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# Sustainability of healthcare improvements for patients admitted with community-acquired pneumonia: follow-up data from a quality improvement project

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## BACKGROUND

Community-acquired pneumonia (CAP) is common and associated with high mortality and healthcare expenses.[1] As in other diseases, adherence to management recommendations showed to be variable in CAP, due to multiple factors including lack of knowledge, personal beliefs and inefficient healthcare processes.[2 3]

To increase adherence to management recommendations for CAP in Denmark, we have recently conducted and reported a multicentre quality improvement project.[4] Based on data from a baseline period (November 2017–February 2018), we designed interventions to improve management of patients hospitalised with CAP at three centres. A fourth hospital served as control centre. The interventions were applied throughout an 8-month intervention period (March–October 2018), and short-term sustainability of the interventions was assessed in a 4-month early follow-up period (November 2018–February 2019). As CAP incidence in Denmark is highest in the cold season, we chose these months for our studies. The outcome measure in the study was adherence to a CAP bundle, consisting of chest X-ray, lower respiratory tract samples, CURB-65 (confusion, urea, respiratory rate, blood pressure, age ≥65) score[5] and antibiotics within 8 hours of admission. Adherence to the bundle increased from 11% at baseline to 41% at early follow-up at the intervention centres, with no improvements at the control centre.[4] Due to the interdependence of the bundle elements, we considered

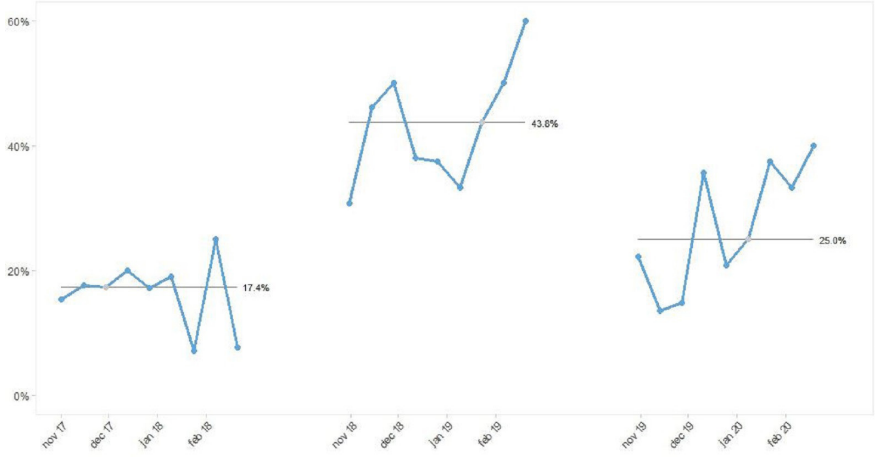


**Figure 1** Run chart showing the proportion of patients receiving the CAP care bundle (i.e. chest X-ray, lower respiratory tract samples, CURB-65 score and antibiotics) within 8 hours of admission in the baseline period (November 2017 to February 2018), the early-follow-up period (November 2018 to February 2019) and the late-follow-up period (November 2019 to February 2020). Each dot represents 8-29 cases of CAP. The figure has been produced by the first author using the open source software R (V.3.6.0, R Core Team 2019).

Table 1 Overview of healthcare interventions applied at Gentofte Hospital in the intervention period (March 2018–October 2018) and thereafter

| | Implemented in the intervention period | Maintained after the intervention period |
|---|---|---|
| Technical Interventions | | |
| Repeated hands-on training in tracheal suction for physicians | x | x |
| Repeated hands-on training in sputum induction by nurses | x | x |
| Non-technical interventions, educational activities | | |
| Repeated education of physicians at the relevant departments | x | |
| Repeated education of nurses at the relevant departments | x | |
| Personal feedback to physicians via email | x | |
| Non-technical interventions, educational material | | |
| Standardised PowerPoint presentations on CAP | x | |
| Regular newsletter distribution | x | |
| Pocket cards on CAP | x | x |
| Posters on guideline-based CAP treatment at the departments | x | x |
| Process improvements | | |
| Authorising triage nurses to order chest X-rays | x | x |
| Authorising triage nurses to order LRTS | x | x |
| MCS and PCR for atypical bacteria analysed using the same LRTS | x | x |
| CURB-65 as a standard phrase in the EHRS | x | x |
| Order sets for CAP in the EHRS | x | x |

