

## ORIGINAL ARTICLE

# Making use of mortality data to improve quality and safety in general practice: a review of current approaches

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**Objective:** To review studies of the use of mortality data in quality and safety improvement in general practice.

**Design:** Narrative review.

**Methods:** Search of Medline, Embase and CINAHL for articles reporting mortality monitoring or mortality reviews in general practice. The included articles were reported in English and of any study design, excluding case reports and comment pieces. Studies of palliative care and bereavement, and of primary care programmes in developing countries, were excluded.

**Results:** 229 articles were identified in the searches, 65 were identified as potentially relevant and 53 were included in the review. The studies addressed the impact of primary care provision on mortality rates, methods of monitoring mortality, and the role of audit and death registers in quality and safety improvement. General practitioners were interested in using mortality data but reported difficulties in obtaining complete information. There were no experimental studies of the impact of the use of mortality data, and little evidence of long-term systematic initiatives to use mortality data in quality and safety improvement in general practice.

**Conclusions:** Mortality data are not used systematically in general practice although general practitioners appear interested in the potential of this information in improving quality and safety. Improved systems to provide complete data are needed and experimental studies required to determine the effectiveness of use of the data to improve general practice care.

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Data about mortality in general practice populations have not been routinely used to monitor performance or plan practice policies and services (in this paper we use the term general practice to include family practice, and general practitioners to include family practitioners and family physicians). The data may not have been readily available to general practitioners, or may have been regarded as difficult to interpret in the context of small populations. However, in the UK increased attention is being paid to mortality monitoring following the discovery that the doctor Harold Shipman unlawfully killed around 236 of his general practice patients.<sup>1–2</sup> The inquiry set up to investigate what happened recommended the development of a national system for monitoring general practice mortality rates, that practices should keep death registers, and that health authorities should undertake reviews of samples of records of deceased patients.<sup>3</sup>

Despite the interest in monitoring mortality in general practice, concerns have been raised about the practicality of mortality monitoring at the level of the practice<sup>4</sup> and the government has initiated a review of this issue along with other of the inquiry's recommendations. Thus, the role of monitoring in informing practice policies and promoting quality improvement remains unclear. Monitoring may have potential to support improvements in quality and safety within practices, but whether and how this potential may be realised is uncertain. Therefore, we undertook a review to investigate the potential of mortality monitoring in general practice. The specific aims of the review were to identify what methods have been used to review mortality data in general practice and how the data have been used.

## METHODS

We searched MEDLINE (1966 to end 2005), EMBASE (1980 to end 2005) and CINAHL (1982 to end 2005) for papers reporting studies of mortality monitoring or mortality reviews in general practice. Search terms included relevant subject headings

supplemented by appropriate free-text terms for general practice and primary health care and death and mortality. Reference lists of papers were scanned to identify additional papers (copies of the search strategies are available on request from the authors).

We included papers published in English reporting experimental and non-experimental studies of methods of compiling and maintaining information on deaths in general practice, reviews of deaths for quality improvement, health service provision and targeting of health initiatives, and studies of monitoring of mortality rates to detect illegal or aberrant behaviour by general practitioners. We defined general practice populations as people with primary healthcare services available to them from general or family practice or other primary healthcare providers, whether or not they were currently using these services. People in these groups may be identified from population registers or registers of patients maintained by primary care services, depending on the systems adopted in different countries. Studies of patients identified because they had used other services such as hospitals were excluded. We excluded case reports, letters and comment pieces. We also excluded studies of the care and experiences of terminally ill patients, palliative care, euthanasia, bereavement counselling, studies of disease epidemiology, and evaluations of primary care programmes in developing countries. Abstracts of articles identified in the searches were reviewed, potentially relevant articles being obtained. In view of the types of studies included in the review, a quantitative analysis was not appropriate, and therefore we summarised articles in a table and present a narrative review.

