

THE BURDEN OF ADULT PNEUMOCOCCAL DISEASE IN 50+ POPULATION IN HUNGARY

Balázs Salfer, MA¹, István Somfay, Msc¹, Bence Nagy, MD¹

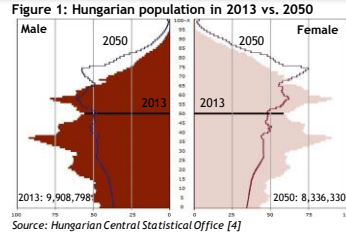
¹Healthware Consulting Ltd.

Background and Aims

Streptococcus pneumoniae causes many diseases like invasive bacteremic pneumonia, septicemia, and meningitis which are called invasive pneumococcal disease (IPD). The most prevalent form of IPD in older adults is community-acquired pneumonia (CAP). Underestimation of pneumococcal infections is mainly due to the low sensitivity of diagnostic tools and underuse of bacteriological laboratory confirmation methods. The incidence, morbidity and mortality of IPD are especially elevated in older adults and present a significant burden to individuals and to society. [1,2]

The incidence and mortality rate of pneumococcal infections is increasing in the 50+ population, due to immunosenescence (gradual deterioration of the immune system by aging). Age and other chronic comorbidities are considered as a risk factor for incidence and severity of pneumococcal diseases. [2]

The prevalence of pneumonia, meningitis and septicemia cases recorded among 50+ Hungarian population has been growing. One of the main reasons of the year by year higher occurrences is the ever ageing population (Figure 1), where the incidence is higher generating significant incremental resource utilization. As per the latest estimate of The Hungarian Demographic Research Institute, the ratio of the 50+ population in Hungary will increase from 38% to 48% between 2013 and 2050. [3]



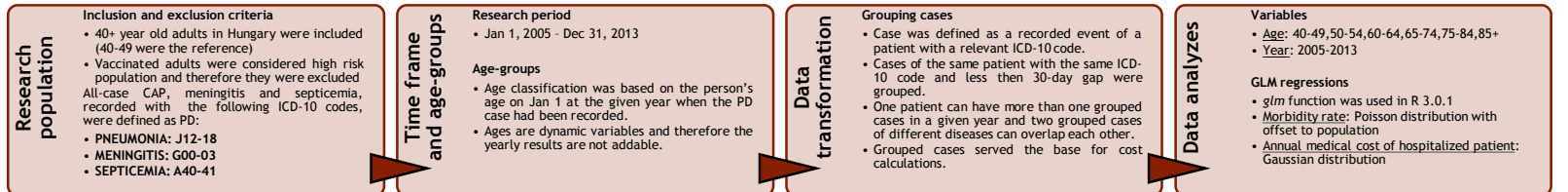
Source: Hungarian Central Statistical Office [4]

The aims of the research are to show the burden and to project the increasing health care cost of the pneumococcal diseases in order to highlight the need for adult vaccination programmes.

Pneumonia, meningitis and septicemia diseases put significant direct burden to the inpatient care and medication budgets in the young and adult population. Based on empirical data from the National Center for Epidemiology, the pneumococcal vaccination program among children, which was introduced a several years ago, successfully avoids the disease in significant part of the cases. [5] However among adults (50+) - due to the lack of or inappropriate prevention - the incidence of the diseases is growing and causing death in many cases.

Methods

The retrospective research determines whether the probability of morbidity and the direct health care cost of all-case CAP, meningitis and septicemia (pneumococcal disease - PD) over 50+ have changed (using general linear model - GLM) based on validated real world aggregated financial data of the entire (approx. 10m) Hungarian population (National Health Insurance Fund Administration database - NHIFA). The research includes the 2005-2013 period in 6 age-groups and direct healthcare cost of inpatient, outpatient care, diagnostics and medication, but excludes indirect cost. The Hungarian Central Statistical Office population data was used to offset the age-groups. Voluntarily vaccinated patients were considered high-risk population and therefore excluded from the research. Relative risks (RR) were calculated by e raised to the power of the estimate.



