National Institute for Health and Care Excellence

Final

Chapter 24 Assessment through acute medical units

Emergency and acute medical care in over 16s: service delivery and organisation

NICE guideline фп

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Developed by the National Guideline Centre, hosted by the Royal College of Physicians

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ISBN: 978-1-4731-2741-8
Chapter 24 Assessment through acute medical units

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Update information

Minor changes since publication

February 2019: A minor wording change was made to recommendation 13 to clarify which admission settings it applies to.

24 Acute medical units

24.1 Introduction

The Acute Medical Unit (AMU) (also often called the acute assessment unit (AAU) or medical admissions unit (MAU)) is the first point of entry for patients referred to hospital as an acute medical emergency (AME) by their GP and those requiring admission from the Emergency Department. Its primary role is to provide rapid definitive assessment, investigation and treatment for patients. AMUs have been established in many NHS hospitals and the specialty has evolved rapidly over the past decade. New medical teams with Consultants in Acute Medicine have been established leading to a redesign of the way medical care is delivered. AMUs are distinctly different to that of general wards in NHS hospitals and are configured with operational policies to provide an optimal environment for high quality of medical and nursing assessment and care, 24 hours a day, over 7 days a week prior to admission, discharge or transfer to the appropriate environment.

24.2 Review question: Does admission or assessment through an acute medical unit (AMU) increase hospital discharges, improve patient outcomes and hospital resource usage?

For full details see review protocol in Appendix A.

Table 1: PICO characteristics of review question

Population	Adults or young people (>16 years of age) with a suspected or confirmed AME.
Intervention	Assessment and management through the AMU at any part in the clinical pathway that is direct to AMU from GP or via ED.
Comparison	Direct admission to a general medical ward from ED or by GP referral (in the absence of AMU in hospital).
Outcomes	**Patient outcomes:** • Quality of life (CRITICAL) • Length of stay/ time to discharge (CRITICAL) • Patient and/or carer satisfaction (CRITICAL) • Readmissions up to 30 days (IMPORTANT) • Mortality (CRITICAL) • Avoidable adverse events (CRITICAL) • Direct discharges or zero length of stay admissions (IMPORTANT) • Number of discharges within 48-72 hours (IMPORTANT) • Outlying/Boarding (IMPORTANT) • A&E 4 hour waiting target (IMPORTANT) **Staff outcomes:** • Staff satisfaction (IMPORTANT)
Study design	Systematic reviews (SRs) of RCTs, RCTs, observational studies only to be included if no relevant SRs or RCTs are identified.

24.3 Clinical evidence

Three observational studies of which 2 were before-studies and 1 prospective cohort study were included in the review.[15,25,43] These are summarised in Table 2 below. Evidence from these studies is summarised in the clinical evidence summaries below (Table 3; Table 4; Table 5). See also the study

selection flow chart in Appendix B, study evidence tables in Appendix D, forest plots in Appendix C, GRADE tables in Appendix F and excluded studies list in Appendix G.

No randomised controlled trials were identified which compared admission through an Acute Medical Unit (AMU) to direct admission to a general ward. Observational studies were included which controlled for confounders, either through the use of multivariate analysis or propensity matching of the sample population. All 3 studies controlled for multiple confounders in their analysis.

A variety of different units were included in this review which were equivalent to an AMU. These were the Acute Admissions Unit (AAU) and the Acute Medical Admissions Unit (AMAU).

Table 2: Summary of studies included in the review

Study	Interventions and comparisons	Population	Outcomes	Comments
Coary 2014[15] Prospective cohort study	Initial allocation to AMU (structured environment) versus Initial allocation routine medical ward (unstructured environment).	All emergency general medical admissions (n=66,933) from 36,271 unique patients admitted to a secondary care hospital in the Republic of Ireland. Patients admitted from the emergency department directly into the intensive care unit or the high dependency unit were excluded.	30 day in-hospital mortality. Multivariate analysis: adjusted for acute illness severity, Charlson Co-Morbidity Index, sepsis status, chronic disabling score and major disease primary coding in the Respiratory and Cardiovascular categories.	Results presented as reported in study - adjusted ORs and CIs. No raw data provided in the study.
Li 2010[25] Retrospective Before and after study	Admission within 3rd year post-AAU establishment versus Admission 1 year pre-AAU establishment.	Acute general medical admissions (n=5304) to a tertiary referral hospital in Australia in the 2 year-long study periods (2003 and 2006). Post-AAU group propensity matched to Pre-AAU comparison. Matched variables were: sex, intensive care unit admission (or not), clinical characteristics defined by principal diagnoses and comorbidities defined by secondary diagnoses.	Length of hospital stay, in-hospital mortality.	2652 propensity matched post-AAU group selected from total admission (n=3992). Mean (SD) age significantly different; Pre-AAU: 68.3 (19.1) Post-AAU: 72.0 (18.7).
Rooney 2008[43] Prospective	Admission post-AMAU establishment versus	All emergency general medical admissions (n=30,366) from	30 day in-hospital mortality.	Results presented as reported in study - adjusted

