Process of care and activity in a clinically inclusive ambulatory medical unit; progressive effect over time on clinical outcomes and acute medical admissions

Authors

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Abstract

Clinically relevant outcomes for same day emergency care provided by ambulatory emergency care units (AEC) are largely unknown. We report the activity and outcomes for a large UK adult AEC operating an ambulatory care-by-default model without specific exclusion criteria.

The AEC consultant triaged all acute medical referrals to either the AEC or the standard non-ambulatory 'take' pathway during AEC opening hours.

The proportion of acute medical referrals seen in the AEC increased to 42% (mean 700 referrals seen per month) in the last 6 months of the study and numbers seen in the non-ambulatory pathway fell. The commonest diagnoses were for chest pain, pneumonia, cellulitis, heart failure and urinary system disorders. 74.8% of patients completed their care in a single visit. In the last calendar year the conversion rate from AEC to inpatient admission was 12%, and the 30 day readmission rate was 6.9% and 18% for the AEC and non-ambulatory pathway respectively. Across the whole study period the 30 day mortality rate was 1.6% and 6.9% for the AEC and non-ambulatory pathway respectively.

This ambulatory approach is safe and effective.

Article

Introduction

Over the 12 years to 2018, emergency hospital admissions in England increased by 42% to 6.02 million per annum, while NHS hospital beds numbers fell by 16.2% to 106,374.[1,2] Over the 5 years to 2018, unplanned emergency admissions to our hospital increased by 9.7%, with no increase in inpatient medical beds.[3] Ambulatory emergency care units (AEC) provide hospital level urgent medical services without the need for an overnight stay. This service, termed 'same day emergency care (SDEC)' by NHS England is a key element of the 2019 NHS Long Term Plan, aimed at reducing demands on inpatient medical facilities and improving patient experience.[4]

Our AEC opened at the end of 2015 in a large university-affiliated UK hospital. Prior to this the general medical service undertook around 13,000 emergency patient assessments each year, predominantly in a medical emergency assessment unit (EAU) co-located with the emergency department (ED).

Instead of specific referral criteria for selecting patients for the AEC, a senior clinician triages referrals. All external medical referrals are taken by the AEC phone holder who is either a consultant or a middle grade doctor under direct always-present consultant supervision. Constant consultant presence in the AEC ensures rapid senior decisions in the patient journey.

The utilization and outcomes of AEC in the UK have been little reported, despite a major shift in NHS strategy towards ambulatory care.[4,5] We analysed the activity and outcomes of our AEC over 3 years and assessed its impact on the pre-existing non-ambulatory pathway.

Methods

We obtained hospital spell data for patients admitted to the Oxford University Hospitals NHS Foundation Trust from December 2015 and discharged by the end of March 2019 with a treatment function of acute general medicine, geriatric medicine or ambulatory medicine (spells represent complete hospital stays as described by NHS Digital).[6] The outcomes included the monthly number of medical attendances (counting spells), admission rate, readmission rate at 30 days, and mortality rate at 30 days. Data analysis is described in the supplementary methods section.

Operational aspects of the AEC

The AEC was additional to the existing model whereby acute medical patients were clerked by the on-take medical team in EAU or the emergency department (ED) (Figure 1). The AEC was not co-located with either EAU or ED. The AEC medical team was onsite between 08:00 and 21:00 (09:00-19:00 at weekends) and led by a consultant physician who was physically present in the unit. Nursing staff provided care until 23:00. By the end of the study period daily medical staffing included 2-3 registrars, 2-4 senior house officers/core medical trainees/Foundation Year 2 doctors, and a physician associate. At peak times a second

consultant was rostered. The unit comprised 4 bays (2 contained 4 beds each and 2 contained 4 reclining chairs each) plus 2 side-rooms and a rapid nurse assessment room.

There were no specific exclusion criteria for adult patients. From 08:00-21:00 all external medical referrals went to the AEC phone holder who triaged patients to AEC or the medical take. The phone holder was either the AEC consultant or a middle grade doctor (for training purposes) taking calls under direct consultant supervision. Internal referrals could be made to the AEC phone holder or the on-take middle grade doctor. Other referral outcomes included redirection to separate daily transient ischaemic attack clinics, daily DVT clinics, telephone advice, signposting to community services or recommendations to consult another specialty. Internal referrals to AEC were accepted from the ED team and ED triage nurses could refer patients who had not seen a doctor. AEC undertook active surveillance of ED patients to pro-actively move those with medical problems to AEC. Overnight, the referral phones were held by the generic hospital at night on-take team (middle grade) who could accept AEC referrals for the next day(s).

Phone holders wrote initial plans for incoming patients, who were booked in at reception on arrival then seen by a nurse. This initial assessment included vital signs, venepuncture, cannulation and electrocardiography if appropriate. Mobile patients then sat in the waiting room and immobile patients or those with markers of severe illness were moved to a bay. Board rounds led by the consultant and senior nurse occurred at least twice daily to coordinate patient care and flow. On discharge, patients were given written information with AEC phone numbers and open access to return for up to 72 hours. Some patients were electively brought back for follow-up and others were discharged with hospital-at-home nursing care overseen by AEC clinicians. During their visit patients could be referred to any specialist team, including the heart failure, respiratory, acute oncology teams (including joint weekly virtual oncology rounds) and occupational/physiotherapist specializing in frailty. Patients who needed admission were moved to an inpatient ward under the care of the general medical take or specialty team as appropriate.

Results

Opening of an AEC with an inclusive acceptance policy was associated with a fall in numbers of patients on non-ambulatory pathways.

