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RESEARCH

Fall prevention with supplemental and active forms of vitamin D: a meta-analysis of randomised controlled trials

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Cite this as: *BMJ* 2009;339:b3692
doi: 10.1136/bmj.b3692

ABSTRACT

Objective To test the efficacy of supplemental vitamin D and active forms of vitamin D with or without calcium in preventing falls among older individuals.

Data sources We searched Medline, the Cochrane central register of controlled trials, BIOSIS, and Embase up to August 2008 for relevant articles. Further studies were identified by consulting clinical experts, bibliographies, and abstracts. We contacted authors for additional data when necessary.

Review methods Only double blind randomised controlled trials of older individuals (mean age 65 years or older) receiving a defined oral dose of supplemental vitamin D (vitamin D_3 (cholecalciferol) or vitamin D_2 (ergocalciferol)) or an active form of vitamin D (1α-hydroxyvitamin D_3 (1α-hydroxycalciferol) or 1,25-dihydroxyvitamin D_3 (1,25-dihydroxycholecalciferol)) and with sufficiently specified fall assessment were considered for inclusion.

Results Eight randomised controlled trials (n=2426) of supplemental vitamin D met our inclusion criteria. Heterogeneity among trials was observed for dose of vitamin D (700-1000 IU/day *v* 200-600 IU/day; P=0.02) and achieved 25-hydroxyvitamin D_3 concentration (25(OH)D concentration: <60 nmol/l *v* ≥60 nmol/l; P=0.005). High dose supplemental vitamin D reduced fall risk by 19% (pooled relative risk (RR) 0.81, 95% CI 0.71 to 0.92; n=1921 from seven trials), whereas achieved serum 25(OH)D concentrations of 60 nmol/l or more resulted in a 23% fall reduction (0.77, 0.65 to 0.90). Falls were not notably reduced by low dose supplemental vitamin D (1.10, 0.89 to 1.35; n=505 from two trials) or by achieved serum 25-hydroxyvitamin D concentrations of less than 60 nmol/l (1.35, 0.98 to 1.84). Two randomised controlled trials (n=624) of active forms of vitamin D met our inclusion criteria. Active forms of vitamin D reduced fall risk by 22% (0.78, 0.64 to 0.94).

Conclusions Supplemental vitamin D in a dose of 700-1000 IU a day reduced the risk of falling among older individuals by 19% and to a similar degree as active forms of vitamin D. Doses of supplemental vitamin D of less than 700 IU or serum 25-hydroxyvitamin D concentrations of less than 60 nmol/l may not reduce the risk of falling among older individuals.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Recent systematic reviews suggest a non-significant reduction in falls among individuals receiving supplemental vitamin D

Vitamin D has a direct beneficial effect on muscle, and improved strength and balance in several trials in older persons

WHAT THIS STUDY ADDS

A dose of 700-1000 IU supplemental vitamin D a day reduced falls by 19%, and by up to 26% with vitamin D_3, within 2-5 months of treatment initiation

Vitamin D may not reduce falls at doses of less than 700 IU a day

Active forms of vitamin D do not appear to be more effective for fall prevention than 700-1000 IU of supplemental vitamin D

INTRODUCTION

Vitamin D has direct effects on muscle strength modulated by specific vitamin D receptors present in human muscle tissue.[1 2] In several trials of older individuals at risk for vitamin D deficiency, vitamin D supplementation improved strength, function, and balance in a dose-related pattern.[3-5] Most importantly, these benefits translated into a reduction in falls.[3-5]

Overall results have been mixed for fall prevention with vitamin D. This may be explained in part by the use of low doses of vitamin D, as suggested by a 2004 meta-analysis of limited data from three trials on supplemental vitamin D.[6] Several trials on vitamin D have been performed since 2004; thus, the importance of vitamin D dose for the prevention of falls should be reassessed.

The aim of this meta-analysis was to assess the efficacy of vitamin D supplementation, with and without calcium, for the prevention of falls among older persons by dose and serum concentration of 25(OH)D achieved. In addition, we assessed the efficacy of active forms of vitamin D compared with supplemental vitamin D in the prevention of falls.

METHODS

Search strategy and data extraction

We conducted a systematic search for all relevant articles from 1995 to 2008. See bmj.com for databases and search terms. Data extraction was conducted independently by two authors.

Inclusion criteria

Randomised controlled trials of fall prevention with a defined oral dose of supplemental vitamin D (vitamin

D_3 (cholecalciferol) or vitamin D_2 (ergocalciferol)) or oral active vitamin D (1α-hydroxyvitamin D_3 (1α-hydroxycalciferol) or 1,25-dihydroxyvitamin D_3 (1,25-dihydroxycholecalciferol)) in individuals aged 65 years or older with a minimum follow-up of three months were identified. To be included in the primary analysis, the trial design had to be double blind and the assessment of falls sufficiently specified according to the following criteria: (*a*) falls had to be a primary or secondary end point defined at the onset of the trial; (*b*) the study had to include a definition of falls and how they were assessed; and (*c*) falls had to be assessed for the entire trial period. Eligible studies that did not meet the criteria for the primary analysis were included in a sensitivity analysis, such as studies involving older patients in an unstable health state (that is, those recruited during acute inpatient care).

