Active life expectancy in people with and without diabetes

Carol Jagger, Elizabeth Goyder, Michael Clarke, Nicolas Brouard and Antony Arthur

Abstract

Background The aim of the study was to investigate the feasibility of monitoring older people’s health by measuring active life expectancy among older people with and without diabetes using routinely collected primary care data.

Methods The study comprised the first five rounds of a routine health assessment of those aged 75 years and over belonging to a large Midlands general practice (list size 32,500). A nurse carried out the health assessments in the participant’s home. Being active was defined as the ability to perform (without difficulty, help or use of aids) at least six of seven activities of daily living (ADLs). Mortality data were collected through the practice register together with regular linkage to information from the Office for National Statistics. Period health expectancies were calculated for those known or found to be diabetic through the health assessments and for non-diabetic individuals.

Results Calculation of active life expectancies (ALE) was based on 2474 persons (212 with and 2262 without diabetes). At all ages, people with diabetes had lower life expectancy and spent fewer years active. The proportion of remaining life spent active was, however, similar for both groups at younger ages, but by age 85 years people with diabetes spent only 32 per cent of remaining life active compared with 42 per cent for those without diabetes.

Conclusion Annual health assessments of the over-75s in primary care together with linkage to mortality data provide a feasible method of monitoring older people’s health, particularly for subgroups at greater risk of disability. At Strategic Health Authority or Primary Care Trust level these methods can monitor health needs, highlight health inequalities and evaluate intervention strategies.

Keywords: aged, activities of daily living, disability, longitudinal data

Introduction

Continuing increases in life expectancy in most countries have concentrated efforts on the relationship between the quality and the quantity of life at older ages. Recent trends within the UK suggest that the years gained have not been years free of disability, although the level of severity appears to have diminished.1–3 There is, therefore, room for improving the health and well-being of older people in England by extending their active life, as identified in Standard Eight of the National Service Framework for older people.4

The establishment of Primary Care Trusts (PCTs) should move attention towards the local provision of effective and efficient health services for a defined population alongside national and regional concerns to improve public health and target health inequalities. Public Health Observatories are also being set up in each English region charged with strengthening the availability and use of health information, so as to monitor population health and needs and to support the reduction of health inequalities. All require good population health indicators and forecasts of future population health and ill-health for geographically defined populations. As the 85 years and over age group is the fastest growing sector of our population and the greatest consumption of health care occurs in the final years of life,5,6 monitoring the health of this section of the population will be of particular importance.

One established method of monitoring the health of older populations is through active life expectancy (ALE), which is based on the ability to perform basic personal care tasks necessary for older people to live independently.7 Methods of calculating health expectancy use either cross-sectional or longitudinal data. They are widely available and their caveats are well documented, in contrast to newer population health indices such as the disability adjusted life expectancy8 (DALE) and the earlier disability adjusted life years9 (DALY), which weight the

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life spent in different health states and therefore tend to discriminate against older people.10

One possible source of data for the calculation of ALE is the much underrated annual assessment of those aged 75 years and over in primary care, which was initiated as part of the general practitioners’ contract in 1990.11 However, routinely collected data are often of poorer quality than purposefully designed longitudinal survey data. There is considerable variability in the way practices organize and deliver their over-75 assessments12 and evidence suggests they are carried out at less frequent intervals than annually.13 Until recently there was no generally available software that could deal with these problems. We aim to illustrate the feasibility of monitoring population health by estimating ALEs for those with and without diabetes, using these routinely collected data and newly developed software14 to take into account missing responses and variability in the intervals between assessments.

Methods

The data come from routine health assessments in one large general practice (16 full-time and 3 part-time doctors, total list size 32 500). The practice is the only one serving the town and surrounding area of Melton Mowbray, Leicestershire. To undertake the health assessments, the practice was divided into 12 zones and letters were sent to all registered patients aged 75 years and over in each zone in turn, to offer them a structured health assessment by a nurse in their own home. All community dwelling patients and those living in nursing or residential homes were included regardless of recent contact with their doctor and assessed identically. Further details of the health assessments have already been reported15,16 and this paper uses the first five assessments covering the period October 1990 to February 1999.

Three states were used in the calculation of active life expectancy: active, not active and dead. Death information was obtained by flagging all patients offered at least one assessment with the Office for National Statistics. Active was defined as a subject report of ability to perform (without difficulty, aids or help) at least six of seven activities of daily living (ADLs): mobility around the home, getting to and from the toilet, transfer from chair, transfer from bed, feeding, dressing and bathing. For each activity, the nurse asked first whether the subject had difficulty in doing the activity and second whether the subject used any help or aids, with examples of aids for each activity being given. A small number of individuals (n = 4) stated that they were independent without difficulty but felt a need for help and these were recoded to independent with difficulty.

Diabetes was ascertained by self-report of the patient to the nurse, who had access to the patient’s medical notes during the visit. Newly detected cases of diabetes where patients tested positive for glycosuria using urine test strips during the health assessment were considered diabetic for the purposes of analysis. Diabetic status at first assessment was used in the analysis.

