Overdiagnosis in publicly organised mammography screening programmes: systematic review of incidence trends

Karsten Juhl Jørgensen, Peter C Gøtzsche

EDITORIAL by Welch

The Nordic Cochrane Centre, Rigshospitalet, Dept 3343, Blegdamsvej 9, DK-2100 Copenhagen, Denmark

Correspondence to: K J Jørgensen kj@cochrane.dk

Cite this as: *BMJ* 2009;339:b2587
doi: 10.1136/bmj.b2587

ABSTRACT

Objective To estimate the extent of overdiagnosis (the detection of cancers that will not cause death or symptoms) in publicly organised screening programmes.

Design Systematic review of published trends in incidence of breast cancer before and after the introduction of mammography screening.

Data sources PubMed (April 2007), reference lists, and authors.

Review methods One author extracted data on incidence of breast cancer (including carcinoma in situ), population size, screening uptake, time periods, and age groups, which were checked independently by the other author. Linear regression was used to estimate trends in incidence before and after the introduction of screening and in older, previously screened women. Meta-analysis was used to estimate the extent of overdiagnosis.

Results Incidence data covering at least seven years before screening and seven years after screening had been fully implemented, and including both screened and non-screened age groups, were available from the United Kingdom; Manitoba, Canada; New South Wales, Australia; Sweden; and parts of Norway. The implementation phase with its prevalence peak was excluded and adjustment made for changing background incidence and compensatory drops in incidence among older, previously screened women. Overdiagnosis was estimated at 52% (95% confidence interval 46% to 58%). Data from three countries showed a drop in incidence as the women exceeded the age limit for screening, but the reduction was small and the estimate of overdiagnosis was compensated for in this review.

Conclusions The increase in incidence of breast cancer was closely related to the introduction of screening and little of this increase was compensated for by a drop in incidence of breast cancer in previously screened women. One in three breast cancers detected in a population offered organised screening is overdiagnosed.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Screening for cancer detects inconsequential cancers and leads to overdiagnosis and overtreatment

A Cochrane review of the randomised trials of mammography screening documented 30% overdiagnosis

Overdiagnosis in publicly organised mammography screening programmes has not been evaluated systematically

WHAT THIS STUDY ADDS

Overdiagnosis of breast cancers in a population offered organised mammography screening was 52%

This extent of overdiagnosis equates to one in three breast cancers being overdiagnosed

This article is an abridged version of a paper that was published on bmj.com. Cite this article as: *BMJ* 2009;339:b2587

INTRODUCTION

Although screening for cancer leads to earlier detection of lethal disease it also detects cancers that will not cause death or symptoms, called overdiagnosis.[1] Autopsy studies found that 37% of women aged 40-54 who died from causes other than breast cancer had invasive or non-invasive cancer.[2 3]

Overdiagnosis can be measured in a randomised trial with lifelong follow-up if people are assigned to a screening or control group for as long as screening would be offered in practice, usually 20 years. Overdiagnosis would be the difference in number of cancers detected during the lifetime of the groups, provided the control or age groups not targeted are not screened. In the absence of overdiagnosis the initial increase in cancers in the screened groups would be fully compensated for by a similar decrease in cancers among older age groups no longer screened, as these cancers would already have been detected. We estimated the extent of overdiagnosis in screening programmes by comparing trends in breast cancer incidence before and after screening.

METHODS

We identified articles through PubMed with data on breast cancer incidence for both screened and older, non-screened age groups for at least seven years before screening and seven years after screening had been fully implemented (see bmj.com). Both authors extracted data independently on population size, screening uptake, length of time before and after the implementation of screening, and incidence of breast cancer for both screened and non-screened age groups. If data on carcinoma in situ were missing, we estimated overdiagnosis with these cases included, assuming that they would contribute 10% of the diagnoses in a population offered screening.[4 5]

The prescreening year was usually the year before implementation of screening. If the levels of invasive breast cancer or carcinoma in situ increased abruptly in the years immediately before the introduction of screening, we excluded these years from estimates of trends before screening.

To compensate for changes in background incidence

in the screened group we carried out a linear regression analysis of the prescreening years and extended this regression line to the last observation year. We used the calculated value for this year to estimate the expected incidence in the absence of screening. We did another linear regression analysis for the screened group but used the observed incidence in that part of the screening period where the programme was fully implemented and past any prevalence peak. The rate ratio between the result for the last observation year determined by linear regression and the expected incidence in that year constituted our estimate of overdiagnosis.

In the age group that exceeded the age for screening, we studied whether the observed increase in the incidence of breast cancer in the screening period was lower than the expected increase, in both cases using linear regression. We considered that the difference between the observed and expected incidence was due to a compensatory drop and we calculated the size of this drop as a rate ratio.

From this rate ratio we calculated the number of breast cancer cases per 100 000 women that corresponded to the drop in the older age groups. Similarly, for the screened groups we calculated the number of extra cases of breast cancer per 100 000 women that corresponded to the increase. We used a correction factor to compensate for the many more women in the younger, screened age group than in the older age group of previously screened women (see bmj.com). We calculated the percentage of breast cancer cases uncompensated for of the total percentage increase in incidence among screened women (see bmj.com). Overdiagnosis was the observed percentage increase in incidence multiplied by the percentage of uncompensated for breast cancers.

We combined the estimates using Comprehensive Meta Analysis version 2.2.046 (random effects model). We used population sizes and age distributions obtained from internet sources[6] or authors.

RESULTS

Overall, 2546 of 2861 identified titles were not relevant (see bmj.com). Of the remaining 315 articles, four were included as core articles and one was added when the search was updated. Data were from the United Kingdom; Manitoba, Canada; New South Wales, Australia; Sweden; and parts of Norway (table).[7-11]

United Kingdom

Screening started in the UK in 1988 for women aged 50-64, with national coverage by 1990, and was expanded to women aged 65-70 in 2002.[12] Data from England and Wales covered 1971-99 in graphs with five year age groups.[7] These data were combined and the prescreening period defined as 1971-84. The period 1993-9 was used to estimate the most recent trend. The increase in incidence of invasive cancer in women aged 50-64 was 41% above the expected rate, interpreted as overdiagnosis as there was no compensatory drop in the older age groups (figure). The incidence in younger age groups (30-49 years) increased by 7% over expected rates and in older age groups (65-74 years) by 1% over expected rates. No data were available for carcinoma in situ. Assuming that 10% of the diagnoses in a population offered screening are for carcinoma in situ,[4 5] overdiagnosis would be 57% (table).

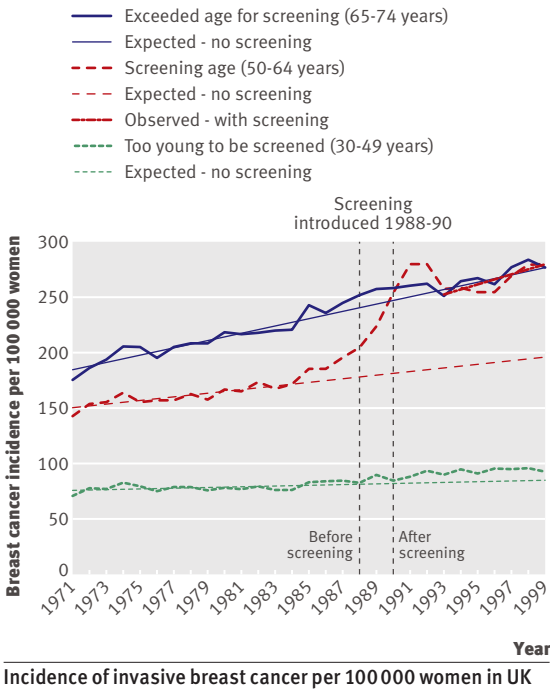
Manitoba, Canada

No national data were found for Canada. In Manitoba, elective screening has been available since the late 1970s, with implementation in 1995 for women aged 50-69.[8] A study compared incidence up to 1999.[8] More recent data were received from the author (see bmj.com). As the incidence of carcinoma in situ started to increase in 1979, the prescreening period was defined as 1970-8. The period 1995-2005 was used to estimate the trend after screening. In the invited group the incidence for invasive cancer was 35% above the expected rate, and when carcinoma in situ was included it was 59% higher. For women aged 70-84 the rate was 15% below expected,

Overview of individual estimates of overdiagnosis for invasive breast cancer, excluding cases of carcinoma in situ except for Manitoba, Canada

Variables	United Kingdom	Manitoba, Canada	New South Wales, Australia	Sweden	Norway (AORH counties)
Period for estimation of prescreening trend	1971-84	1970-8	1972-87	1971-85	1980-94
Selection method for last prescreening year	Opportunistic screening starts	Opportunistic screening starts	Last year before screening	Last year before screening	Last year before screening
Period for estimation of postscreening trend	1993-9	1995-2005	1996-2002	1998-2006	2000-6
Breast cancer incidence in final year of observation (per 100 000 women)					
Screened age group:					
Observed (regression analysis)	278	318/375*	291	328	303
Expected (regression analysis)	197	236/236*	211	242	213
Observed/expected	1.41	1.35/1.59	1.38	1.35	1.42
Exceeded age for screening:					
Observed (regression analysis)	278	401/442*	317	303 (1998)	246
Expected (regression analysis)	277	498/522*	289	338 (1998)	289
Observed/expected	1.01	0.81/0.85	1.10	0.90	0.85
Compensatory drop	No	Yes	No	Yes	Yes
Overdiagnosis (%) with CIS	NA	44	NA	NA	NA
Estimated overdiagnosis (%), assuming 10% CIS	57		53	46	52

AORH=Akershus, Oslo, Rogaland, and Hordaland; NA=not available; CIS=carcinoma in situ.
*Without/with CIS.