Outcome measures

Our primary outcome measure was the relative risk of having at least one fall among persons receiving vitamin D with or without calcium compared with the risk among those individuals receiving placebo or calcium supplementation alone. We analysed separately the effect of supplemental vitamin D and active forms of vitamin D, and evaluated both dose and 25(OH)D concentrations achieved for supplemental vitamin D.

Quality assessment

We examined the following methodological features most relevant to the control of bias: randomisation; masking of treatment allocation; blinding; adherence; and withdrawals. Given that vitamin D is available over the counter, trials had to be double blind to be included in the primary analysis. Open design trials that met the general eligibility criteria were included in the sensitivity analysis.

Statistical methods

Outcomes were analysed on an intention to treat basis by using random effect models. In addition, we calculated the difference in relative risks to determine the number needed to treat to prevent a person from falling.

Heterogeneity among studies was explored by predefined covariates using the Q statistic as a test (significant for $P<0.10$). We explored heterogeneity by dose of vitamin D and 25(OH)D concentration achieved by using visual inspection and random effect meta-regression analysis. Additional subgroup analyses undertaken for supplemental vitamin D included type of vitamin D (D_2 *v* D_3), gender, age (<80 years *v* ≥80 years), treatment duration (<12 months *v* ≥12 months), level of independence (independent *v* institutionalised), and additional calcium supplementation. To evaluate publication bias, we used Begg's test and Egger's test with all eight trials from the primary analysis or all 15 trials from the sensitivity analysis.

RESULTS

A total of 164 articles were found in our initial search. After exclusions ten randomised trials were included in the final analysis—eight that studied either vitamin D_2 or vitamin D_3 and two that assessed active forms of vitamin D. See bmj.com.

Trials assessing supplemental vitamin D

The eight trials that studied supplemental vitamin D involved 2426 individuals in total, 81% of whom were women, and participants had an approximate mean age of 80 years. All participants were in stable health and were living in the community or in nursing homes. Vitamin D_3 was used in five studies and vitamin D_2 in three studies. Vitamin D_2 or D_3 was given in a daily dose ranging from 200 IU to 1000 IU. Treatment duration varied from 2 months to 36 months. Calcium supplementation was used in both treatment and placebo groups in five randomised controlled trials, and the dose varied between 500 mg/day and 1200 mg/day. In one study, calcium was provided only in the treatment group, and vitamin D alone was compared with placebo in two trials. Adherence varied between 68% and 100%, with seven out of eight trials reporting adherence of 80-100%.

In the eight randomised controlled trials, the pooled relative risk for any dose of vitamin D preventing a fall was 0.87 (95% CI 0.77 to 0.99). However, heterogeneity in results was seen among studies (Q test: P=0.05), although this was resolved after stratifying trials by daily dose (200-600 IU *v* 700-1000 IU).

The pooled relative risk for the seven studies with 700-1000 IU supplemental vitamin D a day (1921

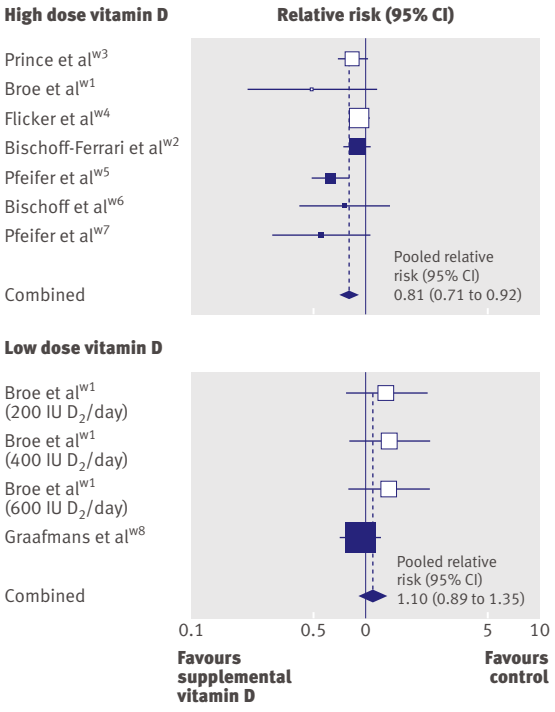

Fig 1 | Fall prevention with high dose (700-1000 IU a day) and low dose (200-600 IU a day) of supplemental vitamin D. Boxes represent relative risks, and the size of the boxes is proportional to the size of the high dose supplemental vitamin D trials included in the primary analysis. Error bars represent 95% confidence intervals. Shaded boxes indicate trials with vitamin D_3 and white boxes indicate those with vitamin D_2