The AEC opened in December 2015 and successive service improvements were subsequently implemented. These included a move to a larger ward, direct telephone access for the ambulance service to AEC doctors, rapid nurse assessment, a satellite pharmacy in the unit and a full-time physiotherapist with expertise in frailty (Figure 2A). During the 38-month study period there were 20,125 completed patient spells comprising 16,497 individual patients (Figure 2A/B/C). The number of AEC spells increased from 4390 in year 1, to 6536 in year 2 and 7702 in year 3 and the number of non-ambulatory pathway spells decreased by 6% over this period (year 1 -12851, year 2 - 12231, year 3 -12057). For the last 6 months of the study the mean monthly number of spells on AEC was 700 and overall 42% of the acute medical spells were on AEC. The mean age of AEC patients was 59.5 years (range 16 – 103) compared to 67.3 (range 16-105) for the non-ambulatory pathway. Most AEC referrals were from primary care (47.2%) and ED (20.8%) with the remainder mainly from paramedics and a small

number from community hospitals. The number of patients aged 75 or under increased to be consistently higher in the AEC than in the non-ambulatory pathway after 18 months (Figure 2B). Within a single spell an AEC patient might attend once or return for reviews on other days (Figure 2D). 74.8% of spells consisted of only a single visit and 14.0% of spells spanned two consecutive days.

We surveyed the clinical problems seen on AEC by analysing 3-digit ICD10 codes for the final primary diagnosis (Table 1). The highest number was for a 'symptom' based code used to refer to chest pain and the second most common code was for pneumonia.

Table 1 Spell numbers for the most common ICD10 diagnostic codes for AEC and the non-ambulatory pathway.

Rank	AEC	Number of spells	Non-ambulatory pathway	Number of spells
1	Pain in throat and chest	1919	Pneumonia, unspecified organism	4925
2	Pneumonia, unspecified organism	1127	Other disorders of urinary system	2348
3	Cellulitis and acute lymphangitis	819	Pain in throat and chest	1759
4	Heart failure	784	Other chronic obstructive pulmonary disease	1506
5	Other disorders of urinary system	642	Other sepsis	1310
6	Abnormalities of breathing	631	Heart failure	1044
7	Atrial fibrillation and flutter	553	Unspecified acute lower respiratory infection	858
8	Unspecified acute lower respiratory infection	521	STEMI & NSTEMI myocardial infarction	792
9	Pulmonary embolism	428	Atrial fibrillation and flutter	759
10	Other and unspecified soft tissue disorders, not elsewhere classified	423	Headache	720
11	Other chronic obstructive pulmonary disease	420	Cellulitis and acute lymphangitis	651
12	Other disorders of fluid, electrolyte and acid-base balance	363	Asthma	627
13	Headache	347	Infectious gastroenteritis and colitis, unspecified	604
14	Syncope and collapse	319	Syncope and collapse	571
15	Viral infection of unspecified site	296	Acute kidney failure	570
16	Iron deficiency anaemia	294	Other symptoms and signs involving the nervous and musculo-skeletal systems	494
17	Abnormalities of heartbeat	266	Other diseases of digestive system	488
18	Abdominal and pelvic pain	253	Angina pectoris	464
19	Acute kidney failure	246	Other disorders of fluid, electrolyte and acid-base balance	459
20	Phlebitis and thrombophlebitis	238	Influenza due to other identified influenza virus	444

For some diagnoses the absolute numbers of patients seen on AEC increased such that over time the majority were seen on AEC (supplementary figure 1). These codes typically described a general symptom or problem and included chest pain, cellulitis, abnormalities of breathing, unspecified soft tissue problems, palpitations and phlebitis/thrombophlebitis. For some conditions, such as atrial fibrillation where the severity and complexity of patients' problems can vary, broadly equal numbers of patients were seen on AEC and the non-ambulatory pathway. Headache and syncope only showed a major shift towards AEC in the third year. For iron deficiency anaemia there was a large increase in AEC spells with no change in the small number of cases seen through the non-ambulatory pathway. The primary diagnosis was cancer in around 10 AEC patients per month (supplementary figure 2).

Admission rate and inpatient bed utilization for AEC patients

We determined the number of patients who were seen on AEC, but then admitted directly to an inpatient bed under the inpatient medical teams. Patients triaged to the non-ambulatory pathway and seen on EAU were either admitted to an EAU bed or an inpatient ward elsewhere or discharged from EAU. To contextualize the AEC admission rate, we compared it to the corresponding admission rate from EAU (Figure 3A). The mean admission rates were 13.8% from AEC (9.6% and 18.0% in patients aged 75 or under and over 75 respectively) and 54.9% from EAU (47.3% and 62.4% in patients aged 75 or under and over 75 respectively). The AEC admission rate fell from 16.6% in the first full calendar year to 12% in the last calendar year.

For the 20 commonest diagnoses on AEC the admission rate was highest for acute kidney failure (24.1%), pneumonia-unspecified organism (20.4%), heart failure (19.7%), other disorders of the urinary system (16.3%) and other chronic obstructive pulmonary disease (14.3%)(Supplementary table 1 for comparison with EAU). The diagnoses with the lowest admission rates from AEC included abnormalities of breathing (0.4%), abnormalities of heartbeat (0.6%), pain in throat and chest (1.1%) and diagnoses of 'other - unspecified soft tissue disorders' (0.9%) and 'viral infection of unspecified site' (2.7%).

The mean number of beds occupied overnight in the hospital was 13.9 for patients coming through the AEC pathway and 165.4 for medical patients in the non-ambulatory pathway. Although the number of patients seen on AEC increased substantially over time, the number of beds occupied by patients admitted from AEC remained constant over 3 years (Figure 3b, 2A).

