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# Hospitals' star ratings and clinical outcomes: ecological study

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The English Department of Health is developing global measures of the performance of all NHS bodies, including 166 acute hospital trusts. Since 2000-1, the trusts get zero, one, two, or three stars to indicate performance.[1] This rating may not reflect the effectiveness of clinical care measured in patient outcomes because of the lack of accurate routine data.[2] One exception is in adult critical care[3]; we checked whether a hospital's rating provided an indication of its clinical outcomes.

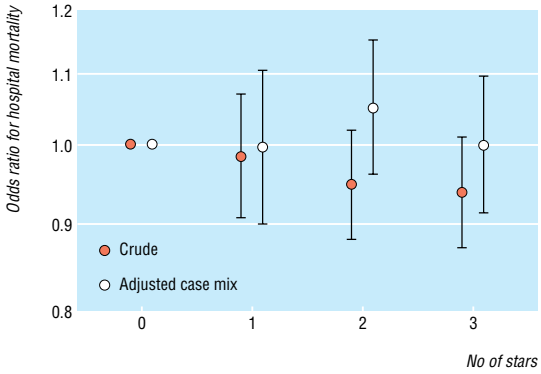
## Methods and results

We compared the 2001-2 rating of 102 acute hospital trusts for which we had validated data for that year. We calculated each patient's predicted risk of death before discharge from hospital[4] and compared it with actual mortality for all admissions in 2001-2 for each unit.

We compared rating with crude mortality at the patient level rather than aggregated by hospital; our sample of hospitals with all hospitals; and university with non-university hospitals using $\chi^2$ tests for trend. We compared rating with size of intensive care unit and mean age of patients, using Spearman's ρ. We calculated confidence intervals for mortality adjusted for risk, using logistic regression of mortality on rating and predicted log odds of mortality. We tested rating and adjusted mortality using the likelihood ratio test.

The distribution of ratings for the 102 acute hospital trusts was similar to that for all 166 trusts ($\chi^2=1.7$; $P=0.19$). Rating was associated with teaching status (university hospitals had more stars than non-university hospitals—52% *v* 29% had three, 38% *v* 45% had two, 5% *v* 19% had one, 5% *v* 7% had zero; $\chi^2=3.9$; $P=0.05$) but not size of its critical care unit (Spearman's $\rho=0.09$; $P=0.34$).

Rating and crude mortality for critical care admissions were significantly associated ($\chi^2=4.1$; df = 1; $P=0.04$) (figure): mortality in trusts with three stars was about 4% lower than in trusts with zero stars. However, case mix of critical care admissions also differed considerably. Rating was inversely associated with the mean age of critical care admissions ($\rho=-0.19$; $P=0.04$). The association between rating and hospital mortality was no longer significant when case mix differences were taken into account ($P=0.4$) (figure).




Odds ratio for crude case mix and for case mix adjusted for risk hospital mortality by star rating of acute hospital trust

## Comment

For adult critical care, star ratings do not reflect the quality of clinical care provided by hospitals. Patients do just as well in a trust with no stars as they do in one with three stars. Crude mortality data are misleading because they ignore the fact that higher rated trusts tend to be teaching institutions with patients who are less severely ill on admission to critical care units.

We did not expect to find an association between the rating of the whole trust and the effectiveness of critical care. Firstly, hospitals are complex organisations containing many services; performance across a hospital will not be uniform—a poorly rated hospital may contain some excellent services and vice versa. Secondly, ratings are determined by a small number of process measures; outcome measures play only a small

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role and are based on scant poor quality data, which do not adequately account for case mix.

The study's principal limitation is its confinement to one small, though important, group of patients and services. Our findings may be atypical, and trusts' ratings may reflect outcomes elsewhere in hospital care.

If these findings reflect other areas of hospital care, the government is not yet fulfilling its "commitment to provide patients and the general public with comprehensive, easily understandable information on the performance of their local health services."[1] Outcome ought to be a principal concern alongside process indicators, such as waiting times and cleanliness; to fulfil its aim, the government needs to use specialised clinical databases (accessible through www.docdat.org).[5]

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# Pertussis vaccination in infancy and asthma or allergy in later childhood: birth cohort study

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Some studies have shown a link between vaccination of infants with whole cell inactivated pertussis vaccine and the later development of asthma and atopy.[1 2] A randomised controlled trial disagreed with these findings, but follow up was done until only 30 months of age.[3] Our previous report of the lack of an association between pertussis vaccination and wheezing disorders was based on outcomes in early childhood.[4] In this study we have examined the association between pertussis vaccination in infancy and asthma or atopy by age 7.5 years in a large, population based birth cohort.

## Participants, methods, and results

Participants were the 13 971 children who survived to 1 year in the Avon longitudinal study of parents and children. The study method has been described previously,[5] and details can be found on the study website (www.alspac.bris.ac.uk). We obtained the vaccination status for each child from the child health surveillance database. We categorised children with regard to pertussis as fully vaccinated (completed a primary course of diphtheria, tetanus, and pertussis vaccination), partially vaccinated (completed a primary course of diphtheria and tetanus but did not receive pertussis vaccine) or non-vaccinated (no vaccinations). We excluded other combinations from analysis. We obtained three wheezing outcomes based on parental self report questionnaires (asthma at 69-81 months, wheeze with whistling on the chest at 69-81 months, and asthma diagnosed by a doctor at 91 months) and one atopy outcome based on skin prick tests at age 7 years. We defined atopy as one or more positive reactions (wheal ≥2 mm) to a panel of three common allergens. We selected several variables as potential confounders of the relation between exposure and outcome, which were, however, not considered to be in the causal pathway. These were, from mother's questionnaire data: maternal education, maternal smoking during pregnancy, maternal history of asthma or eczema, maternal financial difficulties, damp housing, overcrowding, child's ethnicity, number of siblings, contact with cats in the home, duration of breast feeding, and passive exposure to tobacco smoke; and, from medical records: birth weight, sex, gestational age, and maternal age at delivery. We used Pearson's $\chi^2$ (or Fisher's exact test if the predicted number of subjects in any category was less than five) for our data analysis of univariable associations between vaccination status and possible confounders and principal outcomes. We used multivariable logistic regression models to evaluate associations between immunisation status and asthma and allergy outcomes while controlling for potential confounders.

Vaccination history was available for 13 810 children, of whom 13 109 (94.9%) were fully vaccinated, 446 did not have pertussis vaccination (340 non-vaccinated; 106 partially vaccinated), and 255 had some other combination. The table shows numbers of subjects with outcome data for each of the principal outcomes. The cumulative prevalence of asthma diagnosed by doctors was 20.3% (n=1597) at 91 months. The prevalence of reported asthma at 69-81 months was 12.4% (n=1024), reported wheeze with whistling at 69-81 months 9.8% (n=798) and atopy at 7 years 20.5% (n=1324). The table shows the adjusted and unadjusted odds ratios and 95% confidence intervals from logistic regressions for each of the principal outcomes. Although unadjusted analyses showed significant associations (asthma at

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