Chronic respiratory disease and multimorbidity: Prevalence and impact in a general practice setting

S. O’Kelly a,*, S.M. Smith a, S. Lane b, C. Teljeur a, T. O’Dowd a

a Department of Public Health and Primary Care, Trinity College Dublin, Ireland
b Department of Respiratory Medicine, AMNCH, Tallaght, Dublin 24, Ireland

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KEYWORDS
Multimorbidity; General practice; COPD; Asthma; Chronic disease; Co-morbidity

Summary
Background: Multimorbidity is defined as two or more co-existing chronic conditions within an individual and is common in general practice. It is associated with poorer outcomes for patients. This study aimed to establish the prevalence of multimorbidity in patients with chronic respiratory disease in general practice and to describe its impact on health service use.

Methods: Cross-sectional study based in general practice in Dublin. Drug and disease code searches were performed to identify adult patients with a diagnosis of chronic respiratory disease. Medical records were reviewed for chronic respiratory diagnosis, other chronic conditions, demographic characteristics, General Practitioner (GP) and practice nurse utilisation rates, and numbers of medications.

Results: In a general practice population of 16,946 patients 3.9% had chronic respiratory disease and 60% of these had one or more co-existing chronic condition(s). GP and practice nurse utilisation rates, and number of medications were significantly higher among those with multimorbidity compared with those with respiratory disease alone. Multivariate analysis showed that increasing age and low socio-economic status were significantly associated with multimorbidity.

Conclusion: The majority of patients with chronic respiratory disease have multimorbidity. Clinical guidelines based on single disease entities and outcomes are not as easy to implement and may not be as effective in this group.

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Introduction
Multimorbidity has been defined as two or more co-existing chronic conditions within an individual.1–3 It is of particular relevance for patients, their carers and healthcare providers as previous studies have shown an inverse relationship between increasing numbers of co-existing diseases and health-related quality of life.4–6 Qualitative
work has established that the main concerns for patients with multimorbidity are loss of function, polypharmacy, a negative effect on their well-being and relationships, and difficulties with co-ordination of their care.7,8

Previous studies have demonstrated high levels of co-existing disease among those with chronic respiratory disease, although most have limited the conditions studied to a pre-defined list.9–13 The presence of co-existing conditions in patients with chronic respiratory disease has been shown to reduce health-related quality of life,14 reduce the potential benefits of rehabilitation,15 and contribute to mortality.16,17

Managing the health needs of patients with multimorbidity is an integral part of routine general practice. However, there has been relatively little published research on the subject to date.18 Chronic respiratory disease is among the most prevalent conditions in the literature on multimorbidity.1,2

The aim of this study was to establish the prevalence of multimorbidity in adult patients with chronic respiratory disease in general practice, categorise the number and types of additional chronic conditions recorded, and to describe demographic characteristics, GP and practice nurse utilisation rates and numbers of medications in adult patients with chronic respiratory disease with and without multimorbidity.

Methodology

Study design

Cross-sectional descriptive study based on a review of medical records by a clinical (GP) research fellow in three general practice populations.

Setting

The study was based in three general practices in urban areas in Dublin. The structure of Irish general practice is outlined in Fig. 1 and further details are available elsewhere.19 The practices used in this study were selected from the Trinity College Dublin network of research and teaching practices. The proportion of patients qualifying for free medical care under the General Medical Services (GMS) scheme was similar in the study practices and representative of the general population.

Patient identification

Disease code and drug searches were undertaken by the GP researcher within the computerised database in each practice. The disease code search identified patients registered with four codes from the International Classification of Primary Care (ICPC)20: chronic bronchitis, chronic obstructive pulmonary disease, asthma and “respiratory disease other”. Codes for acute respiratory events and lung cancer were not included. The research group which includes three general practitioners and a consultant respiratory physician devised a list of the most commonly used respiratory-specific drugs. The drug list consisted of the following groups: Beta2-agonists, inhaled steroids, xanthines, sodium Cromoglycate, montelukast, anticholinergics, and combination preparations. The database in each practice was used to search for patients who had been prescribed any of the listed drugs at least once and at any time on record. The records of all patients on this database were searched to confirm the presence of chronic respiratory disease and to identify other chronic conditions. In this way, a register of individuals with chronic respiratory disease and a sub-register of those with multimorbidity were created in each practice. Having completed the searches in Practices 1 and 2 and identified a prevalence of chronic respiratory disease of approximately 3%, a power calculation was performed to estimate the sample size of charts to be screened in Practice 3 in order to ensure detection of a similar prevalence with a margin of ±1%. This indicated that 1825 charts needed to be screened. As Practice 3 had 4030 potential charts, half were randomly selected by screening every second chart. (See Fig. 2) Where a patient had documented chronic bronchitis, or both asthma and chronic obstructive pulmonary disease (COPD) were documented in the patient record they were classified as having COPD.

