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Prevalence and patterns of multimorbidity in Australia

Helena C Britt, Christopher M Harrison, Graeme C Miller and Stephanie A Knox

ABSTRACT

Objectives: To estimate the prevalence and patterns of multimorbidity in a sample of patients attending general practice, in the population who attended general practice in 2005, and in the Australian population.

Design, setting and participants: Secondary analyses of data from a study of prevalence of selected conditions (a substudy of the BEACH [Bettering the Evaluation And Care of Health] program); data were provided by 305 general practitioners for 9156 patients seen in July–November 2005, based on knowledge of the patient, patient self-report, and medical records. Listed conditions were classified according to the Cumulative Illness Rating Scale morbidity domains.

Main outcome measures: Prevalence of morbidity in each domain; prevalence of specific patterns of multimorbidity (defined as presence of morbidity in two or more domains).

Results: Prevalence of multimorbidity was estimated as 37.1% of surveyed patients, 29.0% of people who attended a GP in 2005, and 25.5% of the Australian population. Prevalence and complexity (number of domains present) increased with age: 83.2% of surveyed patients aged 75 years or older had multimorbidity, 58.2% had morbidity in three or more domains, and 33.4% in four or more. Prevalence of multimorbidity did not differ between the sexes. The most common morbidity combinations were arthritis/chronic back pain + vascular disease (15.0% of sample), a psychological problem + vascular disease (10.6%) and arthritis/chronic back pain + a psychological problem (10.6%). We estimate that 10.6% of people attending a GP in 2005 and 9.3% of the population have arthritis/chronic back pain + vascular disease (other morbidity types studied), and this group accounted for about 15.2 million Medicare-claimed general practice encounters in 2005.

Conclusions: This study provides the first insight into prevalence and patterns of multimorbidity in Australia. Knowledge of the common combinations of multimorbidity may help in planning the health services needed in the future by an ageing population with an increasing burden of multimorbidity.

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See also page 66
The BEACH study uses random samples of GPs, each providing data about a cluster of encounters. SAS version 9.1.3 (SAS Institute Inc, Cary, NC, USA) was used to adjust for clustering at individual GP level. The sample survey results were adjusted to provide prevalence estimates for the population attending a GP in 2005–2006, and the population of Australia, as described elsewhere. Three methods have been validated to some degree for measuring multimorbidity: the Johns Hopkins Adjusted Clinical Group case-mix system, the Charlson Comorbidity Index, and the Cumulative Illness Rating Scale (CIRS).

Three methods have been validated to some degree for measuring multimorbidity: the Johns Hopkins Adjusted Clinical Group case-mix system, the Charlson Comorbidity Index, and the Cumulative Illness Rating Scale (CIRS). We chose the last as it has been validated and applied in family practice. It uses the presence of illness in each of 14 organ domains plus a measure of severity of each domain to provide an index of total chronic medical illness burden. We allocated the surveyed morbidities into these synergistic domains (ie, management of one problem is usually beneficial for management of another within the group). They fell into eight of the 14 domains. Our category “malignant neoplasms” was too broad to be allocated to a single CIRS domain, so we added it as an independent morbidity type, giving a total of nine morbidity domains (Box 1).

Respondents with more than one surveyed morbidity within a single CIRS domain were counted only once for that domain. Prevalence of illness in each CIRS morbidity domain among the sample was calculated. Multimorbidity was defined as presence of illness in two or more morbidity domains. Results are presented as estimated prevalence of each domain and of combinations of domains in the sample; estimated prevalence among patients who attended a primary care practitioner at least once in 2005–2006, after adjustment for attendance rates by age–sex category, and estimated population prevalence. Estimated numbers of national encounters with patients having each multimorbidity combination were made through simple extrapolation from the crude prevalence estimate to the number of services by GPs in April 2005–March 2006.

The most common combinations of domains were first investigated for all patients with at least two morbidity domains, followed by patterns among those with three or more (a subgroup of the first analytical group), and then patterns among those with four or more (a subgroup of both previous groups). Only the 12 most common combinations of two or more morbidity types are presented here. The full results for all combinations are available at the website of the Family Medicine Research Centre (http://www.fmrc.org.au/publications/appendices/).