Incidence of invasive breast cancer per 100 000 women in UK

and for women aged 35-49 it was 32% below expected.

The 59% increase in women aged 50-69 corresponds to 140 extra breast cancer diagnoses per 100 000 women, and the 15% decline in women aged 70-84 corresponds to 80 fewer breast cancer diagnoses per 100 000 women. In Manitoba, 2.3 times as many women are aged 50-69 than are aged 70-84,[6] and 75% (=(140×2.3-80)/(140×2.3)) of the increase is therefore uncompensated. A conservative estimate of overdiagnosis is therefore 44%.

New South Wales, Australia

The introduction of screening in Australia varied from state to state, and follow-up was short. For New South Wales, where screening was introduced during 1988-95, a graph showed an increase of 55% for invasive cancer over expected rates in women aged 50-69.[9] When the prescreening period was defined as 1972-87 and the period 1996-2002 was used to estimate the trend after screening, this age group showed an increase of 38% over expected rates (see bmj.com). Among women too young to be screened the increase in incidence was constant (see bmj.com). No compensatory drop was observed in women older than 70 years; the incidence was in fact larger than expected. Overdiagnosis including carcinoma in situ was 53% (table).

Sweden

Nationwide screening started in Sweden in 1986, and in 1998 almost all eligible women had been offered screening.[13] For various counties in 1999, eight targeted age ranges were described[13]; most commonly 50-69 years. A study reported an increase in invasive cancer after screening of 69% above expected rates in women aged 50-59 and 27% in women aged 60-69 .[10] After adjustment for lead time, the increases in 2000 were 54% and 21%, respectively.[10] Another report[14] showed similar increases, without a compensatory drop in older age groups, whereas a third report noted a drop in incidence of 12% in the over 75s, and no change for women aged 70-74.[15]

Data up to 2006 were received from one of the authors (see bmj.com).[15] The meta-analysis focused on the age group 50-69, as this is the only group offered screening in all regions. Using the prescreening period as 1971-85 and the period 1998-2006 to estimate the trend after screening, the estimated increase for invasive cancer over expected rates was 35%, or 86 additional breast cancers per 100 000 women in the last observation year. A constant increase in incidence was seen among women too young to be screened (see bmj.com). A drop occurred among women aged 70-84, but incidence approached the expected rate at the end of the observation period (see bmj.com). In the middle of the interval after screening had started in 1998, 10% fewer invasive breast cancers were detected than expected, or 35 fewer cancers per 100 000 women; 88% of the increase was therefore uncompensated. When carcinoma in situ was included overdiagnosis was 46% (table).

Norway

Screening was introduced in Norway in 1995-6 for women aged 50-69 in Akershus, Oslo, Rogaland, and Hordaland counties gaining national coverage in 2004 (see bmj.com).[11] In Akershus, Oslo, Rogaland, and Hordaland, a peak in prevalence for invasive breast cancer was followed by stable levels, above prescreening rates in the screened group.[11 15] Screening is generally offered to women aged 50-69, but about 50% of those aged 70-74 were probably screened,[16] and incidence initially increased by 30% in this group and then decreased to prescreening levels. The incidence in women aged 20-50 and over 74 was stable.

Additional data were received from an author.[15] The age group 50-69 years was considered as screened. The prescreening period was defined as 1980-94 and the period 2000-6 was used to estimate the trend after screening. The increase in invasive breast cancer was estimated as 42% above expected rates, or 90 additional breast cancers per 100 000 women in the last observation year. Among women too young to be screened the increase in incidence was constant. A 15% drop was seen among women aged 70-79, but a similar drop was also observed in the rest of Norway before screening was fully implemented (see bmj.com). The drop was conservatively considered as compensatory. The 15% fewer invasive breast cancers correspond to 43 fewer cancers per 100 000 women. This means that 86% of the increase was uncompensated for, or that overdiagnosis was 37%. When carcinoma in situ was included overdiagnosis was 52% (table).

Meta-analysis

The total overdiagnosis of breast cancer in publicly available mammography screening programmes (including carcinoma in situ) was 52% (95% confidence interval 46% to 58%; see bmj.com). Heterogeneity was moderate (I^2=59%).

DISCUSSION

In populations offered organised screening for breast cancer, overdiagnosis (the detection of cancers that do not cause death or symptoms) was 52%. Carcinoma in situ was included in this estimate[1 17 18]; the overdiagnosis for invasive breast cancer only was 35% (95% confidence interval 29% to 42%).

We took account of the increasing background incidence by comparing the observed rates of breast cancer with the expected rates for the last year of observation, using projected incidence rates from prescreening trends. Our assumption of a constant, linear increase in the background incidence was supported by data from age groups that were too young to be screened (see bmj.com). The incidence of breast cancer only deviated from a linear increase around the time screening was introduced. This was the case in all included areas, despite screening being introduced at different times. It is therefore unlikely that changes in risk factors or cohort effects could explain the non-linear increases in incidence of breast cancer with the introduction of screening.

The trend after implementation of screening was estimated under the assumption that screening leads to a higher incidence that increases at about the same rate as the background incidence did before screening.[19] Our data support this assumption (see bmj.com).

As we have data on long follow-up it is unlikely that the increasing incidence in the screened age group will be compensated for later on. Screening theory implies that a compensatory drop would be apparent shortly after women leave the screening programme and thus after comparatively short follow-up.[19]

Not all women in all areas passed from the screened age group to the previously screened age group within our observation period. In England and Wales, however, practically all women aged 65-74 would have been offered screening previously at the end of our observation period, but we did not find a compensatory drop in incidence of breast cancer (see bmj.com).

Some authors use statistical models to adjust their estimate of overdiagnosis for lead time.[20-24] This approach is problematic as all models carry a high risk of bias.[25]

The recent decline in use of hormone replacement therapy is a possible explanation for the reduction in incidence in the United States from 2002, particularly as such a decline did not occur in the under 50s.[26] We did not, however, see similar declines in the other countries.

In Norway the effect of screening was separated from that of hormone replacement therapy use, as incidence trends in regions with and without screening could be compared at the same calendar times. Although use of hormone replacement therapy is likely to be similar, a noticeable increase occurred in invasive cancer with the introduction of screening (see bmj.com).

Conclusion

We estimated 52% overdiagnosis of breast cancers in a population offered organised mammography screening—that is, one in three breast cancers is overdiagnosed.

We thank Alain Demers (Department of Epidemiology and Cancer Registry, CancerCare Manitoba) for supplying data for Manitoba, Per-Henrik Zahl (Folkehelseinstituttet, Oslo) for supplying data for Sweden and Norway, and Gilbert Welch for helpful comments on the manuscript.

Contributors: See bmj.com.

Funding: None.

Competing interests: None declared.

Ethical approval: Not required.

