

## ABSTRACT

Aim- To describe the characteristics of case-managed patients presenting at accident and emergency (A & E) and to explore the distribution of their attendances and admissions.

Background- Recently, the UK Government announced extended-hours primary care provision in an effort to reduce the growing utilization of A & E. No evidence is available to understand the use of acute services by this high-risk patient group.

Method- A cross-sectional design utilising routinely collected anonymised A & E attendance and hospital admission data from 2010-2015.

Results- The case-managed population is typically 70 years and older and most often arrive at A & E via emergency services and during the night (00:00-08:59). A large proportion are subsequently admitted having a statistically significant A & E conversion rate. No variables were predictive of admission.

Conclusion- The high level of A&E conversion could indicate case-managed patients are presenting appropriately with acute clinical need. However, inadequate provision in primary-care could drive decisions for admitting vulnerable patients.

### Key words

case management, long-term conditions, chronic disease management, after-hours care, data accuracy

## **INTRODUCTION**

Long-term conditions (LTCs) are diseases, which currently have no cure but can be managed by medication and other therapies (Department of Health 2005a). Patients with LTCs account for a large number of all inpatient bed days and pose an increasing burden on NHS resources (Department of Health 2008). Preventing people from being admitted to hospital is a priority for the NHS for several reasons, including the high and increasing cost of this care in comparison to other forms of care, as well as disrupting elective care by increasing waiting lists (Department of Health 2005b). The number of people suffering from one or more LTC is expected to rise with the ageing demographic and thus pose a significant burden to the NHS and healthcare organisations alike (Age UK 2015). By 2020, 7 million people in England aged over 60 are likely to have two or more long-term conditions (NHS Confederation 2016). The British government recognised this burden and implemented the NHS and Social Care long-term conditions model, which launched in England in 2005; the case management programme was the priority action for reducing this burden (Department of Health 2005c). The purpose of this programme was to reduce hospital admissions and improve quality of life by offering integrated and holistic care management to patients with complex, multiple long-term conditions at risk of hospitalisation. The evaluation of the two-year pilot programme indicated that it had not reduced hospital admissions, but the patients and carers valued the service in other ways such as the case manager's clinical skills and availability and appreciated the service (Gravelle *et al.* 2007). In 2013, a £50 million pilot scheme was announced to extend the hours of primary health care over growing concerns of the burden on A & E and speculation that the operating hours of primary care were forcing patients to overuse A & E services out-of-hours (NHS England 2014, Lazou 2015). This raises the question of whether the Monday to Friday standard operating hours of the case management programme result in a disproportionate amount of out-of-hours hospital admissions for its patient population.

## **BACKGROUND**

The NHS and global healthcare is challenged with providing high quality care and support for people suffering with long-term conditions. It is estimated 17.5 million adults in Great Britain are living with Understanding the distribution of A&E attendances and hospital admissions for the 2 case managed population: a single case cross sectional study.

chronic disease (Department of Health 2005b, Ham & Singh 2006); moreover, individuals with chronic disease account for 80% of all GP consultations (Department of Health 2005a). Five per cent of these patients also account for 42% of annual bed use and 33% of unplanned emergency admissions. In 2013/2014, there were over 2.2 million emergency admissions to English hospitals of people aged over 60, at a cost of £ 3.4 billion (NHS Confederation 2016).

Prior to 2004, community provision was seen as inflexible, struggling and reactive rather than proactive (Department of Health 2005b, Department of Health 2005c). By reducing unplanned admissions and improving supportive care in the community, cost savings in the region of £400 million per year were estimated (Department of Health 2005c). Policy drivers and the need to improve the quality of life of those with LTCs have been crucial in shaping this new model of care delivery by case management.

Case managers are highly skilled advanced nurses with Masters level training and independent prescribing skills and are seen as key in delivering planned, coordinated and personalised care to adults with long term complex needs (Department of Health 2004, Department of Health 2005b, Ham & Singh 2006). In Department of Health policy, the strategic aim of introducing 3000 case managers was to reduce reliance on hospital care, increase the range and responsiveness of community services, improve the quality of care for people with LTCs and plan for, predict and prevent crises in care management. Hutt *et al.* (2004) wrote that case managers should support new ways of working to reduce unplanned admissions.

