# PROJECTING OF FUTURE NEED AND CONSUMPTION HEALTH CARE FROM THE PERSPECTIVE AGEING OF AMBULATORY PATIENTS IN FACILITIES OF AGEL 2012-14

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## Abstract

The subject of our efforts in 2015 (see Běláček et al) was to examine the potential possibilities of linking of selected data for examined patients at facilities of AGEL group (hospitals and clinics) with available data of official demography statistics in Moravian-Silesian, Olomouc and Prague regions. We have used the standard ratio coefficients from the official Czech demographic prognoses for the years 2018, 2023 and 2028 with conclusion that the aging of population in the Czech Republic will be probably with the more significant response in specific age groups outpatients than in population as a whole.

The subject of this contribution is to monitor the future health needs on level of lifestyle diseases (identified by ICD-10) compared with its increasing consumption (aggregation of the nomenclature of medical specialties). Within each of the available hospitals and polyclinics were selected numbers of patients by unique personal ID numbers, memberships in years 2012-14, ages, sex, outpatient facilities and unique primary diagnoses.

From results of formal analysis can be evident which groups with specific Dg and those inside medical professions (at the aggregate level) might to bear the greatest burden in the future from the perspective of those most exposed age groups of patients (consistently with regional morbidity projections already operated before).

**Keywords:**

*the need and consumption of healthcare, aging of population, demographic projections derived, lifestyle diseases, International Classification of Diseases /ICD 10/, dial of medical specialties*

## 1 Introduction

Aging population in European countries can be seen as a socio-economic process that can be formally modeled with great fidelity via component demographic projections. Input parameters of projections are intensities of mortality and fertility (or migrations, eventually) according to age and gender. At the level of Czech regions (NUTS 3) are future population states projected from the current regional age structures and on the base of experience with long-term evolution of intensity demographic rates in Czech Republic and in the neighboring European countries. This evolution is largely determined for horizons of future 15-25 years.

Generally geographic trends will be naturally transferred into the structure of patients treated in medical facilities (MF), of course. We have an opportunity to analyze morbidity based on the number of patients who were ambulatory examined in 2012-2014 in the 13 hospitals and clinics Agel Inc. located in the Moravian-Silesian (6 MF), in Olomouc region (6 MF) and in Prague (1 FF). Only formal use of indices from demographic prognoses of Czech statistical office (CSO) for the years 2018, 2023 and 2028 (see [1]) led us to the conclusion that in the structures of the numbers of outpatients we will find apparently the more dramatic transfers into the older age groups than inside aging of the population alone (compare Charts 5 vs 6 for Moravian-Silesian Region at [2] or at [3] for all three regions). We monitor the need for medical care via the most significant lifestyle diseases [4] and in connection with health care based on a special dial of medical specialties [5] at the level of this contribution.

## 2 Materials and methods

In collaboration with Department of Planning and Controlling at AGEL, Inc. Prostejov - the most significant nationwide medical service provider of the Czech market - we created for the years 2012-4 the aggregate working database of ambulatory patients treated in 13 hospitals and clinics. In paper [2] we have used the numbers of patients sorted according to unique identification number, year, age and sex (each patient within the unique MF care occurs in the grading of the year just once; N = 3315 sentences for the total number P = 4234402 patients); this sorting scheme appears to us as clearest for standard geodemographic comparison. For the purpose of more detailed analyzes have been carried out yet another special types of sorting - a) reflecting the medical profession (N = 49464; P = 9125028); - b) reflecting the medical profession combine with the unique primary diagnosis dial ICD-10 (N = 2,831,048; P = 17,621,284); this final sorting is generally most closely in relation to total amount of patients examined in every medical facility.

We used the five-year age structure of the population according to gender and demographic prognoses CSO from 2014 for the Moravian-Silesian Region, Olomouc Region and for Prague with horizons in 2018, 2023 and 2028 for demographic calculations. We projected the number of patients in every age group x (= 0, 5, …, 95+) for every year t (= 2018, 2023, 2028) according to the

$$P_x^t = P_x^{t-5} \cdot (S_x^t / S_x^{t-5}),$$

where $S_x^t$ denote the mean states of living persons aged x (in year t) and $P_x^{t-5}$ **indicates**

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the number of patients (within sorting classifications ad a-b) from the previous period. All preparatory calculations and computation were performed by IBM SPSS program (see [6]) and MS Excel.