1 Vainio H, Bianchini F. *IARC handbooks of cancer prevention vol 7: breast cancer screening*. Lyon: IARC Press, 2002.
2 Nielsen M, Thomsen JL, Primdahl S, Dyreborg U, Andersen JA. Breast cancer atypia among young and middle-aged women: a study of 110 medicolegal autopsies. *Br J Cancer* 1987;56:814-9.
3 Welch HG, Black WC. Using autopsy series to estimate the disease "reservoir" for ductal carcinoma in situ of the breast. *Ann Intern Med* 1997;127:1023-8.
4 Lindgren A, Holmberg L, Thurfjell E. The influence of mammography screening on the pathological panorama of breast cancer. *APMIS* 1997;105:62-70.
5 NHS. *Screening for breast cancer in England: past and future*. Publication No 61. Department of Health: NHS cancer screening programmes, 2006. www.cancerscreening.nhs.uk/breastscreen/publications/nhsbsp61.html.
6 Statistics Canada. 2008. www12.statcan.ca/english/census06/data/topics/RetrieveProductTable.cfm?Temporal=2006&PID=88984&GID=838031&METH=1&APATH=3&PTYPE=88971&THEME=66&AID=&FREE=0&FOCUS=&VID=0&GC=99&GK=NA&RL=0&TPL=RETR&SUB=0&d1=0.
7 Johnson A, Shekhdar J. Breast cancer incidence: what do the figures mean? *J Eval Clin Pract* 2005;11:27-31.
8 Demers AA, Turner D, Mo D, Kliewer EV. Breast cancer trends in Manitoba: 40 years of follow-up. *Chronic Dis Can* 2005;26:13-9.
9 Chiu C, Morrell S, Page A, Rickard M, Brassil A, Taylor R. Population-based mammography screening and breast cancer incidence in New South Wales, Australia. *Cancer Causes Control* 2006;17:153-60.
10 Jonsson H, Johansson R, Lenner P. Increased incidence of invasive breast cancer after the introduction of service screening with mammography in Sweden. *Int J Cancer* 2005;117:842-7.
11 Hofvind S, Sorum R, Haldorsen T, Langmark F. [Incidence of breast cancer before and after implementation of mammography screening]. *Tidsskr Nor Laegeforen* 2006;126:2935-8.
12 NHS Health and Social Care Information Centre. Breast screening programme, England: 2004-05. www.cancerscreening.nhs.uk/breastscreen/breast-statistics-bulletin-2004-05.pdf.
13 Sjönell G, Ståhle L. [Health checks with mammography does not reduce breast cancer mortality]. *Läkartidningen* 1999;96:904-13.
14 Hemminki K, Rawal R, Bermejo JL. Mammographic screening is dramatically changing age-incidence data for breast cancer. *J Clin Oncol* 2004;22:4652-3.
15 Zahl PH, Strand BH, Mæhlen J. Incidence of breast cancer in Norway and Sweden during introduction of nationwide screening: prospective cohort study. *BMJ* 2004;328:921-4.
16 Møller B, Weedon-Fekjær H, Hakulinen T, Tryggvadottir L, Storm HH, Talback M, et al. The influence of mammographic screening on national trends in breast cancer incidence. *Eur J Cancer Prev* 2005;14:117-28.
17 Welch GH. *Should I be tested for cancer?* California: University of California Press, 2004.
18 Douek M, Baum M. Mass breast screening: is there a hidden cost? *Br J Surg* 2003;90:44-5.
19 Boer R, Warmerdam P, de Koning H, van Oortmarssen G. Extra incidence caused by mammographic screening. *Lancet* 1994;343:979.
20 Svendsen AL, Olsen AH, von Euler-Chelpin M, Lynge E. Breast cancer incidence after the introduction of mammography screening: what should be expected? *Cancer* 2006;106:1883-90.
21 Paci E, Miccinesi G, Puliti D, Baldazzi P, De Lisi V, Falcini F, et al. Estimate of overdiagnosis of breast cancer due to mammography after adjustment for lead time. A service screening study in Italy. *Breast Cancer Res* 2006;8:R68.
22 Olsen AH, Jensen A, Njor SH, Villadsen E, Schwartz W, Vejborg I, et al. Breast cancer incidence after the start of mammography screening in Denmark. *Br J Cancer* 2003;88:362-5.
23 Olsen AH, Agbaje OF, Myles JP, Lynge E, Duffy SW. Overdiagnosis, sojourn time, and sensitivity in the Copenhagen mammography screening program. *Breast J* 2006;12:338-42.
24 Paci E, Warwick J, Falini P, Duffy SW. Overdiagnosis in screening: is the increase in breast cancer incidence rates a cause for concern? *J Med Screen* 2004;11:23-7.
25 Zahl PH, Jørgensen KJ, Mæhlen J, Gøtzsche PC. Biases in published estimates of overdetection due to screening with mammography. *Lancet Oncol* 2008;9:199-201.
26 Ravdin PM, Cronin KA, Howlader N, Berg CD, Chlebowski RT, Feuer EJ, et al. The decrease in breast-cancer incidence in 2003 in the United States. *N Engl J Med* 2007;356:1670-4.

Accepted: 30 January 2009

How citation distortions create unfounded authority: analysis of a citation network

Steven A Greenberg

EDITORIAL by Fergusson

Children's Hospital Informatics Program and Department of Neurology, Brigham and Women's Hospital, Harvard Medical School, 75 Francis Street, Boston, MA 02115, USA
sagreenberg@partners.org

Cite this as: *BMJ* 2009;339:b2680
doi: 10.1136/bmj.b2680

ABSTRACT

Objective To understand belief in a specific scientific claim by studying the pattern of citations among papers stating it.

Design A complete citation network was constructed from all PubMed indexed English literature papers addressing the belief that β amyloid, a protein accumulated in the brain in Alzheimer's disease, is produced by and injures skeletal muscle of patients with inclusion body myositis. Social network theory and graph theory were used to analyse this network.

Main outcome measures Citation bias, amplification, and invention, and their effects on determining authority.

Results The network contained 242 papers and 675 citations addressing the belief, with 220 553 citation paths supporting it. Unfounded authority was established by citation bias against papers that refuted or weakened the belief; amplification, the marked expansion of the belief system by papers presenting no data addressing it; and forms of invention such as the conversion of hypothesis into fact through citation alone. Extension of this network into text within grants funded by the National Institutes of Health and obtained through the Freedom of Information Act showed the same phenomena present and sometimes used to justify requests for funding.

Conclusion Citation is both an impartial scholarly method and a powerful form of social communication. Through distortions in its social use that include bias, amplification, and invention, citation can be used to generate information cascades resulting in unfounded authority of claims. Construction and analysis of a claim specific citation network may clarify the nature of a published belief system and expose distorted methods of social citation.

WHAT IS ALREADY KNOWN ON THIS TOPIC

In addition to its scholarly use, citation has social uses, both self serving and as a tool for persuasion

One distortion of this persuasive aspect of citation, citation bias, has been recognised in clinical trial reporting where it may lead to false belief about a therapy's efficacy

WHAT THIS STUDY ADDS

Distortions in the persuasive use of citation—bias, amplification, and invention—can be used to establish unfounded scientific claims as fact

Categorising these distorted uses of citation and having vocabulary for them aids in their recognition

How scientific data evolve into entire published biomedical belief systems around specific claims can be studied through a device called a claim specific citation network and the use of social network theory

This article is an abridged version of a paper that was published on bmj.com. Cite this article as: *BMJ* 2009;339:b2680

INTRODUCTION

To understand how a belief system shared by a scientific community evolves from data across papers within a specialty I analysed the example of β amyloid protein, which is known for its role in Alzheimer's disease but has also been claimed to be produced by and injure skeletal muscle fibres in inclusion body myositis. This belief system was chosen partly because this view seems to be accepted by many as likely or established fact (stated in at least 200 journal articles), and directs research and treatment trials for these patients.