Study	Interventions and comparisons	Population	Outcomes	Comments
Before and after study	Admission 1 year pre-AMAU establishment. Multiple before/after comparisons. One (1 year) study period before AMAU set up. Four consecutive (1 year) post-AMAU study periods.	19,528 patients admitted to a secondary care hospital in the Republic of Ireland. Patients admitted from the emergency department directly into the intensive care unit or the high dependency unit were excluded.	Multivariate analysis: adjusted for acute illness severity, Charlson Co-Morbidity Index, modified APACHE II score, number of admissions, acute or non-acute ward, age, gender and major disease categories.	ORs and CIs. No raw data provided in the study. Same setting and database as Coary 2014.

Table 3: Clinical evidence summary: Initial admission to AMU compared to Initial admission to routine medical ward

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Initial admission to other ward	Risk difference with Initial admission to AMU (95% CI)
30 day in-hospital mortality	66933 (1 study) 30 days	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	OR 0.64 (0.59 to 0.69)	No adjusted control group risk reported	Absolute effect cannot be calculated

(a) All non-randomised studies automatically downgraded due to selection bias. Studies may be further downgraded by 1 increment if other factors suggest additional high risk of bias, or 2 increments if other factors suggest additional very high risk of bias.

Table 4: Clinical evidence summary: Admission post-AMAU compared to Admission pre-AMAU

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Admission pre-AMAU	Risk difference with Admission post-AMAU (95% CI)
In-hospital all-cause mortality (1 year post-AMAU versus pre-AMAU)	11505 (1 study)	⨁⊖⊖⊖ VERY LOW[b] due to risk of bias	OR 1.81 (1.47 to 2.23)	No adjusted control group risk reported	Absolute effect cannot be calculated
In-hospital all-cause mortality (2 year post-AMAU versus pre-AMAU)	11433 (1 study)	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	OR 1.2 (0.98 to 1.47)	No adjusted control group risk reported	Absolute effect cannot be calculated
In-hospital all-cause mortality (3 year post-AMAU versus pre-AMAU)	12126 (1 study)	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	OR 0.73 (0.6 to 0.89)	No adjusted control group risk reported	Absolute effect cannot be calculated
In-hospital all-cause mortality (4 year post-AMAU versus pre-AMAU)	11730 (1 study)	⨁⊖⊖⊖ VERY LOW[b] due to risk of bias	OR 0.28 (0.23 to 0.34)	No adjusted control group risk reported	Absolute effect cannot be calculated

(a) Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.

(b) All non-randomised studies automatically downgraded due to selection bias. Studies may be further downgraded by 1 increment if other factors suggest additional high risk of bias, or 2 increments if other factors suggest additional very high risk of bias.

Table 5: Clinical evidence summary: Admission post-AAU (2 years after establishment of AAU) compared to Admission pre-AAU

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Admission pre-AAU	Risk difference with Admission post-AAU (95% CI)
In-hospital all-cause mortality	5304 (1 study)	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 0.91 (0.71 to 1.17)	46 per 1000	4 fewer per 1000 (from 13 fewer to 8 more)
Length of hospital stay	5304 (1 study)	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision		The mean length of hospital stay in the control groups was 6.8 days	The mean length of hospital stay in the intervention groups was 0.8 lower (1.3 to 0.3 lower)

(a) All non-randomised studies automatically downgraded due to selection bias. Studies may be further downgraded by 1 increment if other factors suggest additional high risk of bias, or 2 increments if other factors suggest additional very high risk of bias.

(b) Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.

24.4 Economic evidence

Published literature

No relevant economic evaluations were identified.

The economic article selection protocol and flow chart for the whole guideline can found in the guideline's Appendix 41A and Appendix 41B.

In the absence of health economic evidence, unit costs were presented to the guideline committee – see Chapter 41 Appendix I.

24.5 Evidence statements

Clinical

Initial admission to AMU compared to Initial admission to routine medical ward

One study comprising 66,933 people evaluated initial admission to AMU to improve patient outcomes and hospital resource usage in adults and young people at risk of an AME, or with a suspected or confirmed AME. The evidence suggested that initial admission to AMU may provide a benefit for reduced 30 days in-hospital mortality. The evidence was graded very low quality.

Admission post-AMAU compared to Admission pre-AMAU

One study comprising 30,366 people evaluated admission to AMAU to improve patient outcomes and hospital resource usage in adults and young people at risk of an AME, or with a suspected or confirmed AME. The evidence suggested that admission post-AMAU may provide a benefit for reduced in-hospital all-cause mortality at 3 years and 4 years. The evidence suggested there was no difference at 2 years following establishment, while there was a possible increase of in-hospital mortality at 1 year. The evidence was graded very low quality for all outcomes.

