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Hospitalization due to acute exacerbation of chronic pain: An intervention study in a university hospital

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HIGHLIGHTS

- Hospitalization with acute exacerbation of complex chronic pain is a hidden problem.
- Chronic pain services typically focus on outpatients rather than inpatients.
- We started a physician-led pain round to address complex pain issues in inpatients.
- We identified 20 patients frequently hospitalized by chronic pain for long periods.
- The intervention was successful in some patients, but not in the cohort as a whole.

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ABSTRACT

Background and aims: Hospitalization as a result of acute exacerbation of complex chronic pain is a largely hidden problem, as patients are often admitted to hospital under a variety of specialities, and there is frequently no overarching inpatient chronic pain service dedicated to their management. Our institution had established an inpatient acute pain service overseen by pain physicians and staffed by specialist nurses that was intended to focus on the management of perioperative pain. We soon observed an increasing number of nurse-to-nurse referrals of non-surgical inpatients admitted with chronic pain. Some of these patients had seemingly intractable and highly complex pain problems, and consequently we initiated twice-weekly attending physician-led inpatient pain rounds to coordinate their management. From these referrals, we identified a cohort of 20 patients who were frequently hospitalized for long periods with exacerbations of chronic pain. We sought to establish whether the introduction of the physician-led inpatient pain ward round reduced the number and duration of hospitalizations, and costs of treatment.

Methods: We undertook a retrospective, observational, intervention cohort study. We recorded acute Emergency Department (ED) attendances, hospital admissions, and duration and costs of hospitalization of the cohort of 20 patients in the year before and year after introduction of the inpatient pain service.

Results: The patients' mean age was 38.2 years (±standard deviation 13.8 years, range 18–68 years); 13 were women (65.0%). The mode number of ED attendances was 4 (range 2–15) pre-intervention, and 3 (range 0–9) afterwards ($p = 0.116$). The mode bed occupancy was 32 days (range 9–170 days) pre-intervention and 19 days (range 0–115 days) afterwards ($p = 0.215$). The total cost of treating the cohort over the 2-year study period was £733,010 (US$1.12m), comprising £429,479 (US$656,291) of bed costs and £303,531 (US$463,828) of investigation costs. The intervention did not achieve significant improvements in the total costs, bed costs or investigation costs.

Conclusions: Despite our attending physician-led intervention, the frequency, duration and very substantial costs of hospitalization of the cohort were not significantly reduced, suggesting that other strategies need to be identified to help these complex and vulnerable patients.

Implications: Frequent hospitalization with acute exacerbation of chronic pain is a largely hidden problem that has very substantial implications for patients, their carers and healthcare providers. Chronic pain services tend to focus on outpatient management. Breaking the cycle of frequent and recurrent

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hospitalization using multidisciplinary chronic pain management techniques has the potential to improve patients' quality of life and reduce hospital costs. Nonetheless, the complexity of these patients' chronic pain problems should not be underestimated and in some cases are very challenging to treat.

1. Introduction

There is a strong focus on reducing the need for emergency hospital admission and the duration of hospitalization in most global healthcare systems. Uncontrolled acute pain is one of the most common symptoms causing emergency hospital admission. In general, pain alerts healthcare professionals to a clinical problem that can then be treated appropriately.

Chronic pain persists beyond the normal, expected healing time and therefore is thought not to have an acute warning function [1]. Nevertheless, when chronic pain is severe and disabling, it may lead to unplanned hospital admission. In a proportion of patients with chronic pain, the cause of pain cannot ultimately be identified, even after repeated admissions under a variety of specialties.

Most healthcare professionals will have met patients who present to primary or secondary care frequently with a variety of recurrent clinical problems [2]. Many attend with acute exacerbations of what has become a chronic pain problem. In some of these patients the diagnosis is clear, but in a substantial proportion a diagnosis is not made, despite multiple and often repeated investigations [3]. In others, the intensity of pain experienced by the patient is thought to be out of proportion to that expected.

