research

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ORIGINAL RESEARCH Observational study

Performance of UK National Health Service compared with other high income countries

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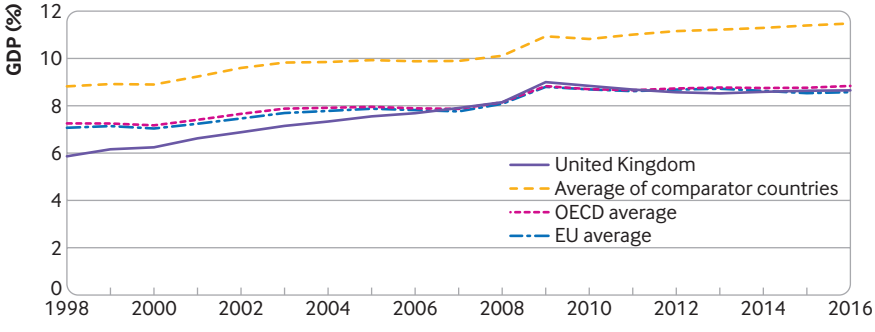
Study question How does the performance of the UK National Health Service compare with the health systems of other high income countries across key areas of health system performance?

Methods This observational study used secondary data from international organisations such as the Organization for Economic Cooperation and Development (OECD) to examine performance across the UK NHS compared with the health systems of Australia, Canada, Denmark, France, Germany, the Netherlands, Sweden, Switzerland, and the United States. It included comparable indicators encompassing all aspects of healthcare, including spending, structural capacity, accessibility, utilisation, quality, and health outcomes. The focus was on the most recent data available, typically 2017, as well as trends since 2010 when available and comparable.

Study answer and limitations The UK had lower total health spending and slower growth in expenditure than comparator countries (UK $3825 (£2955) per capita in 2017; study average $5700). Despite already low levels of labour, the UK is making do with fewer doctors and nurses, a challenge that is likely to be exacerbated in the context of Brexit. Although access to care compared favourably with other countries, utilisation was lower than average. Health service outcomes, as well as heath status, compared relatively poorly with the group. The data presented in this paper are purely descriptive, and the interpretation of the results is sensitive to the selection of comparator countries.

What this study adds This study provides a comprehensive comparison of how the UK NHS performs relative to other high income countries, OECD member nations, and European Union member nations, with a more complete picture than before of how the NHS is performing.

Funding, competing interests, and data sharing No funding. Data can be found in the online technical appendix.



Total expenditure on health in UK, comparator countries, Organization for Economic Cooperation and Development (OECD) member nations, and European Union (EU) member nations. UK values shown are as represented by the Office for National Statistics and the OECD for comparator countries. The OECD data were only available for comparator countries until the year 2016. GDP=gross domestic product

Average annual growth rate (%)

Average of comparator countries					
0.22	0.09	0.07	0.23	0.08	0.07
United Kingdom					
0.23	0.23	0.20	0.17	-0.03	0.02

The health effects of fine particulate air pollution

ORIGINAL RESEARCH Time stratified, case crossover study

Short term exposure to fine particulate matter and hospital admission risks and costs in the Medicare population

