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ORIGINAL ARTICLE

Slovak and Czech OECD Data under the Magnifying Glass: Cardiovascular Pharmaceutical Consumption by Defined Daily Dose

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Abstract

OBJECTIVE: The aim of this study is to point out certain discrepancies and inaccuracies in reporting data concerning the consumption of cardiovascular pharmaceuticals (Anatomical Therapeutic Chemical code C, cardiovascular system) – measured in defined daily doses (DDDs) per 1,000 inhabitants per day – as reported by the Slovak Republic and the Czech Republic for the year 2014. This data also appears in the online database of the Organization for Economic Co-operation and Development (OECD) Health Statistics.
METHODS: First, we take the Czech wholesalers' data by DDD as reported to the OECD, and we compare this Czech data with the Slovak data. We calculate the Slovak data by the method traditionally used in the Slovak Republic (SDS – standard dose of substance). However, the data we use for the Slovak Republic is that reported by health insurance companies and hospital pharmacies, while the official data reported to the OECD is based on wholesalers' reports. Secondly, we recalculate medicine consumption for both countries using DDD.
RESULTS: A comparison based on the first methodological approach shows the Slovak Republic having a higher consumption of cardiovascular medicines than the Czech Republic. A second comparison, using the same measurement tool (DDD) for both countries, shows cardiovascular medicine consumption to be actually lower in the Slovak Republic as compared to the Czech Republic.
CONCLUSION: Our results indicate that, when actual DDDs for both countries are used, cardiovascular pharmaceutical consumption in the Slovak Republic is shown to be lower than in the Czech Republic.

HIGHLIGHTS

1. What is already known about the topic?

The methods for calculating pharmaceutical consumption are generally known. However, in this paper we highlight the application of these methods in the everyday statistical experience of two transition countries.

2. What does the paper add to existing knowledge?

We point out a discrepancy in the reporting of data for the Slovak Republic to the OECD. In 2014 the Slovak Republic did not report pharmaceutical consumption based on actual DDD as defined by the WHO, because it had not updated its DDD values when they were altered by the WHO. As an example, note that in 2009 the DDD for atorvastatin (ATC code C10AA05) was changed, but this change was not reflected in Slovak official analyses prepared for the OECD. When we corrected the DDD values for cardiovascular pharmaceuticals, the Slovak consumption became lower than that of the Czech Republic, quite in contradiction to what one sees in the OECD Health Statistics Data 2016 database.

3. What insights does the paper provide for informing health care-related decision making?

This paper points to the importance of accurate data and careful measurements for health care related decision making. Decisions based on incorrect data can lead to lower quality health care, as our case documents.

INTRODUCTION

In the 1960s, pharmaceutical consumption research began as an attractive field after the publication of a study by two consultants at the World Health Organization (WHO) Regional Office for Europe – Engel and Siderius (WHO 2017a, Engel & Siderius 1968). This pioneering study showed great differences in drug utilization between population groups within six European countries, and later led to the development both of the Anatomical Therapeutic Chemical (ATC) classification, and a crucial tool for pharmaceutical utilization measurement called the defined daily dose (DDD) (WHO 2017a).

The DDD represents "the assumed average maintenance dose per day for a drug used on its main indication in adults" (WHO 2017a) and is a basic measurement unit used for monitoring pharmaceutical consumption – including by the Organization for Economic Co-operation and Development (OECD).

The basis for the calculation of pharmaceutical consumption by DDD for reporting to the OECD are two documents published by the World Health Organization Collaborating Centre for Drug Statistics Methodology (hereinafter referred to as the "WHO") (OECD 2016a). The first document is *Guidelines for ATC classification and DDD assignment* (hereinafter referred to as *"Guidelines"*), which enables users to understand the ATC/DDD system and includes ATC/DDD interpretative guidelines (WHO 2017a). The second is the *ATC index with DDDs*, which consists of a list of all established ATC codes with their ATC level names and DDD values for plain substances (WHO 2017a, OECD 2016a).