## RESULTS

We identified 229 articles in the searches, of which 65 were assessed as potentially relevant. Of these, 53 were eventually included (see table 1), 17 of which involved studies to assess

**Table 1** Summary information on the included studies

Author	Country	Topic	Setting	Method	Results and conclusions
Impact of primary care on mortality rates Campbell 2003 <sup>13</sup>	US	Cervical cancer incidence and mortality	67 counties in Florida, 1993–5	Investigation of associations using available databases	More family physicians per 10 000 population was associated with a lower cervical cancer incidence and mortality
Franks 1998 <sup>17</sup>	US	Cost and mortality	Data from the US 1987 National Medical Expenditure Survey	Investigation of associations between having a primary care physician and mortality and costs	Having a primary care physician was associated with lower mortality and costs than having a specialist as personal physician
Gulliford 2004 <sup>20</sup>	UK	Population mortality	99 health authorities in England in 1999	Linear regression analysis	Higher supply of GPs was not associated with decreased mortality
Guilliford 2002 <sup>19</sup>	UK	Population health indicators	99 English health authorities in England in 1999	Linear regression analysis	There was only weak evidence for an association between GP supply and mortality indicators
Harms 1997 <sup>21</sup>	Netherlands	Hypertension	Four practices with systematic management and 8 with usual care	Matched cohort study	There was no measurable difference in mortality
Pathman 2005 <sup>18</sup>	US	Improvements in population mortality rates	Rural counties with physician shortages	Comparison of additional support on mortality	The support scheme was not associated with improvements in mortality
Macinko 2003 <sup>16</sup>	US	Population health outcomes including mortality	18 developed countries	Investigation of associations between features of primary care and mortality	Strong primary care systems were associated with lower all-cause mortality
Shi, 1992 <sup>5</sup>	US	Population mortality	All US states	Investigation of associations between supply of primary care physicians and mortality	Primary care physician supply was associated with reduced mortality rates
Shi 1994 <sup>6</sup>	US	Population all cause and disease specific mortality	All US states	Multivariate analysis	Primary care physicians supply was associated with lower overall mortality
Shi 1999 <sup>7</sup>	US	Mortality and income inequality	US states	Adjusted multiple regression	Primary care and income inequality were both associated with mortality
Shi 2001 <sup>15</sup>	US	Mortality and ethnicity	273 US Metropolitan areas in 1990	Linear regression	Primary care supply was associated with lower mortality but not when the black population was analysed separately
Shi 2003 <sup>10</sup>	US	Stroke mortality	50 US states (1985–95)	A time series cross-sectional analysis	Access to primary care was associated with lower stroke mortality
Shi 2003 <sup>8</sup>	US	Income inequality and mortality	50 US states	Cross-sectional multivariate analyses	Mortality rates declined as the supply of primary care physicians increased
Shi 2005 <sup>11</sup>	US	Mortality patterns in rural and urban areas	All US counties, 1990	Cross sectional analysis was	In non-urban areas, primary care supply was associated with lower mortality
Shi 2005 <sup>12</sup>	US	Population mortality	3081 US counties, 1990	Multivariate regression	Supply of primary physicians was associated with lower mortality
Shi 2005 <sup>14</sup>	US	Population mortality	50 US states	Multivariate analyses	Primary care provision supply associated with lower mortality, and exerted a greater impact on black than white mortality
Shi 2004 <sup>9</sup>	US	Infant mortality and low birth weight	50 US states	Regression models using data from 1985–95	Primary care supply was associated with lower infant mortality and reduction in low birth weight
Monitoring mortality Aylin 2003 <sup>24</sup>	UK	Feasibility of a system to monitor mortality rates in primary care	Five English health authorities, 1993–9	Retrospective analysis	The mortality charts are potentially useful for monitoring, but improved data are required
Billeff 2005 <sup>28</sup>	UK	Higher than expected patient mortality in general practice	One primary care trust, 5 GPs	Analysis of mortality data and record review	High mortality was associated with nursing homes. Record review did not disclose poor practice
Frankel 2000 <sup>26</sup>	UK	Mortality as a performance measure for small populations	Practices in England in 1998	Estimation of the number of deaths for practice populations	There would be a large number of false positives (approximately 45 per year)
Mohammed 2001 <sup>25</sup>	UK	Utility of control charts	Primary and secondary care	Control charts produced from various data sources	Control charts could have potential in monitoring to detect excess mortality in general practice
Mohammed 2004 <sup>29</sup>	UK	Reasons for high mortality rates in general practice	Two GPs	Analysis of patient data using cumulative sum plots	Excess mortality was explained by the proportion of patients in nursing homes
Mohammed 2005 <sup>23</sup>	UK	Monitoring mortality rates in general practice	A health district in Northern Ireland with 114 general practices	Control charts	Practices supported the provision of data but were anxious about public disclosure
Nimmo 2003 <sup>22</sup>	UK	Providing general practices with mortality data	Grampian, Scotland 1991–9	Provision of expected and observed mortality rates	Three practices were found to have higher mortality than expected and two lower, thought due to nursing homes
Pinder 2002 <sup>27</sup>	UK	Feasibility of monitoring	A single health authority in England with 350 GPs	Standardised mortality ratios calculated for each GP	Three GPs were identified as having statistically high mortality rates in both years

