

## Prevalence of chronic disease in the elderly based on a national pharmacy claims database

SIR—The elderly are the fastest growing sector of society with those  $\geq 70$  years of age accounting for nearly 8% of the Irish population [1, 2]. Yet there is little or no baseline information on the prevalence of chronic disease in this population [3]. This lack of information on health trends can inhibit accurate predictions for future health care needs in this age group.

The most recent data on prevalence of chronic disease were reported in the 2000 'Health and Social Services for Older People I' (HeSSOP I) survey [4], which relied on self-reported illness and involved 937 community-dwelling adults  $\geq 65$  years of age. HeSSOP I provides insight into the prevalence of certain chronic conditions. However, this was not the primary purpose of the survey, and disease definition was vague, for example, 'memory/concentration problems'. It is also likely to underestimate disease prevalence as it excludes those in nursing homes.

This article explores the potential for using a national pharmacy claims database to estimate prevalence of disease. The data are readily available, are collected on a continuous basis and cover the majority of prescribing in those aged  $\geq 70$  years. However, the data are not diagnosis linked; thus, combination of drug therapies are used as surrogate markers of disease [5]. This approach lacks specificity for certain conditions as some drugs have broad licensed indications; however, this method has been used and validated in other settings [6–11].

The aim of this study was to estimate chronic disease prevalence in an elderly national population using an existing prescribing claims database.

### Methods

The Irish HSE—Primary care reimbursement services (HSE—PCRS) pharmacy database was used. The HSE—PCRS provides free health services, including medicines to 1.2 million people in Ireland. It is a means-tested scheme for people aged  $< 70$  years, but since July 2001 it is free to all those aged  $\geq 70$  years. It is estimated that over 97% of this age group avail of the medical card scheme [3].

A framework for identifying conditions from the pharmacy database using drug WHO ATC codes was developed from the chronic disease score classification I [5, 8, 12] (see Appendix 1 in the supplementary data on the journal website, <http://www.ageing.oxfordjournals.org>). The national HSE—PCRS prescribing database for 2004 was used. The study population was defined as all individuals aged  $\geq 70$  years who were dispensed three or more items associated with a specific chronic condition during the 12-month period. Restricting to a minimum of three scripts was felt to reduce the likelihood of including prescriptions associated with misdiagnosis or incidental users.

### Statistical analysis

Chronic disease prevalence rates were calculated for the elderly population based on the number of patients aged  $\geq 70$

years ( $n = 316,928$ ). Cost of drug therapy was calculated as the sum of the ingredient drug costs for the combination of drugs used, and cost per patient was the total cost divided by the population with that condition. The age (70–74 years and  $\geq 75$  years) and gender (female is the reference group) distribution of chronic disease is examined; incidence ratios and 95% confidence intervals (CIs) are presented. All analysis was performed using SAS (v 9.1 SAS Institute, Cary, NC, USA).

### Results

In 2004, 86% (271,518) of elderly patients received three or more drug items for at least one of the nine chronic conditions identified in Table 1. Those aged  $\geq 75$  years accounted for 62% (169,019) of the population, and 59% (161,114) were females.

Table 1 gives the prevalence data for chronic conditions among this elderly population. Cardiovascular disease (CVD) was the most common at 72%. This was followed by central nervous system (CNS) conditions at 37%, musculo-skeletal conditions at 28%, upper gastrointestinal (GI) at 24% and respiratory at 14%. Diabetes, thyroid disease and glaucoma occurred in 5–8% of this population, and cancer therapy was received by 4% but is likely to be an underestimate [13].

Overall, CVD was the highest costing condition to treat; however, the cost per patient was relatively low at €390 per year compared with dementia at €907 or respiratory conditions at €540 per patient per year.

### Co-morbidities

There was a high level of co-morbidity, with two chronic diseases experienced by 27% (86,514), three conditions by 19% (60,930) and four or more conditions by 14% (44,035) of the population. The average cost for a single condition was €316, which increased to €609 for two, €870 for three and €1164 per patient per year for those with four conditions. CVD and CNS conditions were the most frequently occurring combination at 30% (94,271), followed by 23% (72,986) for CVD and musculo-skeletal conditions, 20% (63,296) for CVD and upper GI conditions and 13% (42,430) for CNS and musculo-skeletal conditions.

