RESEARCH ARTICLE

Comparison of the Five Danish Regions Regarding Demographic Characteristics, Healthcare Utilization, and Medication Use—A Descriptive Cross-Sectional Study

Daniel Pilsgaard Henriksen1*, Lotte Rasmussen2, Morten Rix Hansen2,3, Jesper Hallas2,3, Anton Pottegård2

1 Department of Respiratory Medicine, Odense University Hospital DK–5000 Odense C, Denmark,
2 Clinical Pharmacology, Department of Public Health, University of Southern Denmark, Odense, Denmark,
3 Department of Clinical Chemistry and Pharmacology, Odense University Hospital DK–5000 Odense C, Denmark

* dphenriksen@health.sdu.dk

Abstract

Background

While Denmark is well known for its plethora of registers. Many studies are conducted on research databases that only cover parts of Denmark, and regional differences could potentially threaten these studies’ external validity. The aim of this study was to assess sociodemographic and health related homogeneity of the five Danish regions.

Methods

We obtained descriptive data for the five Danish regions, using publicly available data sources: Statbank Denmark, the Danish Ministry of Economic Affairs, and Medstat.dk. These data sources comprise aggregate data from four different nationwide registers: The Danish National Patient Register, The Danish Civil Registration System, The Danish Register of Medicinal Product Statistics, and The Danish National Health Service Register for Primary Care. We compared the Danish regions regarding demographic and socioeconomic characteristics, health care utilization, and use of medication. For each characteristic, one-year prevalence was obtained and analyses were performed for 2013 and 2008 to account for possible change over time.

Results

In 2013, 5,602,628 persons were living in Denmark. The mean age was 40.7 years in the entire Danish population and ranged between 39.6 to 42.4 years in the five regions (coefficient of variation between regions [CV] = 0.028). The proportion of women in Denmark was 50.4% (CV = 0.009). The proportion of residents with low education level was 28.7% (CV = 0.051). The annual number of GP contacts was 7.1 (range: 6.7–7.4, CV = 0.040), and 114 per 1,000 residents were admitted to the hospital (range: 101–131, CV = 0.107). The annual number of
persons redeeming a prescription of any medication was 723 per 1,000 residents (range: 718–743, CV = 0.016). Analyses for 2008 showed comparable levels of homogeneity as for 2013.

Conclusions
We found substantial homogeneity between all of the five Danish regions with regard to sociodemographic and health related characteristics. Epidemiologic studies conducted on regional subsets of Danish citizens have a high degree of generalizability.

Introduction
Studies using administrative data are the backbone of epidemiological research[1]. The Danish population has previously been described as one large cohort[2], and referred to as the epidemiologist’s dream[3]. Virtually all medical care in Denmark is furnished by the national health authorities with limited or no co-payment from the patient, and perfect linkage can be achieved using the unique Danish Civil Registration Number assigned to all Danish citizens[4]. The availability of nationwide registries on hospitalizations[5], cancers[6], drug use[7], income[8], and education[9], allows a detailed account of vital health parameters on the level of the single individual. In addition to the nationwide registers, regional registers also exist [10–13]. These registers often have a higher level of detail than the nationwide registers and may allow the researcher to address other research questions. However, this comes at the expense of a smaller sample size, a lower statistical precision and the recurring question of generalizability or external validity, potentially affecting the high quality studies published from these registers [14].

Using publicly available high quality national administrative data, the aim of this study was to assess whether the five regions of Denmark by themselves each can be considered representative samples of the Danish population in terms of sociodemographic parameters and health related utilization and thereby whether studies that employ regional data sources in general should address generalizability as part of their aim.

Setting
Overview of the Danish healthcare system
Until 2007, the Danish National Health Service was divided into 16 sections: 14 counties and the municipalities Frederiksberg, and Copenhagen, with each county further subdivided into municipalities. After 2007, the counties were combined into five regions[15] (Fig 1).

Each region runs the public hospitals and health services including general practice. A typical general practitioner’s (GP) office receives 95% of its operating income from public funds [16]. Taxes finance approximately 83% of all healthcare expenses, including free access to hospitals, outpatient clinics, GP’s, as well as partial reimbursement of prescribed medicines. The remaining patient copayments make up approximately 17% of the total health expenditures, and primarily constitutes co-payment of medication and dental care[16].