Much debate has arisen following the Gravelle *et al.* (2007) publication that indicated there was no reduction in emergency admission rates to hospital regarding the effectiveness of services. Hutt and Rosen (2005) and Roland *et al.* (2005) further emphasised weak evidence in the reduction of hospital admissions, work force and training issues, and patient selection and identification stratification methods used in case management. The overuse of acute services has drawn recent media attention following a report which indicated a ‘weekend effect’ and it has been suggested that extended service hours of community provision could reduce the burden on the acute setting (Hamilton *et al.* 2016).

Traditionally, the case management of patients is delivered between the hours of 8am and 6pm advancing the question; do case managed patients rely on acute service provision out-of-hours?

## METHODS

### Aim

The aim of this study was to describe the characteristics of case managed patients presenting at accident and emergency and to explore the distribution of their attendances and admissions. In doing so, an understanding of the use of A & E services and admissions to hospital during standard operating hours and out of hours periods could be derived.

### Design

A cross-sectional observational design was adopted utilising routinely collected A & E attendance and hospital admission data of a case managed population from an acute hospital trust in the West Midlands for the period 01.04.10 – 31.08.15. Where appropriate, the data was compared with publicly available national Hospital Episode Statistics (HES) (Health and Social Care Information System 2014) for the participating Trust and the area for the period 01.04.13 – 31.03.14.

### Participants

A single NHS Trust within the West Midlands region provided A & E attendance and hospital admission data for the case managed population. The Trust serves an urban population of over 450,000 and sees in the region of 100,000 emergency department visits per year. The Trust also provides community care services and the case management service is delivered within a virtual ward model. The virtual ward model provides multidisciplinary case management using the staffing, systems and daily routines of a hospital ward to deliver preventive hospital admission avoidance care to patients in their own homes (Lewis *et al.* 2011).

No direct human participation was required to conduct this study as routinely collected administrative data was utilised in an anonymised format. All recorded A & E episodes for the case managed population within the Trust were included for the period of 01.04.10-31.08.15 with the exception of Understanding the distribution of A&E attendances and hospital admissions for the case managed population: a single case cross sectional study. 4

two records for patients who were aged below 18. Since the case management population is only provided for patients over the age of 18, these records were erroneous and consequently excluded.

### **Data Collection**

Anonymised hospital episode statistics for attendance to the accident and emergency department were extracted from the participating Trust's electronic record system. Data for the period 01.04.10-31.08.15 were downloaded into comma-separated value (CSV) files. Variables provided included: gender, ethnicity, age, attendance date and time, referral source, primary diagnosis, primary investigation, length of stay (admission data) and attendance disposal.

### **Ethical Considerations**

University research ethical approval was granted for this study. Local research and development approval was sought, and a letter of access was granted. Data was provided in an anonymised format in accordance with the Data Protection Act 1997. University data protection guidelines for the collection and storage of research data were followed.

### **Data Analysis**

Analysis was undertaken using Microsoft Office 2015, Excel 15.0 (Microsoft 2015) and SPSS version 22 (IBM 2013). Descriptive statistics were applied to the whole dataset and where relevant, compared to the publically available HES for the year 2013/14 (Health and Social Care Information System 2014). HES Data for the participating NHS Trust is referred to as 'provider level' and for the local region as 'area level'. Where appropriate, inferential statistics were applied according to the data type. For categorical data, Chi Squared of number association was applied, and for continuous data t-tests were conducted, P values were two-sided and less than 0.05 was considered statistically significant. A binary logistic regression was preformed to identify predictive factors for being admitted to hospital. The degree to which various statistical models fitted the observed data was compared using the Nagelkerke R-square value of the all-variable outputs.

## **Validity, reliability and rigour**

Clear description of the process of analysis in the research protocol was an important factor in demonstrating the reliability of the research process (Roberts *et al.* 2006). To ensure rigour, the data was analysed by two of the researchers separately and then reviewed by a third. This promoted accuracy, dependability, trustworthiness and consistency.

## **RESULTS**

For the period 01.04.10-31.08.15, there were 9008 type 1 attendances at A & E representing 3355 case managed patients. The mean number of attendances per patient was 5.36 (mode = 1, median = 2, 95% CI [5.3, 5.42], range: 1-92).