Table 2 summarises the age and gender distribution for the six most prevalent conditions. There is a consistent pattern of diseases between the age groups, with CVD, respiratory disease and diabetes more prevalent in males. CNS, musculo-skeletal and GI conditions were more common in females.

### Discussion

The demographic structure of the study population closely mirrored that of the  $\geq 70$  age group national population where women account for 58% and those aged  $\geq 75$  years 63% [1].

Eighty-six per cent of the elderly population had experienced at least one of the nine chronic conditions identified. Three-quarters were receiving CVD medication, of which  $> 40\%$  was for ischaemic vascular conditions. However, anti-hypertensive therapy accounted for the majority of prescriptions. There was an estimated prevalence of between 20% and 30% for CNS, musculo-skeletal or upper GI diseases.

**Table 1.** Prevalence of chronic diseases and cost of drug therapy in an elderly population

| Disease group                 | Specific condition                               | Number of cases  | Rate per 1000 |                     |                      |
|-------------------------------|--|------------------|---------------|---------------------|----------------------|
|                               |  |                  | population    | Drug cost (000) (€) | Cost per patient (€) |
| CVD                           |  | 227,194          | 717           | 87,905              | 387                  |
|                               | Ischaemic conditions (IHD, PVD, cerebrovascular) | 137,435          | 434           | 1,471               | 107                  |
|                               | Hypertension/heart failure                       | 198,071          | 625           | 41,391              | 209                  |
|                               | Hypercholesterolemia                             | 89,351           | 282           | 30,037              | 336                  |
|                               | Arrhythmias                                      | 33,521           | 106           | 937                 | 30                   |
| CNS (excluding sedation only) |  | 117,333 (94,833) | 370 (299)     | 33,245 (32,154)     | 283 (339)            |
|                               | Psychiatric disorders                            | 66,710           | 211           | 16,359              | 245                  |
|                               | Anxiety  | 43,603           | 138           | 932                 | 21                   |
|                               | Parkinson's disease                              | 7,890            | 25            | 2,432               | 308                  |
|                               | Sleep disturbance                                | 67,834           | 214           | 3,228               | 48                   |
|                               | Epilepsy   | 12,450           | 39            | 1,980               | 159                  |
|                               | Dementia   | 8,927            | 28            | 8,102               | 907                  |
| Musculo-skeletal conditions   |  | 90,391           | 285           | 21,982              | 243                  |
|                               | Rheumatological conditions                       | 77,059           | 243           | 13,080              | 170                  |
|                               | Pagets/osteoporosis                              | 24,265           | 77            | 7,493               | 309                  |
|                               | Gout   | 8,627            | 27            | 545                 | 63                   |
| Upper GI conditions           |  | 757,000          | 239           | 5,688               | 75                   |
| Respiratory conditions        |  | 44,736           | 141           | 24,164              | 540                  |
| Diabetes                      |  | 24,392           | 77            | 8,096               | 332                  |
| Thyroid disorders             |  | 23,233           | 73            | 5,867               | 25                   |
| Glaucoma                      |  | 15,502           | 49            | 4,324               | 279                  |
| Cancer <sup>a</sup>           |  | 13,231           | 42            |                     |                      |

CNS, central nervous system; CVD, cardiovascular disease; GI, gastrointestinal; IHD, ischaemic heart disease; PVD, peripheral vascular disease.

<sup>a</sup>Cancer prevalence is underestimated, and cancer cost data are not available.

**Table 2.** Gender variation stratified by age group for six most prevalent conditions: female is the reference group

| Condition        | Gender | 70–74 years                               |                 |           | >75 years                                 |                 |           |
|------------------|--------|---|-----------------|-----------|---|-----------------|-----------|
|                  |        | Rate per 1000                             | Incidence ratio | 95% CI    | Rate per 1000                             | Incidence ratio | 95% CI    |
|                  |        | Female (n) = 44,877;<br>Male (n) = 38,885 |                 |           | Female (n) = 89,079;<br>Male (n) = 54,353 |                 |           |
| CVD              | Female | 803                                       |                 |           | 852                                       |                 |           |
|                  | Male   | 835                                       | 1.04            | 1.03–1.05 | 847                                       | 1.0             | 0.99–1.01 |
| CNS              | Female | 432                                       |                 |           | 521                                       |                 |           |
|                  | Male   | 296                                       | 0.69            | 0.67–0.7  | 385                                       | 0.74            | 0.72–0.75 |
| Musculo-skeletal | Female | 381                                       |                 |           | 364                                       |                 |           |
|                  | Male   | 275                                       | 0.72            | 0.71–0.74 | 281                                       | 0.77            | 0.76–0.78 |
| GI               | Female | 253                                       |                 |           | 334                                       |                 |           |
|                  | Male   | 209                                       | 0.82            | 0.81–0.84 | 260                                       | 0.78            | 0.77–0.79 |
| Respiratory      | Female | 151                                       |                 |           | 144                                       |                 |           |
|                  | Male   | 175                                       | 1.15            | 1.13–1.18 | 203                                       | 1.41            | 1.39–1.44 |
| Diabetes         | Female | 79  |                 |           | 70  |                 |           |
|                  | Male   | 126                                       | 1.58            | 1.54–1.63 | 106                                       | 1.52            | 1.48–1.56 |