Comparisons between those included in the analysis with those excluded were on the basis of other health data from the assessments: self-rated health using a three-point scale of good, fair, poor (the fair and poor categories being combined for analysis); cognitive impairment assessed by the 12-item Information/Orientation (I/O) sub-test of the CAPE assessment;17 difficulty with vision and hearing (each coded for analysis as no impairment, impairment); self-reported urinary incontinence; systolic and diastolic blood pressure measured by the nurse, with hypertension defined as systolic blood pressure ≥160 or diastolic blood pressure ≥90.18

Statistical methods

The IMaCH software (version 0.64)14 was used to calculate active life expectancy from the five rounds of health assessments, for those with and without diabetes at first health assessment. For a given age, the transition probabilities between the health states (active and not active) and from the health states to death were assumed to satisfy a multinomial logistic model. Using the embedded Markov process, transitions between health states from rounds n months apart were represented as the product of 1 month transitions to approximate as far as possible the underlying continuous time process. Missing assessments and variable intervals between assessments can be accommodated and the software produces health expectancies and standard errors. Active life expectancies for ages below 75 years (the minimum age observed in our data) were found from extrapolation of the logistic model of transition probabilities on age. The same theoretical basis has been used for health expectancy calculations from longitudinal data by other researchers19,20 although, unlike IMaCH, the software is not generally available.

Results

During the period covered by the five health assessments, 3630 people were drawn from the practice register as eligible for at least one assessment. A total of 624 persons were never assessed (through refusal, hospitalization or having died before the nurse visit). Of the 3006 people who were assessed at least once, 513 had only one assessment and were still surviving, thus not contributing to the calculation of active life expectancy. The majority of these 513 (388) had had a first assessment at the fifth round. A further 19 patients had no information on diabetic status. Comparison of the exclusions (n = 532) with those analysed (n = 2474) showed that those excluded were younger, had lower levels of hypertension and higher levels of hearing impairment, but were broadly similar on all other morbidity measures (Table 1).

The probability of death from an active state over a 2 year period shows the greatest differential between those with and those without diabetes (Figure). Transitions to death from the inactive state are higher for both groups but again more likely
for those with diabetes. The likelihood of recovery of health (from inactive to active) is smaller for those with diabetes although the differential diminishes with age.

Total life expectancy and active life expectancy together with the standard errors and the proportion of remaining life spent active are shown for the total population (n = 2474) and for those with diabetes (n = 212) and those without (n = 2262) in Table 2. Total life expectancy at all ages was considerably reduced for those with diabetes, with a difference of 3 years at age 75 years. Those with diabetes also spent fewer absolute years active, with a difference of over 2 years at age 75 years.

However, differentials between the proportion of remaining life spent active were small until age 80 years, but by age 85 years subjects with diabetes spent 10 per cent less of their remaining life active compared with those without diabetes.

To assess whether differences in active life expectancies between those with and without diabetes were a result of other differences in morbidity, health and demographic measures at first assessment were compared between the two groups. Those without diabetes had a greater proportion of women (64.7 per cent versus 54.3 per cent) and lower proportions with vision impairment (16.1 per cent versus 23.6 per cent), hypertension (46.6 per cent versus 52.2 per cent) and fair or poor self-rated health (27.9 per cent versus 34.3 per cent). Levels of cognitive impairment, incontinence and hearing impairment were, however, similar between the two groups.

**Discussion**

Active life expectancies have been calculated in the United Kingdom for some years, using cross-sectional data from the General Household Survey. However, the omission of those living in institutional care and the effect of policy changes such as the National Health Service and Community Care Act make trends difficult to interpret. Additionally, cross-sectional data, although more readily available, depend on the past history of cohorts and therefore a truer picture of the way the health of a population is evolving is given by the current rates at which people become ill or recover, requiring longitudinal data.

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**Table 1** Baseline demographic and health data for those included in the analysis of active life expectancy and those excluded (percentages)

<table>
<thead>
<tr>
<th>Excluded from analysis (n = 532)</th>
<th>Included in analysis (n = 2472)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>60.5</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
</tr>
<tr>
<td>75–79 years</td>
<td>80.3</td>
</tr>
<tr>
<td>80–84 years</td>
<td>12.0</td>
</tr>
<tr>
<td>85+ years</td>
<td>7.7</td>
</tr>
<tr>
<td>Hearing impairment</td>
<td>24.0</td>
</tr>
<tr>
<td>Vision impairment</td>
<td>17.0</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td>10.4</td>
</tr>
<tr>
<td>Fair or poor self-rated health</td>
<td>23.8</td>
</tr>
<tr>
<td>Incontinent of urine</td>
<td>16.3</td>
</tr>
</tbody>
</table>

**Figure** Two year transition probabilities: active to inactive, inactive to active, active to death and inactive to death for those with and without diabetes.
Our paper has demonstrated the utility of the over-75 health assessment in general practice for calculating active life expectancy at older ages and therefore for monitoring the interplay between mortality and morbidity for particular at-risk subgroups, such as those with diabetes. The prevalence of diabetes in our cohort was 9.4 per cent, comparable with although slightly higher than the 8.7 per cent in men and 6.6 per cent in women aged 75 years and over in the Health Survey for England.22 We have, however, included newly identified cases at the first assessment, which accounted for 21 per cent of all cases, although we do not have information from medical notes after the health assessment was conducted to confirm diagnosis.