Admission post-AAU compared to Admission pre-AAU

One study comprising 5304 people evaluated admission to AAU to improve patient outcomes and hospital resource usage, in adults and young people at risk of an AME, or with a suspected or confirmed AME. The evidence suggested no difference 2 years after establishing an AAU on in-hospital all-cause mortality and length of hospital stay. The evidence was graded very low quality for all outcomes.

Economic

No relevant economic evaluations were identified.

24.6 Recommendations and link to evidence

Recommendations	**13. Assess and treat people who are admitted with undifferentiated medical emergencies in an acute medical unit.**
Research recommendations	**-**
Relative values of different outcomes	Mortality, patient and/or carer satisfaction, avoidable adverse events, and quality of life were considered by the committee to be critical outcomes. Readmissions, number of discharges within 48-72 hours, length of stay in hospital, direct discharges or 0 length of stay admissions, staff satisfaction, outlying/boarding, and the emergency department A&E 4 hour waiting target were considered by the committee to be important outcomes.
Trade-off between benefits and harms	There was evidence from 3 observational studies comparing assessment and admission through an AMU to direct admission to a general ward. No randomised controlled studies were identified for this question. The results were not pooled for meta-analysis because of differences in study design, comparison, control of confounders and the absence of raw data required for meta-analysis. There was one prospective cohort study comparing initial admission to AMU with initial admission to routine medical ward. This study looked at mortality only. The evidence suggested that initial admission to AMU rather than a routine medical ward might provide a benefit for reduced in-hospital mortality (reported within 30 days of being admitted). One prospective study comparing mortality rates before and after the establishment of an AMU suggested that admission to AMU might provide a benefit for reduced in-hospital all-cause mortality at 3 and 4 years after the establishment of the unit. However, at 1 year, there was a possible increase in in-hospital mortality and at 2 years, the evidence suggested that there was no difference in this outcome following establishment of the unit. The third, retrospective study suggested there was no difference 2 years after establishing an AMU in hospital all-cause mortality and length of stay. No evidence was identified for patient satisfaction, quality of life, number of readmissions within 30 days, number of discharges within 48-72 hours, avoidable adverse events, direct discharges or zero day admissions, carer satisfaction, staff satisfaction, outlying/boarding and the A&E 4 hour waiting target. There was therefore mixed evidence for the benefit of admission through an AMU. The evidence suggested that improvements in survival following establishment of an AMU could take time to realise, perhaps because of a lag phase between changing structures and changing processes of care. In the UK, most hospitals already have an AMU as part of their management pathway for patients with AMEs so the issue of deterioration due to establishment of the AMU is unlikely to be a current risk. It was also recognised that the logic for establishing AMUs was based on mitigating the undesirable consequences of distributing acute and potentially unstable acute medical admissions across the hospital, since doing so bears comparison with the adverse effects of 'outlying' patients during periods of excessive hospital occupancy. The evidence was largely limited to the impact on mortality, but the expertise available in the committee indicated that the benefits of an AMU would extend beyond mortality. These might include improvements in patient flow and reduction in error and adverse events when compared to the alternative of direct admission to general wards, and the likely focus on promoting timely hospital discharge direct from the AMU, with follow-up if required the following day. There are also the 'difficult to measure' outcomes such as reducing the burden on the general medical

Recommendations	13. Assess and treat people who are admittted with undifferentiated medical emergencies in an acute medical unit.
Research recommendations	-
	wards and hospital staff by not having acutely unwell patients distributed throughout the hospital. Health systems wishing to develop AMUs should incorporate these process measures and the other outcomes defined above in research evaluations using cluster-randomised or step wedge designs.
Trade-off between net effects and costs	No relevant economic evaluations were identified. Unit costs were presented to the committee (Chapter 41 Appendix I). Staffing intensity might be higher in the AMU than on an ordinary ward. However, it is likely that the cost would be at least partly offset by reduced length of stay and better patient flow. In theory, there could be some economies of scale by concentrating the most acutely ill during the assessment and early treatment phase in a single location where they are easily managed by the most appropriately trained staff in the hospital. The evidence available showed a slight reduction in patient length of stay. The studies also suggested that any incremental cost would be balanced by better patient survival. The committee noted that the resources required to establish an AMU could be derived in part from reallocation of existing resources rather than new funding. Two studies included in the clinical review set in the same hospital provided evidence for this; reconfiguring 2 general medical wards located near the emergency department and diagnostic services into an AMU. The focus of an AMU would be to group patients in need of acute care in the same geographical location of the hospital whilst receiving the same care with increased efficiency and patient safety. The committee noted that the skill set of the staff working in the AMU was an important factor in the effectiveness of the service. This includes the use of expert staff such as acute internal medicine (AIM) physicians to take the lead in the AMU. In hospitals where AMUs are currently not part of current practice or do not involve expert staff such as AIM physicians as part of the service, this could have a significant resource impact which could be offset by reconfiguration of roles of existing staff. Also, changing the emphasis of new consultant appointments (to preferentially employ AIM physicians) can also further reduce the resource impact and ensure that specialty expertise is realised.
Quality of evidence	All outcomes reported for this review were of very low quality. Primarily this was due to the inclusion of observational studies and the associated risk of bias this study design entails compared to randomised controlled trials. The committee noted that it would be unlikely that randomised controlled trials would ever be undertaken in this area, but more robust studies (that adequately control for confounders) assessing components of care or service design could be feasible. All the included observational studies controlled for confounders either through the use of multivariate analysis or propensity matching of the sample. For the outcome mortality, 2 of the 3 studies used multivariate analysis, controlling for a number of population and morbidity confounders, whilst the third used propensity matching which controlled for a reduced number of confounders in comparison. The evidence identified included patients being referred from both ED and general practice as these populations were not sub-grouped. No economic evidence was identified.
Other considerations	The committee noted that admission via an AMU was in line with national priorities identified by the Society for Acute Medicine (SAM) and that it was current practice within the UK, although the terminology used may vary regionally. Published