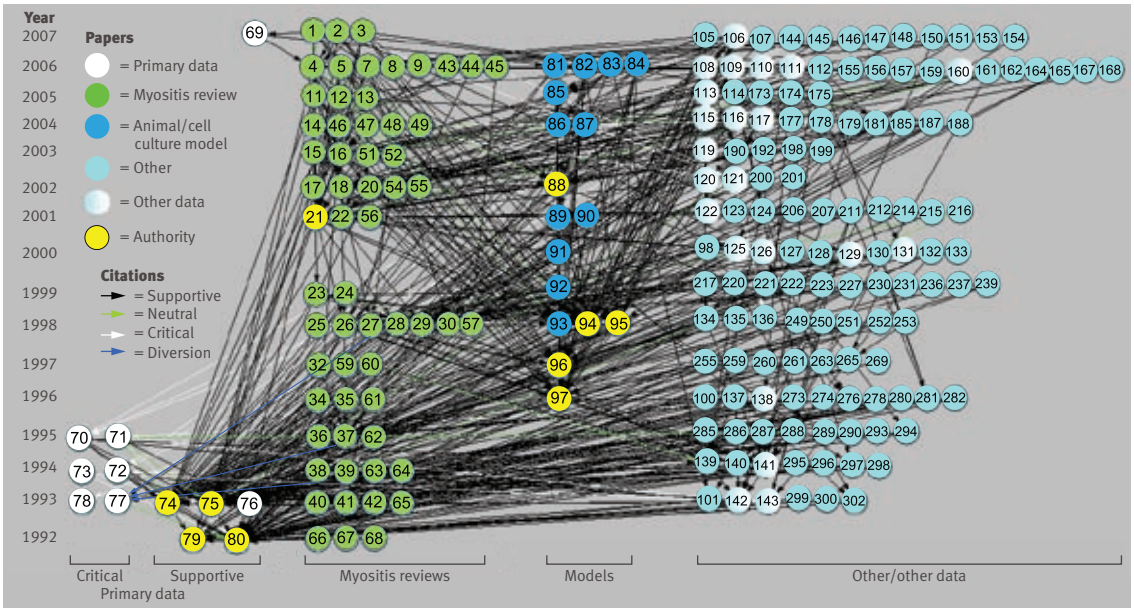
METHODS

The methods are described elsewhere (see web extra note 2). Briefly, queries identified all English language PubMed indexed articles potentially containing statements pertaining to any of three related molecules (β amyloid precursor protein, its transcript, or one of its potential cleaved protein products, β amyloid) and muscle disease. I collected all statements addressing the belief and citations supporting these statements. Papers were classified as primary data (with experimental data addressing the specific and abnormal presence of these molecules in inclusion body myositis muscle), myositis review (with the term myositis or equivalent in the title), model (reporting cell culture or animal experiments), or other. I classified each citation as supportive, neutral, or critical according to how its underlying statement supported the belief. The constructed network was further extended into research proposals funded by the US National Institutes of Health. (See web extra for details of references prefixed with an "s".)

RESULTS

A claim specific citation network was constructed from 242 of 766 potential papers containing statements addressing the claim that β amyloid and its precursors are abnormally and specifically present in inclusion body myositis muscle fibres among many other muscle diseases and the 675 citations supporting these statements (figure). This network contained 220 609 citation paths.

Within networks certain nodes receive large amounts of network traffic, termed "authorities."[1] Under social network theory, authority of a claim indicates the community's net belief about it. By examining the patterns of connections among the nodes,[1] four primary data papers, five model papers, and one review paper constituted the 10 most authoritative papers, all expressing the view that the claim was true.



Claim specific citation network. Citations regarding claim that β amyloid precursor protein mRNA or protein, or β amyloid protein, is abnormally present in inclusion body myositis muscle. The network is organised according to paper category and year of publication. Authority status (yellow) was defined computationally by network theory. Many citations flow to supportive primary data but not critical data. Papers are represented as nodes (n=218) and citations as directed edges (supportive n=636, neutral n=18, critical n=21, diversion n=3). Twenty four papers contain statements pertaining to claim but do not make or receive citations about it (not shown). Paper numbering according to web extra references

Citation bias against critical primary data

Four of the 10 authoritative papers provided experimental data addressing the claim.[s74 s75 s79 s80] They were from the same laboratory, two of which[s79 s80] probably reported mostly the same data without citing each other. These papers had major technical weaknesses, most notably a lack of data on number of affected muscle fibres and a lack of specificity of reagents for distinguishing β amyloid protein from β amyloid precursor protein.

Six primary data papers received no or few citations (figure). These papers contained data refuting or weakening the claim. Three papers[s71 s73 s77] from independent laboratories reported that 28 of 35 patients with inclusion body myositis studied had no affected muscle fibres while the remainder had five or fewer affected muscle fibres. Two papers[s70 s72] by the laboratory that wrote the four authority papers reported that β amyloid precursor protein transcript and protein were not specific to inclusion body myositis but were present in muscle fibres during regeneration in all diseased controls. These findings weaken the view that abnormal amounts of these molecules have any specificity to inclusion body myositis and that they cause degeneration of myofibre in patients with inclusion body myositis. One of these papers[s70] offered an alternative source than myofibre production for the molecules and indicated that β amyloid was non-specifically present in other inflammatory myopathy muscle.

Supportive but not critical data achieved authority over the 12 years since publication (see bmj.com); the supportive papers received 94% of the 214 citations to these primary data, whereas the six papers containing data that weakened or refuted the claim received only 6% (differing citation frequency, P=0.01). Citation bias (statistically significant differences in number of citations received among primary data papers) seemed to be specifically against critical data not the laboratory producing it, as two papers[s70 s72] that were biased against were written by the research group that wrote four of the highly cited supportive papers.

Citation bias to justify models

Citation bias was used to claim that animal and cell culture experiments are valid models of inclusion body myositis, in 17 papers.[s81-s97] Of the 32 citations to primary data from these papers, 31 (97%) flowed to the four highly supportive papers,[s74 s75 s79 s80] whereas only one citation (3%) was made to any of the six papers that presented data weakening or refuting these as valid models (see bmj.com).

Citation diversion

Some papers cited content but distorted it, termed citation diversion. One primary data paper[s77] reported no β amyloid precursor protein or β amyloid in three of five patients with inclusion body myositis and its presence in only a "few fibres" in the remaining two patients. Three papers[s28 s37 s38] cited these data (figure) reporting that they "confirmed" the claim. These data are furthermore exaggerated and generalised into a view that β amyloid precursor protein is "accumulated in vacuolated muscle fibers of s-IBM patients[s77, others]" as stated

by one paper,[s28] supported by an erroneous citation because three patients in one paper[s77] had 1.4% to 5% of their myofibres vacuolated but all lacked β amyloid precursor protein. Over the ensuing 10 years these three supportive citations developed into 7848 supportive citation paths—chains of false claim created by citation diversion.

Amplification through influential papers and citations

Between 1996 and 2007 support for the claim grew exponentially, with the number of supportive citations and citation paths increasing sevenfold and 777-fold, to 636 citations and 220 553 citation paths. In contrast, the critical view grew to only 21 citations and 28 citation paths (see bmj.com). No papers refuted or critiqued the critical data, but instead the data were just ignored. The increased support was facilitated by a small number of papers not reporting any primary data, through which large amounts of traffic flow.

The term amplification describes the expansion of a claim's belief system by citation to papers lacking any data addressing it. Amplification is not inherent to published belief systems. Authors could choose to cite only primary data when making claims, resulting in amplification minimal networks. Amplification of a claim is instead introduced into belief systems through the citing of papers that lack data addressing the claim.

Invention

Certain types of fact developed andspread through the belief system. These facts were not those that arose from restatement of published claims, but rather involved different mechanisms either deliberate or through scholarly negligence, herein called invention. For example, a subclaim (accumulation of β amyloid occurs early and precedes other abnormalities) has variously been stated as hypothesis, likelihood, or fact in 27 papers supported by 37 citations. Nine of these citations (24%), used to support text making these claims, flowed to papers that contained no statement on the temporal relation of β amyloid to other abnormalities in inclusion body myositis muscle (dead end citations). This subclaim transformed from hypothesis to "fact" through citation alone, a process that might be called citation transmutation (see bmj.com). Thus one paper[s5] contained it as fact supporting this statement by citing the paper[s80] where it had only been proposed as hypothesis.

In another form of invention, claims are introduced as fact through a "back door," bypassing peer review and publication of methods and data. This is accomplished by repeated misrepresentation of abstracts as papers.

Bias and invention in National Institutes of Health funded research proposals

Through the publication of papers and the demonstration of these publications as evidence of productivity, the elements of bias, amplification, and invention can be used indirectly to support requests for research funding. To determine if these elements were used directly to support such requests, the network was extended from the PubMed indexed literature into the research sections and bibliographies of National Institutes of Health funded grant proposals containing text addressing the claim.[2] Of 27 grant proposals requested, nine were released by the National Institutes of Health. These seemed to be the proposals most pertinent to the belief system.

Citation bias or invention was present in eight of these proposals (see bmj.com). Of 23 citations to primary data addressing the claim's validity, 20 were made to supportive primary data, two were instances of citation diversion, and one was made to critical content. Invention of fact supported through citation to hypothesis, dead end citation, and abstracts misrepresented as papers were present in these funded proposals. These were sometimes used directly to justify requests for funding of the proposed studies

DISCUSSION

Separate from its scholarly use, citation may be used for self serving purposes[3] or as a tool for persuasion.[4] These aspects of citation might be called social citation. I studied how distortions of the persuasive aspect of social citation may result in unfounded fact. Network theory applied to citation networks constructed from entire paper bibliographies, such as the science citation network,[5] can disclose societal attitudes to journals and specific papers (for example, impact factors), but these networks are not suitable for understanding the foundation for belief in specific claims. When networks are instead confined to citation pertaining to one set of related claims (a claim specific citation network), they become focused tools for understanding social communication pertaining to the claims—what is in effect the published record of a belief system shared by a community.