Table 1 Continued

Author	Country	Topic	Setting	Method	Results and conclusions
Audit and registers Beaumont 2003 <sup>35</sup>	UK	A general practice death register	One inner London general practice	Descriptive	578 deaths were recorded during the study, and age standardised death rates reduced from 35.6 to 27.1 over the study period
Berlin 1993 <sup>32</sup>	UK	Feasibility of providing GPs with a death register	A single health authority	Weekly list of patient deaths sent to GPs	It is possible to create a death register for GPs
Berlin 1992 <sup>52</sup>	UK	Critical incident technique	One general practice	Descriptive	Communication failures were the most common factor in incidents giving rise to concern
Black 1984 <sup>34</sup>	UK	A review of deaths in one general practice	A single general practice, 1964–82	Descriptive	41% were due to cardiovascular causes and 35% to cancers
Bucknall 1999 <sup>55</sup>	UK	A confidential review of asthma deaths	Scotland, 1994–6	Assessment of the cause of 235 deaths	Management of the final attack was satisfactory in 71% of cases
Caldwell 1971 <sup>33</sup>	UK	Report on 100 consecutive deaths	A single general practice, 1969–70	Data were recorded about the place, cause and manner of deaths	84% of deaths occurred in hospital; 32% of deaths were due to cardiovascular causes and 39% to respiratory causes
Hermoni 1992 <sup>44</sup>	Israel	Audit of deaths to identify avoidable causes	One village in Israel, 1974–89	Record review	21% of deaths were associated with a total of 44 factors considered avoidable
Harrison 2005 <sup>53</sup>	UK	Confidential enquiry into asthma deaths	A single region of the UK, 2001–3	57 deaths investigated through record review and discussion with the GP	Medical care was judged appropriate in 33% of cases
Hart 1987 <sup>49</sup>	UK	Audit of 500 consecutive deaths in a general practice	A single general practice, 1964–85	Audit of 500 deaths	45% of all deaths were thought to have avoidable factors, of which 59% were attributed to patients, 20% to GPs, 4% to the hospital, and 17% others
Hart 1991 <sup>50</sup>	UK	Identification and management of cardiovascular risk factors	A single general practice	Retrospective review of records and calculation of mortality rates	Mortality was lower than in a similar local population that did not receive the same intensive risk factor management
Holland 2002 <sup>55</sup>	UK	Confidential inquiry into asthma deaths	One health region	218 GPs completed the questionnaire	53% of those who had read the reports from the inquiry reported altering their clinical management
Holden 1996 <sup>43</sup>	UK	An audit of deaths	20 GPs	Descriptive (511 deaths over a 6 month period)	Participants in the audit reported lessons on patient management, preventive care and other issues
Holden 1996 <sup>45</sup>	UK	Audit of deaths	Four general practices	Descriptive	Cigarette smoking was the most commonly identified potentially preventable factor
Holden 1998 <sup>51</sup>	UK	Potentially preventable factors	Four general practices	Data collection forms were completed after a death occurred (1263 deaths)	5% of factors were attributed to the general practice team and included: delayed referral, failure to prescribe aspirin, and failures in diagnosis and treatment
Holden 2001 <sup>40</sup>	UK	Audit of place of death	One general practice, 1992–2000	Prospective data collection (714 patients)	73% of patients had been under the care of the GP at time of death
Khunti 1996 <sup>30</sup>	UK	Death registers	A single general practice	Descriptive	A record of the cause of death could be ascertained for 99% of cases
Khunti, 2000 <sup>47</sup>	UK	Referrals for autopsy	A single general practice	An audit of 651 deaths in a four year period	76 (11.7%) were investigated by autopsy. 75 had been requested by a coroner and 1 by a hospital doctor, none being requested by the GP
Khunti 2001 <sup>31</sup>	UK	Deaths in a single practice	833 deaths 1994–9	Report of an audit	27% of deaths were due to cardiovascular causes, 28% respiratory, and 16% cancers
King 2005 <sup>57</sup>	UK	Critical incident reviews of suicides	10 general practices	12 deaths were reviewed	Changes arising from the reviews included improved procedures and communication
Lakasing 2005 <sup>39</sup>	UK	Deaths in a single practice	A single general practice	Use of a death register and record review	Comparison with death rates in the district indicated a higher rate of deaths in the practice than expected
Meara 1990 <sup>46</sup>	Ireland	Deaths in a practice	A single practice	Review of records	99 deaths occurred, 45 from cardiovascular diseases. The average age at death of smokers was 67.8 years compared with 77.6 for non-smokers
Oppewal 2004 <sup>41</sup>	Netherlands	Deaths in general practice	17 general practices	The GP recorded information about each death	The maintenance of a death register in general practice was recommended, and a format proposed
Payne 1993 <sup>56</sup>	UK	Confidential inquiry into deaths from cerebrovascular and hypertensive diseases under age 75	Health authority with a population of 250 000	Clinician interviews and/or record review	29% of all cases and 44% with definite hypertension had avoidable factors that may have contributed to death
Riain 2001 <sup>42</sup>	Ireland	Deaths of general practice patients	103 GPs	Prospective data collection	39% of 297 deaths occurred at home, and cardiovascular disease and cancers were the most common causes