When comparing to publically available HES data at the provider and area level, data for the same 2013-14 period, was extracted from the case managed dataset and analysed. For this period, there were 1832 attendance representing 969 patients. The mean number of attendances per patients was 1.89 (mode = 1, median = 1, 95% CI [1.81, 1.97], range: 1-25). There were 95,375 and 896,768 attendances at the provider and area level data respectively but owing to the nature of the data, it is not possible to know how many patients this represents.

### **Demographics of Attendances**

The mean age of case managed patients attending A & E for the period 01.04.10-31.08.15 was 78.72 years old (mode = 84, median = 81, 95% CI [78.49, 78.95], range: 19-103). For the period 2013-2014, the mean age of all attendances was 79.35 years (mode = 85, median = 81, 95% CI [78.9, 98.8], range: 29-103). The publically accessible HES data used for the year 2013-14 doesn't provide data at the individual attendance level, therefore, to compare, the two datasets have been categorised into '0-49 years of age', '50-69 years of age' and '70 years and older' and the case management dataset aggregated accordingly, this can be seen in Figure 1.

**Figure 1: Age of patients attending A&E at the case managed level, provider level and area level**

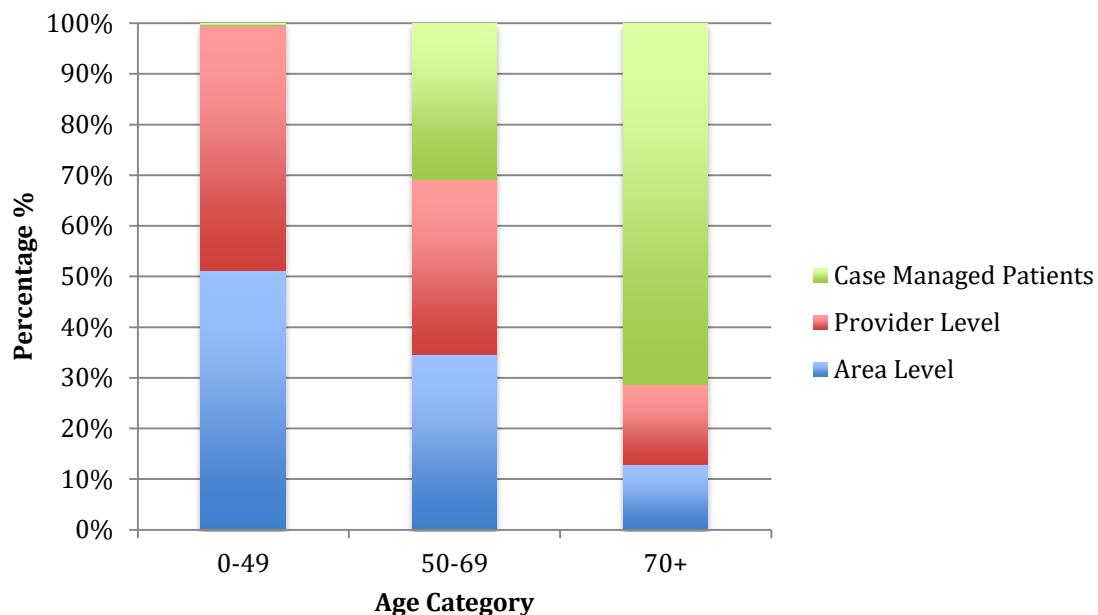


Figure 1. Age of patients attending A & E at the case managed level, provider level and area level.

Case managed patients presenting at the participating A & E are older than the general population presenting at A &E at the same Trust and within the local area.

With regards to gender, 52.92% (95% CI [51.89, 53.95]) of attendances for the period 01.04.10-31.08.15 were by females and 47.08% (95% CI [46.05, 48.11]) were by males. With respect to patients at the provider and area level for the year 2013-14, more attendances were by males than females (female=46.83%, 95% CI [46.51, 47.15]; male=53.17%, 95% CI [52.85, 53.49]; and female=48.80%, 95% CI [48.7, 48.9]; male=51.20%, 95% CI 95% [51.5, 51.3] respectively). Whereas for the same period for the case managed population, females accounted for more attendances (54.75%, 95% CI [52.13, 57.37]) than males (44.25%, 95% CI [41.63, 46.87]). The difference in gender for the three populations was significant ( $\chi^2$  p<0.001). Post hoc testing (Bonferroni correction applied to produce an adjusted p value of 0.0167) revealed that the populations between the case managed patients and the provider's patients, and the area level patients were significantly different

(X<sub>2</sub> p<0.001, X<sub>2</sub> p<0.001 respectively). However, the provider level and area level patients did not differ (X<sub>2</sub> p=0.785).