The general approach taken here (see bmj.com) addressed belief in claims; no experiments were done addressing their truth. The computational analysis of the claim specific citation network representing this belief system detected certain distortions in the patterns of citation that would not have been expected had only scholarly citation been used. Primary data that weakened or refuted claims on which the belief was based were ignored (citation bias) and a small number of influential papers and citations exponentially amplified supportive claim over time without presenting new primary data (amplification). Certain related claims were invented as fact. The combined effects of these citation distortions resulted in authority of the belief (acceptance of it) according to social network theory.

There are varied forms and consequences of distorted persuasive citation seen in this study (see bmj.com). Citation bias against critical content can be used for the systematic support of claim,[6] results in

the loss of implications of isolated data, and can be used to justify construction of animal models, which can then be circularly used to amplify claims. Such animal models have enormous appeal, and some publications describing them achieved authority status in this network (figure) despite reporting no data addressing the claim. Amplification involves repetitive citation of review papers or other papers lacking data, often through self citation, features noted previously in a variation of a claim specific citation network.[7] Invention has multiple variations.

Three factors may account for how citation distortions created authority in this belief system. Foremost is the power of citation through the choice of which papers to cite and which to ignore (citation bias), by citing but distorting content (citation diversion), and by using citation to invent fact (citation transmutation, dead end citation, and back door invention).

Second is an inherent property of negative results, which failed to spread through the network. These were not repeatedly cited by their authors in subsequent papers as perhaps there was simply nothing further to say. The progression from data to accepted claim is different within a single paper compared with across a collection of papers in a specialty. Within a single paper readers generally view new claims as false until proved true through convincing methods and results. Across a network of papers, however, the barrier to the propagation of negative results biases claims as being viewed as true until proved false.

Thirdly, this belief system is possibly an information cascade,[8 9] an entity resulting when people perceive advantage in accepting the prevailing view over any private information they may have when making choices. Many authors may just not be aware of the critical data, as these data are effectively isolated from the discourse about this claim and not mentioned in any review articles. Although unsound information cascades are in theory fragile and fall apart quickly when exposed,[8] this may not occur in biomedical belief systems, where contradicted claims may persist.[10]

Many published biomedical belief systems may be information cascades because repetition of claims is ubiquitous in the biomedical literature. Many are built on sound data, with authors repeating claims after trusting the published expert opinion of their colleagues. However, there are incentives for generating and joining information cascades regardless of their soundness. Joining an information cascade aids publication as articles have to say something and negative results are biased against.[11] Generating and joining an information cascade may improve the likelihood of obtaining funding because hypothesis driven research is an essential requirement[12] at many funding agencies such as the National Institutes of Health, and successful funding generally requires a "strong hypothesis . . . based on current scientific literature"[12]—that is, the published belief system of a claim. Chances for successful funding may therefore be increased through joining the cascade (repeating the claim and proposing experimental plans around it). In the extension of this citation network into text funded by National Institutes of Health research grants, citation bias, diversion, or invention were often present. Once research funding has been used to join a cascade there are further incentives to interpret results through confirmation bias to demonstrate success of the research for subsequent funding. Although joining an information cascade may be an optimal behaviour for some people, it reduces the likelihood that future investigators can discover whether it is sound.[9]

Methods for the construction and analysis of comprehensive claim specific citation networks present challenges and limitations. These include interpreting meaning of text, as people may reasonably interpret text differently, and understanding the distinct phenomena observed. In principle many biomedical claims have an associated citation network, the study of which provides a powerful approach to detecting citation bias, amplification, and invention, and understanding the nature of the authority of the claim.

I thank Daniel Rockmore (Department of Mathematics, Dartmouth College); Daniel Jonah Goldhagen; Peter Park (Harvard Medical School); and Einer Elhauge (Harvard Law School), for thoughtful discussions. Anthony Amato (Harvard Medical School) carried out validation of extracted text and citations.

Funding: SAG is in part supported by National Institutes of Health grants R01NS43471 and R21NS057225, and Muscular Dystrophy Association grant MDA4353. These grants did not contain specific aims directly encompassing this research.

Competing interests: SAG had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Ethical approval: Not required.

1 Kleinberg JM. Authoritative sources in a hyperlinked environment. *Proceedings of the ACM-SIAM symposium on discrete algorithms* 1998:668-77. www.cs.cornell.edu/home/kleinber/auth.pdf (accessed 24 Jan 2009).
2 National Institutes of Health Freedom of Information Act Office. www.nih.gov/icd/od/foia/index.htm
3 Hyland K. Self-citation and self-reference: credibility and promotion in academic publication. *J Am Soc Inform Sci Technol* 2003;54:251-9.
4 Gilbert GN. Referencing as persuasion. *Soc Stud Sci* 1977;7:113-22. www.jstor.org/stable/284636 (accessed 28 Feb 2009).
5 Garfield E. Citation indexes for science. *Science* 1955;122:108-11.
6 Dickersin K. Reporting and other biases in studies of Neurontin for migraine, psychiatric/bipolar disorders, nociceptive pain, and neuropathic pain. http://dida.library.ucsf.edu/pdf/oxx18r10 (accessed 28 Feb 2009).
7 Hengstman GJD, van Engelen BGM. Polymyositis, invasion of non-necrotic muscle fibres, and the art of repetition. *BMJ* 2004;329:1464-7.
8 Bikhchandani S, Hirshleifer D, Welch I. A theory of fads, fashion, custom, and cultural change as informational cascades. *J Political Econ* 1992;100:992-1026.
9 Banerjee AH. A simple model of herd behavior. *Quart J Econ* 1992;107:797-817.
10 Tatsioni A, Bonitsis NG, Ioannidis JPA. Persistence of contradicted claims in the literature. *JAMA* 2007;298:2517-26.
11 Wikipedia, the free encyclopedia. Publication bias. http://en.wikipedia.org/wiki/Publication_bias (accessed 24 Jan 2009).
12 How to Write a Research Grant. Guidelines from the National Institute of Neurological Disorders and Stroke. www.ninds.nih.gov/funding/write_grant_doc.htm (accessed 24 Jan 2009).

Accepted: 17 March 2009

Exploring preferences for place of death with terminally ill patients: qualitative study of experiences of general practitioners and community nurses in England

Daniel Munday, Mila Petrova, Jeremy Dale

Health Sciences Research Institute, Warwick Medical School, University of Warwick, Coventry CV4 7AL

Correspondence to: D Munday
d.munday@warwick.ac.uk

Cite this as: *BMJ* 2009;338:b2391
doi: 10.1136/bmj.b2391

ABSTRACT

Objective To explore the experiences and perceptions of general practitioners and community nurses in discussing preferences for place of death with terminally ill patients.

Design Qualitative study using semistructured interviews and thematic analysis.

Participants 17 general practitioners and 19 nurses (16 district nurses, three clinical nurse specialists).

Setting 15 general practices participating in the Gold Standards Framework for palliative care from three areas in central England with differing socio-geography. Practices were selected on the basis of size and level of adoption of the framework.

Results All interviewees bar one had experience of discussing preferred place of death with terminally ill patients. They reported that preferences for place of death frequently changed over time and were often ill defined or poorly formed in patients' minds. Preferences were often described as being co-created in discussion with the patient or, conversely, inferred by the health professional without direct questioning or receiving a definitive answer from the patient. This inherent uncertainty challenged the practicability, usefulness, and value of recording a definitive preference. The extent to which the assessment of enabling such preferences can be used as a proxy for the effectiveness of palliative care delivery is also limited by this uncertainty. Generally, interviewees did not find discussing preferred place of death an easy area of practice, unless the patient broached the subject or led the discussions.

Conclusions Further research is needed to enable development of appropriate training and support for primary care professionals. Better understanding of the importance of place of death to patients and their carers is also needed.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Home death has been identified as the most common preference expressed by patients at the end of their life. Preferences for place of death can, however, change over time or be poorly formed.

Discussing, eliciting, and recording preferred place of death has been identified as an important aspect of palliative care and is encouraged in England in the recent *End of Life Care Strategy*.

Little previous research has reported on the experiences of primary care professionals in addressing this issue.

WHAT THIS STUDY ADDS

This study explores the perceptions and experiences of general practitioners and nurses in eliciting place of death preferences and in enabling patients to die at their preferred place

The results offer insights into the complex nature of these preferences, the constraints to eliciting and acting on them, and the implications for auditing, quality assessment, and training of primary care professionals.