Mortality of patients assessed on AEC compared to EAU

The mortality of patients selected for ambulatory care on an AEC using an inclusive approach such as ours is unknown. The 30-day mortality for the AEC patients was 1.6% compared to 8% for patients in the non-ambulatory pathway. Following discharge, mortality remained lower for AEC patients than EAU patients over time, with 28.9% of patients seen on EAU dead by 3 years compared to only 14.6% of those seen on AEC (Figure 4). We stratified patients into

subsets by age and by whether they were admitted to an inpatient ward from AEC or EAU. Increased age and the requirement for admission to an inpatient bed from either AEC or EAU were associated with increased mortality at 30 days (Table 2 and Supplementary Table 2 for mortality by diagnosis) and beyond (Supplementary figure 3). For all corresponding subsets, mortality at 30 days was higher among EAU patients than AEC patients (Table 2).

Table 2 Mortality at 30 days following the start of a patient's first spell stratified by age, whether admitted to an inpatient bed and whether admitted from AEC or EAU.

Age	Admitted	Mortality (%)	
		AEC	EAU
</=75	No	0.60	1.90
</=75	Yes	2.80	6.20
>75	No	2.50	9.60
>75	Yes	11.00	15.70

30-day readmission rates are lower for patients selected for the ambulatory pathway compared to the non-ambulatory pathway

We determined how many patients were readmitted within 30 days of discharge from AEC or from the non-ambulatory pathway (Figure 5A). We defined readmission as one of: a return to EAU, an admission to medicine from ED or a return to AEC resulting in inpatient admission. As expected, the readmission rate was higher for older patients compared to those 75 years or less (Figure 5B). After the first few months the readmission rate was lower than that for the non-ambulatory pathways. The overall readmission rate to the non-ambulatory pathway from AEC in the last calendar year of follow-up was 6.9% compared to 18.0% for the non-ambulatory pathway. For the 20 commonest diagnoses on AEC, the readmission rate from AEC was lower than that from EAU (supplementary table 3).

Discussion

In a recent national audit 95% of UK hospitals had some form of ambulatory unit, but patient selection is not standardized and the outcomes are largely unstudied.[7] Ambulatory pathways may be restricted to specific clinical presentations and highly selective in their patient intake. We studied the activity and outcomes of an ambulatory unit which operates without any restrictive referral criteria, but with a policy of full discretion for clinicians to make individualised decisions about ambulation based on assessment and consultation with each patient.

Over the 3 years since the AEC opened, the number of medical patients managed through the ambulatory pathway rose rapidly and the number managed through the traditional non-ambulatory pathway fell. Factors contributing to increased ambulatory activity included pro-active outreach recruitment of patients to AEC from the emergency department,

encouragement to primary care to refer patients to AEC rather than send them to the emergency department, enthusiastic staff, support from senior management, availability of hospital-at-home services and full, rapid access to most hospital diagnostics.

The rise in AEC activity was greater than the decline in the non-ambulatory pathway. However, the fall in non-ambulatory activity occurred in the context of a 13.5% rise in ED attendances in our hospital over 5 years and a 28% rise in emergency admissions across the NHS over 10 years.[3,8] Several factors may contribute to a smaller fall in the non-ambulatory pathway than the rise in AEC activity. Patients who were pro-actively recruited from ED to the AEC might otherwise have been discharged directly by ED. Ease of access to AEC may have lowered the barrier to referral and, for example, referrals with iron deficiency anaemia increased steadily, paralleling a 53% rise from 2014 to 2018 in ambulatory attendances for anaemia across the NHS.[9]

For conditions such as pulmonary embolism, there was a shift to the majority being seen on AEC. NHS England targets incentivise ambulatory management of low severity pulmonary embolism and we have demonstrated that ambulatory management is safe with more severe pulmonary embolism.[10,11] Respiratory infection was the most common diagnosis on AEC, but was more common in the non-ambulatory pathway likely reflecting the need for oxygen or fluids and possible delirium or poor mobility in the elderly. New cancer diagnoses are common in the AEC and a weekly virtual oncology ward round tracked progress of these patients. There were similar numbers of patients with cellulitis on AEC and non-ambulatory pathway, but a striking summer peak on AEC suggests a difference in the clinical context, with seasonal issues such as insect bites affecting the AEC numbers (supplementary figure 1). Future analyses of secondary diagnoses and co-morbid illnesses will be needed to understand this further.

Inpatient admissions from AEC fell over time and contributory factors may include increasing experience of patient suitability for ambulation by AEC clinicians and referrers, increased availability of specialist frailty occupational and physiotherapists and greater use of a hospital-at-home service. The 'AMB score' has been used elsewhere to select patients for an ambulatory pathway but scoring components such as need for intravenous therapy are less relevant with a good hospital at home service.[12,13] The national early warning score (NEWS2) has been used pre-hospital to predict mortality and need for critical care, but is untested as a tool for determining safety of ambulation.[14-16]

The lower mortality in AEC patients compared to patients in the non-ambulatory pathway, suggests that even without referral criteria, clinicians selected patients with lower severity of illness. In over 75 year olds admitted to hospital, the lower mortality in those admitted via AEC suggests that admission through AEC is not disadvantageous.