Methods
Data sources
We retrieved publicly available aggregate data from four different nationwide registers: The Danish National Patient Register[5], The Danish Civil Registration System[17], The Danish
Danish Regions—Sociodemographic and Health Differences

Region of Northern Denmark
Central Denmark Region
Region of Southern Denmark
Region Zealand
Capital Region of Denmark
Register of Medicinal Product Statistics[7], and The Danish National Health Service Register for Primary Care[18].

The aggregate data, which was based on data from the four databases above, was retrieved from three different sources:

1. StatBank Denmark is a free-of-charge database containing detailed aggregate statistical information on the Danish Society[19]. The database is hosted by Statistics Denmark, a state institution under the Ministry of Economic Affairs and the Interior[20]. Statistics Denmark was founded in 1850 as an extension of the representative government established by the first constitution of 1849[20]. Statistics Denmark is a governmental institution collecting information electronically provided by administrative registers of different governmental agencies[21]. From this data source, we obtained demographic and socioeconomic data, as well as health utilization (both primary—and secondary care).

2. The Danish Ministry of Economic Affairs and the Interior provides free and public access to key measures of the Danish population[22]. We used this database to identify the proportion of citizens living in urban areas.

3. Medstat.dk contains statistics on the sale of medicines in Denmark based on the data reported to the Register of Medicinal Product Statistics[23]. It is mandatory to report the sale of medicines, and therefore, the data cover all sales from pharmacies and non-pharmacy outlets in Denmark. The sale statistics from primary care are available from 1996 onwards, including a number of individual level parameters. The Register of Medicinal Product Statistics also includes data about medicines sold to hospitals on an aggregate level. Drug use statistics from hospitals are available from 1997 onwards[23].

We used data from 2013 for our primary analysis, but also obtained the same data from 2008 in order to compare the years, and identify potential differences in the population development over time.

Definitions

**Demographic characteristics.** Age was grouped into 10-year intervals. Population density was defined as number of residents divided by area in square kilometers. Urbanization was defined as the percentage of residents in a region who lived in a town with more than 200 residents. Marital status was categorized as married, never married, divorced, or widowed.

**Socioeconomic characteristics.** Income was reported as the mean income of each person in eight income categories (including individuals ≥15 years of age). Unemployment was defined as the proportion of persons aged 15–64 years unemployed in each region. Education was categorized according to the highest attained educational level: <10 years (primary and lower secondary school), 10–12 years (vocational education and upper secondary school), >12 years (short, medium and long-term higher education)[24].

**Healthcare utilization.** Three measures of healthcare utilization were used: 1) annual number of hospital admissions per 1,000 residents, 2) annual number of outpatient contacts per 1,000 residents, and 3) annual number of GP contacts per resident. GP contacts included daytime visits, telephone consultations, email consultations, and out of hours on-call GPs. A patient could have more than one GP contact per day.
Medication use. Two measures of medication use were used: 1) annual number of persons filling a prescription of any medicine per 1,000 residents, and 2) the annual number of persons filling a prescription of the 6 most commonly used main medication categories in the Anatomical Therapeutic Chemical Classification System (ATC) (ATC: A Alimentary tract and metabolism; C Cardiovascular system; D Dermatologicals; J Antiinfectives for systemic use; N Nervous system; R Respiratory system)[25].

Analysis

We obtained data for the entire Danish population, and stratified by the five regions (Capital Region of Denmark, Region Zealand, Region of Southern Denmark, Central Denmark Region, and Region of Northern Denmark). We presented demographic- and socioeconomic characteristics as 1-year prevalences in absolute numbers and proportions from 2013, and repeated the analyses for the year 2008.

Coefficients of variation (CV) (standard deviations divided by the means) were computed across the five regions as a measure of the differences.

Data management, analyses, and graphics were performed with Stata version 13.1 (Stata Corporation LP, Texas, USA).

All Stata codes as well as a detailed guide on how to extract the raw data and reproduce the study results including how to generate the figures are available at http://www.github.com/dphenriksen.

Ethics statement

The study was conducted entirely based on publicly available aggregate data, and therefore no ethics statement was required.

Results

Demographic characteristics

In 2013, 5,602,628 persons were living in Denmark, and 50.4% (N = 2,823,776) were women. The Capital Region of Denmark comprised 30.9% of the entire Danish population, Region Zealand 14.6%, Region of Southern Denmark 21.4%, Central Denmark Region 22.7%, and Region of Northern Denmark 10.4% (Table 1). The proportion of women in the five regions ranged from 49.7% (Region of Northern Denmark) to 51.0% (Capital Region of Denmark) (Table 1).