Data collection

The GP researcher extracted data from medical records on age, sex, socio-economic status, chronic respiratory diagnosis, any other chronic conditions recorded, number of attendances with a doctor or practice nurse in the previous twelve months and the number of regular medications used respiratory-specific drugs. The drug list consisted of three general practitioners and a consultant respiratory physician devised a list of the most commonly used respiratory-specific drugs. The drug list consisted of the following groups: Beta2-agonists, inhaled steroids, xanthines, sodium Cromoglycate, montelukast, anticholinergics, and combination preparations. The database in each practice was used to search for patients who had been prescribed any of the listed drugs at least once and at any time on record. The records of all patients on this database were searched to confirm the presence of chronic respiratory disease and to identify other chronic conditions. In this way, a register of individuals with chronic respiratory disease and a sub-register of those with multimorbidity were created in each practice. Having completed the searches in Practices 1 and 2 and identified a prevalence of chronic respiratory disease of approximately 3%, a power calculation was performed to estimate the sample size of charts to be screened in Practice 3 in order to ensure detection of a similar prevalence with a margin of ±1%. This indicated that 1825 charts needed to be screened. As Practice 3 had 4030 potential charts, half were randomly selected by screening every second chart. (See Fig. 2) Where a patient had documented chronic bronchitis, or both asthma and chronic obstructive pulmonary disease (COPD) were documented in the patient record they were classified as having COPD.
recorded in the medical records. This data was collected between October 2008 and April 2009 and anonymised.

Analysis

Univariate analyses were performed with Pearson $\chi^2$ statistics. Multivariate analyses were performed using multiple logistic regression models with goodness of fit measured using the Hosmer–Le Cessie test. Age, gender and socio-economic status were included in the multivariate model irrespective of their statistical significance. All those aged 70 years or more were entitled to free medical care under the GMS scheme and therefore this could not be used as an indicator for low socio-economic status in this age group. Analysis regarding socio-economic status was therefore restricted to patients under 70 years of age. Comparisons of utilisation rates and medications between those with and without multimorbidity were tested for significance using the Wilcoxon test.

Results

The drug code and drug searches resulted in a total of 1331 records for screening. Six hundred and fifty three had chronic respiratory disease and of these, 393 (60%) had multimorbidity. (See Fig. 2)

As expected, the percentage of patients with multimorbidity increased with age. (See Table 1) Among those with chronic respiratory disease aged 18–29 years, 27% (41/150) of patients have multimorbidity compared to 90% (86/96) in those aged over 70. Twenty four percent (159/653) of the total sample with chronic respiratory disease had one additional chronic condition, 20% (130/653) had two additional chronic conditions, and 16% (104/653) had 3 or more additional conditions. There was a higher prevalence of multimorbidity among female patients and those with lower socio-economic status. (See Table 2)

Asthma was the most commonly documented respiratory diagnosis in this study, making up two-thirds of the total sample, and 54% of those with respiratory disease and multimorbidity. The proportion of patients with multimorbidity was higher among those with COPD than those with asthma or any other respiratory diagnosis (see Table 3)

Univariate analysis identified significantly higher rates of multimorbidity in females, patients with low socio-economic status, and increasing age. In the multivariate analysis all factors were significantly associated with multimorbidity. (See Fig. 3) A diagnosis of asthma or other chronic respiratory disease was not significantly associated with multimorbidity in the multivariate analysis indicating that the apparent higher rates of multimorbidity in those with COPD compared with asthma can be attributed to the older age of those with COPD. The goodness of fit of the multivariate model was adequate ($p = 0.41$).