In our institution, a team of specialist inpatient nurses was established to manage perioperative pain, and supervise patient controlled and epidural analgesia regimes on the wards. The remit of the team quickly evolved to include the management of non-surgical patients with acute and chronic pain problems. It became clear that there was a cohort of approximately 20 patients who were being admitted frequently under one or more specialties with acute uncontrolled exacerbations of chronic pain. It was also clear that an acute hospital was not the ideal environment in which to address these patients' needs.

Having recognized the complexity of many of these pain syndromes, we sought to reduce the frequency of unplanned admissions to hospital and improve the symptoms and experiences of this vulnerable group of patients.

To do so, we instituted regular inpatient pain rounds under the supervision of a pain physician, with a view to refining, reducing or replacing analgesia regimes, offering interventions (if appropriate), introducing chronic pain management strategies and enlisting the support and input of allied health professionals (such as physical and occupational therapists, psychologists, mental health professionals and rehabilitation physicians).

The objectives of this retrospective observational intervention study were to understand the burden on patients and our institution of frequent or lengthy episodes of hospitalization for acute-on-chronic pain exacerbation, and to establish whether an intensive physician-led programme could reduce this burden. We sought to establish the number, duration, and costs of hospital admissions, investigations and therapy of the 20 patients with acute-on-chronic pain exacerbation who spent the longest periods as inpatients in our hospital, a 1,000-bed university hospital, over 1 year. We compared these with a second 1-year period immediately afterwards, when regular physician-led inpatient pain rounds had been fully established, allowing us to judge the impact of this strategy on patient outcomes.

2. Materials and methods

2.1. Study design and approval

This was a retrospective, interventional cohort study. It was registered and approved as a service evaluation with our institution's audit office.

2.2. Identification of patient cohort

We used written and electronic pain service records to identify the 20 adults known to the inpatient pain team who spent the most days as hospital inpatients at Addenbrooke's Hospital, Cambridge, United Kingdom, between April 30, 2008 and April 30, 2009. We retrospectively reviewed all Emergency Department (ED) attendances and episodes of acute hospitalization to identify the nature of the admission and whether the primary symptom was acute-on-chronic pain, or where control of chronic pain symptoms had complicated or prolonged admissions for other clinical reasons. We excluded children ($\leq$17 years), and adults admitted due to trauma, for planned surgery unrelated to the axis of chronic pain or exacerbations of medical co-morbidities in which pain management was not a feature of the hospital stay.

2.3. Parameters measured

For each patient, and for each episode of hospitalization, we recorded the source of admission (self-referral to the ED, primary care referral to hospital speciality or planned elective admission), inpatient ward (general medical, general surgical, orthopaedic, neurosurgery, gynaecology, critical care), primary axis of pain and length of any subsequent hospitalization. We also recorded investigations undertaken for each admission, including biochemistry, haematology, blood transfusion, microbiology, imaging, nuclear medicine, cardiology and endoscopy. Finally, we recorded requests for liaison psychiatry review, and for physiotherapy, occupational therapy and psychologic assessment. The costs of hospital accommodation, investigations and therapy were obtained from our institution's finance department, and the total cost of each admission was calculated.

2.4. Intervention

From May 2009 to May 2010 a regular attending physician-led inpatient pain service ward round was initiated, to complement the work of the inpatient specialist nurse team. This took place twice weekly, and focused on patients with acute exacerbation of chronic pain, to improve symptoms, minimize repetition of unnecessary investigations, facilitate discharge from hospital and subsequent outpatient management, and reduce the risk of readmission. Patients with acute exacerbation of chronic pain who attended the ED during a round were assessed by the team with a view to avoiding the need for hospitalization. We therefore examined the admissions of the same cohort of 20 patients between May 1, 2009 and May 1, 2010 to establish the effect of this intervention.

Table 1
Specialty under which the cohort was hospitalized, pre- and post-intervention.