The mean age was 40.7 years in the entire Danish population, ranging from 39.6 years (Capital Region of Denmark) to 42.4 (Region Zealand) (CV = 0.028).

The proportion of residents in 10-year age categories stratified by gender and region are presented in Fig 2A–2C.

The overall population density was 131 persons per km² (Table 1). The population density in the five regions ranged between 74 persons per km² (Region of Northern Denmark) to 679 persons per km² (Capital Region of Denmark) (CV = 1.230) (Table 1).

Socioeconomic characteristics

Among residents aged 15 to 69 years, a total of 1,140,481 (28.7%) had a highest attained education level below 10 years, and 1,062,977 (26.7%) had a highest attained education level above 12 years. The Capital Region of Denmark had the lowest proportion of residents with low education level (24.0%), and Region Zealand had the highest proportion (32.2%). Of all Danish residents, 13.7% were categorized as having an income below 100,000 DKR (below €13,400)
ranging from 12.7% (Region Zealand) to 14.6% (Capital Region of Denmark. In total, 3.1% had an income of 750,000 DKR or above (above €100,500) ranging from 2.0% (Region of Northern Denmark) to 4.7% (Capital Region of Denmark) (Fig 3). For results on marital status and unemployment, see Fig 3.

Table 1. Demographic and socioeconomic characteristics of the Danish population, as well as stratified by the five Danish regions in 2013.

|                  | Denmark | Capital Region of Denmark | Region Zealand | Region of Southern Denmark | Central Denmark Region | Region of Northern Denmark | Coefficient of variation |
|------------------|---------|---------------------------|---------------|---------------------------|-----------------------|---------------------------|--------------------------|
| Total            | 5,602,628 (100.0%) | 1,732,068 (30.9%) | 816,359 (14.6%) | 1,201,419 (21.4%) | 1,272,510 (22.7%) | 580,272 (10.4%) | 0.395 |
| Gender           |         |                           |               |                           |                       |                           |                          |
| Women            | 2,823,776 (50.4%) | 884,093 (51.0%) | 411,393 (50.4%) | 602,869 (50.2%) | 637,052 (50.1%) | 288,369 (49.7%) | 0.009 |
| Men              | 2,778,852 (49.6%) | 847,975 (49.0%) | 404,966 (49.6%) | 598,550 (49.8%) | 635,458 (49.9%) | 291,903 (50.3%) | 0.010 |
| Mean age         |         |                           |               |                           |                       |                           |                          |
| Total            | 40.7    | 39.6                      | 42.4          | 41.5                      | 40.0                  | 41.7                      | 0.029 |
| Women            | 41.7    | 40.6                      | 43.4          | 42.4                      | 40.8                  | 42.7                      | 0.029 |
| Men              | 39.8    | 38.5                      | 41.5          | 40.6                      | 39.2                  | 40.8                      | 0.031 |
| Population densitya |     |                           |               |                           |                       |                           |                          |
| Urban            | 131     | 679                       | 113           | 98                        | 98                    | 74                         | 1.230 |
| Urbanizationb    | Urban   | 81%                       | 96%           | 80%                       | 79%                   | 77%                       | 73%                      | 0.109 |

*a residents per km²

b proportion of residents living in cities with ≥ 200 citizens relative to total number of residents in the Region[22].

doi:10.1371/journal.pone.0140197.t001

Fig 2. Proportion of residents by 10-year age categories in Denmark, as well as by the five regions in 2013. (2A) Total, (2B) Females, (2C) Males

doi:10.1371/journal.pone.0140197.g002
Healthcare utilization

The annual number of GP contacts for the entire Danish population was 7.1 per resident, and ranged between 6.7 (Capital Region of Denmark) to 7.4 (Region Zealand and Region of Northern Denmark).

Fig 3. Socioeconomic characteristics (annual income, education, marital status, and unemployment) in proportions of the Danish population, as well as stratified by the five Danish regions in 2013.

doi:10.1371/journal.pone.0140197.g003
Southern Denmark), (CV = 0.041) (Table 2). For the entire Danish population, 114 per 1,000 residents were admitted to the hospital in 2013, ranging from 101 (Central Denmark Region) to 131 (Region Zealand) (CV = 0.107) (Table 2). For a detailed overview of the mean number of GP contacts by age, see Fig 4. For details of outpatient contacts, admissions, and in-hospital bed-days, see Table 2.