In a BMJ podcast, Daniel Munday talks to Duncan Jarvies about how important place of death is to patients at the end of their life.
Access it at http://podcasts.bmj.com/bmj

INTRODUCTION

The recent publication of the *End of Life Care Strategy* for England has highlighted the importance of enabling patients to express preferences regarding end of life care and for recording these wishes in an advance care plan.[1 2] A central aspect of choice concerns patients' preference for place of death In this paper, we describe general practitioners' and community nurses' perceptions and experiences of exploring patients' preferred place of death and the issues that they report as influencing whether or not this preference is met. All participants were working in practices enrolled in the Gold Standards Framework for palliative care and this study forms part of the wider evaluation of the framework.[3-5]

METHODS

Questions concerning the health professionals' approach to and experiences of discussing preferred place of death (box 1) were included within a wider interview schedule (methods of data collection have been described fully elsewhere).[3-5] Semistructured interviews were performed and observational data were collected from 15 purposively sampled practices in three areas with different socio-geography. A total of 36 interviews were carried out—17 with general practitioners and 19 with community nurses (16 district nurses and three clinical nurse specialists in palliative care).

Data analysis was undertaken using a broadly realist theoretical approach.[6] The thematic analysis was supplemented with a framework analysis to further explore the relationships between emergent themes and issues relevant to clinical practice in palliative care.[7]

RESULTS

Four main themes concerning preferences for place of death were identified: the nature of preferences; how they were identified; how they were recorded; and how they were achieved.

Nature of preferences for place of death

The strongest message conveyed by the interviewees was that they considered place of death preferences as typically dynamic and/or incompletely defined.

Preferences evolve and can change

The most widely reported change was a reversal of the preference for dying at home owing to the patient

experiencing distressing symptoms, becoming frightened, feeling vulnerable, or becoming concerned for his or her family. There was also a tendency for patients to replace the previously expressed preference to die at a specific place (for example, home or hospice) with a desire to remain at the place where they were currently being cared for.

> "He was very open, you know, said from the start he wanted to die at home. That's what it was but then to the end he said, 'I can't let my family go through this anymore. I can't let them suffer the distress of seeing me like this.' . . . and said, 'get me into the hospice. I don't want my family to see me in this'." (district nurse 12, practice I)

> "And then she turned around and she said, 'you know, I wouldn't mind dying here [hospice]'. And I said, 'Oh, are you sure, because you wanted to die at home?' 'No,' she said, 'I think this is a lovely place, the staff are so friendly'." (general practitioner 15, practice J)

Preferences can be ill defined

Some preferences could also be seen as relatively weak; that is, only a leaning in one direction or another rather than indicating a definitive wish.

> "And they will say, 'Well, I'd rather be at home with my dear ones' or 'I'd rather be in a hospice and not cause stress at all' . . . so you can't always get a yes/no answer in these kind of situations." (general practitioner 14, practice I)

Box 1 | **Questions regarding preferred place of death from wider interview schedule**

The first set of questions covers broad topics related to preferred place of death. The second set of questions includes examples of prompts and probing questions that were used selectively in response to cues from the interviewees' answers

Broad topics questions

- What do you think of the idea of getting patients to talk about preferred place of death?
- Do you ask patients about their preferred place of death and how do you go about this?
- Are there any situations where preferred place of death wouldn't be discussed? Why not if there are?
- Who brings up the topic of preferred place of death?
- How does discussing preferred place of death with patients make you and your colleagues feel?
- Are these preferences recorded and, if so, when?
- Can you give me a recent or memorable example where you felt preferred place of death was dealt with well? Can you give me an example where you felt less satisfied?

Examples of prompts and probing questions

- How frequently do you think patients' preferences should be checked [if you say they are changing]?
- If the patient changed their mind, would it be documented?
- How do you define appropriate [moment for asking about preferred place of death]?
- How do you take cues from the patient about when and if to discuss preferred place of death?
- How long would you say you need to be acquainted with the patient for them to even start bringing up issues about where they're going to die?
- Do patients ever bring up [preferred place of death]?
- How do you actually deal with patients who don't want to discuss [preferred place of death]?
- Do you feel that there's enough training?
- What do you do when a patient's wishes are different from those of their carers and families?
- Do you ever think about whether you have any inhibitions about discussing [preferred place of death] with [patients]?

Identifying preferences for place of death

Techniques for identifying preferences

In straightforward situations, patients stated clearly where they would prefer to be cared for or "opened a door" to the discussion by acknowledging that they were dying.

> "A significant number of times, I guess, patients will actually say directly to you, 'look, I'm quite ill, I know I'm quite ill, the one thing I'd really like is to be looked after here because I'm quite comfortable here'. And we'll have that discussion." (general practitioner 5, practice C)

> "If they were to say, 'well, I know I'm going to die', then they have sort of opened up the door and I can follow on with that, and that's an easy task." (district nurse 5, practice D)

If the patient did not bring up the issue in a very direct way, the discussions were described as being more subtle, using euphemistic vocabulary, and relying much more on giving, picking up, and interpreting cues.

> "I don't ask them their preferred place of death. I'd ask them, 'how are you managing, how are you getting on, is there anything…?' If you go in a home situation you read the signs, you read the body language of the relative, of the carers as well, and also other people who are going in to help that patient." (general practitioner 17, practice M)

> "Yes, very rarely they'll say 'I want to die at home.' It's always 'when I can't cope any more and I can't go to the toilet on my own,' 'I don't want the children to see me like this.' These are terms that they will use." (district nurse 7, practice D)

Times when discussing preferred place of death becomes inappropriate

Most interviewees could recall patients with whom they had found it extremely difficult or impossible, unethical, or potentially damaging to the doctor-patient relationship to discuss preferred place of death. This situation was almost invariably attributed to the patient being "in denial".

> "Undoubtedly, there are some people who need to keep going by denial and, you know, they don't want to talk about it." (general practitioner 10, practice E)

In other cases, interviewees felt that discussing preferences was primarily unethical and, as a consequence, difficult, such as when the patient's attitude was construed as one driven by hope, rather than denial.

> "But some people won't admit that they are going to die, see. It's difficult to stop people's hope . . . and I still think if somebody thinks that they

are going to get through this, I don't think it was really up to me to say no you're not, you know, I find that still difficult, and it does destroy hope." (district nurse 11, practice H)

Co-constructing place of death preferences

Not infrequently, interviewees believed that their professional opinion of what would be best for a particular patient differed from the patient's preference, or they were aware that the patient's desire would be difficult or impossible to accommodate. Interviewees then described engaging more actively in influencing preferences or managing the patient's expectations.

"Occasionally you do have someone that wants to die at home and it's not appropriate . . . and you then have to say to them, 'well, look, we will try [to accommodate] your wishes as best as we can, but if at any stage you need more care than we can give, that's when we'll need to think about going somewhere else'." (general practitioner 15, practice J)

"Sometimes if you've got an old lady and she has absolutely no relatives at all, and there might be a 90 year old neighbour who pops in, and she says, 'no, my neighbour will do it, it's alright, my neighbour will do that.' You have to say, 'well, actually, she can't, we think we ought to think about something else'." (district nurse 14, practice M)

Descriptions of crisis situations demonstrated the decisive role that health professionals can play in preference formation. In crisis situations, earlier preferences tended to disintegrate and patients were often unable to form or communicate new ones. A few interviewees described an approach by which they helped the patient and family put together an explicit new preference.

"And that would be a crisis situation where you would say, 'OK, what do you want to do here, shall we continue trying to get this sorted at home or would you want to look at going into the hospice or hospital?'" (clinical nurse specialist 2, practice F)

Primary care professionals' feelings on discussing preferred place of death

Only one interviewee mentioned never having discussed preferred place of death. None of the remainder described difficulty if the discussion was broached by the patient.

"Maybe I am inhibited to ask people, but I'm not inhibited to if they instigate it, I'm quite happy to talk about it with them, and to tell them what alternatives are available to them and what care would be available for them if they choose to stay at home. So I'm quite happy to talk about it when they are happy to talk about it." (district nurse 7, practice D)

Interviewees varied widely in how they felt about initiating the discussion themselves. Most typically, the health professionals distinguished between easy and more difficult situations on the basis of the patient's personality, acceptance, and response; the relationship formed with them; and/or contingent situational factors (for example, the "timing" of the discussion).

"I don't feel uncomfortable with it really. I mean, once one's built up a good relationship and can be honest with the patient, you know, once the patient is ready to accept that they are going to die and so on . . . once the time is right, I don't feel uncomfortable discussing it." (general practitioner 9, practice E)

A few interviewees did not make distinctions between easy and more difficult cases and found raising the issue generally not easy, not pleasant, or outright difficult.