**Table 1** Continued

Author	Country	Topic	Setting	Method	Results and conclusions
Rose 1984 <sup>48</sup>	Australia	GPs involvement in death and dying	One general practice, 1976–81	Retrospective collection of data from records and certificates	The most important determinant of the GP's attendance was place of death
Stacy 1998 <sup>37</sup>	UK	A system to produce a death register for GPs	205 GPs	Survey of GPs' views about the service	Respondents found the information useful for communication with the primary healthcare team, bereavement follow-up, administration and audit
Wagstaff 1994 <sup>36</sup>	UK	Sources of information on patient deaths	305 GPs	Questionnaire survey	The most common sources for information were hospital discharge summaries (54%) and patients' relatives (46%)
Webb 2002 <sup>38</sup>	UK	The value of practice-level mortality data for health needs assessments	Two large practices	Cause-specific standardised mortality rates and years of life lost were calculated	The study practice had almost four times as many years of life lost associated with alcoholism, and three times as many associated with substance abuse when compared with the reference practice

the impact of provision primary care services on mortality, 8 studies and reports of systems to monitor patient mortality rates in general practice, and 28 studies or reports of general practice registers, audits and confidential inquiries in single practices or groups of practices.

Most of the studies of the impact of primary care provision used regression modelling of data extracted from existing datasets, and had been undertaken in the US. The US studies indicated an association between the supply of primary care physicians and lower mortality<sup>5, 6</sup> even when socioeconomic status and ethnicity were accounted for.<sup>7, 8</sup> The finding held for infant mortality,<sup>9</sup> stroke mortality,<sup>10</sup> all-cause, heart disease and cancer mortality,<sup>11, 12</sup> cervical cancer rates and mortality,<sup>13</sup> and the magnitude of the effect varied between black and white ethnic groups.<sup>14, 15</sup> There was also an association between level of development of primary care and all-cause mortality in a study involving 18 wealthy countries.<sup>16</sup> In a comparison of primary care physicians and specialists in the role of personal doctor, patients of family physicians experienced lower mortality rates, after adjusting for demographic and disease status.<sup>17</sup> However, in another US study, no relationship was found between falls in mortality rates and the provision of additional primary care services in physician shortage areas.<sup>18</sup>