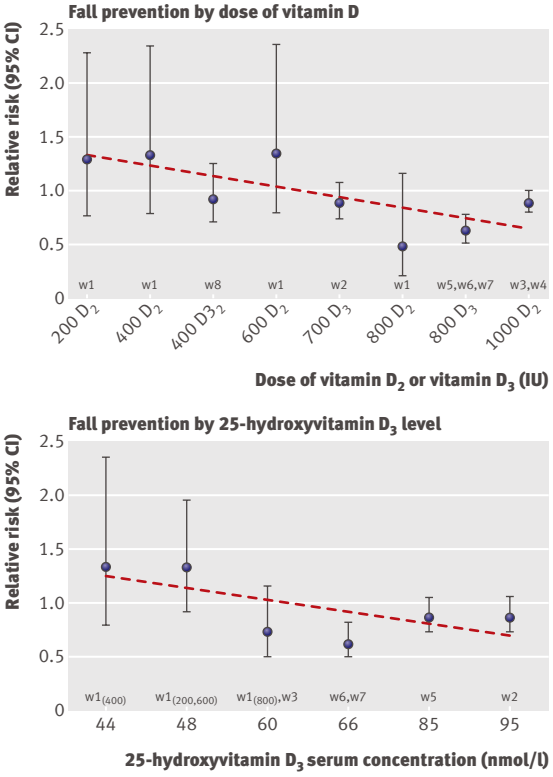

Fig 2 | Fall prevention by dose and achieved 25(OH)D concentrations. Circles represent relative risks and error bars represent 95% confidence intervals. Trendline is based on series of effect sizes (circles). There were three trials with 800 IU D_3, so the effect size for 800 IU D_3 is the pooled result from these three trials. Likewise, the effect size for 1000 IU D_2 is the pooled result from the two trials with 1000 IU D_2. We have listed the same dose D_2 and D_3 separately in the graph to account for their potential different impact on fall reduction. As there were two data points from the Broe et al trial that reached 48 nmol/l, two trials that reached 60 nmol/l, and two trials that reached 66 nmol/l, we pooled each of the sets

individuals) was 0.81 (0.71 to 0.92) suggesting that a high dose of vitamin D a day reduced the risk of a person falling by 19% (fig 1). The pooled risk difference for the high dose was 9.4% (5.1% to 13.7%; P<0.0001), so the number needed to treat was 11 (7 to 20) for a treatment duration of 2-36 months. The pooled relative risk for the two trials with a dose of less than 700 IU (200-600 IU) vitamin D a day was 1.10 (0.89 to 1.35; Q test: P=0.42) indicating that less than 700 IU vitamin D a day did not reduce fall risk.

Achieved serum 25(OH)D concentrations of 60 nmol/l or more resulted in a 23% fall reduction (pooled relative risk 0.77, 0.65 to 0.90), whereas concentrations of less than 60 nmol/l had no effect on number of falls (1.35, 0.98 to 1.84).

Figure 2 shows the relationship between vitamin D and falls, and suggests that fall prevention begins with a daily dose of 700 IU supplemental vitamin D. This threshold was confirmed in a meta-regression of 2426 individuals, in which a significant inverse relationship was found between dose and the risk of sustaining at least one fall (beta estimate for dose: ≥700 IU *v* <700 IU=−0.337; P=0.02). Figure 2 also suggests that a 25(OH)D concentration of 60 nmol/l is required for fall prevention. This possibility was likewise confirmed by a meta-regression of 1447 individuals (two trials did not provide 25(OH)D data), which indicated a significant inverse relationship between 25(OH)D serum concentration and the risk of sustaining at least one fall (beta estimate for 25(OH)D concentration: ≥60 nmol/l *v* <60 nmol/l=−0.586; P=0.005).

See bmj.com for full details of all subgroup and sensitivity analyses.

Trials of oral active forms of vitamin D

We found two randomised controlled trials of active forms of vitamin D that met our inclusion criteria. The two trials included 624 individuals with a mean age of 73 years, 70% of whom were women. In both studies, patients in the treatment group were more likely to experience hypercalcaemia (up to 3 mmol/l) than were those in the control group. The incidence of hypercalcaemia was twice as frequent in the treatment group as in the placebo group in one trial (12% *v* 6%). The pooled relative risk for fall prevention for active forms of vitamin D was 0.78 (0.64 to 0.94), and active forms of vitamin D reduced the risk of falls by 22%.

Fall prevention with active forms of vitamin D compared with high dose supplemental vitamin D

The pooled relative risk for fall prevention of 0.78 for active forms of vitamin D was similar to the pooled relative risk of 0.81 for high dose of supplemental vitamin D. The ratio of the two effect sizes (pooled relative risk supplemental vitamin D/pooled relative risk active forms of vitamin D) was 1.04 (0.84 to 1.31), suggesting that active forms and standard forms of vitamin D have statistically indistinguishable effects on fall prevention.