Recommendations	13. Assess and treat people who are admitted with undifferentiated medical emergencies in an acute medical unit.
Research recommendations	-
	guidance on the implementation of an AMU in the UK is available from the Royal College of Physicians London (RCP) and quality indicators and quality standards for an AMU are available from SAM {WESTMIDLANDS2012}. The committee noted that the only setting for which evidence was identified were large hospitals such as large teaching and tertiary care centres. However, as the way in which AMUs are set up to deliver care (that is, to the undifferentiated patients with an AME) it was felt that the results were generalisable to smaller centres, and indeed many smaller hospitals do have an AMU. It was also felt that in smaller hospitals, this method of working would likely be more efficient due to pooling of limited resources and concentrating the impact in a confined area. The committee noted that assessment via an AMU is current practice in the majority of hospitals (more than 90% of UK hospitals have an AMU) in the UK and therefore, the recommendation reflects this position. AMUs have become widely established because of the sustained opinion of the clinical community that they bring significant clinical benefits to patient care locally and nationally. Pragmatically, it makes sense in terms of economics, structure and process to concentrate resources for newly presenting patients with AMEs in one area rather than distributing such patients throughout the hospital. The model replicates established intensive care units where resources and expertise are concentrated in one area during periods of maximal patient dependency. Acuity as a justification for co-location is well established for coronary care units (CCUs) and hyper-acute stroke units (HASUs). However, the justification for AMUs, that they manage a diverse case mix at the point of maximal acuity and uncertainty post-admission to hospital, also makes it difficult to evaluate their effectiveness, while the complexity and cost of setting up AMUs militates against doing this in the setting of a randomised controlled trial. Consequently, high-level research evidence is not available. A systematic review suggested that the benefits of an AMU include reduced length of stay and patient and/or carer, and staff satisfaction without an impact on readmission rates.[46] Some of the studies from the systematic review that met our protocol inclusion criteria have been included; however, other studies in the systematic review had either inappropriate comparisons or reported univariate analysis, hence were not included. The committee chose to develop a strong consensus recommendation in favour of retaining AMUs based on the evidence they had available and their experience of AMUs in practice. The committee highlighted that, where there is well-characterised pathology, healthcare providers should refer to the relevant NICE clinical guideline, which might recommend bypassing admission through an AMU. For example, this may include conditions with well-defined pathways such as NICE clinical guideline 68 Stroke and NICE clinical guideline 167 Myocardial infarction with ST-segment elevation.[36,37] The purpose of the AMU is to assess and manage patients with an AME who are often undifferentiated and often have multiple medical problems. Where care has been established for a single organ dysfunction, this should be followed at the point of identification. The committee also felt that ongoing assessment and evaluation of AMUs is crucial. There are already standards and clinical quality indicators that have been produced by the Society for Acute Medicine. It was felt that units should continually measure adherence to such standards and benchmark themselves against other units for quality assurance. In addition to direct outcomes such as mortality and length of

Recommendations	**13. Assess and treat people who are admitted with undifferentiated medical emergencies in an acute medical unit.**
Research recommendations	**-**
	stay, indirect measures of impact should be monitored, such as delayed transfers from the Emergency Department or the impact of the AMU on the downstream medical wards. The committee noted that the name and function of AMU services varied widely across the healthcare system and emphasised the importance of standardising taxonomies. The committee felt that although location (such as an AMU being close to ED, radiology and ICU) can have an impact on patient care, the processes of care also determines whether that location is associated with improved patient outcomes. Many general medical wards are unable to provide the level of supervision (nurse, junior doctor or consultant) that the patient requires. The establishment of AMUs provides that level of supervision during the first 48-72 hours of presentation, which has been shown to be a vulnerable phase in the patient's journey in hospital. Recommendations on admission via an elderly care assessment unit can be found in Chapter 25.