Specialty	Pre-intervention year (bed-days of hospitalization)	Post-intervention year (bed-days of hospitalization)	*p*-value
General medicine	917	700	
General surgery	64	66	
Gynaecology	37	23	
Orthopaedics	40	0	
Neurosurgery	20	9	
Critical care	23	5	
Total	1,101	803	0.215

2.5. Statistical analysis

All data were anonymized before analysis. Parameters are presented as the mean ± standard deviation (SD), mode (range) or the number (proportion, %), as appropriate. Costs are shown in US Dollars (with Pounds Sterling, £, in parentheses), and were converted using the exchange rate on the last day of the study (£1.00 = US$1.528; May 1, 2010). The distribution of data was assessed using the Shapiro–Wilk test, and the paired *t*-test or Wilcoxon signed rank test used to compare outcomes in the pre- and post-intervention years for non-normally distributed data per patient and for the entire cohort, respectively. The chi-squared test was used to compare ED admission rates. All statistical analyses were undertaken with the **R** statistics programme (version 3.4.0; R Foundation for Statistical Computing, Vienna, Austria) [4].

3. Results

3.1. Patient cohort

Of the cohort of 20 patients, 13 were women (65.0%). The patients' mean age on April 30, 2008 was 38.2 years (±SD 13.8 years, range 18–68 years). The principle axis of chronic pain was the abdomen in 10 patients (50.0%), the musculoskeletal system in five patients (25.0%), the pelvis in three patients (15.0%) and the chest in one patient (5.0%). The remaining patient (5.0%) had chronic widespread pain syndrome.

3.2. Contact with acute hospital services pre-intervention

In the year before the initiation of the physician-led inpatient ward round, the cohort of 20 patients had 111 contacts with acute hospital services: either ED attendances with or without subsequent hospital admission, or primary care referral for immediate assessment or planned elective admission. We excluded two of these episodes from our analysis: one emergency admission via the ED following a road traffic collision and the same patient's subsequent elective admission for removal of a distal fracture fixation locking plate.

Of the remaining 109 acute contacts, 107 (98.1%) were self-referrals to the ED; the primary clinical problem in each case was an acute exacerbation of chronic pain symptoms. The remaining two episodes (1.9%) were elective admissions for inpatient investigation of chronic pain. During the first year, none of the patients were referred to hospital by their primary care physician. The mode number of ED attendances was 4 (range 2–15). As a result of these attendances, patients were hospitalized 83 times (77.6% of ED attendances) and discharged from the ED on 24 occasions (22.4% of ED attendances). As a consequence, the cohort spent 1,101 days occupying acute hospital beds, the mode bed occupancy was 32 days (range 9–170 days). The specialties under which the cohort was admitted are shown in Table 1.

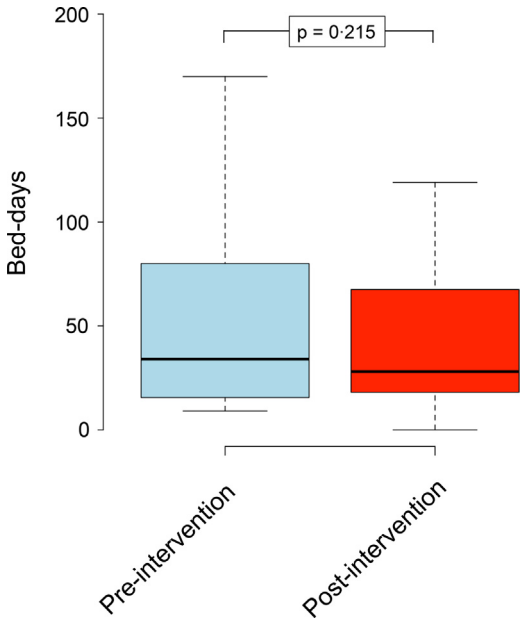

Fig. 1. Box-and-whisker plot showing the cohort's bed occupancy before and after physician-led intervention.

3.3. Contact with acute hospital services post-intervention

In the year after the initiation of the physician-led inpatient ward round, the cohort of 20 patients had 89 contacts with acute hospital services, either ED attendances with or without subsequent hospital admission, primary care referral for immediate assessment or planned elective admission. We excluded five of these episodes from our analysis: one admission with diltiazem-induced bradycardia, one admission for an exchange of an intra-medullary nail and three admissions relating to elective breast augmentation (elective admission for the procedure, an emergency admission for the management of wound infection and elective admission for refashioning of the incision).