**Ethics approval**

Ethics committees of the University of Sydney and the Australian Institute of Health and Welfare approved the BEACH study and the substudy on which this analysis is based.

**RESULTS**

**Prevalence of each morbidity domain**

Among the 9156 patients surveyed, vascular problems were the most prevalent morbidity domain (31.5%), followed by arthritis/chronic back pain (26.5%), and psychological problems (24.7%) (Box 2). The interpretation of these results is that, for example, 31.5% of GP encounters are with patients who have at least one of the listed vascular conditions.

Because older people have more chronic diseases and attend GPs more often, adjustment of results to the total population attending general practice resulted in a decrease in estimated prevalence of all morbidity domains. For example, we estimate that 24.6% of patients who attended a GP once in 2005–2006 have a vascular disease currently being managed (Box 2).

**Prevalence of multimorbidity**

Of the 9156 patients, 39.6% had no illness in any of the morbidity domains, and 23.3% had illness in only one domain. The remaining 3398 (37.1%) were classed as having multimorbidity. Almost two-thirds (61.5%) of patients with illness in at least one of the morbidity domains had multimorbidity, by far the most having illness in two or three domains. However, 10.1% of the sample had illness in four or more domains, and 1.8% in six or more. Adjusted results suggested that 29.0% of the population who attend general practice, and 25.5% of the population overall, have multimorbidity as measured in this study (Box 3).

There was no difference in prevalence of multimorbidity between male and female patients (Box 4). Prevalence increased steadily with age, from 2.6% among the sampled people younger than 25 years to almost half of those aged 65–74 years, and four out of five of those aged 75 years or older (Box 4). Likelihood of increased numbers of morbidity domains also steadily increased with age, with 0.6% of patients younger than 25 years having three or more morbidity domains, compared with 58.2% of those aged 75 years or older having three or more, and 33.4% having four or more domains.

After adjustment, 19.3% of patients who attend general practice had multimorbidity involving vascular disease, 16.6% involving arthritis and/or chronic back pain, and 14.8% involving a psychological problem (Box 2). The patients most likely to have multimorbidity were those with cardiac disease (ratio of adjusted prevalence of multimorbidity to morbidity, 98.6% [7.0%/7.1%]) and those with cerebrovascular disease (91.7%). Those least likely had asthma/chronic obstructive airways disease (59.8%) or a psychological problem (67.0%).

**Common multimorbidity combinations**

Box 5 shows the 12 most common combinations of two morbidity domains for all patients with multimorbidity. The most prevalent morbidity combination was arthritis/chronic back pain + vascular disease (15.0% of the sample), followed by psychological problem + vascular disease and arthritis/back pain + psychological problem (both 10.6%) (Box 3). The most common combinations among those with morbidity in three or more domains were arthritis/back pain + vascular disease + psychological problem (6.1%) and arthritis/back pain + vascular disease + psychiatric conditions (5.7%).
2 Prevalence of morbidity in each CIRS domain and multimorbidity arising from that domain