"Me personally? I find it very difficult, still. I think the nurses, it's an easy cop-out to say the nurses are much better at it . . . if you're going in for a fairly short visit, it's sometimes a lot more difficult to get round to place of death and fears about the actual process of dying." (general practitioner 10, practice E)

Finally, a small group of interviewees (three general practitioners who had described little or no involvement in discussing preferred place of death and a very experienced district nurse) denied any difficulty in having the discussion.

"No problem, I think it helps to, if you think it is an issue then to resolve that issue I think is fine, it makes everybody feel more comfortable with where we're going." (general practitioner 6, practice C)

Recording and auditing preferences for place of death

Interviewees focused on their concerns with regard to recording preferred place of death rather than the benefits. The benefits—improved communication, protection against unplanned hospital admissions, and increased likelihood of having the discussion—were, however, greatly valued by those who mentioned them.

The main concern identified was a direct consequence of the complexity of preference formation and identification, which led to a difficulty in recording a preference.

"Now if by saying they're prepared to go into a hospice, are they saying their preferred place of death is a hospice or is their preferred place of death still home, but they are realising that, basically, that is not possible, therefore they are making a choice to go into a hospice although that's not their preference?" (general practitioner 17, practice M)

> "At what point do you record it? Five minutes before they die when they actually don't want to be moved? Or, a week ago when they said, 'no, I want to be in hospital, it's too much trouble for my wife'? Or, in the middle when they haven't got consciousness so they can't make a decision?" (district nurse 8, practice E)

Some interviewees were also apprehensive about potential deviations from good practice. One such concern related to the possibility that preferences for place of care are forced on to patients.

> "She [a clinical nurse specialist] had to practically badger this patient to tell her where they wanted to die, and I felt it was inappropriate and unnecessary, when the lady said she wanted to stay at home, she was almost forcing saying, 'Oh, I want to die at home'." (district nurse 7, practice D)

> "There might be something else that's really on their mind, you know, that they'd really like to be talking about and you're sitting there thinking, 'I really need to find out where this person would like to die'." (district nurse 6, practice D)

Constraints to enabling patients to die at their preferred place

The constraints to enabling patients to die at their preferred place as reported by interviewees relate to contingent factors or wider issues (for example, family capacity or service availability). These are presented schematically in box 2.

Box 2 | Constraints to enabling patients to die at their preferred place

Constraints arising from the social support network (when the preference is for a home death)

- Conflict of preferences and/or perceived inability of the carer(s) to cope—particularly likely in patients who have small support network, an elderly carer and/or a carer whose own health is poor, or longstanding issues of negative family dynamics
- Social system collapse owing to the carer(s) experiencing events as being more difficult and frightening than expected and/or becoming physically and emotionally exhausted
- Situations in which the carer finds it impossible not to request active intervention—for example, when they cannot bear to watch a loved one suffer

Constraints arising from service limitations

- Difficulty providing 24-hour care (primarily nursing care and night sitters)
- Very limited availability of hospice beds
- Limited services for carers—for example, opportunities for counselling or respite

Constraints relating to symptom control and the avoidance of unnecessary suffering

- Situations in which keeping the patient at home would make it impossible to achieve optimum symptom control
- Situations in which moving the patient to their preferred place would be more likely to cause unnecessary suffering than result in a "better" death

Constraints relating to the ultimate unpredictability of the precise moment of dying

Patients might die at a non-preferred place in which they were being cared for temporarily because they were:

- Admitted for symptom control or respite
- Awaiting a hospice bed

DISCUSSION

Principal findings

Most interviewees reported that general practitioners and community nurses did not find discussing preferred place of death an easy area of practice. General practitioners and community nurses described how they balanced the imperative given in guidelines to elicit preferred place of death with assessment of the appropriateness of discussing the issue with patients. Although the primary care professionals participating in this study felt that they resisted the impulse to record preferences in a "tick box fashion," they were concerned that other colleagues might be less reflective and coerce patients into unwanted discussions. Some interviewees described how they responded to cues to open up relevant discussions, and how they might need to interpret a patient's preference from general discourse without coming to a definitive answer to the question "where would you like to be when you are dying?" Other interviewees described how in some situations they might be directly involved in negotiating plans with the patient and their family so that the eventual stated preference was co-created. All participants discussed how they needed to draw on considerable skill in communication and to devote time to the process.

Interviewees also reported that even if a firm preference for place of death was established, a rapidly changing clinical situation at the end of life and contingent factors—such as where the best care might be offered, the presence or lack of a social support network, and the availability of services—affected the likelihood of preferences being realised. These factors might even alter the patient's previously strongly held preference.

Limitations

The interviewees were in practices that were early adopters of the Gold Standards Framework programme and are thus likely to have had more than average knowledge and interest in palliative care. This factor might have produced a particularly insightful picture of the nature of preferences for care at the end of life that may not be entirely representative of primary care in the UK.

Furthermore, in this study, participants were not explicitly asked about their approach to discussing the issue of preferred place of death with patients from different ethnic and cultural groups. Recent research has illustrated how patients' perceptions and attitudes at the end of life can vary widely between different ethnic and cultural groups, but also across generations within one group.[8]

Conclusion

Enabling patients to express their place of death preferences and to ultimately achieve them is a complex process that demands a compassionate and skilful approach over time to allow preferences to be determined "in the moment". Further research is needed to explore this important area of practice more fully so that appropriate training and support can be given to primary care professionals, but also in order to achieve better understanding of the importance that patients attach to achieving their preferred place of death.

We thank the participants in the study for their detailed and perceptive responses. We also thank Kashifa Mahmood-Yousuf and Shona Agarwal for doing the interviews; Steven Martin for supporting the work on coding the interviews; and Janice Koistinen for helping to improve the clarity and logic of the text.

Contributors: DM and JD jointly conceived and designed the study. Kashifa Mahmood-Yousuf and Shona Agarwal carried out the interviews. MP analysed the data and developed the interpretative framework. Steven Martin coded part of the interviews independently to compare codes and assignments with those of MP. MP and DM jointly drafted the manuscript. JD and Janice Koistinen contributed to the interpretation and prioritisation of findings, and all authors edited and agreed upon the final manuscript. DM and MP are the guarantors.

Funding: This research was funded by Macmillan Cancer Support. We declare that Macmillan Cancer Support has entrusted our research team to make all decisions associated with collecting, analysing, and interpreting data and presenting findings, and that they have not influenced this process in any way.

Competing interests: DM and JD received a grant from Macmillan Cancer Support to evaluate phases 3-6 of the Gold Standards Framework and are members of the Macmillan Primary Care Research Collaborative. The post of MP has been partially funded by Macmillan Cancer Support.

1 Ethical approval: Multicentre Research Ethics Committee approval; ref 05/Q2803/48.Department of Health. *End of life care strategy*. London: Department of Health, 2008.
2 Murray S, Sheikh A, Thomas K. Advance care planning in primary care. *BMJ* 2006;333:868-9.
3 Dale J, Koistinen J, Mahmood K, Munday D, Petrova M, Thomas K. A national facilitation project to improve primary palliative care: impact of the Gold Standards Framework on process and self-ratings of quality. *Qual Saf Health Care* 2009;18:174-80.
4 Munday D, Mahmood K, Dale J, King N. Facilitating good process in primary palliative care: does the Gold Standards Framework enable quality performance? *Fam Pract* 2007;24:486-94.
5 Mahmood-Yousuf K, Munday D, Dale J, King N. Interprofessional relationships and communication in primary palliative care: impact of the Gold Standards Framework. *Br J Gen Pract* 2008;58:256-63.
6 Mays N, Pope C. Qualitative research in health care: assessing quality in qualitative research. *BMJ* 2000;320:50-2.
7 Pope C, Ziebland S, Mays N. Qualitative research in health care: Analysing qualitative data. *BMJ* 2000;320:114-6.
8 Worth A, Irshad T, Bhopal R, Brown D, Lawton J, Grant E, et al. Vulnerability and access to care for South Asian Sikh and Muslim patients with life limiting illness in Scotland: prospective longitudinal qualitative study. *BMJ* 2009;338:b183.

Accepted: 25 February 2009

CORRECTIONS AND CLARIFICATIONS

Report says workforce planning must accommodate part time working for female doctors
In this news article by Susan Mayor (*BMJ* 2009;338:b2252, print publication 6 Jun 2009, p 1348), we gave the wrong affiliation for Mary Ann Elston. She is, and has been for several years, emeritus reader in medical sociology, in the Department of Health and Social Care at Royal Holloway, University of London.