Of the remaining 84 acute contacts, 79 (94.0%) were self-referrals to the ED; the primary diagnosis in each case was an acute flare of chronic pain symptoms. The remaining five episodes comprised four elective admissions for inpatient investigation of pain and one referral by a primary care physician for an acute pain flare-up. The mode of ED attendances post-intervention was 3 (range 0–9). Two patients in the cohort did not present to our institution in the post-intervention year, but the difference in number of acute presentations to hospital pre- and post-intervention for the whole cohort was not statistically significant ($p = 0.116$).

As a result of these attendances, patients were admitted 65 times (82.2% of ED attendances) and discharged on 14 occasions (17.8%); the proportion of patients admitted from the ED was not significantly different from the pre-intervention year ($p = 0.431$). As a consequence, the cohort occupied inpatient acute hospital beds for 803 days post-intervention; the mode bed occupancy was 19 days (range 0–115 days, $p = 0.215$ compared with the pre-intervention year; Fig. 1).

3.4. Costs of hospitalization pre- and post-intervention

The total cost to our institution of treating the 20-patient cohort over the 2-year study period was US$1.12m (£733,010), comprising US$656,291 (£429,479) of bed costs and US$463,828 (£303,531) of investigation and therapy costs. A comparison of the costs of hospitalization of the cohort before and after intervention is shown in Table 2. Despite the intervention, and the absence of any costs for

Table 2
Costs of treating the patient cohort pre- and post-intervention.

	Pre-intervention year	Post-intervention year	*p* value
Bed costs for cohort	US$378,273 (£247,543)	US$278,018 (£181,936)	0.330
Investigation and therapy costs for cohort	US$228,946 (£149,823)	US$234,883 (£153,708)	0.596
Total costs for cohort	US$607,219 (£397,366)	US$512,901 (£335,644)	0.430
Bed costs per patient	US$18,886 (£12,359)	US$13,901 (£9,097)	0.218
Investigation and therapy costs per patient	US$11,447 (£7,491)	US$11,744 (£7,685)	0.930
Total costs per patient	US$30,333 (£19,850)	US$25,645 (£16,782)	0.496

Costs were converted from Pounds Sterling (£) into US Dollars (US$) using the exchange rate on the last day of the study (£1.00 = US$1.528; May 1, 2010) and rounded to the nearest unit. Data are presented as the mean.

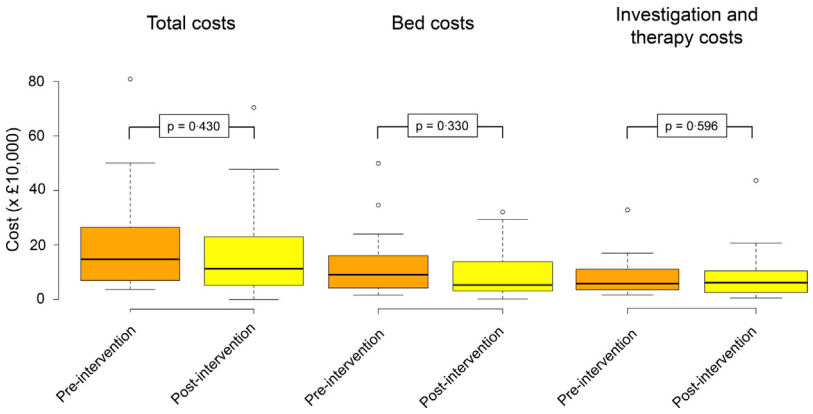

Fig. 2. Box-and-whisker plot showing the total, bed and investigation costs of treating the cohort before and after physician-led intervention.

the two patients who did not present to our institution in the post-intervention year, there were no significant differences in the total costs, bed costs or investigation and therapy costs for the cohort or per patient (Table 2, Fig. 2).

4. Discussion

The burden of acute exacerbation of chronic pain in this relatively young cohort of 20 patients was very substantial. We were struck not only by the high financial costs of caring for these patients, but especially by the obvious impact that frequent and recurrent hospitalizations had on patients' quality of life. The total number of unplanned hospital attendances over the 2-year study period was 193, leading to 148 hospitalizations for a total duration of 1,904 days. The extent of the disruption that this caused to patients' family, work and social lives was very evident, although we did not seek to quantify this in this study. In some cases, repeated and/or lengthy hospitalization became self-defeating; even with careful discharge planning and outpatient follow-up, some vulnerable patients were unable to cope at home, and readmission was almost inevitable.