<table>
<thead>
<tr>
<th>Morbidity domain</th>
<th>No.</th>
<th>Morbidity</th>
<th>2 or more</th>
<th>3 or more</th>
<th>4 or more</th>
<th>Morbidity</th>
<th>2 or more</th>
<th>3 or more</th>
<th>4 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular</td>
<td>2880</td>
<td>31.5%</td>
<td>25.8%</td>
<td>16.9%</td>
<td>9.1%</td>
<td>24.6%</td>
<td>19.3%</td>
<td>12.1%</td>
<td>6.3%</td>
</tr>
<tr>
<td>(29.6%–33.3%)</td>
<td></td>
<td>(24.0%–27.5%)</td>
<td>(15.4%–18.4%)</td>
<td>(8.1%–10.2%)</td>
<td></td>
<td>(23.1%–26.2%)</td>
<td>(17.9%–20.7%)</td>
<td>(10.9%–13.2%)</td>
<td>(5.6%–7.1%)</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>2425</td>
<td>26.5%</td>
<td>22.5%</td>
<td>15.3%</td>
<td>8.4%</td>
<td>20.4%</td>
<td>16.6%</td>
<td>10.7%</td>
<td>5.7%</td>
</tr>
<tr>
<td>(24.7%–28.3%)</td>
<td></td>
<td>(20.8%–24.3%)</td>
<td>(13.8%–16.7%)</td>
<td>(7.3%–9.4%)</td>
<td></td>
<td>(18.9%–21.9%)</td>
<td>(15.2%–18.1%)</td>
<td>(9.6%–11.8%)</td>
<td>(4.9%–6.4%)</td>
</tr>
<tr>
<td>Psych</td>
<td>2261</td>
<td>24.7%</td>
<td>18.0%</td>
<td>11.7%</td>
<td>6.3%</td>
<td>22.1%</td>
<td>14.8%</td>
<td>8.8%</td>
<td>4.5%</td>
</tr>
<tr>
<td>(23.1%–26.3%)</td>
<td></td>
<td>(16.5%–19.5%)</td>
<td>(10.5%–12.9%)</td>
<td>(5.5%–7.2%)</td>
<td></td>
<td>(20.5%–23.6%)</td>
<td>(13.4%–16.1%)</td>
<td>(7.8%–9.7%)</td>
<td>(3.9%–5.1%)</td>
</tr>
<tr>
<td>Asthma/COAD</td>
<td>1256</td>
<td>13.7%</td>
<td>9.5%</td>
<td>6.7%</td>
<td>4.5%</td>
<td>12.7%</td>
<td>7.6%</td>
<td>4.9%</td>
<td>3.2%</td>
</tr>
<tr>
<td>(12.7%–14.7%)</td>
<td></td>
<td>(8.7%–10.4%)</td>
<td>(6.0%–7.5%)</td>
<td>(3.9%–5.2%)</td>
<td></td>
<td>(11.7%–13.8%)</td>
<td>(6.9%–8.4%)</td>
<td>(4.3%–5.6%)</td>
<td>(2.7%–3.7%)</td>
</tr>
<tr>
<td>GORD</td>
<td>1204</td>
<td>13.1%</td>
<td>11.9%</td>
<td>9.2%</td>
<td>5.9%</td>
<td>10.4%</td>
<td>9.1%</td>
<td>6.7%</td>
<td>4.1%</td>
</tr>
<tr>
<td>(11.9%–14.4%)</td>
<td></td>
<td>(10.6%–13.1%)</td>
<td>(8.1%–10.4%)</td>
<td>(5.0%–6.7%)</td>
<td></td>
<td>(9.4%–11.5%)</td>
<td>(8.1%–10.1%)</td>
<td>(5.9%–7.6%)</td>
<td>(3.4%–4.7%)</td>
</tr>
<tr>
<td>Cardiac</td>
<td>977</td>
<td>10.7%</td>
<td>10.4%</td>
<td>8.6%</td>
<td>5.8%</td>
<td>7.1%</td>
<td>7.0%</td>
<td>5.6%</td>
<td>3.8%</td>
</tr>
<tr>
<td>(9.6%–11.7%)</td>
<td></td>
<td>(8.7%–11.5%)</td>
<td>(7.6%–9.6%)</td>
<td>(5.0%–6.6%)</td>
<td></td>
<td>(6.4%–7.9%)</td>
<td>(6.2%–7.7%)</td>
<td>(5.0%–6.3%)</td>
<td>(3.2%–4.3%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>756</td>
<td>8.3%</td>
<td>7.7%</td>
<td>5.9%</td>
<td>3.9%</td>
<td>6.6%</td>
<td>6.1%</td>
<td>4.5%</td>
<td>2.8%</td>
</tr>
<tr>
<td>(7.5%–9.0%)</td>
<td></td>
<td>(7.0%–8.5%)</td>
<td>(5.2%–6.6%)</td>
<td>(3.3%–4.4%)</td>
<td></td>
<td>(6.0%–7.3%)</td>
<td>(5.5%–6.7%)</td>
<td>(3.9%–5.0%)</td>
<td>(2.4%–3.3%)</td>
</tr>
<tr>
<td>CVD</td>
<td>343</td>
<td>3.7%</td>
<td>3.5%</td>
<td>3.1%</td>
<td>2.3%</td>
<td>2.4%</td>
<td>2.2%</td>
<td>1.9%</td>
<td>1.5%</td>
</tr>
<tr>
<td>(3.0%–4.5%)</td>
<td></td>
<td>(2.8%–4.2%)</td>
<td>(2.4%–3.7%)</td>
<td>(1.8%–2.8%)</td>
<td></td>
<td>(1.9%–2.9%)</td>
<td>(1.8%–2.7%)</td>
<td>(1.5%–2.3%)</td>
<td>(1.1%–1.8%)</td>
</tr>
<tr>
<td>Malignant neoplasms</td>
<td>280</td>
<td>3.1%</td>
<td>2.6%</td>
<td>1.8%</td>
<td>1.2%</td>
<td>2.3%</td>
<td>1.8%</td>
<td>1.2%</td>
<td>0.8%</td>
</tr>
<tr>
<td>(2.6%–3.6%)</td>
<td></td>
<td>(2.1%–3.0%)</td>
<td>(1.4%–2.3%)</td>
<td>(0.9%–1.5%)</td>
<td></td>
<td>(1.9%–2.7%)</td>
<td>(1.5%–2.2%)</td>
<td>(0.9%–1.5%)</td>
<td>(0.6%–1.0%)</td>
</tr>
</tbody>
</table>