DDD as a technical unit of measurement created for the purpose of comparing international pharmaceutical consumption is expressed by the WHO in terms of DDDs per 1,000 inhabitants per day (DDDs/1,000 inhabitants/day). It is important to point out that the DDD does not reflect an actual and exact consumption.

The aim of this study is to investigate reasons behind the higher cardiovascular pharmaceutical consumption (ATC code C, cardiovascular system) – measured in DDDs/1,000 inhabitants/day – reported by the Slovak Republic as compared to the Czech Republic in the OECD Health Statistics online database (Table 1).

METHODOLOGY

Sources

In the Czech Republic, the State Institute for Drug Control (SIDC) reports Czech pharmaceutical consumption data to the OECD. The data is reported to SIDC on a monthly basis by wholesalers that sell medicines to pharmacies. The wholesalers' data is publicly available on the SIDC website (State Institute for Drug Control 2017).

In the Slovak Republic, pharmaceutical consumption data for 2014 was provided to the OECD by the private company MCR (OECD 2016a). This data is based on quarterly reports from wholesalers to the Slovak SIDC. The Slovak wholesalers' data is not publicly available, hence not available for direct comparison with the data provided by Czech wholesalers. However, there exists an additional, more precise source for pharmaceutical consumption in the Slovak Republic. The National Health Information Center (NHIC) collects data on a quarterly basis on medicines reimbursed by all health insurance companies in the Slovak Republic (National Health Information Center 2015). In addition, the NHIC also collects data on medicines dispensed via hospital pharmacies. For the purpose of this study, NHIC data represents a more reliable source of consumption data than that provided by MCR.

We used the OECD Health Statistics Data 2016 database, which contained the most recent data available when we were analyzing medicine consumption. This database contained cardiovascular pharmaceutical consumption data, which included the year 2014 for both countries (OECD 2016b). For 2015, the database contained data for the Slovak Republic only – thus we have based our analysis on the 2014 data.

For the Slovak Republic, we used 2014 NHIC data: medicines dispensed via prescription, medicines dispensed via request and reported with a procedure to health insurance companies (included in the reimbursement list but delivered or consumed during a health

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Tab. 1. Cardiovascular pharmaceutical consumption by DDD in the Czech Republic versus the Slovak Republic in 2014 – data reported to the OECD

ATC code	Country	Year 2014
		Number of DDDs per 1,000 inhabitants per day
C-Cardiovascular system	**Czech Republic**	**600.80**
C-Cardiovascular system	**Slovak Republic**	**683.40**
C01A-Cardiac glycosides	Czech Republic	2.90
C01A-Cardiac glycosides	Slovak Republic	2.90
C01B-Antiarrhythmics, Class I and III	Czech Republic	8.00
C01B-Antiarrhythmics, Class I and III	Slovak Republic	10.00
C02-Antihypertensives	Czech Republic	13.60
C02-Antihypertensives	Slovak Republic	33.60
C03-Diuretics	Czech Republic	47.30
C03-Diuretics	Slovak Republic	44.70
C07-Beta blocking agents	Czech Republic	64.60
C07-Beta blocking agents	Slovak Republic	71.00
C08-Calcium channel blockers	Czech Republic	75.10
C08-Calcium channel blockers	Slovak Republic	70.10
C09-Agents acting on the Renin-Angiotensin system	Czech Republic	248.30
C09-Agents acting on the Renin-Angiotensin system	Slovak Republic	198.00
C10-Lipid modifying agents	Czech Republic	112.70
C10-Lipid modifying agents	Slovak Republic	152.20

OECD. OECD Health Statistics 2016. Available from: http://www.oecd.org/health/health-data.htm. [Accessed March 23, 2017].

care contact), and medicines reported by hospital pharmacies to the NHIC (National Health Information Center 2015).

For the Czech Republic, we selected data on pharmaceuticals that were distributed to pharmacies and reported by wholesalers to the SIDC in 2014. This data includes medicines dispensed via prescription, medicines dispensed via request, reported with a procedure to health insurance companies and dispensed by hospital pharmacies (State Institute for Drug Control 2017).