Test for publication bias

We found no evidence for publication bias in the eight supplemental vitamin D trials. See bmj.com.

DISCUSSION

In this meta-analysis, the efficacy of supplemental vitamin D for fall prevention depended on dose and achieved 25(OH)D concentrations among individuals aged 65 years and older. No fall reduction was observed for a daily dose of less than 700 IU vitamin D or achieved serum 25(OH)D concentrations below 60 nmol/l. Daily vitamin D doses in the range of 700 IU to 1000 IU or achieved serum concentrations between 60 nmol/l and 95 nmol/l reduced the risk of falling by 19%. At the high dose range of 700 IU to 1000 IU a day, the benefit of vitamin D was not significantly affected by type of supplemental vitamin D, gender, age, or type of dwelling. Notably, fall prevention with a high dose might not depend on additional calcium supplementation and was attained with treatment for less than 12 months (2-5 months). The benefit was sustained for 12-36 months.

Comparison with other studies

Our findings confirm those in an earlier meta-analysis on falls from 2004.[6] Since then, five double blind trials with sufficient quality fall assessment have been performed. Our meta-analysis included these trials. Several double blind randomised controlled trials have documented fracture prevention with 700-800 IU vitamin D a day,[7-9] but not with 400 IU a day.[10-12]

In another fracture trial, although falls were not assessed, supplementation most likely reduced the number of falls, leading to the fracture risk reduction apparent after six months.[13] Fall reduction was assessed as one of the end points in a 2007 evidence report on vitamin D.[14] Their pooled result suggested a non-significant 8% reduction in falls with vitamin D. A 2007 meta-analysis that focused on vitamin D_3 found a 12% reduction in falls by pooling four trials irrespective of their vitamin D dose or quality of fall assessment.[15]

In our meta analysis, active forms of vitamin D reduced falls by 22% and the high dose supplemental vitamin D reduced falls by 19%, suggesting no difference in efficacy between these alternatives in unselected older persons. However, the efficacy data for active forms of vitamin D was drawn from relatively few studies. In addition, active forms cost more and have a higher risk profile, so we believe adequate dosing of supplemental vitamin D should be preferred.

Limitations of study

As with all meta-analyses, this review has the potential for publication bias; however, we found no evidence for this. With respect to trial quality, our primary analysis was restricted to trials with a double blind design and sufficient quality fall assessment to address the efficacy of vitamin D for fall prevention. In our sensitivity analysis that included additional trials with an open study design or insufficient fall assessment, study variation was larger than expected for the pooled result from all 15 trials (see bmj.com). Even within the 14 high dose trials, variation between trials was larger than expected, supporting our predefined strategy of focusing on fall efficacy from double blind trials with sufficient fall assessment.

Conclusions

Doses of 700 IU to 1000 IU supplemental vitamin D a day could reduce falls by 19% or by up to 26% with vitamin D_3. Conversely, our results do not support the clinical use of vitamin D doses below 700 IU a day for the prevention of falls among older individuals. A 25(OH)D concentration of at least 60 nmol/l is required for fall prevention; therefore, a daily intake of at least 700 IU supplemental vitamin D is warranted in all individuals age 65 and older. Notably, good adherence is essential as the effect of vitamin D on falls will not be proportional below 700 IU a day. Finally, active forms of vitamin D do not appear to be more effective than 700-1000 IU of supplemental vitamin D for fall prevention in older persons.

Contributors: See bmj.com

Funding: This project was funded by a Swiss National Foundations Professorship Grant (PP00B-114864), the Velux Foundation, the Baugarten Foundation, the Vontobel Foundation, and a fellowship from the Robert Bosch Foundation. DPK was funded by the National Institute on Aging (grant P01 AG004390).

Sponsors: No sponsors participated in the design and conduct of the study; in the collection, analysis, and interpretation of the data; or in the preparation, review, or approval of the manuscript.

Competing interests: None declared.

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Accepted: 19 June 2009

pico

Partial protection of seasonal trivalent inactivated vaccine against novel pandemic influenza A/H1N1 2009: case-control study in Mexico City

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Cite this as: *BMJ* 2009;339:b3928
doi: 10.1136/bmj.b3928

This is a summary of a paper that was published on bmj.com as *BMJ* 2009;339:b3928

STUDY QUESTION Was there an independent association between having 2008-9 seasonal trivalent inactivated vaccine and getting influenza A/H1N1 during the epidemic in Mexico?

SUMMARY ANSWER Apparent protection against influenza A/H1N1 was independently associated with seasonal trivalent inactivated vaccine after adjustment for sex and underlying medical conditions conferring a higher risk of influenza related complications.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS Non-clinical evidence, although incomplete, has suggested that seasonal influenza vaccines will confer little or no protection against this novel virus. Our preliminary evidence suggests some protection of 2008-9 trivalent inactivated vaccine against pandemic influenza A/H1N1 2009, particularly severe forms of the disease.