* Equates to estimated prevalence among patients in GP waiting room. † Estimated prevalence among patients who visited a GP at least once in a year.
‡ Where domain included one or two surveyed morbidities, the morbidities are specified.
§ Arthritis/chronic back pain.

3 Distribution of multimorbidity currently under management

<table>
<thead>
<tr>
<th>No. of morbidity domains</th>
<th>No.</th>
<th>Crude per cent of sample* (95% CI) (n = 17 468 583)</th>
<th>Estimated prevalence (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3624</td>
<td>39.6% (37.6%–41.6%) 46.9% (44.9%–48.9%)</td>
<td>53.2% (51.2%–55.2%)</td>
</tr>
<tr>
<td>1</td>
<td>2134</td>
<td>23.3% (22.3%–24.4%) 24.2% (23.0%–25.3%)</td>
<td>21.3% (20.3%–22.2%)</td>
</tr>
<tr>
<td>Multimorbidity</td>
<td>3398</td>
<td>37.1% 29.0% 25.5%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1499</td>
<td>16.4% (15.4%–17.3%) 14.0% (13.1%–14.9%)</td>
<td>12.3% (11.5%–13.1%)</td>
</tr>
<tr>
<td>3</td>
<td>971</td>
<td>10.6% (9.7%–11.5%) 8.0% (7.2%–8.7%)</td>
<td>7.0% (6.4%–7.7%)</td>
</tr>
<tr>
<td>4</td>
<td>513</td>
<td>5.6% (5.0%–6.2%) 4.0% (3.5%–4.4%)</td>
<td>3.5% (3.1%–3.9%)</td>
</tr>
<tr>
<td>5</td>
<td>254</td>
<td>2.6% (2.3%–3.2%) 1.9% (1.6%–2.2%)</td>
<td>1.7% (1.4%–2.0%)</td>
</tr>
<tr>
<td>6</td>
<td>113</td>
<td>1.2% (0.9%–1.5%) 0.8% (0.6%–1.0%)</td>
<td>0.7% (0.5%–0.9%)</td>
</tr>
<tr>
<td>7</td>
<td>41</td>
<td>0.4% (0.3%–0.6%) 0.3% (0.2%–0.4%)</td>
<td>0.3% (0.1%–0.4%)</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>0.1% (0–0.1%) 0.0% (0–0.1%)</td>
<td>0.0% (0–0.1%)</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


Gastro-oesophageal reflux disease (GORD) (5.3%). The most common combinations among those with morbidity in four or more domains were arthritis/back pain + vascular disease + GORD + psychological problem (2.6%) and arthritis/back pain + vascular disease + GORD + cardiac problem (2.2%) (Appendix, Multimorbidity, http://www.fmrc.org.au/publications/appendices/).

