Direct and indirect costs associated with multiple myeloma: a case study from the Slovak Republic.

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Introduction

Innovation is a part of human life. It is visible everywhere, but mostly in healthcare. Thanks to dramatic progress in research and development, people in developed countries live longer and have a much higher quality of life compared to a decade ago.

In the past 100 years, new medical innovation and access to healthcare have helped people survive what previously were deadly diseases. Rising global prosperity in the past decades has converged billions of people in previously poor countries to the medical frontier. And among rich countries, that frontier is yet again on the verge of a great expansion as medical science is rapidly improving its capacity to treat malign conditions (Erixon, 2016). One of the field, where we made substantial progress during last decade is blood cancer and multiple myeloma.

Multiple myeloma (MM) is a plasma cell neoplasm associated with its characteristic clinical complications: anemia, infections, renal impairment or bone destruction. MM is the second most commonly diagnosed hematological neoplasm, with an incidence rate of 6.2 per 100 000 individuals. MM primarily affects the elderly and is typically diagnosed between the ages of 65–74 years, with an estimated 5-year survival rate ranging from 34.5% to 69.6% between 2 000 and 2008 (Fonseca et al., 2017). Patients with MM experience severe bone, blood and renal complications, impacting therapy choices and quality of life. In the last few years, the therapeutic landscape of MM has improved because of the FDA approvals of several new treatments.

According to Morris et al. (2007) approaches to costing basically fall into two broad types: macro – or “top-down” costing, and micro or “bottom-up” costing. These are distinguished largely on the basis of the level of disaggregation at which individual resources are measured and valued as separate components. For the purpose of our analysis we used the „bottom-up“ approach that helped us identify, quantify and value resources in a disaggregated way, so that each element of the costs was estimated individually and they were summed up at the end.

Methods

There is more to the innovation than just payer costs. Each country develops its’ own rules towards new technology evaluation which suits best the local conditions, culture, society development and financial or economic affordability.

In Slovakia, all new innovations are considered solely by the results of cost models based on the payer perspective. Other costs are completely ignored. We analyzed not just direct or payer costs, but also indirect costs associated with MM in Slovakia.

Keywords: direct costs, indirect costs, multiple myeloma, economic analysis, Slovakia
was estimated individually and they were summed up at the end. For the purpose of our analysis we decided to calculate costs, that could be spent on a model patient with MM during the first 12 months since confirmed diagnosis.

Our cost evaluation includes two components of costs that fall into several costing groups. In Table 1 we present all direct medical costs and in Table 2 all available indirect costs (Santerre and Neun, 2009). Direct medical costs mainly consist of medical diagnostics, investigations, outpatient consultations, hospitalization, drugs acquisition, drugs administration and treatment incurred at clinics and hospitals. From the health care system perspective, direct medical costs for diagnosis, pre-operative assessments, treatment, inpatient hospitalization and outpatient specialist clinic follow-up are most relevant. Indirect costs such as productivity loss due to morbidity and mortality, invalidity costs, social security costs for patients were obtained from additional local sources to provide a full costs overview for a model patient with MM.

### Table 1: Direct medical costs used for analysis.

<table>
<thead>
<tr>
<th>Cost groups associated with multiple myeloma</th>
<th>Total costs (2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostics costs (out-patient, radio-diagnostics, laboratory diagnostics, etc.)</td>
<td>€ 2 385.90</td>
</tr>
<tr>
<td>Special medical procedures (e.g. bone marrow transplantation)</td>
<td>€ 17 855.72</td>
</tr>
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<td>Inpatient hospitalization</td>
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</tr>
<tr>
<td>Total therapy costs based on local multiple myeloma guidelines</td>
<td>€ 41 742.69</td>
</tr>
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### Table 2: Indirect costs.

