Estimating the economic consequences of migraine in Sweden. A fiscal model using the government perspective of costs.

EE659

Martins R[1,2], Jakobsson M[3], Surmay G[4], Connolly MP[1,2]

[1] Health Economics, Global Market Access Solutions Sarl, St-Prex Switzerland; [2] University Medical Centre Groningen (UMCG), University of Groningen, Groningen, The Netherlands; [3] Pfizer AB, Pfizer Biopharma Group, Stockholm, Sweden; [4] Pfizer Biopharmaceuticals Group, 66 Hudson Boulevard, New York, NY 10001.

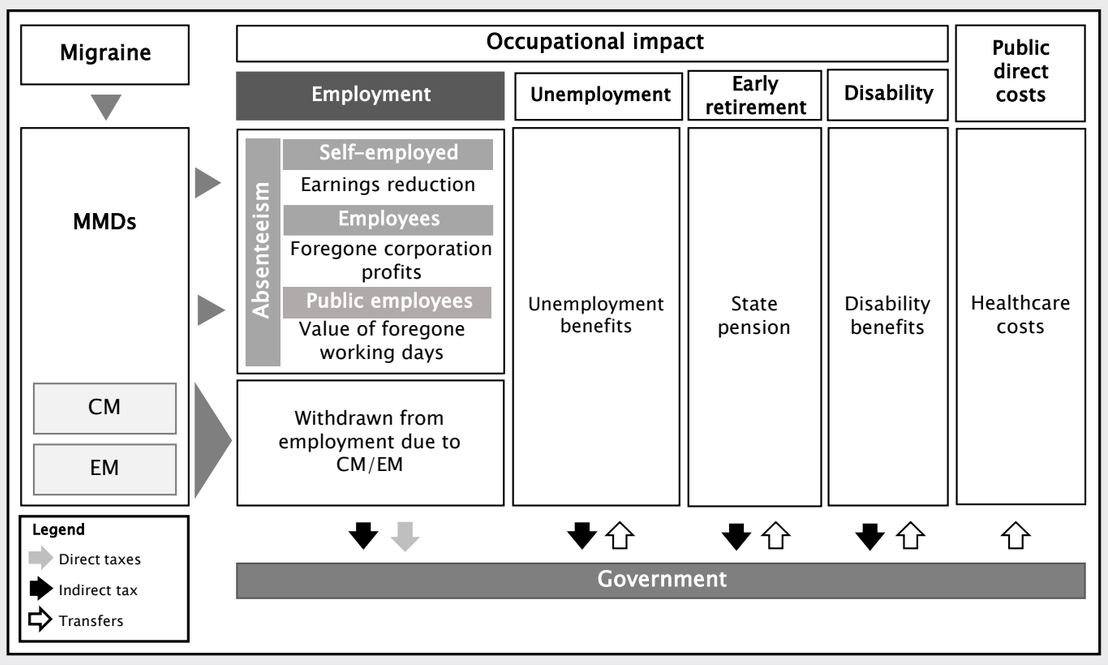
Background

- Migraine is a serious neurological condition manifesting from early adulthood and affecting 16.7% of females and 9.5% of males living in Sweden, about 0.9 to1.3 million adults [1].
- Severity is classified according to monthly headache days (MHDs) in the past 3 months, with episodic migraine (EM) corresponding to <15 MHDs with some being migraine, and chronic (CM) being defined as ≥15 MHDs with at least 8 days per month of migraine character [2].
- Symptoms are highly incapacitating and include pain, nausea, and sensory sensitivity, affecting normal activities of daily living, often over individuals' most productive years [3,4]. The intermittent and subjective manifestations of migraine have contributed to underdiagnosis and undertreatment, further aggravating the burden of the disease [5].
- It has been estimated that half of Swedish migraine sufferers have not received a formal diagnosis [1]. Consequently, focusing on direct healthcare costs to estimate the disease's economic consequences undermines its true burden, particularly with reduced productivity being extremely common [6].
- In countries with tax-funded health systems, understanding the public economic burden of migraine can improve sustainability and inform healthcare decision-making.

Objectives

- This analysis aims to estimate the economic burden of migraine to the Swedish government using an established fiscal modelling framework [7].

Figure 1. Model diagram



Acronyms: CM, chronic migraine; EM, episodic migraine.