In Box 5, Column 4 shows the estimated number of Medicare-claimed encounters nationally in 2005–2006 with patients who have each multimorbidity combination (although some have additional morbidity domains). The adjusted estimate of the proportion of people attending a GP at least once in the study year who have each combination of diseases (± other morbidity domains) is provided in Column 5, and the adjusted estimate for the total population in Column 6. For example, 10.6% of the patients attending GPs in 2005–2006, and 9.3% of the community as a whole (about 1.8 million people) have arthritis/chronic back pain + vascular disease (± other morbidity domains), and this group of people accounted for an estimated 15.2 million general practice Medicare-claimed encounters in 2005–2006.

Columns 7 and 8 indicate the likelihood of more complex morbidity among people in the population with the listed combinations. For example, of the estimated 9.3% of the population who have arthritis/chronic back pain + vascular disease, 31.2% have morbidity in one other studied domain, and 48.2% have morbidity in two or more other domains. Disease complexity was greatest for those with arthritis/chronic back pain + cardiac disease, 21.6% of whom had morbidity in one other domain, and 72.2% in two or more other domains. (More detailed results for specific combinations are available in Appendix, Multimorbidity, http://www.fmrc.org.au/publications/appendices/.)

**DISCUSSION**

This study has given a first insight into the prevalence of multimorbidity in Australia. It suggests that about three in 10 people who...
attend general practice, and one in four Australians overall, have multimorbidity as defined in this study. This aligns with overseas estimates of 30% in Quebec, Canada, and the Netherlands. Extrapolation suggests that over 5 million Australians are currently being managed for diagnosed diseases from at least two of the morbidity domains.

Our finding that prevalence and complexity do not differ by sex but are highly age-related are consistent with the results of other studies. However, our prevalence estimates for older patients (75% for 65–74-year-olds and 83% for those aged 75 years or over) are higher than those from Quebec in 1999 (63.4%), the Netherlands in 1990 (> 60%) and the United States in 1999 (63.4%). These issues are often not considered in guidelines for individual conditions.

Governments are currently considering the structure and function of the Australian health care system. Our study, although only a first step in measuring prevalence of multimorbidity, may help inform planning of health services of the future.

**ACKNOWLEDGEMENTS**

We thank the GPs who participated in the substudy, and the Australian Government Department of Health and Ageing for supplying Medicare claims data used for adjustments. During the data collection period of this substudy, the BEACH program was funded by the National Prescribing Service, AstraZeneca, Roche Products, Janssen-Cilag, Merck Sharp and Dohme, Pfizer Australia, the Office of the Australian Safety and Compensation Council (Australian Government Department of Employment and Workplace Relations) and the Australian Government Department of Veterans’ Affairs.
### 5 Prevalence estimates for the 12 most common combinations of two or more CIRS morbidity domains