Two approaches

First, we take the Czech data by DDD as reported to the OECD, and compare it with the Slovak data, calculating by standard dose of substance. The standard dose of substance (SDS) is defined as the average dose of a substance used in therapeutic indication per one day of treatment (or one cycle of treatment), or as the average number of units of pharmaceutical form per one day of treatment (or one cycle of treatment) (MOH 2011). The SDS is commonly used by authorities in the Slovak Republic, mainly for the purpose of reimbursement of medicines (MOH 2017). The DDD serves as a more precise measurement tool for international pharmaceutical comparison, mainly due to the fact that the SDS – a measurement unit defined by Slovak legislation – is not always equal to the DDD for some substances, and the SDS is used in the Slovak Republic only. For example, the SDS for atorvastatin (ATC code C10AA05) is 10 mg in the Slovak reimbursement list, while the DDD currently assigned to atorvastatin by the WHO is 20 mg (WHO 2017b). Until 2009 the DDD for atorvastatin was 10 mg and thus equal to the Slovak SDS, but in 2009 it was revised to 20 mg by the WHO.

Secondly, in our analysis for the Slovak Republic we recalculated the medicine consumption data, assigning the actual DDD to each substance and calculating the number of DDDs for each package size of medicine which was reported to the NHIC. This analysis is then able to use the same, fully comparable measurement (DDD) for both countries. The source of the data was the same as in our first analysis – SIDC data for the Czech Republic and NHIC data for the Slovak Republic (State Institute for Drug Control 2017, National Health Information Center 2015).

Those substances which do not have an assigned DDD were not included in our analysis. For example, a DDD has not been established for any substances under ATC code C05 – Vasoprotectives. Thus, consumption of pharmaceuticals classified under this code was not included in our analysis. Vasoprotectives

Tab. 2. Cardiovascular pharmaceutical consumption by DDD in the Czech Republic (based on State Institute for Drug Control data) versus Slovak data measured by standard dose of substance (based on Health Information Center data) in 2014

ATC code	Country	2014
		DDDs per 1,000 inhabitants per day (Czech Republic); SDSs per 1,000 inhabitants per day (Slovak Republic)
C-Cardiovascular system	**Czech Republic**	**600.78**
C-Cardiovascular system	**Slovak Republic**	**633.56**
C01A-Cardiac glycosides	Czech Republic	2.85
C01A-Cardiac glycosides	Slovak Republic	2.84
C01B-Antiarrhythmics. Class I and III	Czech Republic	8.01
C01B-Antiarrhythmics. Class I and III	Slovak Republic	9.90
C01 - other	Czech Republic	20.30
C01 - other	Slovak Republic	45.18
C02-Antihypertensives	Czech Republic	13.55
C02-Antihypertensives	Slovak Republic	34.46
C03-Diuretics	Czech Republic	47.28
C03-Diuretics	Slovak Republic	46.58
C04-Peripheral vasodilators	Czech Republic	4.95
C04-Peripheral vasodilators	Slovak Republic	14.18
C07-Beta blocking agents	Czech Republic	67.25
C07-Beta blocking agents	Slovak Republic	59.50
C08-Calcium channel blockers	Czech Republic	75.11
C08-Calcium channel blockers	Slovak Republic	70.17
C09-Agents acting on the Renin-Angiotensin system	Czech Republic	248.27
C09-Agents acting on the Renin-Angiotensin system	Slovak Republic	188.24
C10-Lipid modifying agents	Czech Republic	113.21
C10-Lipid modifying agents	Slovak Republic	162.51

Source: State Institute for Drug Control (Státní ústav pro kontrolu léčiv). Dodávky léčiv - se zaměřením na léčivé přípravky. Available from www.sukl.cz/dodavky-leciv-se-zamerenim-na-lecive-pripravky. [Accessed March 23, 2017].
National Health Information Center (Národné centrum zdravotníckych informácií). Unpublished raw data. Spotreba liekov a zdravotníckych pomôcok v SR 2014, 2015.

are reimbursed neither in the Czech Republic nor the Slovak Republic.