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Appendices

Appendix A: Review protocol

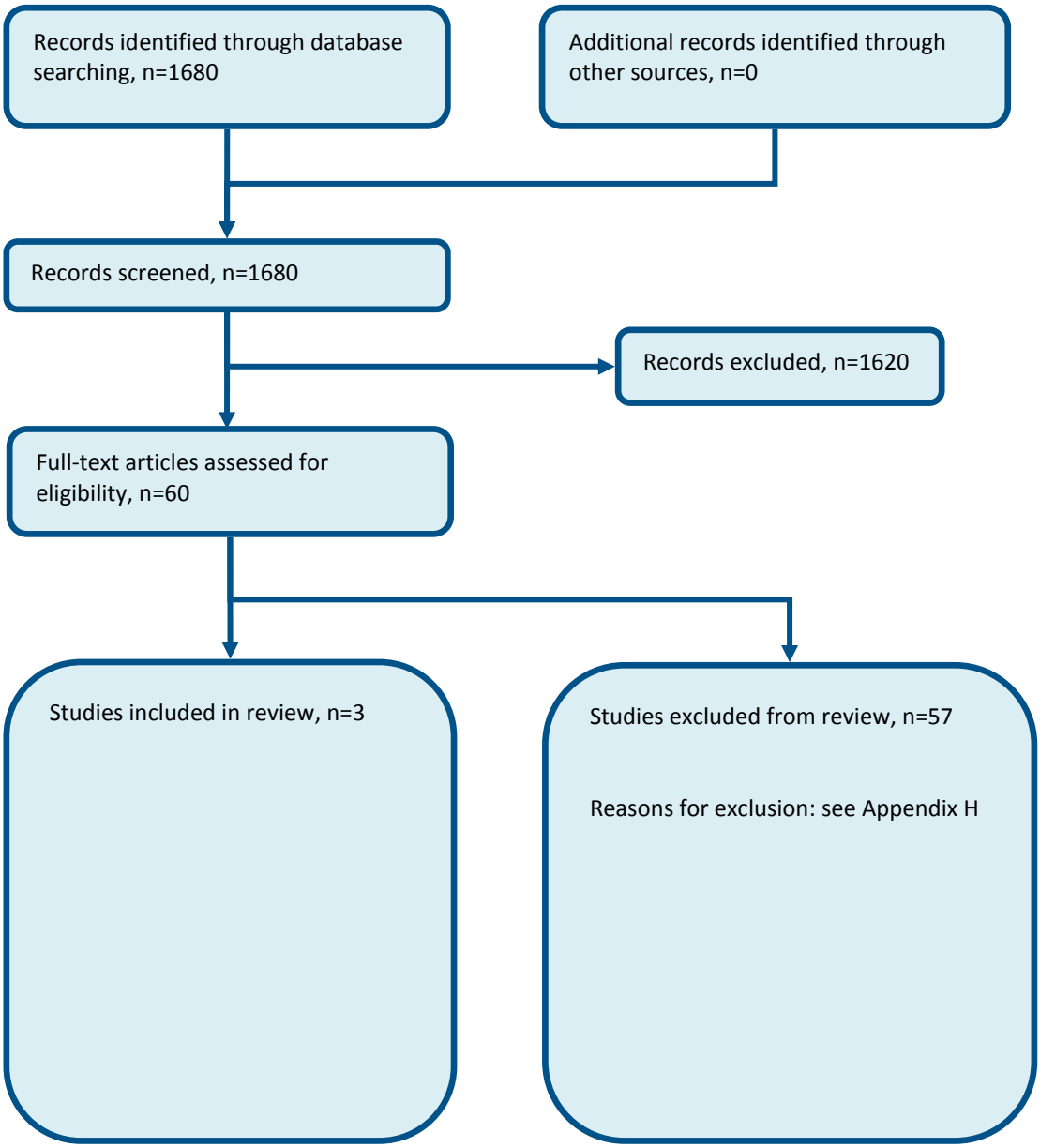
Table 6: Review protocol: Admission through AMU