<table>
<thead>
<tr>
<th>Combination of morbidity domains</th>
<th>No. of patients</th>
<th>Crude rate (95% CI)* (n = 9156)</th>
<th>Estimated national encounters pa (millions)</th>
<th>GP patient population (n = 17 384 208)†</th>
<th>National population†</th>
<th>With 1 more morbidity</th>
<th>With ≥ 2 more morbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis/chronic back pain + vascular</td>
<td>1377</td>
<td>15.0% (13.6%–16.4%)</td>
<td>15.20</td>
<td>10.6% (9.5%–11.6%)</td>
<td>9.3% (8.4%–10.2%)</td>
<td>31.2% (28.6%–33.9%)</td>
<td>48.2% (44.9%–51.5%)</td>
</tr>
<tr>
<td>Psych + vascular</td>
<td>972</td>
<td>10.6% (9.6%–11.7%)</td>
<td>10.73</td>
<td>8.2% (7.3%–9.1%)</td>
<td>7.2% (6.4%–8.0%)</td>
<td>31.2% (28.1%–34.4%)</td>
<td>48.9% (45.0%–52.7%)</td>
</tr>
<tr>
<td>Arthritis/chronic back pain + psych</td>
<td>969</td>
<td>10.6% (9.5%–11.7%)</td>
<td>10.70</td>
<td>8.2% (7.2%–9.1%)</td>
<td>7.2% (6.4%–8.0%)</td>
<td>30.6% (27.3%–33.9%)</td>
<td>45.5% (41.6%–49.4%)</td>
</tr>
<tr>
<td>Cardiac + vascular</td>
<td>783</td>
<td>8.6% (7.7%–9.5%)</td>
<td>8.65</td>
<td>5.8% (5.1%–6.4%)</td>
<td>5.1% (4.5%–5.7%)</td>
<td>25.0% (21.6%–28.4%)</td>
<td>60.4% (55.7%–65.0%)</td>
</tr>
<tr>
<td>GORD + vascular</td>
<td>724</td>
<td>7.9% (6.9%–8.9%)</td>
<td>8.00</td>
<td>5.7% (5.0%–6.5%)</td>
<td>5.0% (4.4%–5.6%)</td>
<td>25.1% (21.6%–28.5%)</td>
<td>63.7% (59.5%–67.8%)</td>
</tr>
<tr>
<td>Arthritis/chronic back pain + GORD</td>
<td>698</td>
<td>7.6% (6.8%–8.6%)</td>
<td>7.71</td>
<td>5.5% (4.7%–6.2%)</td>
<td>4.8% (4.1%–5.5%)</td>
<td>27.9% (24.3%–31.6%)</td>
<td>62.5% (58.5%–66.5%)</td>
</tr>
<tr>
<td>Diabetes + vascular</td>
<td>588</td>
<td>6.4% (5.7%–7.1%)</td>
<td>6.49</td>
<td>5.0% (4.5%–5.6%)</td>
<td>4.4% (3.9%–4.9%)</td>
<td>26.5% (22.4%–30.6%)</td>
<td>53.2% (48.4%–57.9%)</td>
</tr>
<tr>
<td>Arthritis/chronic back pain + cardiac</td>
<td>574</td>
<td>6.3% (5.5%–7.0%)</td>
<td>6.34</td>
<td>3.9% (3.4%–4.4%)</td>
<td>3.5% (3.0%–3.9%)</td>
<td>21.6% (17.7%–25.5%)</td>
<td>72.2% (67.6%–76.8%)</td>
</tr>
<tr>
<td>GORD + psych</td>
<td>520</td>
<td>5.7% (4.9%–6.5%)</td>
<td>5.74</td>
<td>4.5% (3.8%–5.2%)</td>
<td>4.0% (3.4%–4.5%)</td>
<td>24.9% (20.6%–29.1%)</td>
<td>59.3% (54.2%–64.3%)</td>
</tr>
<tr>
<td>Asthma/OAD + vascular</td>
<td>514</td>
<td>5.6% (5.0%–6.3%)</td>
<td>5.69</td>
<td>4.1% (3.6%–4.6%)</td>
<td>3.6% (3.2%–4.1%)</td>
<td>20.0% (15.7%–24.2%)</td>
<td>66.9% (61.9%–71.9%)</td>
</tr>
<tr>
<td>Arthritis/chronic back pain + asthma/OAD</td>
<td>487</td>
<td>5.3% (4.7%–6.0%)</td>
<td>5.38</td>
<td>3.9% (3.3%–4.4%)</td>
<td>3.4% (2.9%–3.8%)</td>
<td>21.1% (17.0%–25.3%)</td>
<td>66.1% (61.1%–71.1%)</td>
</tr>
<tr>
<td>Asthma/OAD + psych</td>
<td>440</td>
<td>4.8% (4.2%–5.4%)</td>
<td>4.86</td>
<td>4.0% (3.4%–4.5%)</td>
<td>3.5% (3.0%–4.0%)</td>
<td>21.8% (17.0%–26.6%)</td>
<td>50.1% (44.4%–55.8%)</td>
</tr>
</tbody>
</table>


* Estimated prevalence among patients in GP waiting room. † Estimated prevalence among patients who visited a GP at least once in a year.

† Estimated prevalence among the Australian population of 19 855 290 (2006 census).

### COMPETING INTERESTS

The funding organisations had no role in the study design, data collection, analysis and interpretation, or the writing and publication of this report.

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### REFERENCES


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