LETTER TO THE EDITOR
INCIDENCE OF DIABETES MELLITUS NARROWLY CORRELATES WITH UNEMPLOYMENT RATE DURING 2000–2012 IN THE CZECH REPUBLIC

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There is a documented association between higher unemployment rates in inner cities and a higher risk of type 2 diabetes mellitus (DM) (1). Higher unemployment at regional level is also associated with a higher prevalence of diabetes mellitus (2). Possible causes for the relationship between unemployment and diabetes mellitus include, for example, limited financial resources, which can lead to underfunded support of physical activity and healthy diets (3, 4). Results from the DIAB-CORE Consortium, a study that examined, among other issues, the relationship between type 2 diabetes mellitus and various social aspects including unemployment in Germany (1, 2, 5), led us to question whether the relationship between unemployment rates and the incidence of diabetes mellitus could be confirmed for larger areas and over longer periods of time in the Czech Republic. We also wanted to determine whether previous findings of a study involving a relatively small sample of patients could be verified using a different methodology based on population data (official unemployment figures) from all 14 administrative regions of the Czech Republic.

We analyzed the relationship between the incidence of diabetes mellitus and unemployment in the Czech Republic, wherein 10,509,286 inhabitants resided during 2012 and the prevalence of diabetes mellitus was 8.0%. The country is divided into 14 higher-level territorial administrative units (regions): in 2012 the least populous was inhabited by 301,726 residents, while the most populous by 1,291,816 residents (6). Data pertaining to patients with diabetes mellitus (more specifically, the number of new diabetes patients per calendar year) were obtained from a register that is maintained by the Institute of Health Information and Statistics of the Czech Republic, to which all physicians are legally obliged to annually report data for diabetes patients in their care (7). Unemployment figures were obtained from a register kept by the Ministry of Labour and Social Affairs, which is managed in accordance with Eurostat/International Labour Office methods (8). At the time this study was conducted, available data from both registers spanned the period from 2000 to 2012.

Given that the unemployment rates among individual regions vary both instantaneously and continuously, we compared the relationship between unemployment rates and the incidence of diabetes mellitus, while taking into account time and inter-regional differences in both population totals and background diabetes incidence. Using the Generalized Additive Model (GAM) (9), regions were represented by i and calendar year was represented by *t*:

$$\left(\frac{new\,DM\,cases}{\#\,of\,nondiabetic\,population}\right)_{it} = \mu_i + s(t) + \beta.unemployment_{it} + \varepsilon_{it}$$

wherein the modeled quantity (the left side of the equation) is a proxy for the regionally-specific incidence. For this, the effect of unemployment was tested (regional and time-specific); coefficient β is estimated from the data, after an adjustment for regionally-specific average incidence (μ_i) and time trend $s(t)$, estimated as a spline, and ε_{it} represents homoscedastic random error.

Thus, we compared the incidence of diabetes mellitus and unemployment rate, while taking into account separate values for individual regions, over the aforementioned period of 2000–2012. The effect of unemployment on DM incidence adjusted for spatial and temporal differences was positive (the estimate of the β coefficient was $4.173 \cdot 10^{-3}$, its standard error was $7.688 \cdot 10^{-4}$) and highly statistically significant ($p < 0.001$). Time trend ($p < 0.001$) and inter-regional incidence differences ($p < 0.001$) were significant as well.

Unfortunately, the diabetes mellitus patient registry does not distinguish types of disease in the annual new patient reports. However, the number of patients registered according to different types of diabetes mellitus in the years 2000 and 2012 was 44,870 and 56,514 individuals, respectively, with type 1 diabetes mellitus: 8,299 and 12,128, respectively, with secondary diabetes; and 599,782 and 772,585, respectively, with type 2 diabetes mellitus. An analysis of the total increase in all diabetes mellitus patients for the given period indicated that type 2 diabetes mellitus ac-

counted for 91.8% of all cases, while type 1 diabetes mellitus accounted only for 6.2%, and secondary diabetes mellitus a mere 2.0%. Due to this significant disproportion, we conclude that the calculation-proven relationship actually reflects the relationship between unemployment and type 2 diabetes mellitus.

Regardless of the degree of uncertainty concerning the type of diabetes mellitus, we consider the results to be important, given their high statistical significance.

The results suggest that unemployment influences the incidence of diabetes mellitus, indicating that DM simultaneously increases with unemployment across all 14 administrative regions in the Czech Republic and it is expected to be a trend over time. Therefore, we believe that a more detailed analysis of data from these registers could provide a more comprehensive view of the relationship between unemployment and type 2 diabetes. Such findings could later serve as a basis for prospective attempts to redistribute financial resources as well as targeted interventions to cover costs associated with the increase in diabetic patients; or even prevent further increases in the number of cases, as the case may be.

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JB designed and conducted the study, performed the analysis and wrote the manuscript. MB was in charge of statistical analyses and analyzed this work, and revised the manuscript. DJZ contributed to the design of the study, and revised the manuscript. MN conducted the study, performed the analysis and revised the manuscript. MK is the guarantor of this work and, as such, had full access to all data and takes responsibility for data integrity and accuracy.

Conflict of Interests

None declared

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