (data not shown).

**Table 3. Triggers of migraine reported by employed migraineurs (n=3,106) in at least one of their *Migraine-Buddy*® records.** The corresponding total days of migraine related to a trigger as well as the proportion of workdays missed related to the trigger are shown

Trigger	Users (n=3106)	Migraine records (n=23,050)	Migraine days (n=31,322)	Missed work days (n=7,197)
Psychological	2,108 (68%)	6,510 (28%)	10,118 (32%)	2,767 (38%)
Sleep	2,168 (70%)	6,896 (30%)	10,297 (33%)	2,444 (34%)
Nutrition	1,796 (58%)	4,759 (21%)	6,990 (22%)	1,767 (25%)
Environment	1,533 (49%)	4,742 (21%)	6,861 (22%)	1,819 (25%)
Exertion	1,488 (48%)	4,333 (19%)	6,389 (20%)	1,492 (21%)
Menstruation	1,641 (53%)	4,552 (20%)	6,661 (21%)	1,670 (23%)
Other	1,161 (37%)	3,634 (16%)	5,016 (16%)	1,056 (15%)
Illness	1,080 (35%)	2,920 (13%)	4,198 (13%)	1,086 (15%)
Unknown	117 (4%)	487 (2%)	700 (2%)	141 (2%)

Each user could specify more than one trigger in each record and therefore numbers may not add up to 100%

- The most commonly reported symptoms recorded by migraine sufferers in their absenteeism-related migraines were body pain (92%), mood and cognition (88%), environmental handicap (86%), depression (47%) and/or sleep alterations (32%) (**Table 4**).

**Table 4. Symptoms reported by working migraineurs at least once in absenteeism-related migraine records.** Number and proportion of users reporting each of the symptoms are shown (n=3106)

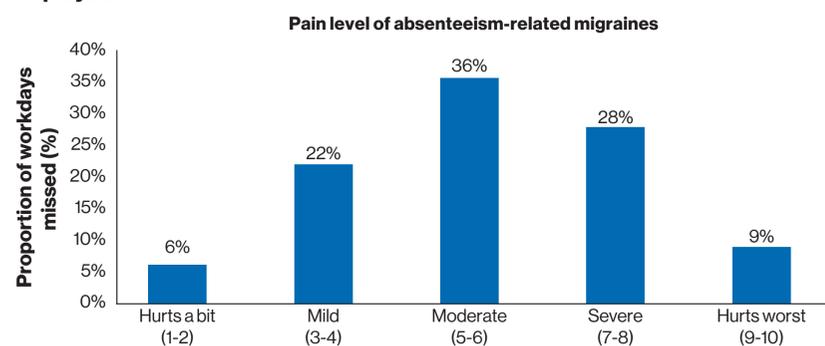
Symptoms	CM (n=730)	8-14EM (n=1237)	4-7EM (n=1139)	Total (n=3106)
Pain/Body	684 (94%)	1145 (93%)	1024 (90%)	2853 (92%)
Mood and cognition	661 (91%)	1114 (90%)	972 (85%)	2747 (88%)
Environmental handicap	643 (88%)	1073 (87%)	944 (83%)	2660 (86%)
Depression	436 (60%)	590 (48%)	435 (38%)	1461 (47%)
Sleep alterations	296 (41%)	435 (35%)	256 (22%)	987 (32%)
Others	271 (37%)	296 (24%)	213 (19%)	780 (25%)
No symptoms	126 (17%)	274 (22%)	161 (14%)	561 (18%)

CM, chronic migraine; EM, episodic migraine

Note: each user could specify more than one symptom per record and therefore numbers do not add up to 100%. Environmental handicap includes ringing in ears (tinnitus), sensitivity to light, noise or smell; mood and cognition symptoms include nausea, anxiety, confusion, blurred vision, moodiness, or giddiness.

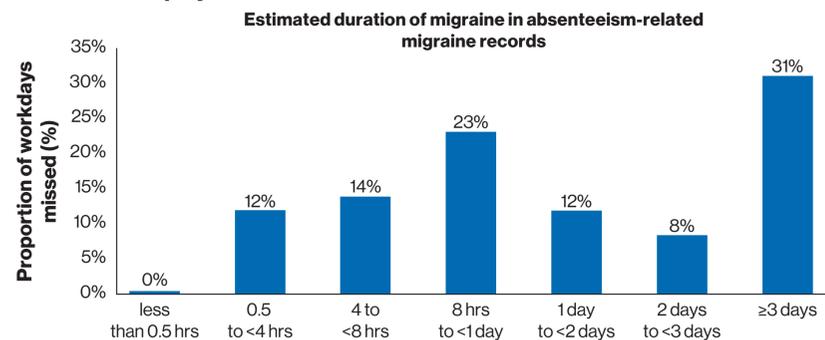
- Although 54% of employed migraineurs reported they did not sense an aura coming, 77% reported weakness and fatigue, 58% numbness and tingling, and 37% visual disturbances in at least one of their migraine records.
- The pain levels and duration of migraine varied across migraine records, however the majority of absenteeism-related migraines were related to moderate or severe pain (**Figure 1**) and duration of more than 3 days (**Figure 2**).

**Figure 1. Pain level of migraine as reported in absenteeism-related migraine records (n=7197) among the *Migraine-Buddy*® users who were considered employed**



Pain scale was presented as 1-2: hurts a bit - pain is present but does not limit activity); 3-4: mild - can do most activities; 5-6: moderate - unable to do some activities; 7-8: severe - unable to do most activities; 9-10: hurts worst - excruciating, unable to do any activities because of pain

**Figure 2. Estimated duration of migraine records as reported in absenteeism-related migraine records (n=7197) by *Migraine-Buddy*® users who were considered employed**



The duration of each migraine record was calculated by the application based on the start and end date reported by *Migraine-Buddy*® users who were considered employed

## Conclusions

- Migraine can have a considerable impact on the lives of affected individuals and affect the work productivity of employed migraineurs irrespective of migraine frequency, as seen from analyzed data collected through a mobile application.
- Employed migraine patients reported that at least 1 in 4 migraines was related to work absenteeism. Those migraines are commonly reported to have at least moderate to severe levels of pain (63% of migraine records).
- Overall an average of 2.3 work days missed per patient were reported within a 28-day observation period which represents an estimated 30.2 work days missed a year, highlighting the high burden of migraine on work productivity.
- Although some limitations with the use of self-reported data recorded via a mobile application may exist, we have descriptively analyzed contemporary real-world data from a large sample of migraineurs (3,900) across countries and the results seem to be consistent with previously reported in the literature<sup>4-6</sup>.

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## Acknowledgements

The authors thank Mrs. Vijayalakshmi Vasanthaprasad (Novartis healthcare pvt ltd) for editorial support and coordinating poster layout preparation and Maninder Reddy Karka (Novartis healthcare pvt ltd) for designing the poster layout.

## Disclaimer

This study was funded by Novartis AG, Switzerland. This poster has been previously presented at the 3<sup>rd</sup> Congress of the European Academy of Neurology in Amsterdam, June 24-27, 2017.

Poster presented at 11<sup>th</sup> European Headache Federation Congress, Rome, Italy, 1-3 December 2017