METHODS

- **Modelling framework** – Migraine-related changes to productivity were estimated for a cohort affected by migraine and compared with a demographically identical cohort in the general population unaffected by the condition (Figure 1). This was achieved using two independent but complementary analyses.
- **Model structure** – A longitudinal model, consisting of a Markov lifetable process simulated the fiscal life of a cohort from the age of 44, a commonly reported age of peak migraine prevalence [8], over a 20-year work life expectancy. An additional cross-sectional model, using the Swedish demographic distribution and published migraine prevalence rates, estimated the annual burden associated with the entire cohort with prevalent migraine living in Sweden.
- **Effect of migraine** – Evidence of migraine's impact on productivity were sourced from peer-reviewed publications identified as result of a targeted literature search conducted on PubMed and Google Scholar. The extracted relative risks of unemployment [9], absenteeism [6], disability [10], and early retirement [11] were applied to baseline rates of these events in the general population, as informed by national statistics.
- **Model results** – Results were summarized as incremental fiscal consequences (IFCs) (Equations 1 to 4). Direct, indirect, and corporation taxes resulting from employment earnings were considered sources of government revenue and depicted as positive values. Public sector absenteeism and transfers in the form of healthcare costs and financial support to individuals (unemployment benefits, and disability or early retirement pensions) were represented as negative values. Longitudinal results were discounted at 3%.

$$IFC = NPV_{Migraine} - NPV_{noMigraine} \quad \textbf{Equation 1}$$

$$NPV_i = \sum_{t=1}^{n} \frac{Taxes_t - Transfers_t - PS\ absenteeism_t}{(1+r)^t} \quad \textbf{Equation 2}$$

$$Tax_t = Direct\ taxes_t + Indirect\ tax_t \quad \textbf{Equation 3}$$

$$Transfers_t = Financial\ support_t + Healthcare\ costs_t \quad \textbf{Equation 4}$$

Where i is the cohort, t is time in years, n is the time horizon, and r is the discount rate.

Acronyms: IFC, incremental fiscal consequences; NPV, net present value; PS, public sector.

- **Sensitivity analyses** – Uncertainty was assessed in deterministic scenarios and one-way sensitivity analysis.

Results

- The migraine cohort was affected by higher rates of absenteeism, unemployment, disability, and early retirement compared to individuals unaffected by the condition.
- **Longitudinal model** – From the age of 44 and over 20 years, an average individual affected by migraine was associated with SEK 487,522 in additional costs to the Swedish government, compared to a person in the general population. This was equivalent to SEK 32,233 per year lived with migraine (Table 1).

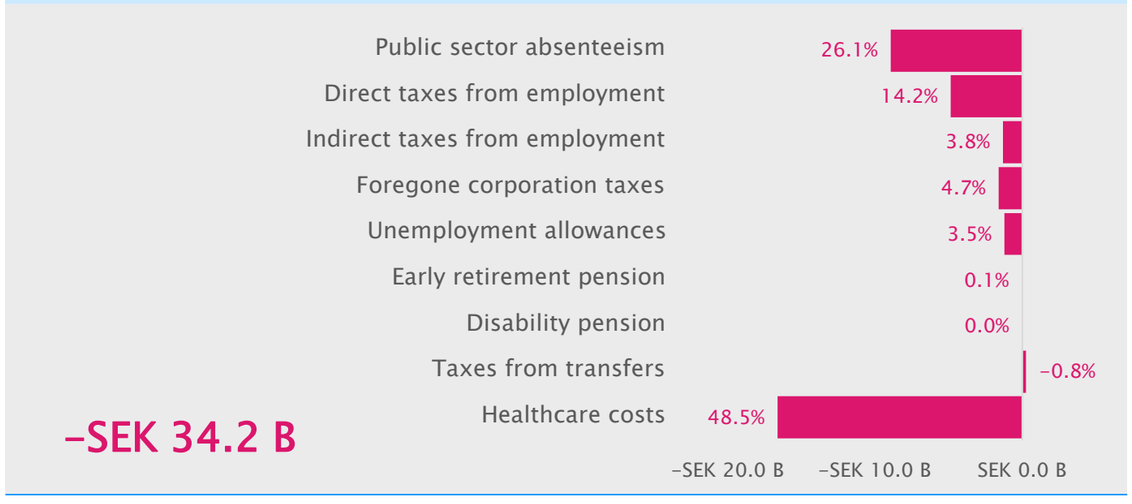
Table 1. Base case longitudinal results

		Migraine population	General population	Incremental	
	Gross income from any employment	SEK 5,026,720	SEK 5,183,153	-SEK 156,434	
Fiscal consequences	Public sector absenteeism	-SEK 200,392	-SEK 33,710	-SEK 166,682	*34.19%*
	Direct taxes from employment	SEK 2,131,329	SEK 2,197,657	-SEK 66,328	*13.61%*
	Indirect taxes from employment	SEK 570,415	SEK 588,166	-SEK 17,752	*3.64%*
	Foregone corporation taxes	-SEK 41,299	-SEK 6,798	-SEK 34,501	*7.08%*
	Unemployment allowances	-SEK 69,077	-SEK 49,634	-SEK 19,443	*3.99%*
	Early retirement pension	-SEK 24,414	-SEK 23,385	-SEK 1,029	*0.21%*
	Disability pension	-SEK 2,701	-SEK 2,554	-SEK 148	*0.03%*
	Taxes from transfers	SEK 26,281	SEK 21,640	SEK 4,641	*-0.95%*
	Healthcare costs	-SEK 547,935	-SEK 361,654	-SEK 186,281	*38.21%*
	Total	**SEK 1,842,206**	**SEK 2,329,728**	**-SEK 487,522**	***100%***
	Life years	15.125	15.125	0.000 [a]	
	Incremental costs per life year lived with migraine			**-SEK 32,233**	

[a] No migraine-related excess mortality was modelled.