Video decision support tool for advance care planning in dementia: randomised controlled trial
This summary version of the Research paper by Angelo Volandes and colleagues (*BMJ* 2009;338:b2159, print publication 6 Jun 2009, p 1372) gave the wrong unique identifier for the paper. It should have said: "Cite this as: *BMJ* 2009;338:b2159 [not b1964], doi: 10.1136/bmj.b2159 [not b1964]" and "This is a summary of a paper that was published on bmj.com as *BMJ* 2009;338:b2159 [not b1964]."

Procedures for ethical review for clinical trials within the EU
When the authors of this analysis article were calculating the time that UK ethics committees took to process their application (from submission to approval), they inadvertently included some of the time required to answer the committees' many inquiries (*BMJ* 2009;338:b1893, print publication 30 May 2009, pp 1302-4). The number of days for the UK national committee in table 1 should be 119 days not 168 and the total and median (range) for the UK should be 197 (143 to 217). In table 2 the figures for national plus local approval (bottom row) should also be 197 (143 to 217). This is still considerably longer than in other countries. The authors also mistakenly stated that they had to get national approval before submitting to local committees. In fact, simultaneous approval was allowed, although experience suggested that it was more practical to do it separately.

Endgames: Statistical Question
The Statistical Question "Sampling distributions" (*BMJ* 2009;338:b2290, print publication 13 June 2009, p 1451) contained two errors. We wrongly said the question had been submitted by John Fletcher—we should have said Philip Sedgwick. We also gave the wrong "elocator" in the citation information—the correct way to cite this Endgame article is: *BMJ* 2009;338:b2290.

Australia will restrict antiretrovirals to high risk cases
We wrongly used the term "antiretrovirals" in the title of this News article about swine flu by Rada Rouse; we should of course have said "antivirals" (*BMJ* 2009;338:b2448, print publication 20 Jun 2009, p 1461).

Front cover of print issue: 27 June 2009
Despite our best efforts, we managed to misspell aneurysm on the front cover of this recent issue; for those interested, we inverted the y and the s.

Vaccine disputes
In this Features article by Rebecca Coombes we inserted a few clarifying words into a quote from Bruce Gellin, deputy assistant secretary for health and director of the National Vaccine Program Office in Washington, DC (*BMJ* 2009;338:b2435, print publication 27 Jun 2009, p 1528-31). Unfortunately our words did not clarify, as they confused polio with tuberculosis. The quote (middle column, p 1531) should have read: "People get further and further away from what these diseases are; they forget the importance of vaccines. They look at these black and white photographs of children [with polio] in an iron lung, and think 'not relevant to me.'"

Effect of the quality and outcomes framework on diabetes care in the United Kingdom: retrospective cohort study
In the bottom graph of the figure in this paper by Melanie Calvert and colleagues (*BMJ* 2009;338:b1870, print publication 6 Jun 2009, pp 1366-70) the units in the labelling on the y axis should have been higher by one order of magnitude. In addition, the top graph should be headed "Diabetes type 1" and the bottom graph "Diabetes type 2."

Please redress the balance of millennium development goals
In this letter by Ian Magrath and colleagues (*BMJ* 2009;338:b2533, print publication 27 Jun 2009, p 1518), the address for Dr Werner Burkart is the International Atomic Energy Agency [not Authority, as published] in Vienna, Austria.

BMA representatives vote to end prescription charges
In this News article by Deborah Cohen (*BMJ* 2009;339:b2650, print publication 4 Jul 2009, p 15) we mistakenly referred to Dr Shaukat Ali as a "consultant from Darlington." He's not; he's a consultant from London and he presented the motion (urging the government to abolish prescription charges in England) on behalf of Greenwich, Bexley & Bromley Division.

Watching over the medical device industry
In this feature article by Jeanne Lenzer we assigned the wrong job title to Dr Richard A Deyo in the caption accompanying his photograph (*BMJ* 2009;338:b2321, print publication 4 Jul 2009, pp 18-20). He is not a "prominent spine surgeon" (as we stated) but a prominent spine surgery researcher; he is based at Oregon Health and Science University, in the United States.

pico

Coronary heart disease mortality among young adults in Scotland in relation to social inequalities: time trend study

Martin O'Flaherty,[1] Jennifer Bishop,[2] Adam Redpath,[2] Terry McLaughlin,[2] David Murphy,[2] James Chalmers,[2] Simon Capewell[1]

EDITORIAL
by Leyland and Lynch

[1]Division of Public Health, University of Liverpool, Liverpool L69 3GB
[2]ISD Scotland, Edinburgh EH12 9ED
Correspondence to: S Capewell
capewell@liverpool.ac.uk

Cite this as: *BMJ* 2009;339:b2613
doi: 10.1136/bmj.b2613

STUDY QUESTION Does the overall decline in coronary heart disease mortality rates in Scotland between 1986 and 2006 differ by age and socioeconomic status?

SUMMARY ANSWER Overall (age adjusted) coronary heart disease mortality rates have continued to decline in Scotland; however, this conceals a flattening in younger groups, particularly among the most deprived people.

Participants, data sources, and settings
We used data on coronary heart disease mortality for the Scottish population for the period 1986-2006. We categorised area level socioeconomic status into fifths by using the Scottish Index of Multiple Deprivation (SIMD), for which data were available for the period 1996-2006.

Design, size, and duration
We used five year moving averages to smooth plots of mortality and of annual changes in age specific mortality. We fitted a Joinpoint regression to estimate annual percentage changes and to detect points in time at which significant changes in these trends occurred.

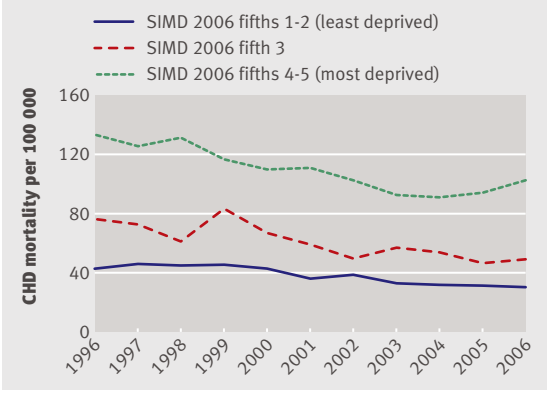
Main results and the role of chance
Between 1986 and 2006 age adjusted mortality from coronary heart disease decreased overall by 60.9% in men and by 56.4% in women. In both men and women aged over 55 years, the annual rate of decline increased between 1986 and 2006. However, in men aged 35-54 the annual percentage change from 2003 was not significantly different from 0% (−0.55%, 95% confidence interval −9.47 to 9.24). Likewise, in women aged 35-54 the annual percentage change was −9.02% in 1989-95 and decreased to −4.94% in 1995-2006, suggesting that the rate of decline was slowing down in young women. Coronary heart disease mortality in men aged 35-54 in the two most deprived fifths decreased between 1996 and 2004. However, the annual change between 2004 and 2006 was not significantly different from 0% (6.4%, −6.72 to 21.38).

Bias, confounding, and other reasons for caution
As most of the changes in trends were seen only in recent years, the confidence intervals for the average annual percentage changes were correspondingly wide. Although the rate of change in young deprived men suggests an increase, the wide confidence interval encompassing zero means that a simple flattening is equally possible. Similar constraints apply when comparing rates of decline between social groups. Although disproportionate miscoding of mortality in deprived areas is possible, the potential for this over a short time seems very low. Because the SIMD health domain takes into account mortality, we repeated the analysis with only the income component of the SIMD; this did not change the results.

Generalisability to other populations
Previous analyses of the flattening of the decline in mortality have mainly concentrated on age and sex effects in developed countries (England and Wales, United States, and Australia), but little attention has been paid to inequalities.

Study funding/potential competing interests
MO'F was supported by UK Medical Research Council. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of ISD.

CORONARY HEART DISEASE MORTALITY TRENDS BY DEPRIVATION (SCOTLAND 1996-2006, MEN AGED 35-54 YEARS)



BMJ pico: advice to authors

For Research articles, we routinely post the full, version only on bmj.com, and prepare an abridged version for the print journal.

To increase readership of research articles in the print *BMJ* and to give authors more control over the abridging, we are piloting a new way of abridging research articles for the print *BMJ*—publishing what is essentially an evidence abstract called BMJ pico. We hope that you will want to take part in this pilot if your research article is accepted. There is no need to prepare a BMJ pico in advance, however—please wait until we have offered to publish your article.

This is a summary of a paper that was published on bmj.com as *BMJ* 2009;339:b2613