The median number of regular medications, and median number of consultations with a GP or practice nurse in the previous 12 months were significantly higher among those with respiratory disease and multimorbidity versus those with respiratory disease alone. Of the total sample, 499 (76.4%) had no consultation with a practice nurse in the previous year, and 606 (92.8%) had consulted fewer than three times Table 4.

Details of the co-existing chronic conditions are outlined in Table 5 with depression, hypertension, cardiovascular disease and musculoskeletal disorders predominating. Depression and anxiety were counted as one condition, even where both were documented in a patient chart as it is generally accepted that there is clinical overlap in signs, symptoms and treatment. Where a patient had two distinct conditions within one category of conditions they were counted separately, for example peripheral vascular disease and heart failure or diverticulitis and gastro-oesophageal reflux disease.

Discussion

This study indicated that 60% of patients with chronic respiratory disease identified in a general practice setting have multimorbidity. As far as we can ascertain this is the first paper based in primary care which has used chronic respiratory disease as the index condition and identified the prevalence of multimorbidity in this population. The median number of regular medications, and median number of consultations with a GP or practice nurse in the previous 12 months were significantly higher among those with respiratory disease and multimorbidity versus those with respiratory disease alone. Of the total sample, 499 (76.4%) had no consultation with a practice nurse in the previous year, and 606 (92.8%) had consulted fewer than three times Table 4.

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### Table 1

<table>
<thead>
<tr>
<th>Age Group</th>
<th>RDA* (%)</th>
<th>RDM* (%)</th>
<th>Total number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>18–29 years</td>
<td>109 (73)</td>
<td>41 (27)</td>
<td>150</td>
</tr>
<tr>
<td>30–45 years</td>
<td>79 (50)</td>
<td>79 (50)</td>
<td>158</td>
</tr>
<tr>
<td>46–69 years</td>
<td>62 (25)</td>
<td>187 (75)</td>
<td>249</td>
</tr>
<tr>
<td>70 + years</td>
<td>10 (10)</td>
<td>86 (90)</td>
<td>96</td>
</tr>
</tbody>
</table>

**RDA* Respiratory Disease Alone, RDM* Respiratory Disease + Multimorbidity.**

### Table 2

<table>
<thead>
<tr>
<th>SES Status</th>
<th>RDA* (%)</th>
<th>RDM* (%)</th>
<th>Total number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SES</td>
<td>130 (50)</td>
<td>313 (79)</td>
<td>443 (68)</td>
</tr>
<tr>
<td>Female</td>
<td>148 (57)</td>
<td>259 (66)</td>
<td>407 (62)</td>
</tr>
</tbody>
</table>

**RDA* Respiratory Disease Alone, RDM* Respiratory Disease + Multimorbidity Low SES**

### Table 3

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>RDA* (%)</th>
<th>RDM* (%)</th>
<th>Total number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>219 (84)</td>
<td>213 (54)</td>
<td>432 (66)</td>
</tr>
<tr>
<td>COPD</td>
<td>37 (14)</td>
<td>169 (43)</td>
<td>206 (32)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (2)</td>
<td>11 (3)</td>
<td>15 (2)</td>
</tr>
</tbody>
</table>

**RDA* Respiratory Disease Alone, RDM* Respiratory Disease + Multimorbidity.**
than those found by Van den Akker et al., and lower than those found by Fortin et al., in general practice settings. Fortin et al. recruited consecutive consulting patients for the study, and therefore the prevalence of multimorbidity will be higher among this group compared with a population sample of patients registered in general practice.

Co-existing chronic conditions found in previous studies were similar to those found in this study, with cardiovascular disease, diabetes and hypertension among the most prevalent. However, the majority of previous studies recording co-existing conditions have limited these to a list of pre-specified diseases such as cardiovascular disease and depression, with some including both acute and chronic conditions.