CI, confidence interval; CNS, central nervous system; CVD, cardiovascular disease; GI, gastrointestinal.

Cardiovascular conditions were the highest costing disease group, but on a cost-per-patient basis respiratory conditions and dementia were the most expensive conditions to treat medically. The prevalence of co-existing diseases suggest that three-quarters of elderly people live with two or more significant chronic diseases; CVD and CNS conditions being the most common combination. There was also a clear gender difference in many of the diseases examined. CVD and respiratory conditions were more prevalent in men, which may reflect higher smoking prevalence, whereas CNS and musculo-skeletal conditions were more common

in women, which may reflect their increased willingness to seek help for these illnesses.

Accurate disease prevalence data are required both from an epidemiological and strategic health care planning perspective. There is a strong association between chronic disease, especially arthritis, CVD and stroke, and a decline in locomotor activity and social participation among the elderly [14, 15]. In addition, life expectancy is increasing with an associated increase in years lived with some degree of disability [16–18]. Underestimating disease and co-morbidity prevalence could have far reaching implications for the

provision of health care and elderly care services in the future. This includes the provision of community services to help maintain elderly people in their own homes, nursing home beds and specialist practitioners.

In Ireland, there is no regular national data collection on health care or pharmacy utilisation, with the exception of the HSE–PCRS database in those aged  $\geq 70$  years. This database represents a unique opportunity to estimate the national prevalence of chronic disease in the elderly population.

This study suggests that the prevalence of chronic disease in the elderly population may be higher than previously thought. In comparison with the HeSSOP I survey, 56% of the survey population reported CVD, 46% musculo-skeletal conditions, 14% respiratory conditions, 6% diabetes, whereas 12–17% reported sleep disturbance or depression/anxiety, but the overall prevalence of CNS conditions was difficult to estimate [4]. Differences are likely to reflect the strengths and limitations of both methodologies and the difficulty in accurately identifying national disease prevalence in specific populations. Self-reported illness relies on a person understanding the medical conditions they are being treated for, whereas the higher self-reported prevalence of musculo-skeletal conditions reflect the fact that this condition does not always result in a chronic prescription. Accurate clinical data with standardised disease definitions supplied by general practitioners are required to validate both methodologies, which are currently not collected in the Irish health care system.

Our study provides a valuable insight into the medical conditions experienced by the elderly population within one country. Pharmacy data are collected in several other countries, and there is the possibility of developing a consensus on surrogate markers for diseases, which could facilitate international comparison of disease states and treatments. This would require standardised methodology and validation against diagnosis data.

### Study limitations

The limitations of pharmacy claims databases are readily acknowledged [5, 8, 19] and mainly concern the lack of definitive diagnosis information (see supplementary data available at the journal website, <http://www.ageing.oxfordjournals.org>). In addition, this methodology cannot identify conditions that are not managed by standard drug therapy or conditions for which there are no drug therapies, for example, some cancers or cataracts. The methodology also needs to be continuously revised as new drug treatments emerge.

### Conclusion

The prevalence of chronic conditions, based on pharmacy claims data, in those aged  $\geq 70$  years in Ireland is high, with a significant level of co-morbidity. In a country with little routine collection of primary diagnosis data, estimating disease prevalence using pharmacy claims data may be a pragmatic means of monitoring disease prevalence in an elderly population. The methodology offers the possibility of international comparison of disease prevalence, prescribing and drug costs in managing chronic conditions.