Participants and setting

Consecutive patients with laboratory confirmed influenza A/H1N1 and three controls with other diseases (not influenza-like illness or pneumonia) living in Mexico City or the State of Mexico and matched for age and socioeconomic status. All participants had been admitted to hospital or been seen as outpatients in a specialty hospital in Mexico City during the study period.

Design, size, and duration

From 29 March to 20 May 2009 we carried out a retrospective frequency matched case-control study (60 cases and 180 controls). For both cases and controls we investigated the use of trivalent inactivated vaccine for the 2008-9 winter season by face to face or telephone interview of the patients or close relatives.

Primary outcome(s), risks, exposures

Odds ratio and effectiveness of trivalent inactivated vaccine against influenza A/H1N1.

Main results and the role of chance

Cases were more likely than controls to be admitted to hospital, undergo invasive mechanical ventilation, and die. Controls were more likely than cases to have chronic conditions that conferred a higher risk of influenza related complications. In the multivariate model, influenza A/H1N1 was independently associated with trivalent inactivated vaccine (odds ratio 0.27, 95% confidence interval 0.11 to 0.66) and underlying conditions (0.15, 0.08 to 0.30). Vaccine effectiveness was 73% (95% confidence interval 34% to 89%). None of the eight vaccinated cases died. We carried out sensitivity analyses on two subsets: patients admitted to hospital and those without high risk underlying conditions. The association between confirmed cases of influenza A/H1N1 and vaccination status continued to be significantly protective. The estimated effectiveness for each subset was 77% (22% to 93%) and 86% (50% to 96%), respectively.

Bias, confounding, and other reasons for caution

We consider that cases and controls originated from the same source population as cases of influenza A/H1N1, and controls were drawn from the same geographical area as the majority of notifications for influenza during the study period. This study is prone to limitations, however, due to a small sample size and the retrospective study design. Estimates for vaccine effectiveness could be inflated because of the high prevalence of chronic conditions and vaccination in our control population

Generalisability to other populations

Studies in other settings are needed.

Study funding/potential competing interests

The study was funded by the Mexican Ministry of Health which had no role in the design, analysis, writing, or interpretation of the study. JLV-G and SPdeLR are employed by Laboratorios de Biológicos y Reactivos de México (BIRMEX).

VARIABLES ASSOCIATED WITH INFLUENZA A/H1N1, BY CONDITIONAL LOGISTIC REGRESSION ANALYSIS

Characteristic	Adjusted odds ratio (95% CI)	P value
Participants (60 cases, 180 controls):		
Vaccinated *v* unvaccinated (2008-9 winter season)	0.27 (0.11 to 0.66)	0.004
Men	0.72 (0.37 to 1.37)	0.3
Underlying conditions*	0. 15 (0.08 to 0.30)	‹0.001
Participants admitted to hospital (59 cases, 61 controls):		
Vaccinated *v* unvaccinated (2008-9 winter season)	0.23 (0.07 to 0.78)	0.018
Men	0.85 (0.37 to 1.97)	0.7
Underlying conditions*	0.20 (0.09 to 0.45)	‹0.001
Participants with no underlying conditions* (45 cases, 60 controls):		
Vaccinated *v* unvaccinated (2008-9 winter season)	0.14 (0.04 to 0.50)	0.003
Men	0.73 (0.31 to 1.73)	0.479

*Medical conditions conferring a higher risk of influenza related complications

pico

Life expectancy in relation to cardiovascular risk factors: 38 year follow-up of 19 000 men in the Whitehall study

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Cite this as: *BMJ* 2009;339:b3513
doi: 10.1136/bmj.b3513

This is a summary of a paper that was published on bmj.com as *BMJ* 2009;339:b3513

STUDY QUESTION What effect do cardiovascular risk factors recorded in middle age have on life expectancy?

SUMMARY ANSWER Despite substantial changes in these risk factors over time, baseline differences in these risk factors were associated with a 10 to 15 year shorter life expectancy from the age of 50.

Participants and setting

Data were collected from 19 019 men aged 40-69 who were working in the civil service in London when they were first examined between September 1967 and January 1970. The study was part of the Whitehall study.

Design, size, and duration

Prospective cohort study of 18 863 men examined at entry in 1967-70 and followed for 38 years, of whom 13 501 died and 4811 were re-examined in 1997.

Main results and the role of chance

Life expectancy was estimated in relation to fifths and dichotomous categories of risk factors (smoking, "low" or "high" blood pressure (≥140 mm Hg), and "low" or "high" cholesterol (≥5 mmol/l)), and a risk score from these risk factors. At entry, 42% of the men were current smokers, 39% had high blood pressure, and 51% had high cholesterol. At the re-examination, about two thirds of the previously "current" smokers had quit smoking shortly after entry and the mean differences in levels of those with high and low levels of blood pressure and cholesterol were attenuated by two thirds. Compared with men without any baseline risk factors, the presence of all three risk factors at entry was associated with a 10 year shorter life expectancy from age 50 (23.7 *v* 33.3 years). Compared with men in the lowest 5% of a risk score based on smoking, diabetes, employment grade, and continuous levels of blood pressure, cholesterol concentration, and body mass index (BMI), men in the highest 5% had a 15 year shorter life expectancy from age 50 (20.2 *v* 35.4 years).