A limitation of this study is the lack of a control group without a respiratory condition for purposes of comparison of co-existing conditions, attendance rates, and numbers of medications. However, our findings can be compared with other primary care studies conducted in the area of multimorbidity. In the current study, the median number of GP visits among those with multimorbidity was 6 and with respiratory disease alone was 2. This can be compared with data from the Central Statistics Office in Ireland for 2007, which showed that the average number of consultations with a GP per person per year was 2.8 nationally. Another Irish study in a younger, deprived population with at least three chronic conditions, had a mean number of consultations in the previous twelve months of 7.2 in those with single morbidity and 11.6 in those with multimorbidity. A Dutch study compared the consultation rates among a general practice population and found a mean annual consultation rate among patients of 3.2 though this varied from 4.2 to 5.7 in patients with one of five selected chronic diseases and from 5.4 to 7.4 in patients with more than one of these diseases.

The median number of regular medications in the current study was 4 among those with multimorbidity and 1 among those with respiratory disease alone. In comparison, results from the Irish study of a younger more deprived group of patients showed that the mean number of medications was 7.3 in patients with multimorbidity, and was 2.3 among those with a single morbidity.

Factors shown to have significant association with multimorbidity in multivariate analysis in the current study were: low socio-economic status, and increasing age. These findings are similar to the results from previous studies in general practice populations in Canada, the Netherlands, and Scotland. Female gender has been found to be significant in some studies and not in others. In this study gender was not associated with multimorbidity when controlled for age and socio-economic status.

A limitation of this study is that it was carried out in three general practices in one country and consequently the findings may not be generalisable. There were differences between the practices in documentation, coding and prescribing. The proportion of those documented as having a chronic respiratory disease was significantly higher in Practice 3 when compared with Practices 1 and 2, however the proportion of patients with chronic respiratory disease and multimorbidity was consistent across the three practices. It may be that the prevalence of those documented as having chronic respiratory disease was higher in Practice 3 due to routine, weekly coding entries compared with opportunistic disease coding used in Practices 1 and 2. Under-diagnosis and misdiagnosis of chronic respiratory disease in general practice, particularly for COPD, have been well documented. Reasons suggested for this include a nihilistic approach or attitude to COPD by medical practitioners, and under-presentation by patients of symptoms such as chronic cough or sputum production. Studies have also demonstrated under-use of spirometry in diagnosing respiratory disease in general practice. There is also international variation in the incentives provided to GPs to diagnose and manage chronic respiratory disease and such incentivisation generally leads to better diagnosis.

**Table 4** Utilisation rates and medications.

<table>
<thead>
<tr>
<th></th>
<th>Median (Interquartile range)</th>
<th>RDA*</th>
<th>RDM*</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP Visits in 1 year</td>
<td>2 (0–5)</td>
<td>6</td>
<td>2–10.25</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Regular Medications</td>
<td>1 (0–2)</td>
<td>4</td>
<td>2–8</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>RDA* Respiratory Disease Alone, RDM* Respiratory Disease + Multimorbidity.</td>
<td></td>
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</tbody>
</table>
System. Inclusion of hyperlipidaemia did not alter the consideration of and management of multimorbidity has been highlighted in recent published work by Starfield et al. There are definitional difficulties in distinguishing between co-morbidity and multimorbidity which will inevitably affect prevalence findings. In co-morbidity there are similar pathogenesis or risk factors, for example hypertension and cardiovascular disease. In multimorbidity there may be no common pathogenesis as for example in asthma and arthritis but there is overlap between the areas of co- and multimorbidity.

A second and important limitation is the lack of smoking data. Smoking status is an important potential confounding factor in the analysis of multimorbidity among patients with chronic respiratory disease. However, difficulties obtaining accurate smoking data in primary care settings have been highlighted in a report on the Quality and Outcomes Framework in the UK, and smoking data is therefore not included in some studies on chronic respiratory disease. Several other studies have also demonstrated a poor correlation between GP records and self-report on current smoking internationally. None of the participating practices routinely record and update current smoking status at every visit. Therefore, we felt that extracting data from the records would not be accurate and as a result was not done.

When a patient is attending with one condition and has regular reviews with a GP are they more likely to be diagnosed with additional conditions? This is a difference with specialist medicine. The need for clarification and consensus on the definition of multimorbidity and constructs for the assessment of and management of multimorbidity has been highlighted in recently published work by Starfield et al. There are definitional difficulties in distinguishing between co-morbidity and multimorbidity which will inevitably affect prevalence findings. In co-morbidity there are similar pathogenesis or risk factors, for example hypertension and cardiovascular disease. In multimorbidity there may be no common pathogenesis as for example in asthma and arthritis but there is overlap between the areas of co- and multimorbidity.