We sought to minimise readmission by planned follow-up visits to AEC, 72-hour open access and hospital-at-home for monitoring and intravenous therapy. Readmission rate at 30 days is a standard NHS quality indicator and our rate of 7% is lower than the overall 2018/19 NHS rate of 14.4% in England.[6,17] Data on readmission rates from ambulatory care is sparse and rates will vary with patient selection—a UK AEC with a 1.3% inpatient admission rate reported a "negligible" readmission rate.[5]

Our experience highlighted several useful steps in establishing an AEC. To allay initial concerns from some clinicians about the safety of ambulation, we undertook robust clinical governance including review of all deaths within 30 days of discharge. Medical trainees rotated through both AEC and inpatient pathways. Referral audit helped ensure that existing community pathways were not inappropriately circumvented. The service expanded rapidly, and a second duty consultant was able to reduce pressure on the phone holder.

Early identification of patients requiring inpatient admission is important, along with a clear operational plan for moving them before the unit closes. It is important for the radiology department to understand that rapid diagnostic imaging is essential for the hospital to run an AEC. A hospital-at-home team can mitigate risk by monitoring patients at home and facilitating intravenous therapy, especially with once daily intravenous antibiotics under microbiological guidance. Learning from patient feedback we now give patients an early estimation of how long they might be on AEC. Overall, patients are positive about the AEC and the avoidance of hospital admission.

Planned developments include increased point of care testing and video calls with our ambulance service for triage to home, ambulatory or inpatient care. Longer opening hours may capture patients who are sent to the non-ambulatory pathway and then discharged home. Training clinicians in risk management and strengthening evidence to guide decisions on ambulation will be important moving forwards. With our ambulation-by-default approach, there is one standard pathway for all urgent medical care which includes an early fork for the minority who need admission to an inpatient bed. Ambulatory care reduces inpatient bed requirements and our outcomes demonstrate the value and safety of an inclusive clinician-driven approach policy to patient selection.

Figures

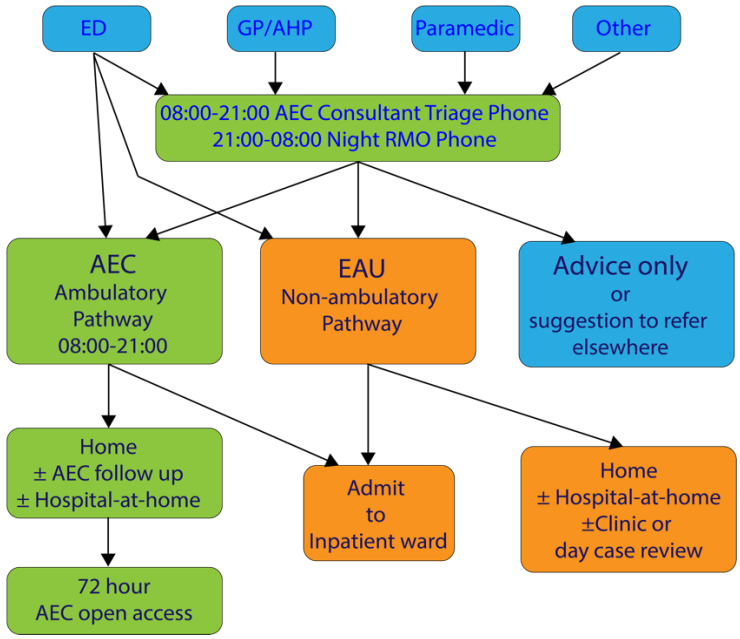

Figure 1 Pathways for acute medical patients (ED – emergency department, AHP – allied health professional, Other includes community hospitals, RMO – resident medical officer, HAH – hospital at home nursing team.

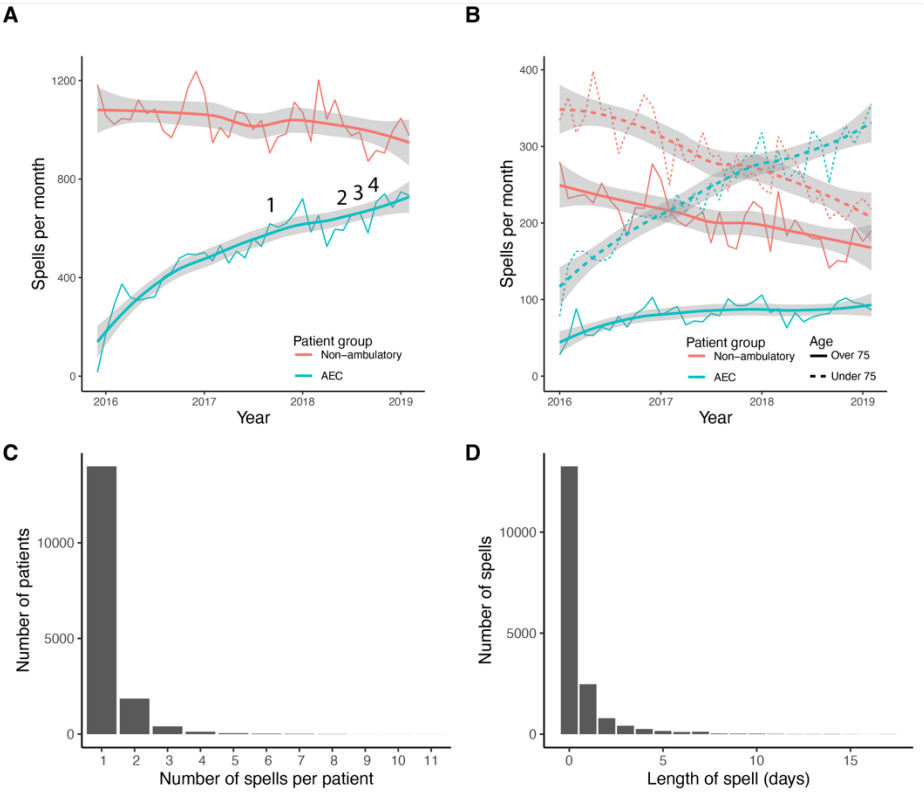

Figure 2. Patient spells on AEC or the pre-existing non-ambulatory pathway. Counts are plotted by month of spell initiation. (A) Counts for all spells on AEC or the non-ambulatory pathway. Numbers indicate upgrades to the AEC pathway: 1. Phone referrals opened to