LIFE EXPECTANCY IN RELATION TO BASELINE CARDIOVASCULAR RISK FACTORS

Systolic blood pressure	Cholesterol concentration	Prevalence at baseline (%)	Mean (SE) life expectancy at age 50 (SE)
Non-smokers			
Low	Low	17.0	33.3 (0.2)
Low	High	17.2	32.2 (0.2)
High	Low	10.9	29.9 (0.3)
High	High	11.8	29.1 (0.3)
Smokers			
Low	Low	13.5	28.1 (0.2)
Low	High	13.5	27.3 (0.3)
High	Low	7.9	24.3 (0.4)
High	High	8.3	23.7 (0.4)

Bias, confounding, and other reasons for caution

As the re-survey of survivors in 1997 indicated that about two thirds of smokers quit smoking within a few years after entry into the study, the observed effects of current smoking in this study for cause specific mortality might have been underestimated, probably by about 50%.

Generalisability to other populations

The study was limited to employed men living in England in 1967-70 and so the findings might not be directly applicable to men in other populations or indeed to women.

Study funding/potential competing interests

British Heart Foundation.

What types of article does the *BMJ* consider?

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Longitudinal histories as predictors of future diagnoses of domestic abuse: modelling study

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Cite this as: *BMJ* 2009;339:b3677
doi: 10.1136/bmj.b3677

STUDY QUESTION Can longitudinal data in patients' historical records, commonly available in electronic health record systems, be used to predict a patient's future risk of receiving a diagnosis of domestic abuse?

SUMMARY ANSWER Intelligent Histories models were able to achieve sensitive, specific, and early prediction of patients' future risk of receiving a diagnosis of abuse.

Participants and setting

We studied anonymised diagnostic data from all patients aged over 18 from one state in the United States who had at least four years between their earliest and latest visits recorded in a state-wide claims database covering six years of inpatient admissions to hospital, admissions for observation, and encounters in emergency departments.

Design, size, and duration

Of the 561 216 qualifying patients, 1.04% (5829) met a narrow case definition for abuse, while 3.44% (19 303) met a broader case definition for abuse and assault. We trained Bayesian prediction models using data from two thirds of the patients and evaluated model performance using data from the remaining one third of the patients. We measured timeliness of detection, sensitivity, specificity, positive predictive value, and area under the ROC curve.

Main results and the role of chance

The models achieved sensitive, specific (area under the ROC curve of 0.88), and early (an average of 10-30 months in advance of diagnosis) prediction of patients' future risk of receiving a diagnosis of abuse. Analysis of model parameters showed important differences between sexes in the risks associated with certain diagnoses. We also developed a prototype visualisation that provides clinicians with instant overviews of longitudinal medical histories and related risk profiles at the point of care. Each coloured bar represents a diagnosis recorded over time, with the colour indicating the risk of abuse (green = low, yellow = medium, red = high; a grey scale version is available from the author). In the example shown here, the risk of abuse would have been detected 34 months before the first recorded diagnosis. This modelling approach could serve as the basis for an early warning system to help doctors identify high risk patients for further screening. Further details of the visualisations can be found at www.intelligenthistories.org.

Bias, confounding, and other reasons for caution

Certain patients might have received a diagnosis of abuse that was not recorded in the dataset, and some visits might have been miscoded. Such omissions and inaccuracies in the data could reduce the performance of the model, but the results show the utility of this approach using real-world data. Potential differences between cases of abuse that typically get diagnosed versus those cases that typically do not get diagnosed might serve as an important bias and might hinder the model's ability to detect the latter.

Generalisability to other populations

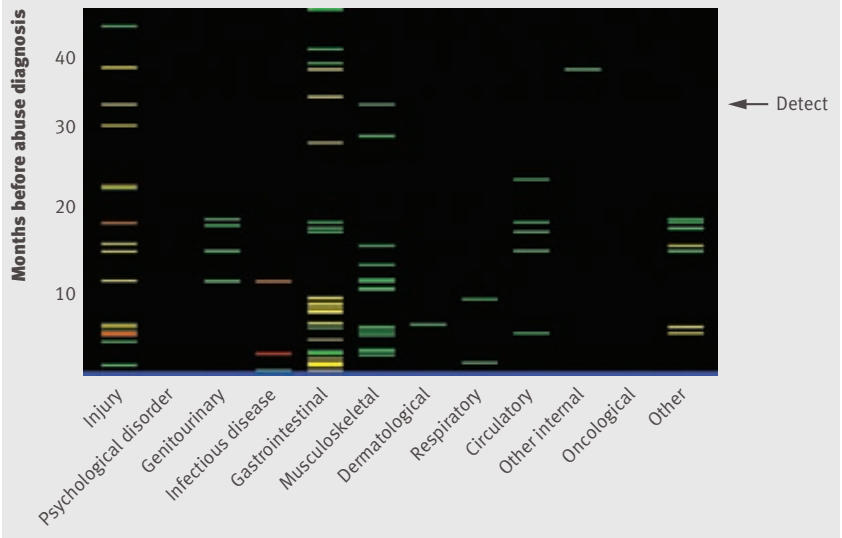
As differences in care and coding practices might affect the generalisability of models from one health environment to another, we recommend the training of a specific model for each healthcare environment. We expect the modelling approach to be generalisable to other settings inside and outside the US, as the minimal set of data elements (ICD-9 codes, dates of visits) used by the model are commonly stored throughout many countries with electronic medical record systems or claims systems. In countries that do not yet have electronic medical record systems, these models would be difficult to implement, though with time, electronic medical record systems are being deployed more widely throughout the world.