Review question	Does admission or assessment through an AMU increase hospital discharges, improve patient outcomes and hospital resource usage?
Guideline condition and its definition	Acute medical emergencies. Definition: people with suspected or confirmed acute medical emergencies or at risk of an acute medical emergency.
Review population	Adults and young people (16 years and over) with a suspected or confirmed AME presenting to ED or GP.
	Adults and young people (>16 years of age).
	Line of therapy not an inclusion criterion.
Interventions and comparators: generic/class; specific/drug (All interventions will be compared with each other, unless otherwise stated)	• Assessment and management through the AMU at any part in the clinical pathway that is, direct to AMU from GP or via ED. • Direct admission to a general medical ward from ED or by GP referral (in the absence of AMU in hospital).
Outcomes	- Quality of life during the study period (Continuous) CRITICAL -Avoidable adverse events CRITICAL - Length of stay during the study period (Continuous) IMPORTANT - Number of outliers/ boarders during the study period (Dichotomous) IMPORTANT - A&E 4 hour waiting target met during the study period (Dichotomous) IMPORTANT - Number of discharges within 48-72 hours during the study period (Dichotomous) IMPORTANT - Number of readmissions (up to 30 days) during the study period (Dichotomous) IMPORTANT - Mortality during the study period (Dichotomous) CRITICAL - Patient satisfaction during the study period (Dichotomous) CRITICAL - Direct discharges or zero day admissions during the study period (Dichotomous) IMPORTANT - Carer satisfaction during the study period (Dichotomous) CRITICAL - Staff satisfaction during the study period (Dichotomous) IMPORTANT
Study design	Systematic reviews (SRs) of RCTs, RCTs, observational studies only to be included if no relevant SRs or RCTs are identified.
Unit of randomisation	Patient Hospital Ward
Crossover study	Not permitted.
Minimum duration of study	Not defined.
Other exclusions	No direct admission to an Intensive Care (ICU) Coronary Care (CCU or Stroke Unit (SU).
Subgroup analyses if there is heterogeneity	Frail elderly (Frail elderly; No frail elderly); effects may be different in this subgroup.
Search criteria	Databases: Medline, Embase and the Cochrane Library.

	Date limits for search: No date limits. Language: English language only.

Appendix B: Clinical article selection

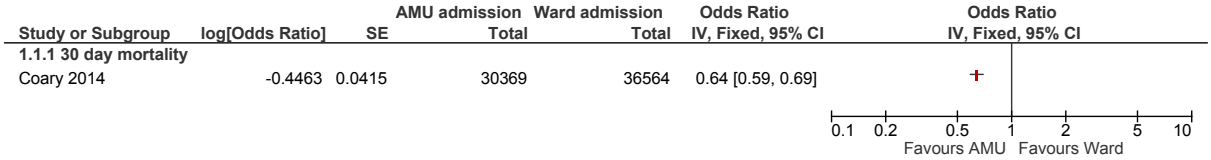
Figure 1: Flow chart of clinical article selection for the review of AMU admission



Appendix C: Forest plots

C.1 Initial admission to AMU compared to Initial admission to routine medical ward

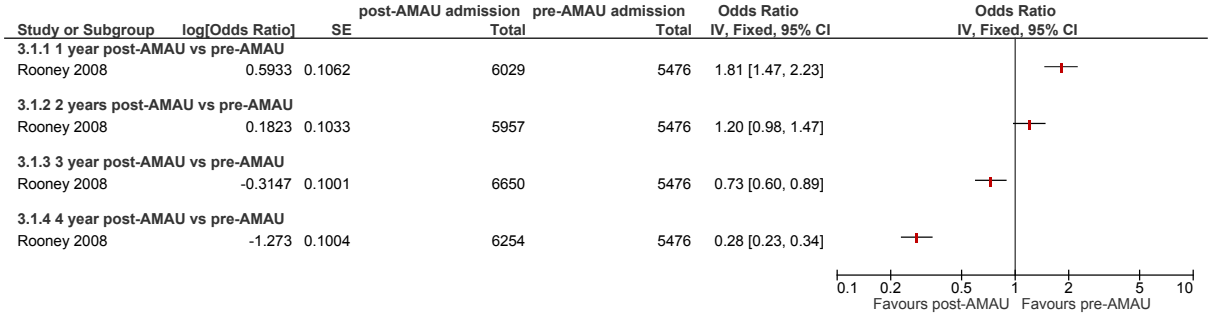
Figure 2: 30 days in-hospital mortality



Summary odds ratio adjusted for acute illness severity, Charlson Co-Morbidity Index, sepsis status, chronic disabling score and major disease primary coding in the Respiratory and Cardiovascular categories.

C.2 Admission post-AMAU versus Admission pre-AMAU

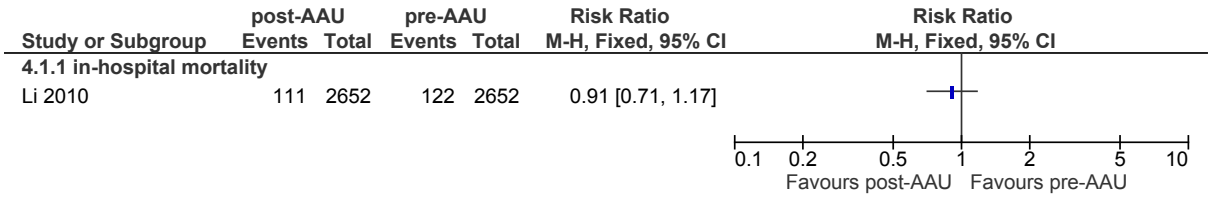
Figure 3: In-hospital all-cause mortality



Summary odds ratio adjusted for acute illness severity, Charlson Co-Morbidity Index, modified APACHE II score, number of admissions, acute or non-acute ward, age, gender and major disease categories.