The problem of recurrent or repeated hospitalizations due to acute exacerbation of chronic pain was also largely hidden in our institution. As pain is a symptom and not a diagnosis, the reasons for hospital admission recorded varied widely, and the patients were not detected by hospital-wide databases or electronic records. This problem was exacerbated by admissions under a variety of (sometimes different) specialties, and it is notable that a substantial proportion of patients were admitted under non-surgical specialties. Indeed, our chronic pain team generally became aware of patients in our cohort due to referrals by ward nurses to our specialist pain nurses. Our specialist nurses' outreach activities had spread awareness of the chronic pain team's capabilities beyond the surgical wards and beyond their originally intended remit of the management of acute perioperative pain. Few of our referrals came from physicians, who perceived that chronic pain services were only offered to outpatients. None of the 20 patients in the cohort had been known to outpatient chronic pain services at their first admission.

Our interventions aimed to reduce the number of hospital attendances, reduce the proportion of attendances that led to hospital admission, reduce the number of investigations, and reduce length of hospital stay. To achieve this, we introduced a comprehensive multidisciplinary approach to inpatients that is part of routine clinical practice for outpatients. This included support from patients' primary care physicians, attending physicians, allied health professionals such as physical and occupational therapists, and specialist pain psychologists. We drew up ED attendance plans [5], and sought to rationalize, refine, reduce and replace strong analgesics wherever possible, with a strong emphasis on opioid replacement or dose reduction. Indeed, the two patients in the cohort who were not hospitalized at all in the second year were successfully treated for opioid-induced constipation.

Although our intervention appeared to save 298 bed-days and US$94,318 (£61,722), we are mindful that there were no statistically significant differences in the frequency of the cohort's ED attendances, the proportion admitted from the ED, bed occupancy or total costs between the pre- and post-intervention years. Nevertheless, our intervention was highly clinically significant for the two patients who did not return to hospital in the post-intervention year, and many of the other patients were hospitalized less often and for fewer days. Not all patients benefited from our strategy, however, and our findings suggest that it requires further refinement and improvement. The clinical challenges posed by these complex patients should not be underestimated [5].

Our study had several limitations. First, it was limited to a single cohort in one institution in a publically-funded healthcare system. Our university hospital is a tertiary referral centre for several specialties, so our findings may not be generalizable to other hospitals operating under different healthcare systems and serving different populations. Second, we did not undertake long-term follow-up, so cannot be sure that improvements were maintained, or were simply a result of the relapsing and remitting nature of chronic pain. Third, we cannot tell whether patients began attending other local

hospitals instead of ours, whether they chose to 'suffer in silence' at home instead of coming to hospital, or whether our intervention led to broader improvements in their quality of life. However, by liaising with colleagues in primary care we were able to establish that the two patients who ceased to attend our institution did not begin to attend elsewhere. Finally, we did not take into account the costs of outpatient care, or changes to patients' drug regimes.

In conclusion, we found that a single cohort of patients frequently admitted to our institution with acute exacerbation of chronic pain were frequently hospitalized for long periods, and incurred substantial treatment and investigation costs. Importantly, the frequency and length of their hospitalization would also make living a normal life almost impossible, which in turn makes outpatient treatment more challenging. Although two patients did not present to acute hospital again after our attending physician-led intervention, the length and costs of hospitalization of the entire cohort were not significantly reduced. This suggests that other strategies need to be identified to help this highly complex and vulnerable group of patients.

Ethical issues

The study was registered and approved as a service evaluation with our institution's audit office. No identifiable patient details are included in the manuscript or the database used for analysis.

Conflicts of interest

None of the authors has a potential conflict of interest to declare, including any financial, personal or other relationships with other people or organizations within 3 years of beginning the submitted work that could inappropriately influence, or be perceived to influence, this work.

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