### Medication use

The annual number of persons redeeming a prescription of any medication from a pharmacy was 723 per 1,000 residents in Denmark, ranging from 718 per 1,000 in the Central Denmark Region to 743 in Region Zealand (CV = 0.016). When stratifying on the most frequently used

---

**Table 2. Healthcare utilization of the Danish population, as well as stratified by the five Danish Regions in 2013.**

|                      | Denmark | Capital Region of Denmark | Region Zealand | Region of Southern Denmark | Central Denmark Region | Region of Northern Denmark | Coefficient of variation |
|----------------------|---------|----------------------------|----------------|---------------------------|------------------------|---------------------------|--------------------------|
| GP contacts per resident | 7.1     | 6.7                        | 7.4            | 7.4                       | 7.1                    | 7.1                       | 0.041                    |
| Secondary Care utilization (per 1000 residents) |         |                            |                |                           |                        |                           |                          |
| Outpatients          | 292     | 268                        | 283            | 333                       | 295                    | 282                       | 0.085                    |
| Outpatient contacts  | 1,301   | 1,302                      | 1,235          | 1,540                     | 1,203                  | 1,111                     | 0.127                    |
| Admitted patients    | 114     | 122                        | 131            | 109                       | 101                    | 107                       | 0.107                    |
| Admissions           | 222     | 233                        | 284            | 201                       | 198                    | 199                       | 0.166                    |
| Hospital (inpatient) bed-days | 721 | 768                        | 852            | 671                       | 606                    | 748                       | 0.129                    |

![Fig 4. Mean number of contacts per resident to the general practitioners divided into 10-year age categories in 2013.](https://doi.org/10.1371/journal.pone.0140197.g004)
drug classes, we found CV values ranging from 0.026 (ATC: R–Respiratory System) to 0.092 (ATC: C–Cardiovascular system). For details of the prevalences of medication use in the 6 most commonly used ATC main categories, see Table 3.

### Development over time

Results of demographic-, and socioeconomic characteristics as well as healthcare utilization and medication use from 2008 are presented in S1 File. No differences in heterogeneity were observed in 2008 as compared to 2013. Further, no major differences in the covariate prevalences were found when comparing 2008 to 2013.

### Discussion

In this study, we found that all Danish regions generally can be considered representative of the Danish population in terms of demographic, and socioeconomic characteristics as well as healthcare utilization and medication use. We found that the results were stable over time, when comparing data from 2008 to 2013.

Sample representativeness is important in epidemiological surveys in order to achieve external validity. Population-based samples could, like in the present study, be obtained in terms of a geographical boundary of all persons living within a certain area. Other criteria for sampling include special types of medical contact such as the general practice research databases[26]. In the US, population-based studies are primarily based on persons receiving certain types of social benefits, like Medicare or Medicaid[27], or special groups like the Veterans Affairs Medical Care System[28]. Thus, the large US databases are more limited in scope and underrepresent minority and underserved populations[29].

The large administrative registers like the Danish National Patient Register[5] and the Danish Cancer Registry[6] are all nationwide, and contain information on all Danish residents. However, the regional clinical databases are of special interest, as they often provide additional valuable clinical information like laboratory values[13], redeemed prescriptions from the pharmacies[10,11], or microbiological data[12]. Due to the difficulties in obtaining this additional clinical information on patients, it is therefore important that the source population (the region of interest) resembles the target population (the entire Danish population). Only a single study has addressed this previously[30] but the study only focused on a minor part of Denmark (Northern Jutland and the island of Funen), and much have changed, structurally and politically, since the study was conducted in 1997.

### Table 3. Medication use in the Danish population per 1,000 residents, as well as stratified by the five Danish Regions in 2013.

|                    | Denmark | Capital Region of Denmark | Region Zealand | Region of Southern Denmark | Central Denmark Region | Region of Northern Denmark |
|--------------------|---------|---------------------------|----------------|---------------------------|------------------------|--------------------------|
| All medication     | 723     | 720                       | 743            | 739                       | 718                    | 734                      |
| A (Alimentary tract and metabolism) | 178     | 164                       | 193            | 187                       | 175                    | 194                      | 0.016
| C (Cardiovascular system) | 244     | 216                       | 264            | 265                       | 241                    | 272                      | 0.092
| D (Dermatologicals) | 179     | 184                       | 172            | 180                       | 184                    | 168                      | 0.040
| J (Antiinfectives for systemic use) | 312     | 325                       | 326            | 322                       | 285                    | 301                      | 0.059
| N (Nervous system)  | 235     | 211                       | 255            | 251                       | 239                    | 249                      | 0.074
| R (Respiratory system) | 168     | 168                       | 173            | 172                       | 162                    | 168                      | 0.026