Based on population estimation of the Hungarian Demographic Research Institute [3] and the research results, we calculated the projected annual health care cost in the 50+ Hungarian population.

- Scenario I.** assumes that the morbidity rate will increase by the average annual growth rate of the previous 9 years ($\frac{Y_t - Y_{t-9}}{Y_{t-9}}$) and the average annual cost per patient will not increase from 2014.
- Scenario II.** assumes the morbidity rate will not increase and the average annual cost per patient will increase by the average annual growth rate of the previous 9 year from 2014.
- Scenario III.** assumes that both the morbidity rate and the average annual cost per patient will increase by the average annual growth rate of the previous 9 years from 2014.

Results

Morbidity

The number of PD patients increased in each disease groups and in total by 16% from 119,614 to 138,308, while the population grew only by 5% (Table 1), resulting a 10% increase in the morbidity rate from 3.4% to 3.7% between 2005 and 2013 in the 50+ population. GLM results were significant in most cases. Aging increased the RR of morbidity in all cases. Year had no effect on morbidity in most cases, except to Meningitis. As per GLM results, aging population is the reason for the morbidity rate increase.

Table 1: PD Morbidity in 50+ Hungarian population

Year	Pneumonia	Meningitis	Septicemia	Total	Population
2005	113,869	204	6,524	119,614	3,565,703
2006	109,842	499	5,678	115,145	3,613,633
2007	123,105	1,342	6,130	129,370	3,658,135
2008	125,528	1,197	6,620	131,972	3,677,570
2009	125,262	991	7,162	131,950	3,693,733
2010	132,722	794	7,208	139,230	3,700,829
2011	136,491	845	8,192	143,736	3,709,271
2012	127,537	1,038	8,958	135,447	3,760,917
2013	129,434	1,229	9,957	138,308	3,759,213

Mortality

The mortality among PD patients increased in each age-group and in total by 67% from 10,126 to 16,873 between 2005 and 2013 in the 50+ population (Table 2). Findings are even worse among the 50+ active population, where the number of deaths almost doubled. In the distribution of deaths among the three pneumococcal diseases, pneumonia has far the highest ratio in this period, which was 72% (50-64: 2,777 and 50+: 12,189) in 2013. Mortality in the active population causes productivity loss on national economy level.

Table 2: Mortality among PD patients

Age	Mortality		Mortality rate	
	2005	2013	2005	2013
50-54	522	858	2.1%	5.0%
55-59	595	1,360	3.0%	5.5%
60-64	852	1,670	5.1%	7.7%
65-74	2,627	4,144	8.9%	11.6%
75-84	3,915	5,666	17.5%	20.7%
85+	1,615	3,175	30.0%	27.4%
Total	10,126	16,873	8.5%	12.2%

Direct health care cost of pneumonia, meningitis and septicemia

Annual health care cost increased by 28% from EUR 21.5m to EUR 27.5m between 2005 and 2013 in the 50+ population, that of 35% was related to the 50-64 year old active population (Table 3). As per GLM results, aging population is the reason for higher PD morbidity and therefore the annual health care cost increase. As per our projection, the annual health care cost of PD patients in the 50+ Hungarian population will significantly increase in the upcoming decades and expected to double by 2050. Even in the best case scenario, it is expected to reach the EUR 30m per year by 2020 (Figure 2).