Of the 8121 attendances for which ethnicity had been recorded (90.15%) for the period 01.04.10-31.08.15, 7822 (96.32%, 95% CI [95.91, 96.73]) attendances represented 'White – British' patients. 'Asian or Asian British – Pakistani' was second most frequent with 1.02% (95% CI [0.8, 1.24]) and 'Black or British Black African' was the least frequent with 0.04% (95% CI [0, 0.8]). No publically accessible HES data was available for comparison.

In examining the 'presenting condition' in the case managed population for the period 01.04.10-31.08.15, more than half the A & E attendances were coded as 'Medical-other' (53.41%, 95% CI [52.38, 54.44]). 'Falls' were the next highest recorded reason (16.24%, 95% CI [15.48, 17]) then 'breathing difficulties' (12.30%, 95% CI [11.62, 12.98]) and 'chest pain' (7.78%, 95% CI [7.23, 8.33]). When in A & E, the most common primary investigation was 'bacteriology' (42.97%, 95% CI [41.95, 43.99]) followed by 'ECG' (25.88%, 95% CI [24.98, 26.78]), 'X-Ray' (6.73%, 95% CI [6.21, 7.25]) and 'urine' (3.99%, 95% CI [3.59, 4.39]). This clinically correlates to the documented reasons for attendance of chest pain, falls and breathing difficulties. Nearly 7% (95% CI [6.18, 7.22]) was coded as 'none' suggesting no investigations occurred while in A & E.

### **Distribution of Attendances**

When examining A & E attendances by the month for the period 2013-2014, November received the highest number of attendances at 169 (9.22%, 95% CI [7.69, 10.75]) and June received the lowest with 117 (6.39%, 95% CI [5.1, 7.68]). HES England wide data (Health and Social Care Information System 2014) has less variation in attendances per month ranging from 7.50% of attendances in February to 8.90% in May and July. No provider level data was publically available for A & E attendances per month.

In terms of days of the week, Friday is the busiest day for case managed patients attending A & E with 279 (15.23%, 95% CI [14.49, 15.97]) attendances on Fridays in the year 2013-2014. The lowest

day for attendances was Tuesday with 234 attendances (12.77%, 95% CI [12.08, 13.46]). At the provider level, Monday is the busiest day with 15,443 (16.19%, 95% CI [15.96, 16.42]) attendances in 2013-2014 and the quietest day is Saturday with 12,889 (13.51%, 95% CI [13.29, 13.73]) attendances. At the area level, Monday was also the busiest day with 143,173 (15.97%, 95% CI [15.89, 16.05]) attendances and Saturday the quietest day with 122,942 (13.71%, 95% CI [13.64, 13.78]) attendances. 11am is the single busiest hour in all three populations. The data for the case managed population can be seen in the Heatmap (Figure 2). The busiest time for case managed patients' remains between 9am to 5pm.

Day/Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Sun	8	4	4	3	3	4	4	13	11	19	17	22	13	17	19	18	14	20	14	4	8	12	13	14
Mon	6	8	6	5	5	3	3	8	8	14	17	18	15	18	19	21	11	13	14	13	17	5	6	5
Tue	3	6	4	4	2	4	5	3	9	13	13	18	10	12	18	18	14	15	14	12	11	3	13	10
Wed	12	9	6	3	8	1	5	8	7	16	19	29	18	17	18	10	17	10	12	10	10	9	7	7
Thu	6	4	8	7	3	13	2	9	10	17	10	11	11	16	14	13	14	14	10	11	15	11	13	7
Fri	3	9	7	7	8	8	4	10	6	11	17	23	22	8	21	11	25	20	9	8	8	12	10	12
Sat	8	9	7	1	5	6	6	9	11	26	14	14	9	19	17	14	14	14	8	14	12	10	7	12

Figure 2: Heatmap of A & E attendances by day and time, 2013-2014 for Case managed patients  
(Red shading indicates higher attendance)