CAP, community-acquired pneumonia; CURB-65, confusion, urea, respiratory rate, blood pressure, age ≥65; EHRS, electronic health record system; LRTS, lower respiratory tract sample; MCS, microscopy, culture, sensitivity.

an adherence of 41% to be a success. However, the main limitation of the previous study was the short follow-up right after the intervention period, leaving us with no knowledge about long-term sustainability.[4] The missing estimation of sustainability is a common problem in quality improvement studies.[6 7] Therefore, we conducted this single-centre follow-up study at Gentofte Hospital, a tertiary university hospital and one of the intervention centres in the previous study.[4]

## METHODS

To assess long-term sustainability of the healthcare improvements, we compared the baseline period with the early follow-up period and a late follow-up period (November 2019–February 2020). Methods of data collection, control and analysis were the same as reported previously.[4] As in the previous study, we assessed adherence to the CAP bundle through statistical process control, using run charts.[4 8]

## RESULTS

At Gentofte Hospital, 170 patients were admitted with CAP in the baseline period, 138 in the early follow-up period and 136 in the late follow-up period. Most interventions designed by our study group throughout the intervention period were continued after October 2018 (table 1). Detailed information about the interventions was published previously.[4]

On average, the bundle was completed in 17% in the baseline period, 44% in the early follow-up period and 25% in the late follow-up period (figure 1). The decrease was mainly caused by substantial changes in CURB-65 documentation (39% baseline, 75% early follow-up, 52% late follow-up).

## DISCUSSION

Adherence to the CAP bundle was considerably higher in the late follow-up period when compared with the baseline period, but lower than in the early follow-up period. As we used the same methods as in the original study, the main limitation of relying on information documented by other healthcare professionals, gathered by an electronic health record audit, still applies.[4]

Definite reasons for a lack of sustainability after quality improvement initiatives are difficult to establish.[6 7] However, we believe that the discontinuation of central interventions has contributed considerably to the decrease in care bundle adherence, those were (1) educational activities, that is, repeated education of healthcare personal every 1–2 months; (2) activities increasing disease awareness, that is, newsletters distributed to staff members on a regular basis; and (3) personal feedback to physicians. These interventions have previously been successfully applied to increase guideline adherence in other healthcare settings.[9–13] However, these interventions are also actions that showed not to be able to create sustained system-based improvement, especially when discontinued.[14]

One other factor potentially leading to a lower degree of guideline adherence can be physician seniority and frequent changes in staff composition. In Denmark, there is a high turnover rate among, especially, early-career physicians (turnover rate approximately 2–4/month at our study centre). Meanwhile, those individuals are often the treating physicians for patients admitted with CAP in the emergency departments. The impact of physician seniority on guideline adherence in CAP has, to our knowledge, not been investigated in the past. However, a study on guideline adherence for the treatment of diabetes found that junior physicians tended to follow

guidelines less than senior physicians.[15] This, combined with a high physician turnover rate, makes a cultural shift and a sustained, high level of guideline adherence a difficult task.

## CONCLUSION

Altogether, the results of our study underline that quality improvement is a continuous process, which must (1) include changes in inefficient healthcare processes and (2) interventions that focus on a system change rather than the individual physicians treating patients.

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**Patient consent for publication** Not required.

**Ethics approval** The study was a clinical audit study without direct patient contact. Patient consent and ethical approval were, therefore, not required to conduct this study. Local approval was granted by the hospital board. Data for analysis were fully anonymised and handled according to the national regulations of the Danish Data Protection Agency (registration number HGH-2017-039).

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