Wei Y, Wang Y, Di Q, et al

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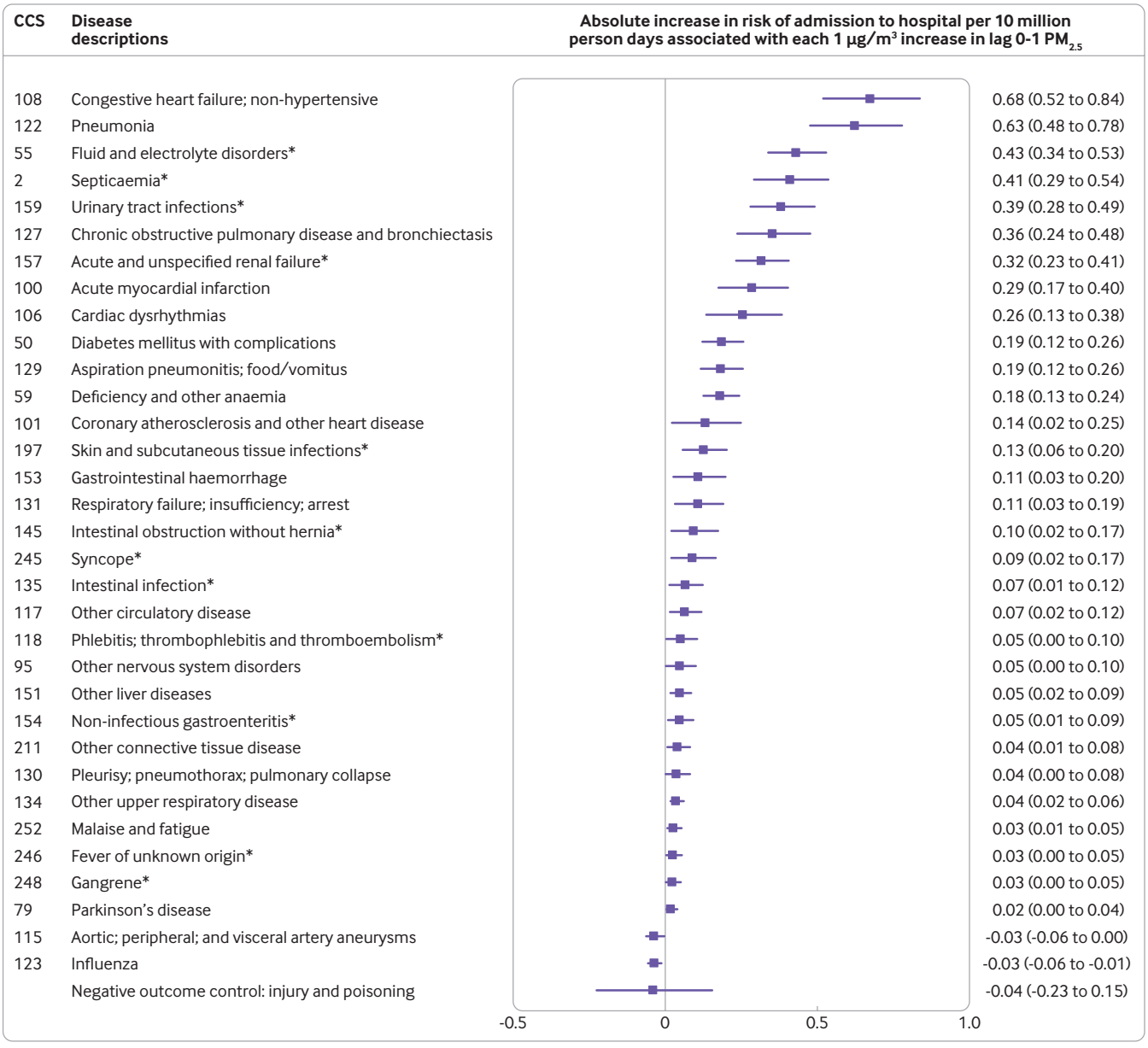
Study question Which causes of hospital admission for adults aged 65 or older are associated with short term exposure to fine particulate matter of diameter less than 2.5 microns ($PM_{2.5}$), do these associations exist at a daily concentration below the World Health Organization's air quality guideline for the 24 hour average exposure to $PM_{2.5}$ (25 μg/m^3), and what are the economic costs associated with a unit increase in short term exposure to $PM_{2.5}$?

Methods Overall, 95 277 169 Medicare inpatient claims of all fee-for-service beneficiaries aged 65 or older in the United States during 2000-12 were analysed. More than 15 000 ICD-9 (international classification of diseases, ninth revision) principal diagnosis codes at discharge were classified into 214 mutually exclusive disease groups. For each disease group, a time stratified, case crossover analysis was conducted to estimate the risk of hospital admission and the corresponding costs associated with 1 μg/m^3 increase in short term $PM_{2.5}$.



Main analysis showing absolute increases in risk of hospital admission, ordered from highest to lowest, associated with each 1 μg/m^3 increase in lag 0-1 $PM_{2.5}$. The main analysis was conducted in the case crossover study setting with lag 0-1 $PM_{2.5}$ as the exposure, adjusted for penalised splines of lag 0-1 air and dew point temperatures for each disease group. The Bonferroni correction was used to adjust 95% confidence intervals for disease groups associated with lag 0-1 $PM_{2.5}$ and negative outcome control (injury and poisoning). CCS=Clinical Classification Software code. *Newly identified disease groups

Study answer and limitations

Short term exposure to $PM_{2.5}$ was associated with increased risk of hospital admission for several prevalent but rarely studied diseases such as septicaemia, fluid and electrolyte disorders, and acute and unspecified renal failure. It was also associated with hospital admissions due to cardiovascular and respiratory diseases, Parkinson's disease, diabetes, phlebitis, thrombophlebitis, and thromboembolism, consistent with previously published results. These associations remained consistent when restricted to days with a daily $PM_{2.5}$ concentration below the WHO 24 hour guideline. In addition, each 1 $\mu g/m^3$ increase in short term exposure to $PM_{2.5}$ was associated with an annual increase of 5692 hospital admissions, 32 314 days in hospital, and 634 deaths at discharge, corresponding to $100m (£78m) annual inpatient and post-acute costs and $6.6bn economic value of lives lost at discharge. The major limitation of this study was that costs incurred after discharge were not fully captured.