There is also the question of whether a co-existing condition is classified as a disease or as a risk factor. For example, hyperlipidaemia was included in this study as the diagnosis involves follow-up consultations, blood tests and may involve taking medication and fulfils the definition of a chronic disease as specified by the World Health Organisation (WHO) and is considered as the equivalent of having additional health conditions in future work on multimorbidity.

Our results showed that multimorbidity is common among patients with chronic respiratory disease, and its presence has an impact on workload and numbers of prescribed medications. We need to incorporate the concept of multimorbidity into our chronic disease management programmes. Potential solutions include the adoption of shared or collaborative care, though a Cochrane review of studies on shared care between primary and secondary care did not find evidence for any significant benefits of shared care over usual care other than improved prescribing. An alternative model such as physician guided care has shown promising initial results in a recent US trial with improvements in patient and physician satisfaction with chronic care, a reduction in the number of admissions to hospital and days spent in hospital and a reduction in care giver strain and depression levels. Respiratory disease is common in both primary and secondary care and it usually coexists with other illnesses. Effective management represents an important clinical challenge for both primary and secondary care physicians.

### Table 5 Co-existing chronic conditions in patients with chronic respiratory disease and multimorbidity (n = 393).

<table>
<thead>
<tr>
<th>Condition</th>
<th>%</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression/Anxiety</td>
<td>28%</td>
<td>110</td>
</tr>
<tr>
<td>Hypertension</td>
<td>28%</td>
<td>107</td>
</tr>
<tr>
<td>Cardiovascular disease (includes cerebrovascular and peripheral vascular disease)</td>
<td>28%</td>
<td>96 patients with 1 condition, 11 patients with 2 conditions, 1 patient with 3 conditions</td>
</tr>
<tr>
<td>Musculoskeletal (includes osteoporosis)</td>
<td>23%</td>
<td>88 patients with 1 condition, 1 patient with 2 conditions</td>
</tr>
<tr>
<td>Endocrine</td>
<td>20%</td>
<td>76 patients with 1 condition, 1 patient with 2 conditions</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>17%</td>
<td>55 patients with 1 condition, 5 patients with 2 conditions, 1 patient with 3 conditions</td>
</tr>
<tr>
<td>Substance Misuse</td>
<td>14%</td>
<td>54 patients with 1 condition, 1 patient with 2 conditions</td>
</tr>
<tr>
<td>Hyperlipidaemia, Dermatological, Neurological, Malignancy</td>
<td>&lt;10%</td>
<td></td>
</tr>
<tr>
<td>Other psychiatric disorder, Ophthalmological, Metabolic, Haematological, Renal disorder</td>
<td>&lt;4%</td>
<td></td>
</tr>
<tr>
<td>HIV, Dementia, Benign Prostatic Hyperplasia, Connective Tissue Disorder, Obesity, Genetic Disorder, Multisystem Inflammatory Disorder</td>
<td>&lt;2%</td>
<td></td>
</tr>
</tbody>
</table>

Deprivation has been shown to be associated with increased morbidity and mortality, greater numbers of psychological problems, shorter consultation times, and poorer access to health services and care. Smoking rates are also higher among those in a lower socio-economic group, which further contributes to increased morbidity and mortality, particularly for respiratory conditions. Due to their association with increased morbidity, smoking and deprivation could be considered as the equivalent of having additional health conditions in future work on multimorbidity.

### Ethical approval

The Research Ethics Committee of the Irish College of General Practitioners approved the study. Data on
individual patients of each participating GP (SOK, SMS and TOD) was collected and anonymised at practice level so no identifiable data left the clinical setting.

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Competing interests

None.

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Author contributions: SOK, TOD, SMS, CT, and SL participated in the design of the study. SOK completed the data collection and drafted the manuscript. TOD, SMS, CT and SL helped draft the manuscript. CT and SOK performed the statistical analysis. All authors read and approved the final manuscript.

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References