At present, there are a number of limitations to using over-75 health assessments for monitoring population health. As demonstrated here, at the level of a single general practice the data are likely to be too sparse to allow analysis by sex as well as by subgroup. In our dataset, those without diabetes were more likely to be female (64.7 per cent versus 54.3 per cent), although as women have higher rates of disability this suggests that our differences in active life expectancy are conservative. In addition, those with diabetes had higher levels of vision impairment, hypertension and fair or poor self-rated health, although these may be a result of diabetes rather than being true confounders. Provided the event of interest is not too rare, analysis at the level of PCT (population range 100,000–300,000) is feasible, although only if planned at that level, as national studies are not of sufficient size for disaggregating at PCT level.23 More critical than the size of the populations is whether agreement can be reached on measuring instruments; when the over-75 health check was proposed, only key areas of assessment were stipulated rather than the best instruments to use. Despite these issues, ‘primary care groups’ could provide ideal community laboratories in which to conduct cohort studies and therefore to more robustly test causal hypotheses.24

 Routinely collected data have a number of advantages for monitoring population health over more specially designed longitudinal or panel studies. Not the least of these are the costs in mounting the latter, particularly of a very elderly population who require shorter intervals between assessment to ensure transitions between health and ill-health are not missed through death. Data such as the over-75 health checks also automatically refresh the population at the younger ages as patients become eligible as they reach 75; a panel study, on the other hand, would have to resample those at younger ages at each wave to maintain the precision on the transition rates at younger ages. If the population is large enough, such routine data, like panel studies, have the ability to differentiate between period and cohort effects. Cohort effects may be particularly influential on the health of older people over time, as considerable differences in level of education have occurred for successive birth cohorts.

Indicators such as health expectancy are ideal tools to monitor health needs and highlight health inequalities because, being independent of the size of populations and of their age structure, they allow direct comparison among different groups (e.g. sex, socio-economic groups), and, in particular in the context of Public Health Observatories and Strategic Health Authorities, regions. Differences in health expectancies between socio-economic groups,25 health authorities23 and local authorities3 have already been demonstrated, although all these estimates have been based on national cross-sectional morbidity data. Longitudinal data give a much richer picture and could explore whether inequalities are due to differences in the incidence of disease or, through consequences such as mortality or disability, in the access to and treatment of disease.

Diabetes is an important condition for health monitoring. The prevalence of diabetes continues to rise in England.26 This will have a major impact on both health service use and population health, as people with diabetes use more health care26 and still have a reduced life expectancy, mainly as a result of cardiovascular complications.27 Although the increased mortality in diabetes is well documented, the impact of diabetes on disability is less so. We have shown that people with diabetes not only have a reduced life expectancy but spend fewer years able to perform basic personal care functions. Moreover, as they age, people with diabetes spend an increasing proportion of their remaining lives with disability, highlighting the need to regularly monitor elderly people with diabetes. Better treatment through improved glycaemic control and early detection and management of risk factors and complications have been shown to reduce morbidity and mortality in trial subjects.26,28 Monitoring of health outcomes is needed to evaluate the effectiveness of

### Table 2 Total life expectancy (TLE), active life expectancy (ALE) and proportion of total life expectancy spent active for those with and without diabetes and the total population

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Total n = 2474</th>
<th>Subjects without diagnosed diabetes n = 2262</th>
<th>Subjects with diabetes n = 212</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TLE (SE)</td>
<td>ALE (SE)</td>
<td>ALE/TLE (%)</td>
</tr>
<tr>
<td>65</td>
<td>16.08 (0.63)</td>
<td>13.38 (0.53)</td>
<td>83.2</td>
</tr>
<tr>
<td>70</td>
<td>12.86 (0.37)</td>
<td>9.97 (0.33)</td>
<td>77.5</td>
</tr>
<tr>
<td>75</td>
<td>10.00 (0.21)</td>
<td>6.90 (0.21)</td>
<td>69.0</td>
</tr>
<tr>
<td>80</td>
<td>7.57 (0.17)</td>
<td>4.31 (0.14)</td>
<td>56.9</td>
</tr>
<tr>
<td>85</td>
<td>5.65 (0.17)</td>
<td>2.33 (0.12)</td>
<td>41.2</td>
</tr>
</tbody>
</table>
both prevention and treatment strategies to reduce the impact of diabetes in local populations.

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Contributors

C.J. and N.B. performed the analyses. C.J. drafted the paper. C.J., M.C. and A.A. were involved in the design of the health assessments. All authors contributed to development of the key ideas of the paper and approved the final manuscript. C.J. will act as guarantor.

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