The relationship between primary care provision and population mortality was not found in two UK studies. In a study of standardised mortality ratios and infant mortality in 99 English health authorities, the relation between GP supply and mortality failed to reach statistical significance after adjusting for deprivation, ethnicity, social class and long-term limiting illness.<sup>19</sup> In a subsequent analysis, lower mortality was found to be weakly associated with increasing practice size.<sup>20</sup> In a study of the impact of systematic management of hypertension in comparison with usual care over a 15 year period, although there were fewer cases of left ventricular hypertrophy and angina in the systematic treatment group, there was no difference in mortality.<sup>21</sup>

The second group of studies related to monitoring systems to detect excess mortality in general practice patient populations. All of these were from the UK and concerned with creating a monitoring system. In one Scottish health district, observed and expected numbers of deaths for each practice were compared, the expected being age, sex and deprivation adjusted estimates based on the district population.<sup>22</sup> Practices were sent reports that showed how they compared with other practices and whether their rates were higher than expected. A high number of patients in nursing homes was suggested as an explanation for excess mortality. In a scheme involving 114 general practices in Northern Ireland, cross-sectional control charts were used and practices provided with feedback and

workshops.<sup>23</sup> Care for patients in nursing homes as well as poor data quality were proposed as the reason for most cases of excess mortality in a study evaluating the feasibility of monitoring using cumulative sum charts.<sup>24</sup> More detailed adjustment for case mix was also recommended, although the charts were judged to be potentially useful for monitoring deaths in primary care. Control charts were evaluated as a monitoring tool in another study,<sup>25</sup> and others have highlighted the inevitability of detecting practices with excess mortality for innocent reasons<sup>26, 27</sup>—false positives—and the time-consuming nature of investigations to determine the cause of excessive mortality.<sup>28</sup> In a report of a process for investigating practices with excess mortality, cumulative sum plots were used to highlight the association between mortality and nursing homes.<sup>29</sup> However, the studies of monitoring systems were all concerned with exploring methods and feasibility rather than the systematic evaluation of the impact of monitoring. There were no experimental studies.

The articles dealing with registers and audit were all concerned with the potential of reviews of deaths to contribute directly to improvements in quality or safety in practices. They included descriptions of methods for creating death registers either in individual general practices<sup>30, 31</sup> or for groups of practices.<sup>32</sup> In studies published more than 20 years ago, practices had simply reported the numbers and causes of deaths among their patients.<sup>33, 34</sup> Several of the more recent studies highlighted the difficulties practices had in obtaining timely and accurate data.<sup>35, 36</sup> Death registers were reported as facilitating communication in primary care teams, bereavement follow-up and practice audit.<sup>37</sup> Information obtained from collection of information about deaths had been used to help practices understand the healthcare needs of their practice populations and enable comparisons between practices.<sup>38</sup> One team reported use of the information to investigate nursing involvement in terminal care at home,<sup>39</sup> three others to investigate place of death,<sup>40–42</sup> three more potentially preventable deaths,<sup>43–45</sup> and others age at death and smoking<sup>46</sup> and referrals for autopsy.<sup>47</sup> In another practice, information was sought about the involvement of the general practitioner in the care of patients before death.<sup>48</sup> In the only study to attempt to directly relate clinical practice to mortality, the collection of information about deaths and clinical performance over 25 years enabled the practice to reflect on the impact of its activities in comparison with other practices.<sup>49, 50</sup> Information on the numbers and causes of deaths had also been used in multipractice audit to promote reflection on potentially preventable deaths.<sup>51</sup>

Confidential inquiries have been used in specialist settings to identify common failings in clinical practice and monitor the



impact of initiatives to improve care. We identified an example of critical incident reviews undertaken by primary care teams,<sup>52</sup> and also examples of locality schemes involving central data collection and analysis combined with feedback to practices, including programmes to investigate deaths due to asthma, stroke and suicides.<sup>53–57</sup> All the articles dealing with audit and registers involved exploration of methods; there were no experimental studies designed to investigate the impact of audit or inquiries into deaths.

## DISCUSSION

We have undertaken a review of studies of use of mortality data in quality improvement activities in general practice, and found evidence of increasing interest in such activity. Two decades ago interest was limited and restricted to descriptions of numbers and causes of deaths, but in the last 10 years exploration has begun of the role of registers, monitoring, audit and critical incident review.