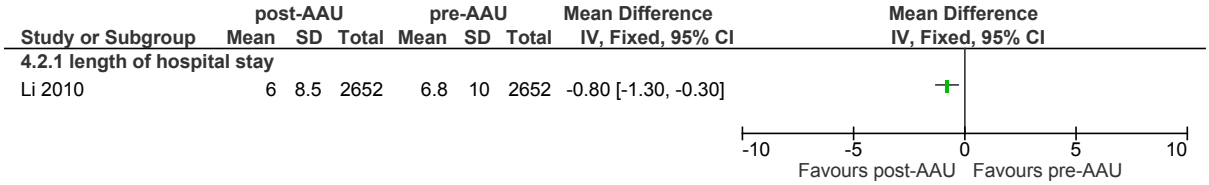
C.3 Admission post-AAU (2 years after establishment of AAU) versus Admission pre-AAU

Figure 4: In-hospital all-cause mortality



Propensity matched for sex, intensive care unit admission (or not), clinical characteristics defined by principal diagnoses and comorbidities defined by secondary diagnoses.

Figure 5: Length of stay



Propensity matched for sex, intensive care unit admission (or not), clinical characteristics defined by principal diagnoses and comorbidities defined by secondary diagnoses.

Appendix D: Clinical evidence tables

Study	Coary 2014[15]
Study type	Prospective cohort study.
Number of studies (number of episodes)	1 (n=66,933).
Countries and setting	Conducted in Republic of Ireland; setting: secondary care hospital.
Line of therapy	Not applicable.
Duration of study	Data collection period: 12 years.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	All admitted emergency general medical patients.
Exclusion criteria	Patients admitted from the emergency department directly into the intensive care unit or the high dependency unit.
Recruitment/selection of patients	National hospital in-patient enquiry (HIPE).
Age, gender and ethnicity	Age: Group 1: 20.8% <40, 24.3% 40-70, 23.5% 60-75, 20.7% 75-85, 10.8% >85; Group 2: 24.4% <40, 24.2% 40-70, 24.0% 60-75, 19.6% 75-85, 7.8% >85. Gender (M:F): Group 1 - 48.6:51.4 Group 2 - 49.2:50.8. Ethnicity: not reported.
Further population details	Data analysis by episode (n=66,933) which was collected from n=36,271 unique patients.
Indirectness of population	No indirectness.
Interventions	(n=30,369) Intervention 1: Initial assessment through the AMAU (59 beds) before discharge or admission. Duration: 12 years. Concurrent medication/care: n/a. (n=36,564) Intervention 2: Direct admission to other wards, this includes Medical Wards (161 beds), Emergency Virtual (a holding area concentrated on triage and initial treatment), Private Ward (patients with more resources and lower deprivation status – 27 beds) and 'Other' Wards (primarily focussed on surgical conditions – 230 beds). Duration: 12 years. Concurrent medication/care: n/a.
Funding	Funding not stated.
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: ASSESSMENT AND MANAGEMENT THROUGH THE AMU AT ANY PART IN THE CLINICAL PATHWAY THAT IS, DIRECT TO AMU FROM GP OR VIA ED. versus DIRECT ADMISSION TO A GENERAL MEDICAL WARD FROM ED OR BY GP REFERRAL (IN THE ABSENCE OF AMU IN	

HOSPITAL). Protocol outcome 1: Mortality during the study period. - Actual outcome: In-hospital mortality at 30 days; Summary OR 0.64 [0.59, 0.69] (adjusted for acute illness severity, Charlson Co-Morbidity Index, sepsis status, chronic disabling score and major disease primary coding in the Respiratory, Cardiovascular categories); Risk of bias: All domain - high, Selection - high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life during the study period; Number of outliers/ boarders during the study period; A&E 4 hour waiting target met during the study period; Number of discharges within 48-72 hours during the study period; Number of readmissions (within 7 – 30 days) during the study period; Patient and/or carer satisfaction during the study period; Direct discharges or zero day admissions during the study period; Carer satisfaction during the study period; Mortality during the study period; Length of stay during the study period.