### 3 Results

#### 3.1 The need of healthcare by the most significant lifestyle diseases

The needs of medical care we can monitor generally on the base of markers derived from codes of International Classification of Diseases (ICD). But the range of ICD-10 (see [7]) contains 22 chapters (with the initial letters A-Z); each of which is divided into several sections, which contain usually still a number of the other specific diagnoses. The database of AGEL has at six-character level identification found for years 2011-14 over 15 thousand unique codes; in our final classification we have actually about 272 different subgroups and 2,056 unique specific diagnoses by a standard restriction at three-character level of ICD-10. Although in population of outpatients is the representation of different diagnoses (and their groups) very uneven, systematic problem solving "the real needs of health care" greatly exceeds the possibilities of this short review. Therefore, we limit ourselves only to a selected group of "lifestyle diseases" that in relation to the number of patients treated in outpatient at facilities of AGEL group, cover almost 25% of diagnoses in our working database.

*Table 1: The numbers of outpatients in 13 health facilities of AGEL group (the region Moravian-Silesian, Olomouc and Prague) in the years 2012-4 with Dg belonging to a group of lifestyle diseases (arranged according to significance).*

| Lifestyle diseases (codes of ICD-10) | 2012 | 2013 | 2014 | %2012-4 |
|---|---|---|---|---|
| 1: diabetes mellitus (E10-E14) | 200655 | 190091 | 191123 | 5,9% |
| 2: neoplasms (C00-C97, D00-D48) | 173738 | 181536 | 204330 | 5,7% |
| 3: hypertension (I10-I15, O10-O11, O13-O16) | 185707 | 176417 | 179755 | 5,5% |
| 4: heart-attack (I20-I25) | 112024 | 104754 | 99483 | 3,2% |
| 5: stroke (I60-I69) | 32831 | 26267 | 25717 | ,9% |
| 6: atherosclerosis (I70) | 28195 | 27991 | 27695 | ,9% |
| 7: mental disorders (F00, F40-F41, F43, G04-G05, G30, G93, R53) | 17521 | 19346 | 19594 | ,6% |
| 8: rheumatic diseases (I00-I07, M05-M06) | 17851 | 16869 | 17189 | ,5% |
| 9: obesity-corpulence (E66) | 6954 | 8587 | 8553 | ,2% |
| 10: premature births, miscarriages, defects of newborns (O03-O08, O60-O62, Q00-Q07) | 1301 | 1112 | 1123 | ,0% |
| aggregation of other codes (diagnoses) ICD-10 | 2539267 | 2456919 | 2552305 | 76,6% |
| Total | 3316044 | 3209889 | 3326867 | 100,0% |

The numbers of outpatients with some diagnoses falling into one of the main groups of lifestyle diseases (according to [3]) are included in Table 1. Although the shares of individual groups of lifestyle diseases from year to year are slightly different, the next ones can be considered as the most important : diabetes mellitus (5.9 % patients), neoplasms (5.7 %) or hypertension (5.5 %). From the etiological point of view we can assign to hypertension still: heart-attack (3.2 %), stroke (0.9 %) or atherosclerosis (0.9 %). Anyway, other groups, such as e.g. mental disorders (within our sample comprising namely: dementia, anxiety disorder, stress responses, Alzheimer's disease, etc. - total about 0.6 %), rheumatic diseases (0.5 %) or obesity (0.2 %), had not feature in relation to the three highest ranked diagnoses above as significant. The lowest group, which includes the premature births and miscarriages (including congenital defects of the nervous system in newborns), can no longer to be considered as a group of lifestyle diseases "in the true sense of the word" (with regard to her real statistically minority representation among patients).

The real and for horizons of 2018, 2023 and 2028 projected age and gender structures of patients with any of the above lifestyle diseases are shown in Charts 1a-f. The most typical movements until 2028, especially strengthening the patients 65-75 aged, are seen among diabetes, hypertension and the neoplasms. (This major trend we have found already at the level of the total numbers of patients in region of the Moravian-Silesian, in Olomouc and in Prague - see [2].) But now we have noticed the more specific trends in the midst of statistically less important lifestyle diseases, especially in a number of cases of significant differences by gender. For example, the numbers of male patients with atherosclerosis (see Figure 1d) are distributed as almost three times higher than in women, while the opposite is true for female patients with rheumatic diseases (Figure 1f). The high proportions of women are also striking in the context with the mental illnesses (Figure 1e); the center of gravity of the age spectrum by these diseases might be moved from the current age of 35 gradually into the age of 55.