Mortality data were used in three ways. In the first, involving principally US studies, interest centred on the provision of evidence that increased primary care physician supply is associated with lower mortality. The findings point to an association in the US, but it would be premature to accept that the relationship is causative because it could be explained by unknown characteristics of either primary care physicians or localities that lead to the concentration of primary care physicians in areas with low population mortality. The association was also identified in an international comparison, but variation in health system characteristics argue for caution in drawing firm conclusions. Evidence is required from experimental or quasi-experimental studies such as time series to confirm whether increasing the provision of primary care services in developed countries does reduce population mortality rates.

The second group of studies were concerned with the identification of practitioners and practices with higher than expected patient mortality rates. These studies were all from the UK and prompted by the Shipman case mentioned earlier. The findings indicate that improved data quality is required, and that the investigation of practices that signal with high mortality rates will often identify innocent explanations. The potential of monitoring to inform quality and safety initiatives has not been investigated in these studies, but the potential is suggested by the third group of studies involving the development of registers and conduct of audit and incident reviews. These indicated that practices had difficulty in obtaining complete information about deaths and found the routine provision of this information helpful in supporting bereaved relatives and facilitating practice-based educational discussions. Practitioners appeared interested in the data but reported difficulties in obtaining complete information and data that enabled them to compare mortality from their own practice with similar practices. Some practices had also undertaken audits to identify potentially preventable causes of deaths, and others had taken part in either practice or locality based critical incident reviews. Critical incident reviews are increasingly common in the UK, and the analysis of reports of reviews of deaths at the locality level could have a role to play in improving patient safety in primary care. There were no experimental studies of these quality improvement methods.

The limitations of the review should be noted. We used a broad search strategy and believe that most relevant articles were identified, but studies of the role of mortality data in audit and quality improvement published in languages other than English were omitted. There may have been progress in some countries which we have not been able to report. The studies were undertaken in a limited number of countries, and the

findings may not be applicable in countries with different healthcare systems. Given the heterogeneous nature of the included studies and the absence of experimental studies, we have undertaken a narrative review only. Nevertheless, with this qualification, our findings do indicate that the development of methods to use mortality data to improve the quality and safety of general practice has begun. Further research is now needed to develop systems to provide data routinely to enable primary care professionals to explore associations between the processes and outcomes of care, and to evaluate the potential of monitoring with feedback and mortality reviews to improve patient safety and promote improved clinical policies.

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## ECHO

### Does telephone triage of emergency calls identify patients with acute coronary syndrome?



Please visit the Quality and Safety in Health Care website [www.qshc.com] for a link to the full text of this article.

The National Service Framework for Coronary Heart Disease requires identification of patients with an acute coronary syndrome (ACS) to enable them to receive pre-hospital thrombolysis. The Advanced Medical Priority Despatch System (AMPDS) with Department of Health (DoH) call prioritisation is the common triage tool for UK emergency calls.

A survey to examine whether the triage tool had allocated appropriate emergency response to patients with ACS analysed all emergency calls to Hampshire Ambulance Service NHS Trust from the Southampton area from January to August 2004. Of the 42 657 emergency calls, 263 patients were subsequently diagnosed in hospital as having an ACS. Of the 263 with ACS, 76 presented without chest pain. In total, 87% of patients with confirmed ACS were classified as requiring a category A, 8 minute response by AMPDS with DoH call prioritisation. The remainder were allocated to a category B, 19 minute response. None of the patients allocated to a category B response presented with chest pain as a chief complaint.

Sensitivity of AMPDS for detecting ACS was 71.1% and specificity 92.5%. The study concluded that only one of approximately every 18 patients with chest pain has an ACS. AMPDS with DoH call prioritisation is not a tool designed for clinical diagnosis and its extension into this field does not enable accurate identification of patients with ACS.

Further work is required to identify the sensitivity and specificity of symptoms reported by patients with ACS if the ability of current triage pathways to identify these patients is to be improved.

▲ Deakin CD, *et al.* *Emerg Med J* 2006;**23**:232–5.