What this study adds

This study discovered new causes, and confirmed known causes, of hospital admissions associated with short term exposure to $PM_{2.5}$, even at a concentration below the WHO air quality guideline. This study also reported substantial economic costs linked to a small increase of short term $PM_{2.5}$.

Funding, competing interests, and data sharing

This study was supported by the National Institutes of Health, National Cancer Institute, Health Effects Institute, and United States Environmental Protection Agency. Authors have no competing interests. No additional data available.

COMMENTARY The harder we look, the more we find

Fine particulate matter (PM) of diameter less than 2.5 microns ($PM_{2.5}$) is ubiquitous, emanating especially from transport and combustion sources. Since a seminal 1993 study showing a clear association between airborne $PM_{2.5}$ and mortality rates in six cities in the United States,[1] many attempts have been made to quantify the global annual burden of mortality due to $PM_{2.5}$—0.8 million in 2005,[2] 3.15 million in 2015,[3 4] and almost 9 million in 2018.[5] This increase reflects not a 10-fold rise in $PM_{2.5}$ exposure, but improved modelling of $PM_{2.5}$ concentrations, and use of real world exposure-response associations incorporating new data from developing nations, which has led to conclusions with increased reliability and, unfortunately, of increased mortality.

$PM_{2.5}$ has been associated with diseases of the respiratory and cardiovascular systems, with cardiovascular disease likely occurring through systemic inflammation and possibly translocation of particulate matter into the circulation.[6] Indeed, ultrafine particles (<100 nanometres in diameter) have been found in the brain and heart.[7 8]

Wei and colleagues confirmed previously established associations between short term $PM_{2.5}$ concentration and respiratory, cardiovascular, and Parkinson's disease, and diabetes mellitus, and found in addition that, through diseases not previously associated with $PM_{2.5}$, each 1 $\mu g/m^3$ increase in $PM_{2.5}$ was associated with 2050 extra hospital admissions, 12 216 days in hospital, and $31m (£24m, €28m) in care costs. These diseases included septicaemia, fluid and electrolyte disorders, renal failure, and infections of the urinary tract, skin, and subcutaneous tissue.

Associated diseases included septicaemia, fluid and electrolyte disorders, renal failure, and infections

No safe limit

Crucially for informing policy, these associations remained even when the analysis was restricted to days when the $PM_{2.5}$ concentration was below the World Health Organization's guideline of 25 $\mu g/m^3$, confirming the conclusions of other authors finding no safe lower limit for exposure to $PM_{2.5}$.[11]

Our knowledge of the health effects of PM is still lacking in many areas—notably the range of disease outcomes associated with particulates and their causality; and the effects of long term exposure, indoor exposure, and ultrafine PM. The relative effects of different PM sources, and any differences between primary PM (released from source) and secondary PM (formed by reactions of pollutant gases following release), are also poorly understood. We urgently need more epidemiological research to uncover new disease associations and to investigate newly reported associations, and toxicology research to explore potential causative mechanisms.

As the burden of disease associated with pollution becomes more apparent, better awareness among health professionals and the public is needed to help prevent pollution associated disease exacerbations, and to push for policies to reduce emissions.

During the 2008 Beijing Olympics, transport and industrial restrictions substantially improved air quality, accompanied by a 46% drop in relative risk of outpatient visits for asthma.[18] Such restrictions are probably unsustainable, but progress has still been made. Thirteen years after the aforementioned seminal study on six US cities,[1] the authors re-evaluated the situation. In the intervening years, five of the six cities showed reduced $PM_{2.5}$ concentrations, and a proportionate reduction in $PM_{2.5}$ associated mortality.[19]

Clearly, there is much still to learn, but we should not mistake knowledge gaps for paucity of evidence. The sooner we act, the sooner the world's population will reap the benefits.