doi:10.1371/journal.pone.0140197.t003
We found that the Capital region had a larger proportion of urbanized area, and a higher population density, than the Danish average, which were the most profound differences we encountered in the data. The Capital region also had a larger proportion of residents with a higher education and a larger proportion of young residents (aged 20–39 years) compared to the Danish average. Other examples of minor differences include a slightly higher rate of outpatient contacts in the South region and a higher rate of admissions in the Zealand region, as well as a lower overall drug consumption in the Central region. In general, however, these differences are only modest, and the residents in the regions appear homogenous in regards to our indicators. This information is of great use to researchers using regional subsets of inhabitants instead of using nationwide samples. Furthermore, it is important to readers of Danish epidemiological research to know that the different regions can be considered a representative sample of the entire Danish population.

There are some limitations associated with the current study. We used only aggregate data, and not data on individual subjects, potentially missing subtle differences within groups. For example, a similar average in hospitalization rate between two regions may coexist with large differences in individual-level distribution of hospitalizations.

Conclusion
The Danish regions were comparable and can each generally be considered representative of the entire Danish population regarding basic sociodemographic characteristics and health care utilization. Epidemiologic studies conducted on a regional subset of Danish citizens are thus considered to be generalizable to the entire Danish population.

Supporting Information
S1 File. Appendix 1. Results of demographic-, and socioeconomic characteristics as well as healthcare utilization and medication use from 2008 (DOCX)
S2 File. Appendix 2. Guide to retrieval of raw data (DOCX)

Acknowledgments
The authors would like to thank Morten Olesen for his highly valuable input on data management and analysis, as well as for validating the published code.

Author Contributions
Conceived and designed the experiments: DPH LR MRH JH AP. Performed the experiments: DPH LR. Analyzed the data: DPH LR MRH JH AP. Contributed reagents/materials/analysis tools: DPH LR MRH JH AP. Wrote the paper: DPH LR MRH JH AP.

References
1. Schneeweiss S, Avorn J. A review of uses of health care utilization databases for epidemiologic research on therapeutics. J Clin Epidemiol. 2005; 58: 323–337. doi:10.1016/j.jclinepi.2004.10.012 PMID: 15862718
2. Frank L. Epidemiology. When an entire country is a cohort. Science. 2000; 287: 2398–2399. PMID: 10766613
3. Frank L. Epidemiology. The epidemiologist's dream: Denmark. Science. 2003; 301: 163. doi:10.1126/science.301.5630.163 PMID: 12855788
4. Schmidt M, Pedersen L, Sørensen HT. The Danish Civil Registration System as a tool in epidemiology. Eur J Epidemiol. 2014; 29: 541–549. doi: 10.1007/s10654-014-9930-3 PMID: 24965263

5. Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. Scand J Public Health. 2011; 39: 30–33. doi: 10.1177/1403494811401482 PMID: 21775347

6. Gjerstorff ML. The Danish Cancer Registry. Scand J Public Health. 2011; 39: 42–45. doi: 10.1177/1403494810393562 PMID: 21775350

7. Wallach Kildemoes H, Toft Sorensen H, Hallas J. The Danish National Prescription Registry. Scand J Public Health. 2011; 39: 38–41. doi: 10.1177/1403494811405098 PMID: 21775365

8. Baadsgaard M, Quitzau J. Danish registers on personal income and transfer payments. Scand J Public Health. 2011; 39: 103–105. doi: 10.1177/1403494810394717 PMID: 21775365

9. Jensen VM, Rasmussen AW. Danish education registers. Scand J Public Health. 2011; 39: 91–94. doi: 10.1177/1403494810394715 PMID: 21775362

10. Hallas J. Conducting pharmacoepidemiologic research in Denmark. Pharmacoepidemiol Drug Saf. 2001; 10: 619. doi: 10.1002/pds.638 PMID: 11980250

11. Ehrenstein V. Existing data sources for clinical epidemiology: Aarhus University Prescription Database. Clin Epidemiol. 2010; 273. doi: 10.2147/CLEP.S13458