Study funding/potential competing interests

This work was supported by the US Centers for Disease Control and Prevention (grant R01 PH000040) and the National Library of Medicine (grants R01 LM009879, R01 LM007677, and G08LM009778). The funders have no involvement with the research.

This is a summary of a paper that was published on bmj.com as *BMJ* 2009;339:b3677

PROTOTYPE VISUALISATION



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Prognosis for patients with chronic low back pain: inception cohort study

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EDITORIAL by Hay and Dunn

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Cite this as: *BMJ* 2009;339:b3829
doi: 10.1136/bmj.b3829

STUDY QUESTION What is the one year prognosis for an inception cohort of patients with recent onset chronic low back pain?

SUMMARY ANSWER Despite the common view that recovery from an episode of chronic low back pain is unlikely, our findings suggest that the prognosis is moderately optimistic for patients with chronic low back pain.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS Chronic low back pain is a major health problem in most societies but its course has not been well investigated because of difficulties in obtaining a representative sample. Our study shows that for people with recent onset chronic low back pain, 35% will recover by nine months and 41% by 12 months.

Participants and setting

The study sample was a subcohort of an inception cohort of 973 consecutive patients with acute low back pain of less than two weeks' duration from primary care clinics in Sydney, Australia. Overall, 406 patients with persistent pain for three months formed the inception cohort of chronic low back pain.

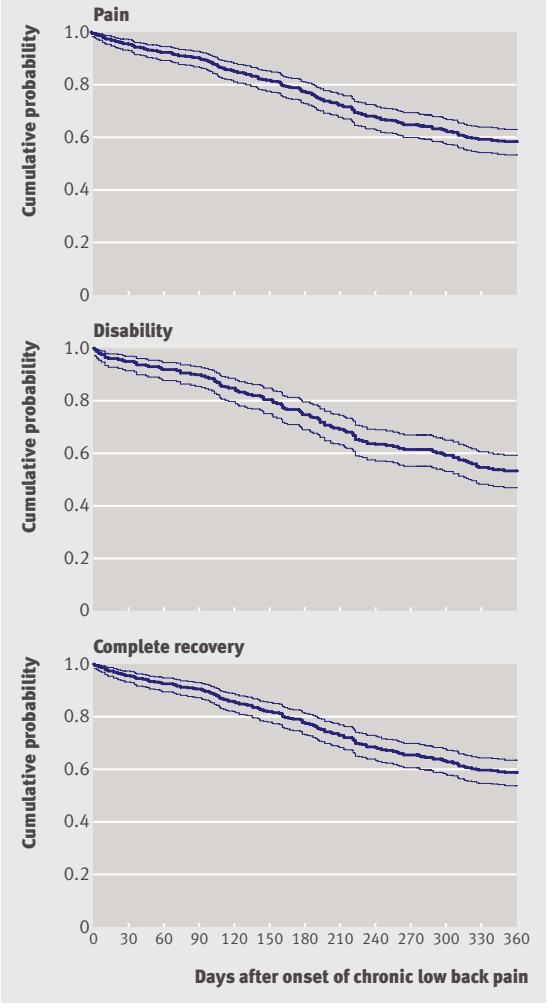
Design, size, and duration

This was an inception cohort study of 406 patients with recent onset chronic low back pain followed up at nine and 12 months. Recovery was determined from measures of pain intensity, pain related disability, and work status using Kaplan-Meier survival probability estimates to describe prognosis.

Main results and the role of chance

Completeness of follow-up was 97% of total person time for all outcomes. As the estimated survival did not fall below 50%, 25th centile survival times are presented: 178 days (95% confidence interval 153 to 209) for disability, 192 (170 to 222) for pain, and 197 (176 to 223) for complete recovery. The cumulative probability of being pain-free was 35% (141 events) at nine months and 42% (165) at 12 months. Of the 259 participants who had not recovered from their pain related disability, 39% (99) had recovered by nine months and 47% (118) by 12 months. The cumulative probability of complete recovery was 35% (139) at nine months and 41% (163) at 12 months (see figure). Only 44 of 406 participants (11%) had not returned to work in their previous capacity at the onset of chronicity and, of these, 46% (20) had returned to work in their previous capacity by 12 months.