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<th>Cost groups associated with multiple myeloma</th>
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<td>Costs associated with absence from work due to illness</td>
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</tr>
<tr>
<td>Costs associated with invalidity due to multiple myeloma</td>
<td>€ 1 502.47*</td>
</tr>
<tr>
<td>Costs associated with long term disability due to multiple myeloma</td>
<td>€ 17 636.18*</td>
</tr>
<tr>
<td>Costs associated with loss of productivity (taxes, other deductions required by law)</td>
<td>€ 2 542.32</td>
</tr>
<tr>
<td>Costs associated with potential productivity loss due to premature death due to cancer</td>
<td>€ 128 179.00</td>
</tr>
</tbody>
</table>

### Results

Based on publicly available resources summarized in the References, we have been able to identify following costs for direct and indirect medical costs, for each cost group separately (Table 3, Table 4). Total direct costs associated with patients with MM during the first 12 months after diagnosis were calculated at € 69 633.31 (Table 3). Total indirect costs that may occur during the same period of time were € 133 534.60 (Table 4). Additionally, we included the number of days on sick leave for patients with MM as reported from official database of Social Insurance Agency (Table 5).

### Table 3: Direct medical costs for the first 12 months after diagnosis for the patient with MM in Slovakia (References: 3, 4, 12, 13, 16, 19 – 26, 31 – 33).

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### Table 4: Indirect costs during the first 12 months after diagnosis for the patient with MM in Slovakia (References: 6, 7, 14, 28 – 30).

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*Cost are mostly acquired after the first 12 months, so they were not included into total costs.
Discussion
We believe that our costs calculation is the first of its kind performed in Slovakia on a model patient with MM. This is also the first complex view on all costs that we were able to acquire from publicly available databases that were directly or indirectly associated with MM diagnosis in Slovakia.

The basis for our analysis were international reviews and randomized controlled trials. Ramon et al. (2013) published a population-based cost analysis that evaluated the cost of all cancers and also those associated with breast, colorectal, lung, and prostate cancers. They focused on direct and also indirect costs. Their study estimated total cancer costs at € 126 billion in 2009 (European Union, EU), with health care accounting for 40% (€ 51.0 billion) of the total costs. Our analysis showed that direct (health care) costs are responsible for at least 34% (€ 69 633.31) of total costs (Table 3). It is important to add that according to Ramon et al. (2013) the health–care costs of cancer varied substantially across the EU from €16 per person in Bulgaria to €184 per person in Luxembourg. Total productivity loss because of premature death due to cancer in the EU was €2.6 billion EUR and productivity loss due sick leaves was €9.43 billion. Costs associated with family taking care of the patient with cancer were €23.2 billion (Ramon et al, 2013). The study clearly showed that similarly to our analysis, the indirect costs associated with cancer were the biggest part of the total costs (66%; € 133 534.60 for MM in Slovakia) (Table 4).

According to Fonseca et al. (2017) MM treatment–related drug costs accounted for 10.6% of total healthcare costs among MM patients in 2000, increasing to 20.3% in 2007 and 28.5% in 2014. Results from our analysis showed that for a model patient with MM treatment related costs accounted approximately for 21% (€ 41 742.69) of total costs (Table 3). Additionally, a recent study from Burns et al. (2016) focused on the area of malignant blood disorders. They focused on direct and also those associated with breast, colorectal, lung, and prostate cancers. They focused on direct and also indirect costs. Their study estimated total cancer costs at € 126 billion in 2009 (European Union, EU), with health care accounting for 40% (€ 51.0 billion) of the total costs. Our analysis showed that direct (health care) costs are responsible for at least 34% (€ 69 633.31) of total costs (Table 3). It is important to add that according to Ramon et al. (2013) the health–care costs of cancer varied substantially across the EU from €16 per person in Bulgaria to €184 per person in Luxembourg. Total productivity loss because of premature death due to cancer in the EU was €2.6 billion EUR and productivity loss due sick leaves was €9.43 billion. Costs associated with family taking care of the patient with cancer were €23.2 billion (Ramon et al, 2013). The study clearly showed that similarly to our analysis, the indirect costs associated with cancer were the biggest part of the total costs (66%; € 133 534.60 for MM in Slovakia) (Table 4).