ambulance paramedics and dedicated weekday 4 x CT/ultrasound scan slots for AEC patients, 2. AEC pharmacy opened, 3. dedicated weekday MRI slot for AEC, 4. Appointment of full-time AEC physiotherapist specializing in frailty. (B) Counts of 1st spells after opening of AEC stratified by age group. (C) Number of patients with the specified number of AEC spells over the study period. (D) Number of AEC patient spells by length of spell in days.

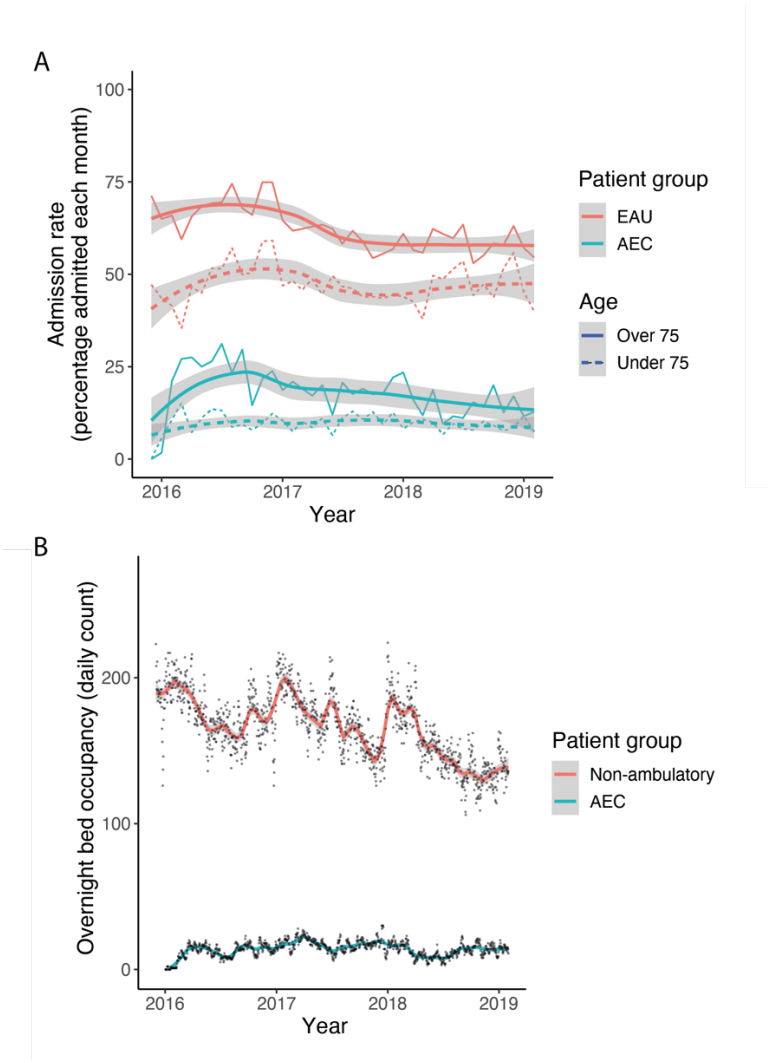

Figure 3 (A) Monthly admission rates from EAU and AEC stratified by age. (B) Daily counts of nightly bed occupancy.

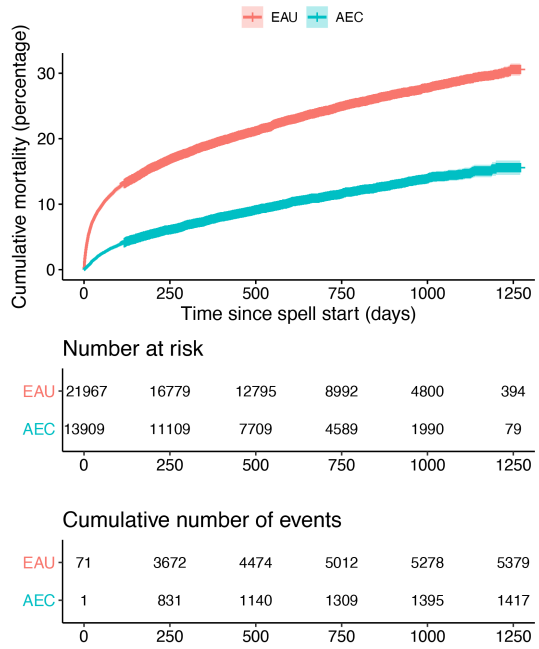

Figure 4 Cumulative mortality in AEC and non-ambulatory pathway patients following the start of their first spell

