



# The Early Mobility Bundle: a simple enhancement of therapy which may reduce incidence of hospital-acquired pneumonia and length of hospital stay

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## ARTICLE INFO

### Article history:

Received 27 December 2013

Accepted 8 May 2014

Available online 20 June 2014

### Keywords:

Activity

Hospital-acquired pneumonia

Length of stay

Physiotherapy

Prevention



## SUMMARY

**Background:** Early mobility facilitated by physiotherapy has been shown to reduce the incidence of hospital-acquired pneumonia (HAP) in patients with hip fractures but its effect on HAP incidence in medical patients has not yet been studied.

**Aim:** To determine whether early mobility aided by physiotherapy reduces the incidence of HAP and length of stay in patients on medical wards.

**Methods:** One respiratory and one elderly care medicine ward in one hospital association in Birmingham, UK, received the 'Early Mobility Bundle'. The bundle consisted of extra targeted physiotherapy and collaboration with ward staff to encourage and promote activity. The incidence of HAP, falls, pressure sores, length of stay (LOS) and activity level were then compared to two matched wards within the same hospital association.

**Results:** HAP incidence was significantly lower in the intervention group ( $P < 0.0001$ ) and remained so after adjusting for confounders ( $P = 0.001$ ). Activity levels were higher ( $P = 0.04$ ) and patients' LOS was more likely to fall in the lowest quartile (OR: 1.44;  $P = 0.009$ ) in the intervention group. There was no significant difference in other outcomes.

**Conclusion:** The Early Mobility Bundle demonstrates a promising method to reduce the incidence of HAP and to increase activity in medical inpatients.

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## Introduction

Hospital-acquired infections (HAIs) are a growing concern in the western world due to their morbidity and cost, with pneumonia among the most frequently occurring. Hospital-acquired pneumonia (HAP) occurs  $\geq 48$  h after admission to

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hospital. In practice, the term HAP frequently includes ventilator-associated pneumonia (VAP; occurring  $\geq 48$  h after initiation of ventilator support) and the majority of the evidence base for prevention relates to this subgroup.<sup>1</sup> The incidence of HAP is estimated at five to 10 per 1000 hospital admissions, although there is no compulsory national reporting – hence this may be an underestimate. Mortality rates are 33–50% in the VAP subset, but there are no reliable published data on the prognosis of wider HAP groups.<sup>1</sup> However, mortality from community-acquired pneumonia (CAP) is higher among patients with pre-existing respiratory disease and those who are elderly, hence prevention of HAP in these subgroups could be particularly beneficial.<sup>2,3</sup>

Inactivity and resultant reduced clearance of secretions are thought to be contributory factors to HAP development. Prevention strategies for VAP already include semi-recumbent (rather than supine) nursing and chest physiotherapy, both strategies aimed at clearing secretions more efficiently.<sup>1,4</sup> Early physiotherapy, targeting mobility rather than chest secretions, is a recognized way of preventing HAIs and reducing hospital length of stay (LOS) in surgical specialties.<sup>5,6</sup> In trauma patients with hip fractures this resulted in reduced incidence of HAP.<sup>7</sup> The utility of directed physiotherapy in reducing incidence of HAP in medical patients has not been studied to date, although enhancing activity by early mobilization has reduced LOS in patients with CAP whereas individual physiotherapy had a similar effect on patients on elderly care, general medical and respiratory wards.<sup>8,9</sup>

This study aimed to test the hypothesis that increased physiotherapy input results in a reduced incidence of HAP in patients admitted to respiratory and elderly care wards.

## Methods

### Study design

The study was conducted in a single hospital association in Birmingham, which has three hospital sites, and used a clustered design, such that patients on two wards (one elderly care, one respiratory) received the intervention and were compared to control patients on two similar specialty wards at a different hospital. The wards were chosen to attempt matching of patient population, and had minimal cross-over of staff. Patients admitted electively or whose primary reason for admission was surgical (e.g. hip fracture) were excluded from data analysis. The primary outcome was incidence of HAP (defined as new consolidation, persistent infiltrate or cavitation on chest radiograph  $>48$  h after admission, confirmed by independent radiological report, in conjunction with appropriate clinical features and/or treatment).<sup>10</sup> Secondary outcomes were LOS, activity levels, rate of falls, and rate of pressure area problems. All data were collected prospectively and patients undergoing procedures beyond usual care gave informed consent. The study was approved by the local ethics committee (13/WM/0003) and registered as a clinical trial (NCT01769742).

The study ran for a duration of six months in 2013. Patients were recruited on the first day of admission to the study wards. Demographics, comorbidities, LOS, incidence of HAP, and activity level (measured by accelerometer) were collected daily. Activity recording was conducted only on patients able to mobilize (i.e. not bedbound) and able to give informed

consent; monitoring was conducted for 48 h using the actigraph, worn at the waist at all times. Hospital reporting systems were used to back up data collected from medical notes and patients on falls and pressure sores.

### Intervention

The 'Early Mobility Bundle' was developed by the therapy team to improve and maintain patient mobility through targeted physiotherapy and collaboration with ward staff. It was an enhancement of usual care and a change in ward culture rather than intensive individual therapy, as we wanted an intervention that would be sustainable after the study ended. The bundle consisted of enhancing the availability of walking aids, provision of occupational therapy equipment to maximize independence, addition of mobility charts, individual instructions and information above each patient's bed, and informing and encouraging all staff to support appropriate movement – for instance patients would be encouraged to get up from bed and walk to the food trolley. Charts were updated regularly by the study physiotherapist and compliance with the bundle monitored. Control wards received usual physiotherapy only. Medical care was not changed by the study team.

### Statistical analysis

Statistical analysis was conducted using SPSS (version 19) comparing the intervention and control groups, with secondary substratification for ward specialty (elderly or respiratory). The  $\chi^2$ -test was used for initial analysis of HAP frequency, with subsequent logistic regression analysis used to adjust for significant confounding factors. Mean LOS was compared using the Mann–Whitney test due to non-normally distributed data, with subsequent regression. Normally distributed data are shown as mean (standard deviation; SD) and non-normally distributed data as median (range), with frequency variables shown as  $n$  (%). Statistical significance was assumed at  $P < 0.05$ . The analyst was blinded to the intervention or control groups.

## Results

Table 1 shows the characteristics of patients on the intervention and control wards and simple unadjusted comparisons for each outcome measure. HAP incidence was lower ( $P < 0.0001$ ) and patients were more active ( $P = 0.04$ ) in the intervention group. There were some significant differences between the groups in terms of demographics, which directed subsequent multivariate analysis.

### Hospital-acquired pneumonia

Since incidence of HAP might be influenced by the difference in admission condition, age, and patient comorbidity, these were adjusted for by logistic regression. Gender was also included in the initial model, as it differed between groups, although there was less biological plausibility to gender influencing HAP incidence than the other variables. The intervention remained associated with lower incidence of HAP with a hazard ratio (HR) of 0.39 [95% confidence interval (CI): 0.22–0.68;  $P = 0.001$ ] (Figure 1A). Age was also associated with HAP risk, with an increase in age of one year being associated with an increase in HAP risk of 5% (95% CI: 2.5–7.5%;

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