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With regards to attendance in hours or out of hours, 41.60% (95% CI [40.58, 42.62]) of attendances were in hours and 58.40% (95% CI [57.38, 59.42]) out of hours, whereby in hours refers to Monday to Friday 8am to 6pm and out of hours is all other times. However, out of hours represents 70% of the week, therefore, there is a disproportionate amount of people attending A & E during standard operating hours compared with out-of-hours. Given variation of demand over a 24 hour period, it is not unexpected that foot flow into A & E is lower during the night, when people are sleeping or less active. Therefore, it is important to consider the use of services with regards to time, with respect to different demand across the day. When comparing the hour of arrival, the case managed population follows a similar trajectory to patients at the provider level and the area level (see Figure 3). Chi squared analyses were conducted to determine whether there was any significant difference between the three populations for the time periods 00:00 – 08.59, 09:00 – 17:59 and 18:00 – 11:59 and indicate

that they are statistically significantly different ( $\chi^2 < 0.05$  for the three way comparison and  $\chi^2 < 0.0167$  for each of the three pairwise comparisons with Bonferroni correction applied to p value).

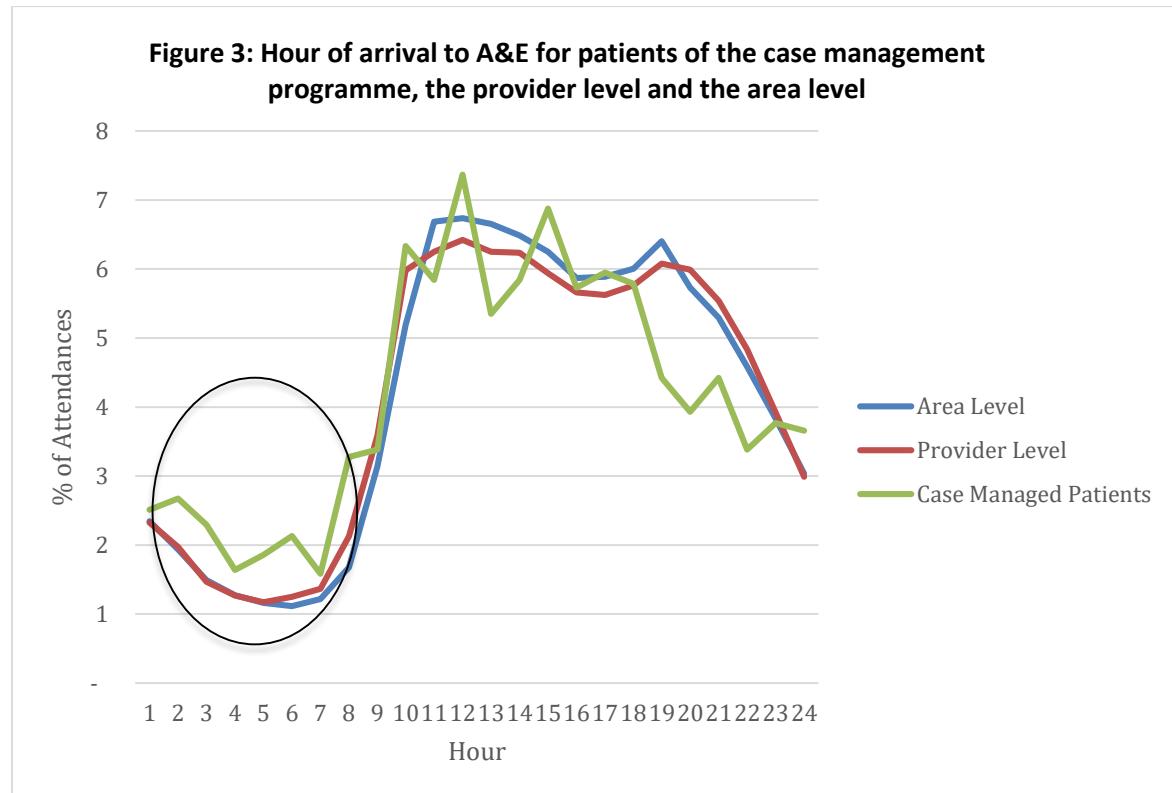


Figure 3. Hour of arrival to A&E for patients of the case management programme, the provider level and the area level