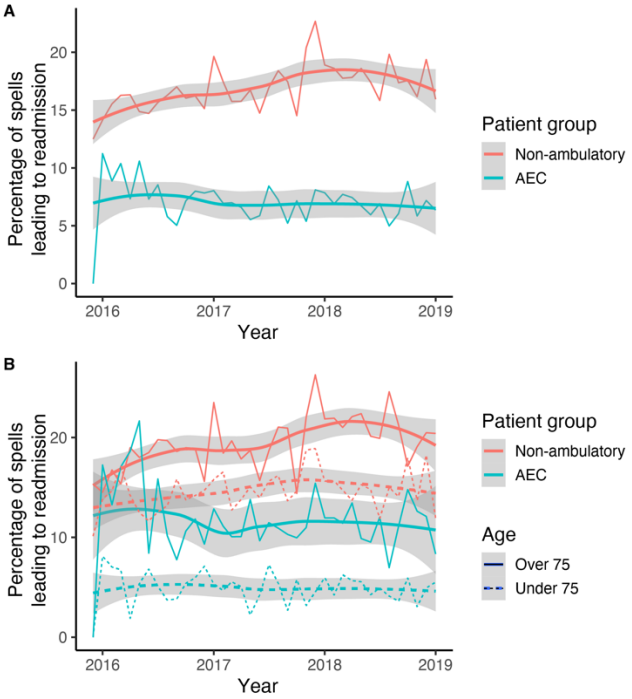

Figure 5 Readmission rates at 30-days from AEC and non-ambulatory pathways. (A) Overall monthly readmission rates and (B) monthly readmission rates stratified by age.

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Supplementary Information

Supplementary methods section on data analysis

We obtained dates of admission, discharge, dates of transfer from the first episode within a spell, details of the admission ward, discharge ward and where relevant second episode ward. We obtained the patients' age at admission, primary diagnosis ICD10 code and where relevant date of death. Death follow-up data was available until 25th June 2019.
The data were analysed in the R statistical environment using the Tidyverse suite of packages. Graphs were drawn using the ggplot R software package (https://www.tidyverse.org/packages/). In graphs of patient numbers, thin lines indicate counts and smoothed lines indicate predicted means derived using a LOESS smoothing function with default settings unless otherwise stated. The shaded area around these smooth lines indicates the 95% confidence interval of the predicted mean. This project was a retrospective service evaluation that was registered as a local quality improvement project with Oxford University NHS Foundation Hospitals Trust and as such was deemed not to require additional external ethical approval.

The whole dataset was first analysed for corrupted rows using the 'problem' function of the readr package in R and corrupted rows and duplicate spells were removed. To restrict the analysis from after the opening of AEC and to avoid analysis of incomplete months, the dataset was pruned to include spells starting on or after 1/1/2016 and before 1/3/19. Further pruning of the dataset included removal of any spells where the admit method was "booked", "planned", or "waiting list" and where the first ward was not an adult medical admission, such as where the first ward was a paediatric ward. Within our dataset it was not possible to determine the number of times a patient attended AEC during a given spell and we therefore counted the overall length of spell and thus the number of zero-day (single visit with no overnight stay) spells. For the counts of length of spell, we excluded spells where patients were admitted or died during the spell.

To analyse the primary diagnoses, we used ICD10 codes (International Statistical Classification of Diseases and Related Health Problems 10th Revision codes) that were pruned to a 3-digit level and analysed in R using the ICD10 database within the package 'icd.data' (https://cran.r-project.org/web/packages/icd.data/index.html). Cancer primary diagnoses were analysed separately after all malignancy-associated ICD10 codes were amalgamated into one group (ICD10 codes beginning with 'C'). Data analysis was based on the primary diagnosis associated with the final discharge episode for any given spell. Readmission status was defined as

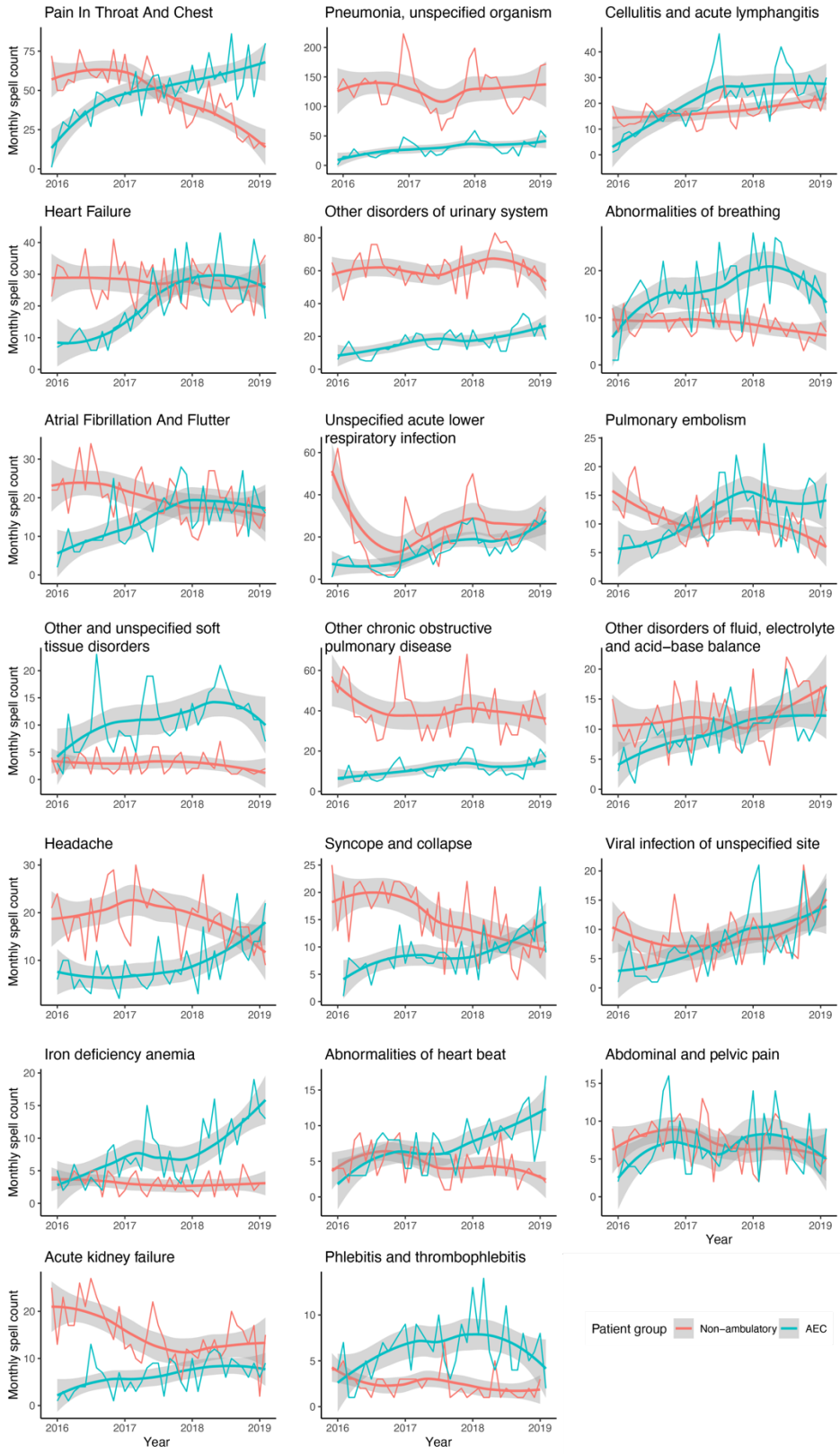
readmission to an acute medical treatment function (as listed above) within 30 days of discharge.