Our study had several limitations. First of all, we were not able to receive reliable and up–to–date cost data from any organizations, registries, portals or web sites in Slovakia. It is well known that Slovakia suffers from no or inadequate healthcare cost data, even though the Ministry of Health of the Slovak Republic is trying to support the external and internal environment with aggregated data from all three insurance companies – so far with questionable success. Direct costs were extracted from available sources (References: 3, 4, 12, 13, 16, 19 - 26, 31 - 33), but with limited success and limited accuracy. We believe that direct cost estimates (Table 3) are close to reality, but we were not able to confirm it.

Another difficult hurdle were indirect costs. The Social Insurance Agency in Slovakia provided data about patients with C90, but not C90.0, so we could only use these data that were closest to reality. Additional issue was connected to productivity loss due to premature death from MM. Unfortunately, these kinds of data are still not available for Slovakia and that is why we had to look elsewhere and take into the consideration the publication from Hanly et al. (2015), where lost productivity because of premature death due to cancer was available and calculated also for Slovakia at € 128 179 (Table 4). Similar results can be found within the study by Ortega et al. (2015), where total productivity loss per person in Spanish patients with haematological malignancies such as the MM, myelodisplastic syndrome and
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Direct and indirect costs associated with multiple myeloma, others, excluding acute leukaemia and lymphoma, was € 132 093. In the study from Pearce et al. (2016) analyzing productivity losses per cancer death in Ireland between 2011 and 2030, testis (€ 364 000 per death), cervix (€ 155 000 per death) and brain cancer (€136 000 per death) were much higher because they affect the full spectrum of working age individuals and are much costlier than our results calculated for MM patients in Slovakia. This is because only 30% of all diagnosed patients with MM are in the productive age and mostly above 50 years old. Additionally, once we were able to obtain data from official state or private institutions, they we were not able to specify if direct or indirect costs data are just for one diagnosis (C90.0) or there are cumulated costs for all diagnosis that patients with MM may have suffered from.

Conclusions

Innovation is central for the quality of health-care and improving health outcomes. It is also central for smart allocation of scarce health-care resources. By reviewing existing research focused especially on the healthcare costs of blood cancer treatment, we have shown that there is a growing gap between the medical innovation frontier and what access to innovative treatments are offered to patients in Europe, and there is a high degree of variation between countries in Europe in access to innovative treatments and resource efficiency. In some areas, there is a clear relation between access to innovation and the reduction of other treatment costs for blood cancers and better access to innovation reduces the need for hospital and other healthcare (Lichtenberg, 2017; Erixon, 2016).

Consequently, patients in many European countries are to-day offered treatments that are increasingly distant from the medical frontier, and the gap between the frontier and current treatments is gradually getting larger. On the current track, the policy of rationing access to innovative healthcare will only increase in strength and consequence. This reaction by governments is understandable. However, it is not necessarily economically rational or the best way to use resources in a way that promotes efficiency and equity. In some areas, preventing access to better treatment will not just prolong or increase human suffering, it will also drive up government expenditures on healthcare and keep people away from the labor market, which will in turn lower tax receipts and, in most countries, raise spending on social security. A general economic rule of thumb for healthcare is that the most expensive way to address illnesses is to not treat them, or to treat the symptoms rather than the source. While there is variety between diseases and areas of medical practice, this particularly holds true for diseases where it is difficult or outright impossible to shift the cost burden to the patient, or for the patient to manage his or her disease in a way that allows them to remain in work or education and not put other demands on the public purse (Erixon, 2016).

We believe that it is important to start a serious discussion about cost data quality, about indirect cost data and about their irreplaceable role in economic analysis in health-care. Our results are far from perfect. We hope they could bring important stimulus into the discussion about valid data. They also bring insight into complex and verifiable costs analysis that are still not present within the healthcare sector, nor officially required. When deciding about new technologies and innovations, it is imperative to take into consideration societal or payer perspective costs, which is also the part of evaluation required by law.

What we need to start to take into consideration as well – mainly in case of innovation with high treatment costs – are indirect costs. So far, we are not able to calculate either of them accurately.

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