### Demographics of Admission

For the period 01.04.10-31.08.15, of the 9008 attendances at A & E for case managed patients, 6,935 (76.99%, 95% CI [76.12, 77.86]) were converted to admissions representing 2,935 case managed patients, who on average were admitted 2.36 times (mode = 1, median = 2, 95% CI [2.3, 2.42], range: 1-44)). The mean age of case management admissions from A & E for the period 01.04.10-31.08.15 was 79.34 years old (mode = 85, median = 81, 95% CI [79.1, 79.58], range: 20-103). With regards to gender, 53.34% (95% CI [52.17, 54.51]) of the case management admissions from A & E for the period 01.04.10-31.08.15 were female and 46.66% (95% CI [45.27, 47.61]) were male. Of the admissions for which ethnicity had been recorded (92.06%) for the period 01.04.10-31.08.15, 6,153 (96.37%, 95% CI [95.91, 96.83]) admissions represented ‘White – British’ patients. ‘Asian or Asian

British – Pakistani’ was second most frequent with 0.94% (95% CI [0.7, 1.18]) and ‘Black or Black British African’ the least frequent with 0.03% (95% CI [0, 0.07]). Length of stay was recorded as less than one day 19.55% (95% CI [18.62, 20.48]) of the time. Maximum length of stay was recorded as 195 days (mean = 8.62, mode = 0, median = 29, 95% CI [8.14, 9.1], range: 0-195).

For the period 01.04.10-31.08.15, 84.89% (95% CI [84.15, 85.63]) of case management patient attendances at A & E arrived via emergency services. Of these, 84.89% of patients, 82.78% (95% CI [81.93, 83.63]) were admitted to hospital (A&E conversion rate). In comparison, 11.81% (95% CI [11.14, 12.48]) of case management attendances presented directly to A & E themselves with an A&E conversion rate of 38.82% (95% CI [35.89, 41.75]). No publically accessible HES data was available for comparison but the England wide A & E conversion rate for the general population is known to be 26% (National Audit Office 2013)

### **Distribution of Admissions**

Admissions from A & E for 2013-2014 are highest in July and October (9.36%, 95% CI [7.82, 10.9]) and lowest in June (6.17%, 95% CI [4.9, 7.44]). With respect to day of the week, more case management attendances were converted from A & E on a Sunday (15.53%, 95% CI [13.62, 17.44]) than any other day of the week, with Tuesday being the lowest (13.01%, 95% CI [11.24, 14.78]). Time of admission is not available; however, more patients attending A&E at 11am were then admitted to hospital than any other hour.

### **Predicting admissions to hospital**

In order to conduct binary logistic regression, data were cleaned of the duplicate attendances for the period 01.04.10 – 31.08.15. Patients who ‘died in the department’ were excluded from the data set, and the remaining information was aggregated into ‘admitted’ and ‘not admitted’ resulting in 3316 unique patient episodes. Of these, 76.80% were admitted to hospital. The model utilised the following variables: gender, in/out of hours, ethnicity, and referral source.

The Wald statistic, demonstrated that only ‘referral source’ made a significant contribution to prediction ( $p<0.005$ ). Nagelkerke’s  $R^2$  of 0.199 on a reduced variable model using only referral source indicated that there are other variables accountable for the majority of the variability in the data.

## DISCUSSION

Case managed patients attending A & E are older than the general population at both the provider level and area level; the majority of attendances of case managed patients are of individuals 70 years and older. This is unsurprising given the nature of the case managed population, whereby it targets patients who are at risk of hospitalisation and suffering co-morbidities, especially as older people are more likely to attend A & E. Nationally, a greater proportion of this age group attend A & E and one fifth of A & E attenders are aged 65 or above; in 2013/2014, there were nearly 3.7 million attendances at English A & Es by people aged over 65 (National Audit Office 2013).

With regards to gender, case managed patients attending A & E are more likely to be female. This could possibly be explained by the gender differences seen for life expectancy. Since case management disproportionately provides care for older people, and a greater number of older people are women as they live longer (Office for National Statistics 2014); the greater number of women attending the emergency department may be because there are greater numbers of women being cared for by the case management programme. If electronic data were available on the demographics of all patients in receipt of case management, analysis could have been undertaken to understand whether a greater proportion of women receiving case management attend the emergency department in comparison to men.