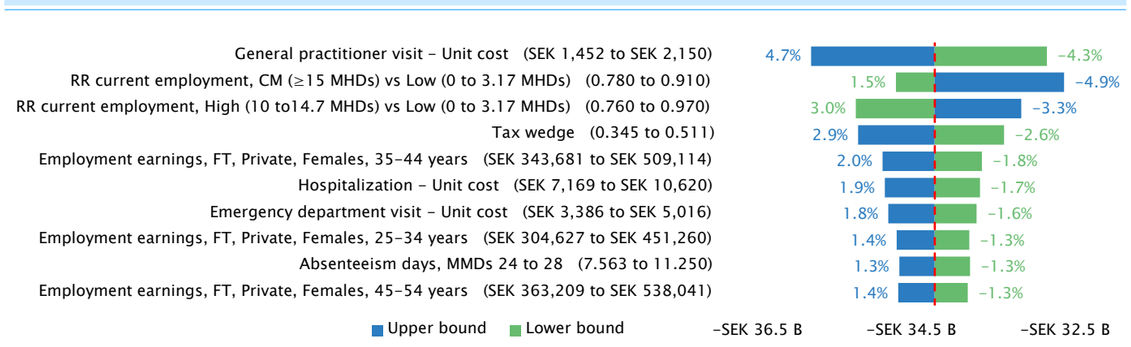
- **Cross-sectional model** – The entire Swedish population affected by migraine was estimated to cost SEK 34.2 billion in 2022 alone, an average of SEK 25,153 per person with migraine.
- The overall fiscal burden was equivalent to 0.5% of Swedish gross domestic product [8] or 5.0% of the annual Swedish healthcare spending [9].

Figure 2. Base case cross-sectional results



- Public sector migraine-related absence represented 26% of the economic burden, half of which was due to absenteeism among healthcare and social care workers.

Figure 3. Tornado diagram



Acronyms: B, billion; CM, chronic migraine; FT, full-time; MHDs, monthly headache days; RR, relative risk.

Discussion

- **Strengths** – **(1)** The analysis applies an established framework, using transparent, and reproducible methods to estimate the excess costs of migraine to the Swedish government. **(2)** The impact of EM on productivity was implemented conservatively, and so are the results by not including elements of greater uncertainty such as presenteeism. **(3)** Combines data across economic domains and disparate sources that would probably not be captured by a single primary research study. **(4)** Results were expressed in monetary terms which can be compared across economic sectors and easily understood by policymakers. **(5)** Uncertainty was extensively explored in sensitivity analyses.
- **Limitations** – **(1)** In the absence of local data, measures of the relative effect of migraine on occupational outcomes were sourced from internationals studies. **(2)** Model combines inputs from very different sources, mostly observational studies, or routinely collected data which contributes to model uncertainty.

CONCLUSIONS

Migraine is associated with important economic losses to the Swedish government.

This study shows that decreased productivity, foregone taxes, and benefit transfers represent 50% to 60% of the overall economic burden to the Swedish government.

REFERENCES

1: Dahlöf C, et al. Cephalalgia. 2001;21(6):664-671.
2: International Headache Society. Cephalalgia. 2018;38(1):1-211.
3: Steiner TJ, et al. The Journal of Headache and Pain. 2014;15.
4: Hjalte F, et al. The Journal of Headache and Pain. 2019;20(1):65.
5: Stovner LJ, et al. The Lancet Neurology. 2018;17(11):954-976.
6: Hansson-Hedblom A, et al. The Journal of Headache and Pain. 2020;21(1):99.
7: Connolly MP, et al. Value in Health. 2017;20(2):273-277.
8: Safiri S, et al. PAIN. 2022;163(2).
9: Stewart WF, et al. J Occup Environ Med. 2010;52(1):8-14.
10: Buse DC, et al. J Neurol Neurosurg Psychiatry. 2010;81(4):428-432.
11: Chalmer MA, et al. Cephalalgia. 2020;40(4):399-406.
12: The World Bank 2023. [Accessed: 19/09/2023].
13: OECD 2023. [Accessed: 19/09/2023].

CONFLICTS OF INTEREST

This study was sponsored by Pfizer.
RM and MPC were paid consultants to Pfizer.
MJ and GS are employees of Pfizer and report no further conflicts.