

Increasing hospitalizations due to pneumonia with no evidence of decreasing severity, in Oxfordshire from 1998 to 2014

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Objective: To investigate changes in incidence of hospitalisations due to pneumonia over the past 16 years at the Oxford University Hospitals (OUH) Trust, and determine if the changes can be explained by changes in case-mix, coding practices, or admission procedures.

Methods: Incidence of pneumonia as a primary diagnosis for OUH inpatients was calculated over calendar time using routinely collected diagnostic codes, and modelled using piecewise linear poisson regression to reflect changes in incidence rates. Other conditions which could be diagnosed alternatively to pneumonia were also modelled to check for possible diagnosis-switching. For those whose primary reason for hospitalisation was pneumonia, length-of-stay and biochemistry markers at admission were modelled using median regression to look for possible changes in severity of illness. 30-day all-cause mortality and microbiology test results were also modelled using poisson regression. Each outcome was stratified by age-group (18-65, 65-75, 75-85, 85+) to control for an ageing population.

Results: Pneumonia as a primary diagnosis increased with an incidence rate ratio (IRR) of 1.039/year (95% CI 1.033-1.045, p<0.001) from 1998-2008, and then at a much faster IRR of 1.083/year (95% CI 1.074-1.093, p<0.001) from 2008 onwards. In 2014, there were on average 129 pneumonia admissions/month. Other conditions which could be alternatively diagnosed as pneumonia also increased during this time, e.g. chronic obstructive pulmonary disorder by IRR 1.033/year (1.029-1.036), acute bronchitis by 1.061/year (1.057-1.065), viral infection by 1.023/year (1.015-1.032), and aspiration pneumonitis by 1.131/year (1.114-1.148). Thirty-day all-cause mortality remained stable at 24.7% overall (IRR=0.997/year, (0.991-1.003)), whilst median length-of-stay was stable at ~6 days up to 2005, then decreased by 0.22 days/year subsequently (-0.27, -1.78). Median CRP (100.1 mg/L in 2014) was stable up to 2009 at 111 mg/L and then decreased slightly by 3.58 mg/L/year (-5.35, -1.65). In contrast, median urea (7.7 mmol/L in 2014) and neutrophil counts (9.8 x10⁹/L in 2014) both increased slightly over the whole period, by 0.033 (0.013, 0.053) mmol/L/year and 0.082 (0.059-0.103) x10⁹/L/year respectively. The proportion of cases with a causative bacterial organism in a blood/respiratory sample was stable until 2005 at ~9%, then decreased by IRR 0.965/year (0.946-0.983). Patterns were similar in different age-groups.

Conclusion: Cases of pneumonia leading to hospitalisation have been increasing rapidly in Oxfordshire, particularly since 2008. There is no evidence to suggest this is driven by changes in pneumonia coding, nor by an ageing population. There is also no evidence that patients with substantially less severe disease are being admitted over time. There is some evidence that doctors are becoming more willing to diagnose pneumonia without any bacterial confirmation, opening the possibility that it has an increasingly viral cause. As pneumonia is a major driver for antibiotic prescribing, investigating less broad and/or shorter antibiotic courses should be a priority.