Accuracy of data coded presented difficulties when examining the ‘ethnicity’ and ‘presenting condition’ variables. Ten per cent of the cases did not record ethnicity in the dataset. Nationally it is well documented that up to 40% of people belonging to minorities could have their ethnicity wrongly recorded in their NHS hospital records (Saunders *et al.* 2013). The NHS has been recording ethnicity since 2000 but audits of the quality of the information have focused on completeness rather than Understanding the distribution of A&E attendances and hospital admissions for the 12 case managed population: a single case cross sectional study.

accuracy and it is unclear why some hospital records are inaccurate (Saunders *et al.* 2013). This has potentially profound implications for the analysis of inequalities in care quality or disease prevalence in different ethnic groups.

In examining the ‘presenting condition’ in the case managed population, more than half the A&E attendances were coded as ‘medical-other.’ This mirrors Hospital Episode Statistics data that shows over two-thirds of all admissions for England were recorded as ‘other’ (Health and Social Care Information Centre 2014). The ‘presenting condition’ variable could not be included in the statistical testing to predict admission, due the high number coded as ‘medical other’, from which accurate inferences cannot be made about the primary purpose for attending A & E. This would have been an informative predictor for admission and highlights the poor quality of coding in certain domains within the dataset.

The findings of this study indicate that more case managed patients attend A & E during the service operating hours of 8am and 6pm, Monday to Friday than out of hours. The trajectory of attendances across the day when presented graphically, does appear to differ from the general population at the provider and area levels, but statistically speaking, all three populations differed from each other significantly. It would appear that case managed patients are more likely to attend A & E during the night than patients at the provider and area level.

The data indicates that three times more case managed patients attending A & E are subsequently admitted to hospital (A & E conversion rate), than the general A & E population in England (National Audit Office 2013). This correlates with the national picture of over 85 year olds being more than twice as likely to be admitted to hospital as an emergency than younger people (NHS Confederation 2016). The conversion of attendances to admissions could indicate a genuine clinical need for specialist hospital care (falls, breathing difficulties, chest pain) that could not reasonably be delivered in the community. This could further be supported by the high rate of attendances to A & E occurring via emergency services, as the most critical and severe cases tend to arrive by ambulance and have a known higher A & E conversion rate (National Audit Office 2013). However, the social

circumstances of the elderly populace, who are more dependent for their holistic care needs (Hamilton *et al.* 2016), may also influence the decision to admit or not if there is inadequate social provision in the community. This phenomenon is well documented in contributing to delayed transfer of care when seeking to discharge patients from hospital (NHS England 2015) and it could be speculated to contribute to the admission rate of case managed patients.

### **Study Limitations**

Owing to the study design, several limitations are present. Firstly, the analysis of secondary data is limited in validity by the quality of the data inputted. The absence of data within certain fields reduces the accuracy of the sample, and reduces the sample size where analysis techniques are unable to compute missing data. Data inputting is prone to human error which can further reduce the accuracy to an unknown extent. Secondly, the application of a single case cross sectional observation study cannot determine causality, only enable description and in some cases identify correlations and relationships. Finally, the coding of variables using categories that ‘catch all’ make it difficult to truly understand the finer details of patient characteristics and their journey.

### **CONCLUSION AND RELEVANCE TO CLINICAL PRACTICE**

This study has found that within their own population, case managed patients do not proportionally attend A & E more in the out of hours than during service hours, however a greater proportion of case managed patients attend A & E during the hours of 00:00 and 08.59 in comparison to patients at the provider level and area level. A large proportion of attendances of case managed patients occur via the emergency services and a large proportion of these attendances are converted to admissions. Understanding the pattern of attendances and admissions for this highly complex patient group and the possible causes of these patterns could guide better care provision across all sectors and services, which this patient group may access. This level of understanding can only be achieved with accurate and complete data that is accessible for analysis. Data that is also integrated across care services would be beneficial; this study was only possible due to the provision of both acute and community services by a single organisation. This data would not be easily retrievable if a different provider delivered the case management programme.

## **Summary Statement**

*What does this paper contribute to the wider global nursing community?*

- The study should contribute to the evidence base on the impact that restricted hours primary/community care services have on A & E attendances and hospital admissions.
- The research should be used to inform the design of case management services and out of hours provision for patients with long-term conditions.
- The data issues identified reinforce the need for improved nursing data metrics, accurate NHS information systems and the greater use of objective data to appraise nursing services.

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## **Conflict of Interest**

The authors declare that they have no competing interests.

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