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Associations of dairy intake with risk of mortality in women and men

Ding M, Li J, Qi L, et al

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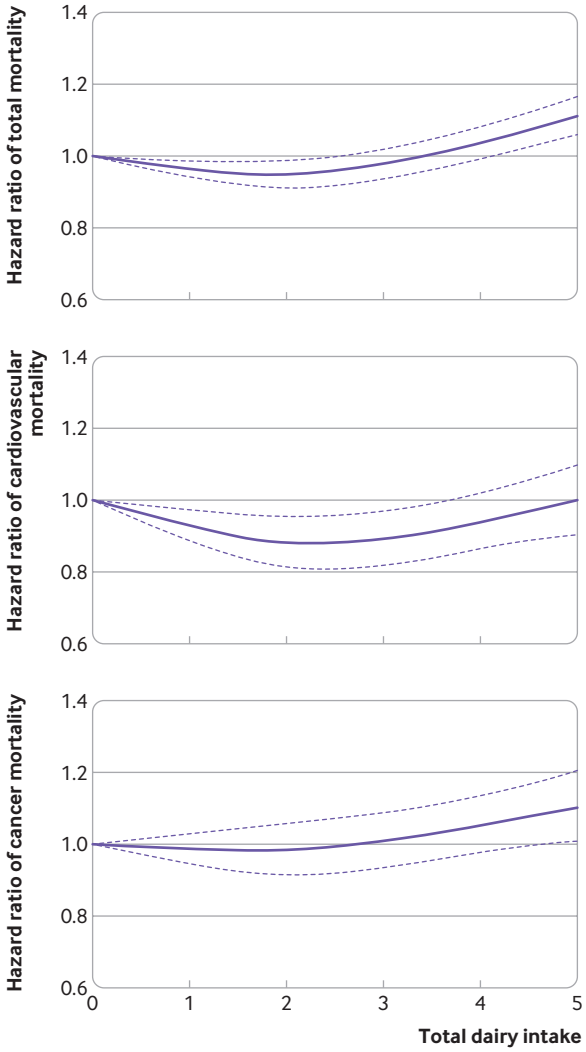
Study question What are the associations between consumption of dairy foods and the risk of total and cause specific mortality?

Methods This analysis included 168 153 women and 49 602 men without cardiovascular disease or cancer at baseline in the Nurses' Health Study, Nurses' Health Study II, and Health Professionals Follow-up Study in the United States. These prospective cohort studies collected data on repeated measures of diet and lifestyle factors. During up to 32 years of follow-up, 51 438 deaths were recorded, including 12 143 cardiovascular deaths and 15 120 cancer deaths. The standard serving sizes were a 240 mL glass for skim/low fat milk and whole milk; one tablespoon (6 g) for cream; 1/2 cup (120 mL) for sherbet or frozen yogurt, ice cream, and cottage and ricotta cheese; and 30 mL for cream cheese and other cheese. Multivariable analysis further adjusted for family history of cardiovascular disease and cancer, physical activity, overall dietary pattern, total energy intake, smoking status, alcohol consumption, menopausal status, and postmenopausal hormone use.

Study answer and limitations
Compared with the lowest category of total dairy consumption (average 0.8 servings/day), the multivariate pooled hazard ratio for total mortality was 0.98 (95% confidence interval 0.96 to 1.01) for the second category of dairy consumption (average 1.5 servings/day), 1.00 (0.97 to 1.03) for the third (average 2.0 servings/day), 1.02 (0.99 to 1.05) for the fourth (average 2.8 servings/day), and 1.07 (1.04 to 1.10) for the highest category (average 4.2 servings/day; P for trend <0.001). For the highest compared with the lowest category of total dairy consumption, the hazard ratio was 1.02 (0.95 to 1.08) for cardiovascular mortality and 1.05 (0.99 to 1.11) for cancer mortality. In food substitution analyses, consumption of nuts, legumes, or whole grains instead of dairy foods was associated with a lower mortality, whereas consumption of red and processed meat instead of dairy foods were associated with higher mortality. Residual confounding could have been present owing to the observational nature of the study.

What this study adds The data from these large study cohorts suggest that a moderate amount of total dairy consumption was not associated with risk of mortality, and a high amount of dairy intake was associated with a slight risk of mortality. No significant associations of total dairy intake with risks of cardiovascular mortality and cancer mortality were found.



Dose-response associations of total dairy intake with risks of total mortality and mortality due to cardiovascular disease and cancer, based on pooled analyses of cohorts from the Nurses' Health Study, Nurses' Health Study II, and Health Professionals Follow-up Study. Multivariable adjusted model was further adjusted for family history of cancer, family history of cardiovascular disease, baseline disease status, baseline body mass index, physical activity, overall dietary pattern, total energy intake, smoking status, alcohol consumption, postmenopausal status, and current postmenopausal hormone use

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The authors declare no competing interests. No additional data available.