KAPLAN-MEIER SURVIVAL CURVES (95% CONFIDENCE INTERVALS) OF RECOVERY FROM PAIN (N=406) AND DISABILITY (N=259) AND COMPLETE RECOVERY (N=406)



Generalisability to other populations

This is the largest inception cohort of patients with chronic low back pain. The characteristics of our sample are likely to be similar to other populations.

Study funding/potential competing interests

This study was supported by a grant from the National Health and Medical Research Council of Australia. The funder had no role in the study design; collection, analysis, and interpretation of data; writing of the report; or decision to submit the article for publication. The National Health and Medical Research Council of Australia funds the research fellowships of CGM, RDH, and NH. The University of Sydney International Research Scholarships funds the PhD of LdaCMC.

This is a summary of a paper that was published on bmj.com as *BMJ* 2009;339:b3829

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Adiposity and weight change in mid-life in relation to healthy survival after age 70 in women: prospective cohort study

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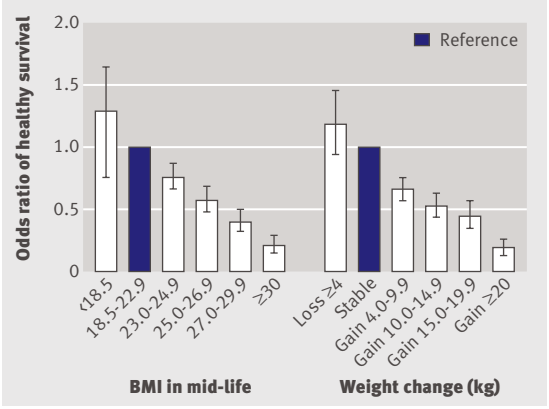
Cite this as: *BMJ* 2009;339:b3796
doi: 10.1136/bmj.b3796

STUDY QUESTION Does mid-life adiposity have any impact on overall health status among women who escape premature death and survive to older ages?

SUMMARY ANSWER Mid-life adiposity, as well as weight change between age 18 and mid-life, decreases the probability of maintaining an optimal overall health status at older ages in women. Women who are lean at early adulthood and maintain a healthy body weight thereafter have the highest probability of achieving healthy survival.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS Adiposity is an established risk factor for premature death and multiple chronic diseases. The current study provides new evidence for adverse effects of mid-life adiposity on healthy survival in ageing women.

EFFECT OF BMI IN MID-LIFE AND WEIGHT CHANGE BETWEEN AGE 18 AND MID-LIFE ON HEALTHY SURVIVAL



Participants and setting

Study participants were a subset of a large prospective cohort study (the Nurses' Health Study) consisting of female registered nurses in the United States.

Design, size, and duration

We identified 17 065 women for whom disease status, cognitive and physical functioning, and mental health were ascertained at age 70 or older. Information on body weight and height was collected at baseline in 1976 when these study participants were, on average, aged 50. Healthy survival was defined as having no history of 11 major chronic diseases and having no substantial cognitive, physical, or mental limitations at age 70 and over.

Main results and the role of chance

Of the women who survived until at least age 70, 1686 (9.9%) met our criteria for healthy survival. Both body mass index (BMI) at baseline and weight gain from age 18 until baseline were associated with a linear reduction in the probability of attaining healthy survival ($P<0.001$ for trend). Every one unit increase of BMI was associated with a 12% reduction in the odds of healthy survival (95% confidence interval 10% to 14%), and every 1 kg weight gain since age 18 was associated a 5% (4% to 6%) reduction. Women who were overweight at age 18 and subsequently gained more than 10 kg of body weight had the worst odds of healthy survival: the adjusted odds ratio was 0.18 (0.09, 0.36) in comparison with women who were lean since age 18.

Bias, confounding, and other reasons for caution

We took advantage of rich data collected in the cohort study and adjusted for a wide variety of demographic, socioeconomic, lifestyle, and dietary covariates at baseline to control for confounding. We not only excluded participants with existing diseases at baseline but also imposed an average 24 year lag period between the assessment of mid-life adiposity and the assessment of healthy survival to minimise the bias of reverse causation. Some measurement errors in the assessments of early adulthood adiposity and weight change probably attenuated the true associations. Our definition of healthy survival is somewhat subjective, and a standardised definition needs to be developed and examined in future investigations.

Generalisability to other populations

This study was conducted among female health professionals with primarily European ancestry. Whether these observations can be generalised to other populations needs to be studied further.

Study funding/potential competing interests

The funders, the National Institutes of Health and the Boston Obesity Nutrition Research Center, had no roles in study design, data collection, data analysis, manuscript preparation and publication, or other aspects of this work.

This is a summary of a paper that was published on bmj.com as *BMJ* 2009;339:b3796

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