Products with a fixed combination of substances were included, and a DDD was assigned based on WHO *Guidelines*. The Czech Republic reported almost all combined products under ATC code C, with only 4 ATC codes not being reported, namely the following: C03EA01 hydrochlorothiazide and potassium-sparing agents, C03EA06 chlortalidone and potassium-sparing agents, C10BA04 simvastatin and fenofibrate, and C10BX03 atorvastatin and amlodipine. In our second comparison, all the above-mentioned fixed combination products were included.

RESULTS

A comparison based on the first methodological approach shows the Slovak Republic having a higher consumption of cardiovascular medicines (Table 2) than the Czech Republic – however, cardiovascular medicine consumption calculated by SDS methodology in the Slovak Republic was 7.29% lower than that shown in the original published OECD data (683.40 DDDs per 1,000 inhabitants per day versus 633.56 SDSs per 1,000 inhabitants per day). This disparity was due to the different source data used in our analysis, which was based on the NHIC data including pharmaceuticals reimbursed by health insurance companies and those dispensed via hospital pharmacies.

A comparison of pharmaceutical consumption based on the second approach – with the same measurement tool (DDD) applied to both countries – shows a slight increase in cardiovascular medicine consumption in the Czech Republic as compared to the first analysis, and also as compared to the official OECD data (Table 3), due to the fact that we include the four ATC codes that the Czech Republic did not report, as mentioned above. But more interestingly,

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Tab. 3. Cardiovascular pharmaceutical consumption by DDD in the Czech Republic (based on State Institute for Drug Control data) versus Slovak data by DDD (based on Health Information Center data) in 2014

ATC code	Country	2014
		DDDs per 1,000 inhabitants per day
C-Cardiovascular system	**Czech Republic**	**620.01**
C-Cardiovascular system	**Slovak Republic**	**547.55**
C01A-Cardiac glycosides	Czech Republic	2.85
C01A-Cardiac glycosides	Slovak Republic	2.84
C01B-Antiarrhythmics. Class I and III	Czech Republic	8.01
C01B-Antiarrhythmics. Class I and III	Slovak Republic	9.90
C01 - other	Czech Republic	20.30
C01 - other	Slovak Republic	45.18
C02-Antihypertensives	Czech Republic	13.55
C02-Antihypertensives	Slovak Republic	20.26
C03-Diuretics	Czech Republic	63.12
C03-Diuretics	Slovak Republic	40.61
C04-Peripheral vasodilators	Czech Republic	4.95
C04-Peripheral vasodilators	Slovak Republic	4.71
C07-Beta blocking agents	Czech Republic	67.25
C07-Beta blocking agents	Slovak Republic	59.50
C08-Calcium channel blockers	Czech Republic	75.11
C08-Calcium channel blockers	Slovak Republic	70.17
C09-Agents acting on the Renin-Angiotensin system	Czech Republic	248.27
C09-Agents acting on the Renin-Angiotensin system	Slovak Republic	204.32
C10-Lipid modifying agents	Czech Republic	116.61
C10-Lipid modifying agents	Slovak Republic	90.04

Source: State Institute for Drug Control (Státní ústav pro kontrolu léčiv). Dodávky léčiv - se zaměřením na léčivé přípravky. Available from www.sukl.cz/dodavky-leciv-se-zamerenim-na-lecive-pripravky. [Accessed March 23, 2017].
National Health Information Center (Národné centrum zdravotníckych informácií). Unpublished raw data. Spotreba liekov a zdravotníckych pomôcok v SR 2014, 2015.

cardiovascular medicine consumption in the Slovak Republic was lower than in the Czech Republic (547.55 versus 620.01 DDDs per 1,000 inhabitants per day respectively) (Table 3). The results show that one of the main sources of this difference is found under ATC code C10 – Lipid modifying agents. Slovakia reported a consumption of 152.20 DDDs per 1,000 inhabitants per day for ATC code C10, the highest reported to the OECD in 2014. Our first analysis – using NHIC data and SDS as measurement for the Slovak Republic – showed a consumption at the level of 162.51 SDSs per 1,000 inhabitants per day for ATC code C10 in the Slovak Republic. However, our second analysis for 2014 demonstrates that when the actual DDDs are used, the consumption of cardiovascular medicines within ATC code C10 decreases to 90.04 DDDs per 1,000 inhabitants per day, which is 40.84% lower than that reported to the OECD (Table 4).