Figure 2: Projected annual health care cost of PD patients in 50+ Hungarian population

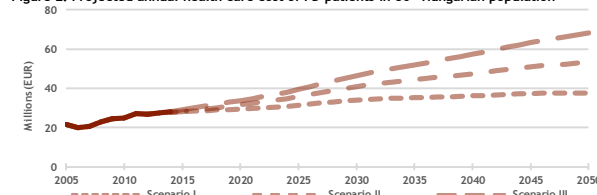


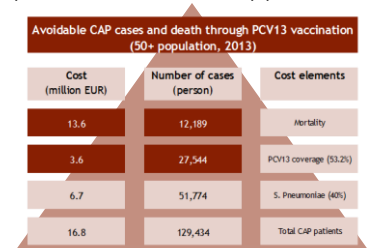
Table 3: Annual direct health care cost of PD in 50+ Hungarian population (EUR)

Year	50-64	65+	Total
2005	7,412,788	15,765,433	21,485,538
2006	6,968,994	14,359,535	19,926,089
2007	7,326,103	15,057,691	20,734,543
2008	8,024,999	16,881,771	22,866,898
2009	8,893,385	18,195,636	24,468,078
2010	8,893,870	18,859,010	24,718,187
2011	10,285,132	20,112,682	26,971,459
2012	8,969,933	21,081,415	26,663,477
2013	9,172,752	21,828,227	27,510,937

* Cost were converted to EUR on 300 HUF/EUR

As per Figure 3, 129,434 people had CAP in 2013, which generated EUR 16.8m direct health care cost. According to literature 40% of CAP is attributable for *S. pneumoniae*, causing EUR 6.7m expense. [2] Based on epidemiological data, the vaccine against 13 serotypes (which has outstanding results in public health immunization programme among children in Hungary) could potentially prevent 27,544 people from the disease, which equals to EUR 3.6m expenditure (potential saving). [6] Preventing the disease, the mortality can be also reduced. CAP related mortality was 12,189 in 2013 based on the NHIFA database. In the 50+ population 2,02m people are in the active, working-age (50-64) cohort, where the employment rate is 49% as per The Hungarian Central Statistical Office data, so among them 1m were employed in 2013. Based on the employment rate and GDP per capita data (EUR 10,161 in 2013, [4]), PD related mortality caused almost EUR 13.6m GDP loss on national economy level in the 50+ population in 2013.

Figure 3: Potentially avoidable cost and GDP loss through pneumococcal vaccination in the 50+ population in 2013



Conclusions

A real world data research confirmed the increase of pneumonia, meningitis and septicemia patient number in the 50+ population, which was 16% increase in the 2005-2013 period. These three diseases affected EUR 27.5m direct health care cost in 2013, which is growing in parallel with the aging population due to lack of organized prevention programme. CAP mortality significantly increased in this period, by 57% in the 50+ population. An additional EUR 13.6m indirect cost could be attributed to case specific mortality loss of GDP on the relevant cohort. A targeted adult pneumococcal vaccination program could be a well definable and in a short-term efficient goal for the Hungarian public health care, which could avoid morbidity and mortality cases, saving resources allocatable to other areas.

References

- [1] Ludwig E, Unal S, Bogdan M et al (2012) Opportunity for healthy ageing: lessening the burden of adult pneumococcal disease in Central and Eastern Europe, and Israel. *Cent Eur J Public Health* 20(2):121-125
- [2] Ludwig, E., Mészner, Zs. [Prevention of Streptococcus pneumoniae (pneumococcal) infections in adults. Recommendation of the Vaccinology Section of the Hungarian Society of Infectious Disease and Clinical Microbiology (October 2014)]. *Orv. Hetil.*, 2014, 155(50), 1996-2004.
- [3] Hungarian Demographic Research Institute (www.demografia.hu)
- [4] Hungarian Central Statistical Office (www.ksh.hu)
- [5] OEK. A pneumococcus surveillance jelenlegi helyzete és eredményei, Magyarország, 2012. október. *Építő* 2012. 19. évfolyam 45. szám, 521-529.
- [6] Tirczka T, Berta B. Invazív Streptococcus pneumoniae szerotipizálás és antibiotikum rezisztencia vizsgálata 2013. évi eredményei. *Mikrobiológiai Közlevél* 2013. XIII. évfolyam 3-4. szám, 26-31.