We noted that spell data did not fully reflect readmissions for ambulatory patients because some patients had new planned spells. For heart failure and cellulitis, for example, we note that patients were sometimes discharged to a hospital-at-home encounter then electively brought back and discharged from AEC—creating a second spell. In the readmission analysis we did not count as readmissions instances where a patient had another spell on AEC within 30 days and completed that spell purely under AEC. Towards the end of the study period only spells with more than 30 days follow-up were analysed. We did not assess re-attendances to the emergency department, non-medical specialties or primary care.

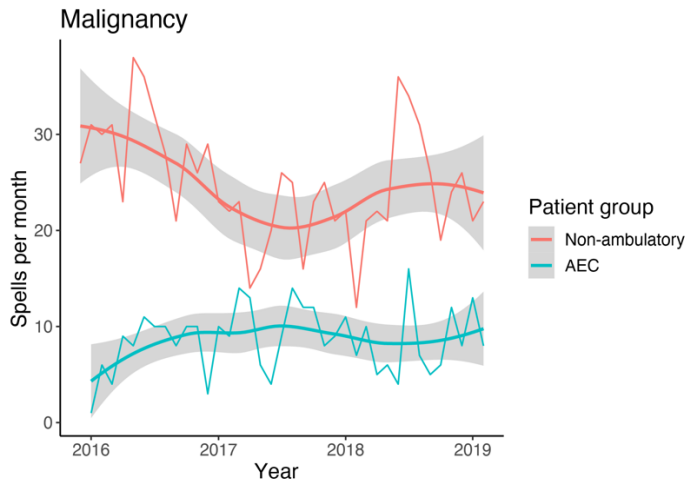
To calculate the admission rate for AEC patients we arbitrarily amalgamated spells completed on AEC that occurred within 7 days of each other into a single spell to overcome the problem of undercounting the true admission rate due to some patients having multiple spells as discussed above. We also removed from the analysis spells where the patient died during the index spell episode. At our institution some medical patients are transferred to nursing home beds ('hub beds') funded by the hospital and technically remain under the care of the hospital. Transfer to one of these beds was not counted as an admission to medicine. Data for the admission rate include a comparison of EAU and AEC spells since in both cases the patients can be discharged directly from the relevant assessment unit. We excluded the small number of medical patients who were admitted directly to an inpatient medical ward without coming through the EAU or AEC. We also did not have data on to the number of ED patients who are reviewed by the medical service in the ED and discharged directly from the ED. In its first year of operation the AEC could stay open overnight and keep up to 6 patients in 'flexi beds'. This overnight stay data is not available and is not reflected in the admission status for the first year of data analysis.

Mortality was assessed for the first spell for each patient only within the dataset. To calculate cumulative mortality, we used the survival package in R and plotted the results using the ggsurvplot function in the survminer R package. The survival time was calculated up to the last available mortality follow-up date of 25th June 2019. The 30-day mortality rate was calculated on a monthly basis as the percentage of spells in that month where the patient died within 30 days of the admission date for the spell.