DISCUSSION

In this paper we demonstrate how using a different source, as in the first approach, can influence conclusions regarding volume of pharmaceutical consumption. However, applying the actual DDD, as in the second approach, has a higher impact on such conclusions in the Slovak Republic.

We believe that the second methodological approach should be used in future as this makes international comparisons among countries more suitable, being based on the actual DDDs assigned by the WHO. We presume that the difference between the OECD Slovak data and our analysis of ATC code C10 consumption is a result of the use of incorrect DDDs in the Slovak official analysis prepared for the OECD. As an example, the DDD used for atorvastatin was not updated in 2009, when it was changed by the WHO. This has a significant impact, as atorvastatin represents a relatively high

Tab. 4. Consumption of lipid modifying agents by DDD in the Czech Republic versus the Slovak Republic (data reported to the OECD, our approach 1, our approach 2)

		Data reported to the OECD	DDDs per 1,000 inhabitants per day (Czech Republic); SDSs per 1,000 inhabitants per day (Slovak Republic)	DDDs per 1,000 inhabitants per day
C10-Lipid modifying agents	Czech Republic	112.70	113.21	116.61
C10-Lipid modifying agents	Slovak Republic	152.20	162.51	90.04

Source: OECD. OECD Health Statistics 2016. Available from: http://www.oecd.org/health/health-data.htm. [Accessed March 23, 2017].
State Institute for Drug Control (Státní ústav pro kontrolu léčiv). Dodávky léčiv - se zaměřením na léčivé přípravky. Available from www.sukl.cz/dodavky-leciv-se-zamerenim-na-lecive-pripravky. [Accessed March 23, 2017].
National Health Information Center (Národné centrum zdravotníckych informácií). Unpublished raw data. Spotreba liekov a zdravotníckych pomôcok v SR 2014, 2015.

share within cardiovascular pharmaceutical utilization in the Slovak Republic.

Our first approach serves an informative purpose, as it compares the different measurement tools used in these countries – SDS for the Slovak Republic and DDD for the Czech Republic. For example, the SDS value for atorvastatin is 10 mg in the reimbursement list in the Slovak Republic, which is the same as the DDD value for atorvastatin before 2009. We present utilization by SDS with the aim of showing that there is a real difference between SDS and DDD. SDS is a Slovak measurement only, one that cannot easily be used for international comparison when another country's consumption is based on DDD, which does not always equal SDS.

We recognize also that there is a difference between the data sources in our analysis – the Czech Republic using distributors' reports, and Slovakia using data reported by health insurance companies and hospital pharmacies. We regard data reported by health insurance companies (or other institutes which reimburse medicines for international comparison of pharmaceutical utilization) as better reflecting actual pharmaceutical consumption within a country. A more precise comparison of Slovak and Czech consumption could be achieved if the Czech Republic also had available data on reimbursed medicines.

We have identified one ATC code – C02AC06 rilmenidine – which is reimbursed in both countries and has a high consumption. However, it was not included in our first analysis for the Czech Republic, or in our second analysis for both countries, as the DDD for this substance has yet to be defined by the WHO. Nevertheless, a more accurate picture of cardiovascular medicine consumption could be presented if a DDD was assigned to rilmenidine.

CONCLUSION

Our results for 2014 indicate that, when actual DDDs for both countries are used, cardiovascular pharmaceutical consumption in the Slovak Republic is shown to be lower than in the Czech Republic. In 2014 cardiovascular pharmaceutical consumption in the Slovak Republic was almost 20% lower than that reported to the OECD.

We recommend that the Slovak Republic reports its pharmaceutical consumption to the OECD according to WHO *Guidelines* using actual DDD, in order to accurately compare its consumption with that of other countries.

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