12. Gradel K, Arpi M, Knudsen J, Schonheyder H, Ostergaard C, Sogaard M. The Danish Collaborative Bacteremia Network (DACOBAN) database. Clin Epidemiol. 2014; 301. doi: 10.2147/CLEP.S66998

13. Grann, Erichsen R, Nielsen, Frøslev, Thomsen R. Existing data sources for clinical epidemiology: The clinical laboratory information system (LABKA) research database at Aarhus University, Denmark. Clin Epidemiol. 2011; 133. doi: 10.2147/CLEP.S17901

14. Pobereskin LH, Sneyd JR. Incidence of hospital admission does not equal incidence of disease. Conclusions drawn from data are incorrect. BMJ. 2000; 320: 1277.

15. Danske Regioner (forening). The regions—in brief. Danish Regions; 2012.

16. Pedersen KM, Andersen JS, Søndergaard J. General practice and primary health care in Denmark. J Am Board Fam Med. 2012; 25: S34–S38. doi: 10.3122/jabfm.2012.02.110216 PMID: 22403249

17. Pedersen CB. The Danish Civil Registration System. Scand J Public Health. 2011; 39: 22–25. doi: 10.1177/1403494810387965 PMID: 21775345

18. Sahl Andersen J, De Fine Olivarius N, Krasnik A. The Danish National Health Service Register. Scand J Public Health. 2011; 39: 34–37. doi: 10.1177/1403494810394718 PMID: 21775348

19. Statistics Denmark. StatBank Denmark [Internet]. 2015 [cited 27 Mar 2015]. Available: http://statistikbanken.dk/statbank5a/default.asp?v=1920

20. Statistics Denmark. About us—Statistics Denmark [Internet]. 2015 [cited 27 Mar 2015]. Available: http://dst.dk/en/OmDS.aspx

21. Thygesen LC, Daasnes C, Thaulow I, Bronnum-Hansen H. Introduction to Danish (nationwide) registers on health and social issues: Structure, access, legislation, and archiving. Scand J Public Health. 2011; 39: 12–16. doi: 10.1177/1403494811399956 PMID: 21899916

22. The Danish Ministry of Economic Affairs and the Interior. The Danish Ministry of Economic Affairs and the Interior. Nøgletal [Internet]. [cited 27 Mar 2015]. Available: http://www.noegletal.dk/

23. Statens Serum Institut. Medstat.dk—Data basis and description [Internet]. [cited 17 Apr 2015]. Available: http://medstat.dk/en/view/datagrundlag_og_beskrivelse

24. Overview of the Danish Education System—Ministry of Education [Internet]. 2015 [cited 27 Mar 2015]. Available: http://eng.uvm.dk/Education/Overview-of-the-Danish-Education-System?allowCookies=on

25. WHO Collaborating Centre for Drug Statistics Methodology. Guidelines for ATC classification and DDD assignment 2013 [Internet]. Oslo, Norway; 2013; Available: http://www.google.dk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CAzQFjAC&url=http%3A%2F%2Fwww.whocc.no%2Ffilearchive%2FPublications%2F1_2013guidelines.pdf&ei=eLU2VbvmM8WMsAHzpYHYDg&usg=AFQjCNGnA8ys3jgm1zOEa74c9f17OaRPQ&sig2=VCYrtrGI3I_O2i8aRo0rwA&bvm=bv.91071109,d.bGg

26. de Lusignan S. The use of routinely collected computer data for research in primary care: opportunities and challenges. Fam Pract. 2005; 23: 253–263. doi: 10.1093/fampra/cmi106 PMID: 16368704

27. Hennessy S, Freeman CP, Cunningham F, Brian LS, Stephen EK. US government claims databases. Pharmacoepidemiol 5th Ed Chichester West Sussex UK Wiley-Blackwell. 2012; 209–223.

28. Boyko EJ, Koepsell TD, Gaziano JM, Horner RD, Feussner JR. US Department of Veterans Affairs medical care system as a resource to epidemiologists. Am J Epidemiol. 2000; 151: 307–314. PMID: 10670556
29. Hsing AW, Ioannidis JPA. Nationwide Population Science: Lessons From the Taiwan National Health Insurance Research Database. JAMA Intern Med. 2015; doi: 10.1001/jamainternmed.2015.3540

30. Gaist D, Serensen HT, Hallas J. The Danish prescription registries. Dan Med Bull. 1997; 44: 445–448. PMID: 9377907