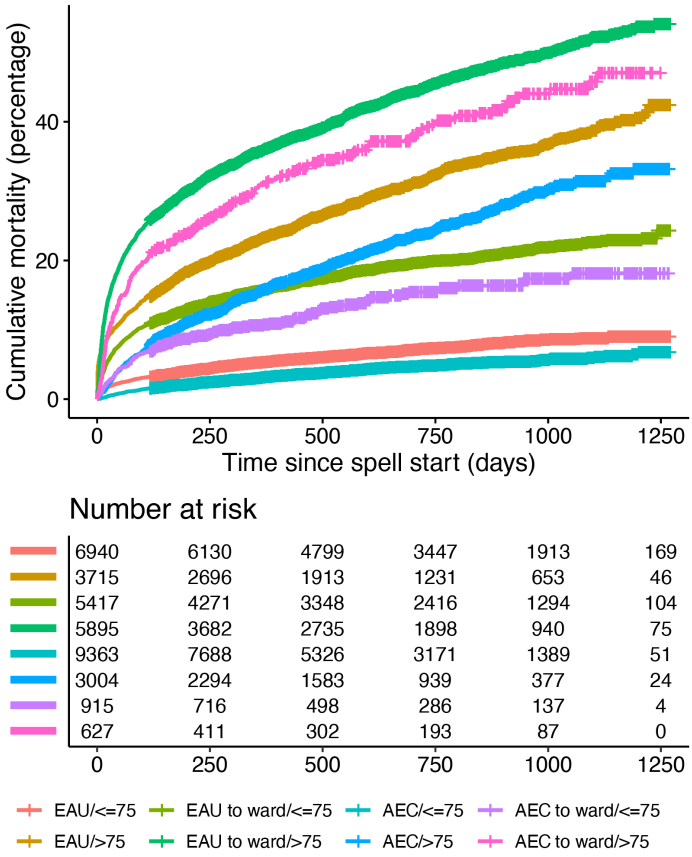
Supplementary Figures



Supplementary figure 1 Patient spells per month on AEC or the non-ambulatory pathway for the 20 most common AEC ICD10 diagnoses.



Supplementary figure 2 Patient spells per month with a primary diagnosis of cancer.



Supplementary figure 3 Cumulative mortality in AEC and non-ambulatory pathway patients (EAU), following the opening of AEC, stratified by age, whether admitted to an inpatient bed ('to ward') and whether admitted from AEC or the non-ambulatory pathway.

Supplementary Tables

Supplementary table 1 Mean monthly rate of admission from AEC to inpatient bed or from EAU to inpatient bed for the duration of the study.

Top 20 most common ICD10 primary diagnosis (3 digits) on AEC	EAU monthly admission rate (percentage)	AEC monthly admission rate (percentage)
Acute kidney failure	75.93	24.05
Pneumonia, unspecified organism	67.70	20.38
Heart failure	70.78	19.67
Other disorders of urinary system	56.96	16.34
Other chronic obstructive pulmonary disease	59.19	14.25
Pulmonary embolism	63.09	13.63
Other disorders of fluid, electrolyte and acid-base balance	48.85	12.08
Phlebitis and thrombophlebitis	38.67	9.10
Cellulitis and acute lymphangitis	59.63	9.00
Atrial fibrillation and flutter	35.67	5.99
Syncope and collapse	29.14	5.68
Abdominal and pelvic pain	25.68	5.37
Iron deficiency anaemia	63.47	3.62
Unspecified acute lower respiratory infection	38.66	3.58
Headache	19.89	3.15
Viral infection of unspecified site	17.65	2.74
Pain in throat and chest	10.64	1.10
Other and unspecified soft tissue disorders, not elsewhere classified	25.50	0.94
Abnormalities of heartbeat	23.79	0.56
Abnormalities of breathing	17.54	0.45

Supplementary table 2 Mean monthly 30-day mortality rate stratified by primary diagnosis for the duration of the study.

Top 20 most common ICD10 (3 digits) primary diagnosis on AEC	Non-ambulatory 30-day mortality rate (percentage)	AEC 30-day mortality rate (percentage)
Acute kidney failure	16.74	5.20
Other chronic obstructive pulmonary disease	8.02	4.83
Heart failure	15.82	4.11
Pneumonia, unspecified organism	19.24	3.86
Iron deficiency anaemia	2.17	2.78
Other disorders of fluid, electrolyte and acid-base balance	4.31	2.03
Pulmonary embolism	8.24	1.74
Unspecified acute lower respiratory infection	7.05	1.28
Other and unspecified soft tissue disorders, not elsewhere classified	0.00	1.18
Atrial fibrillation and flutter	1.88	0.71

Other disorders of urinary system	4.54	0.65
Cellulitis and acute lymphangitis	4.24	0.56
Abnormalities of breathing	2.55	0.39
Syncope and collapse	1.21	0.38
Pain in throat and chest	0.54	0.12
Abdominal and pelvic pain	4.61	0.00
Abnormalities of heartbeat	0.65	0.00
Headache	0.29	0.00
Phlebitis and thrombophlebitis	5.97	0.00
Viral infection of unspecified site	0.00	0.00

Supplementary table 3 Mean monthly 30-day readmission rate stratified by primary diagnosis for the duration of the study.

Top 20 most common ICD10 (3 digits) primary diagnosis on AEC	**Non-ambulatory 30-day readmission rate (percentage)**	**AEC 30-day readmission rate (percentage)**
Acute kidney failure	19.73	16.81
Other chronic obstructive pulmonary disease	28.34	16.04
Other disorders of urinary system	19.93	12.48
Other disorders of fluid, electrolyte and acid-base balance	20.09	10.56
Pneumonia, unspecified organism	19.39	10.54
Heart failure	22.05	8.71
Unspecified acute lower respiratory infection	18.77	6.40
Syncope and collapse	8.58	6.21
Cellulitis and acute lymphangitis	23.65	6.09
Atrial fibrillation and flutter	17.69	6.00
Phlebitis and thrombophlebitis	23.17	5.51
Iron deficiency anaemia	15.32	5.38
Pulmonary embolism	13.39	4.67
Abnormalities of breathing	21.47	4.19
Abdominal and pelvic pain	15.13	4.10
Other and unspecified soft tissue disorders, not elsewhere classified	9.43	4.10
Headache	8.48	4.01
Viral infection of unspecified site	13.31	2.17
Abnormalities of heartbeat	14.84	2.01
Pain in throat and chest	8.61	1.85