### Key points

- There is a lack of accurate prevalence data on chronic diseases in the Irish elderly population.
- Over 85% of this population received regular medications to treat chronic conditions associated with ageing.
- The level of chronic disease and co-morbidity appears much greater than indicated in currently available national data.
- National pharmacy claims databases offer the potential to compare prevalence and treatment of chronic conditions on a regional and international level.

### Acknowledgements

We thank the Health Research Board, Ireland, for financial support. We also thank the HSE–PCRS for the data on which this study is based. The HRB or the HSE–PCRS did not influence the preparation of this article.

### Conflicts of interest

There are no conflicts of interest.

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doi:10.1093/ageing/af1106

## Longitudinal study of the ageing trends in QT interval and dispersion in healthy elderly subjects

SIR—A prolongation of the QT interval and an increase of QT dispersion are associated with higher cardiovascular morbidity and mortality. This is related to electrical instability and the risk of ventricular arrhythmogenesis [1, 2]. Arrhythmias increase in frequency with ageing, probably due to age-associated degenerative changes in the conduction system, including loss of pacemaker and conducting cells and myocardial fibrosis [3]. Many previous cross-sectional population studies investigated the impact of age on QT interval and dispersion and presented conflicting results [4–8]. However, no longitudinal study, which may provide more reliable results about the changes of QT interval and dispersion with ageing, addressed this issue. Hence, this study is designed to evaluate the longitudinal changes of the QT interval and dispersion with ageing in a population of healthy elderly subjects.

### Methods

Study subjects selected from the community were assessed by medical history, physical examination, blood examination, resting electrocardiogram (ECG) and echocardiogram.

Exclusion criteria included diabetes mellitus, hypertension or other chronic diseases by history, haemoglobin <11.0 mg/dl or creatinine >1.5 mg/dl at blood examination, left ventricular hypertrophy with strain, high degree atrioventricular block, complete bundle branch block, myocardial ischaemia or rhythm other than sinus on in the ECG or significant valvular heart disease, depressed left ventricular systolic function or segmental wall motion abnormality in the echocardiogram. One hundred and fifty-one elderly persons were included in this study at baseline. None of the patients was under anti-hypertensive drugs or drugs affecting ventricular repolarisation [9]. The protocol was approved by our Institutional Review Board, and all enrolled patients gave written, informed consent.

Body weight and height were measured, and body mass index (BMI) was subsequently calculated by using the following formula:  $BMI = \text{body weight}/(\text{body height})^2$ . Blood pressures were taken after resting comfortably for 5 min. A computerised automatic mercury-sphygmomanometer (CH-5000, Citizen, Tokyo, Japan) was used on the right arm, with participants in a seated position. The reading was repeated. The mean of these two readings was used. Blood was withdrawn for the assessment of serum fasting sugar, cholesterol, blood urea nitrogen and creatinine. Then, a standard 12-lead ECG was recorded at a paper speed of 25 mm/s and a gain of 10 mm/mV. All the above examinations were repeated three times at intervals of 2 years. To avoid possible circadian variation of QT dispersion, we completed all 12-lead ECG examinations in the morning (around 8–10 a.m.). Finally, 115 persons (90 men; age  $73 \pm 4$  years at initial study) completed all the serial examinations and formed our study group. The reason why 36 subjects did not have complete serial examinations was not for a medical problem but due to loss of contact after they moved away from this community.

The QT interval was manually measured from the beginning of the QRS complex to the end of the T wave, which was defined as the return to the TP baseline (the isoelectronic line). The U wave was excluded, and none of the study subjects had a U wave superimposed on the terminal portion of the T wave. The leads where the T wave could not be reliably determined or its amplitude was too low were excluded from analysis. The QT interval and the preceding RR interval were measured in three consecutive cycles. All ECGs, with those at the same observational stage as a pack, were analysed by a single observer blinded to the clinical data. Subjects with less than nine measurable leads in the ECG were excluded. The QT dispersion was defined as the absolute difference between the maximum and the minimum QT intervals in any of the ECG leads. Both the QT interval and the dispersion were rate-corrected with Bazett's formula as follows: corrected QT (QTc) interval =  $QT/\text{square root of the RR interval}$  [10].

The Statistical Package for the Social Sciences (SPSS) 11.0 for Windows was used for statistical analysis. Repeated-measures analysis of variance (ANOVA) was used to determine the ageing trends in clinical characteristics and QT intervals and dispersions (uncorrected and corrected). Post hoc analysis was performed using a paired sample *t*-test to