#### 3.2 The healthcare consumption by medical professions

To track the consumption of healthcare we monitor the numbers of unique patients examined in selected health facilities in any medical units (including laboratories). To do this, we used the dial of medical specialties, which are available at AGEL database and which actually covers the 63 codes of expertise (out of 116 possible). In Table 2 are given the numbers of ambulatory patients examined in wards HF AGEL between 2012-4 in an aggregation into 7 relatively consistent groups. Almost 50% of outpatient examinations concerns the complementary departments, ie. especially the workplace of clinical biochemistry (23.0%), eventually of microbiology, pathology and screening of breast cancer (2.7%) and further: the workplace in radio-diagnostics and in magnetic resonance imaging (8.5%) and laboratories (hematology, allergology, immunology and genetics - in aggregate 14.4%). But in relation to the need of healthcare are more interesting for us the numbers of patients treated at 26 internal wards (23.6%) and 13 surgical wards (18.8%), and within the "practicioners" (family doctors, first aid and

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Charts 1a-f: The projected evolution of age and gender structures of outpatients in 13 health facilities of AGEL group, which were localized in 2013 in region of Moravian-Silesian, in Olomouc and in Prague in the horizons 2018, 2023 and 2028 by major lifestyle diseases (aggregation codes of ICD-10 see labels in the header).

Chart 2a-f: The projected evolution of age and gender structures of outpatients in 13 health facilities of AGEL group, which were localized in 2013 in region of Moravian-Silesian, in Olomouc and in Prague, in the horizons 2018, 2023 and 2028 according to medical professions (selection - see the descriptions in the header - in the context of the dial from database of AGEL).

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dentistry - totally 4.8%) and/or "no medical fields" (transport of wounded, sick and pregnant; departments of physiotherapy , clinical psychology etc. - totally about 4.2%).

*Table 2: The numbers of outpatients in 13 health facilities of AGEL group (the region Moravian-Silesian, Olomouc and Prague) in the years 2012-4 by aggregated medical professions (departments).*

| Medical specialties (aggregation of the wards) | 2012 | 2013 | 2014 | %2012-4 |
|---|---|---|---|---|
| 1: practicioners (family doctors, first aid, dentistry) | 144966 | 160560 | 164450 | 4,8% |
| 2: internal wards | 759370 | 772937 | 793178 | 23,6% |
| 3: surgical wards | 600107 | 618267 | 637013 | 18,8% |
| 4: no medical fields (transport, physiotherapy etc.) | 131043 | 138971 | 144044 | 4,2% |
| 5: clinical biochemistry, microbiology, pathology and screening of breast cancer | 883653 | 813200 | 836449 | 25,7% |
| 6: radio-diagnostics and magnetic resonance imaging | 289021 | 257567 | 286657 | 8,5% |
| 7: laboratories (hematology, allergology etc.) | 507884 | 448387 | 465076 | 14,4% |
| Total | 3316044 | 3209889 | 3326867 | 100,0% |

The projected age-gender structures of patients for selected 6 special professions we can be found on the Charts 2a-f. While patients which had been examined in the more closely unspecified "internal department" (5.3%), are concentrated in a sophisticated range of 60-80 years, the patients treated via "surgery workplace" (without further specification of 4.4%) are distributed de facto to the entire age range of 20-80 years. Asymmetry of age structures by gender illustrate particularly Charts 2c-d: "workplace of clinical oncology (without radiation oncology)" (1.4%) with a distinct dominance of women and "workplace of urology" (1.9%) with a predominance of male patients. Similarly, on the graph 2e-f within "practitioners for adults" (3.1%) we see the patients in a wider age range with a slight predominance of men, and  - in the mirror Image - within "independent workstation physiotherapists" (1.8%) with a similarly increased prevalence of women.

### 4 Discussion and conclusions

The aim of this paper was briefly and schematically to show, which data bases are now available to advantage of regional demographic projections for the more objective determination of trends in future development needs and use of healthcare in the Czech country. These attempts have been made in the context of our previous analyzes and suggestions to choose of appropriate health indicators from the official national health registers, which are available in the annual periodicity of time series (see [8-9]). In this case, however, we have an universal systematically organized data from the information system of currently the most important providers of medical services in region of Moravian-Silesian and in Olomouc, so our results can be considered - especially for this regions - as reprezentative and generalizable.

Historically arising inequalities and notches, typical for the age structure of the population of the Czech Republic, have been reflected into the Czech regions by a specific manner and now allow to assess also specifics of some traditional developmentally dissimilar localities. It seems, at least according to preliminary analysis, that this is also the path on which basis we could better predict the future development of morbidity and structure of such services for example in Moravian-Silesian region in which we perceive the economic and social evolution traditionally as delayed. Our earlier conceptions concerning the development of health systems at the regional level (see [10]) did not contain such detailed specifics.

Unfortunately, there is no clear correspondence of diagnoses and the medical professions, so that the balance between the need and consumption of healthcare we can still compare so far only at a base of the similarities (or dissimilarities) among the formally projected age-sex structures. (The Diagnoses on Charts 1a-f generally comparable with Charts 2a-f, however, were selected also for the purpose of interesting visual presentation of the results in this article.)  However, we assume that the more detailed use of multivariate data analysis ( tests of homogeneity at  contingency tables, cluster analysis methods etc.) will help us to identify the statistically most significant differences when comparing the age-sex structures of patients.

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