Study	**Li 2010[25]**
Study type	Retrospective before and after study.
Number of studies (number of participants)	1 (n=5304).
Countries and setting	Conducted in Australia; setting: tertiary referral and university teaching hospital.
Line of therapy	Not applicable.
Duration of study	Data collection: two 1 year study periods.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	Admission as a general medical patient.
Exclusion criteria	Not reported.
Recruitment/selection of patients	Computerised hospital database.
Age, gender and ethnicity	Age – Mean (SD): Group 1 – 72.0 (18.7), Group 2 – 68.3 (19.1). Gender (M:F): Group 1 – 44:56, Group 2 – 43:57. Ethnicity: not reported.
Further population details	Post-AAU population sample propensity matched to pre-AAU population sample: Variables matched: sex, intensive care unit admission (or not), clinical characteristics defined by principal diagnoses and comorbidities defined by secondary diagnoses.
Indirectness of population	No indirectness.

Interventions	(n=2652) Intervention 1: Admission through the AAU once it was fully staffed and operational (2 years after establishment), whose remit was to receive adult patients whose clinical profile made them inappropriate for a subspecialty medical unit, or for a surgical service. Consultant physician reviews all new admissions twice a day, and patients requiring longer than 48 hours are transferred to a general medical unit or appropriate medical unit. Duration: 1 year. Concurrent medication/care: n/a. (n=2652) Intervention 2: One year Pre-AAU. Patients were directly admitted to a subspecialty service, or to a general medical team of the day, by the ED doctors. Duration: 1 year. Concurrent medication/care: n/a.
Funding	Funding not stated.
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: ASSESSMENT AND MANAGEMENT THROUGH THE AMU AT ANY PART IN THE CLINICAL PATHWAY THAT IS, DIRECT TO AMU FROM GP OR VIA ED. versus DIRECT ADMISSION TO A GENERAL MEDICAL WARD FROM ED OR BY GP REFERRAL (IN THE ABSENCE OF AMU IN HOSPITAL). Protocol outcome 1: Mortality during the study period. - Actual outcome: In-hospital mortality at 30 days Group 1: 111/2652, Group 2: 122/2652; Risk of bias: All domain - high, Selection - high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness Protocol outcome 2: Length of stay during the study period. - Actual outcome: Mean (SD) length of hospital stay in days; Group 1: 6.0 (8.5), Group 2: 6.8 (10.0); Risk of bias: High ; Indirectness of outcome: No indirectness.	
Protocol outcomes not reported by the study	Quality of life during the study period; A&E 4 hour waiting target met during the study period; Number of discharges within 48-72 hours during the study period; Number of readmissions (within 7 – 30 days) during the study period; Patient and/or carer satisfaction during the study period; Direct discharges or zero day admissions during the study period; Carer satisfaction during the study period; Mortality during the study period; Number of outliers/ boarders during the study period.

Study	**Rooney 2008[43]**
Study type	Prospective before and after study.
Number of studies (number of episodes)	1 (n=33,367).
Countries and setting	Conducted in Republic of Ireland; setting: secondary care hospital.
Line of therapy	Not applicable.
Duration of study	Data collection period 5 years.

Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	All admitted emergency general medical patients.
Exclusion criteria	Patients admitted from the emergency department directly into the intensive care unit or the high dependency unit.
Recruitment/selection of patients	National hospital in-patient enquiry (HIPE).
Age, gender and ethnicity	Age – Median (IQR): Group 1 – 62.0 (41.5-77.8), Group 2 – 62.3 (40.1-77.2), Group 3 – 64.4 (42.2-77.4), Group 4 – 62.6 (40.6-76.9), Group 5 – 62.4 (39.4-77.1). Gender (M:F): Group 1 - 48.6:51.4 Group 2 - 49.2:50.8. Ethnicity: not reported.
Further population details	Data analysis by episode (n=33,367) which was collected from n=19,528 unique patients.
Indirectness of population	No indirectness.
Interventions	(n=6254) Intervention 1: Admission to the hospital 4 years after the establishment of an AMAU (59 bed). Patients requiring hospitalisation were admitted directly to the AMAU from the ED and 70% were expected to be discharged directly (max permitted stay-5 days). Duration: 1 year. Concurrent medication/care: n/a. (n=6650) Intervention 2: Admission to the hospital 3 years after the establishment of an AMAU (59 bed). Patients requiring hospitalisation were admitted directly to the AMAU from the ED and 70% were expected to be discharged directly (max permitted stay-5 days). Duration: 1 year. Concurrent medication/care: n/a. (n=5957) Intervention 3: Admission to the hospital 2 years after the establishment of an AMAU (59 bed). Patients requiring hospitalisation were admitted directly to the AMAU from the ED and 70% were expected to be discharged directly (max permitted stay-5 days). Duration: 1 year. Concurrent medication/care: n/a. (n=6029) Intervention 4: Admission to the hospital 1 year after the establishment of an AMAU (59 bed). Patients requiring hospitalisation were admitted directly to the AMAU from the ED and 70% were expected to be discharged directly (max permitted stay-5 days). Duration: 1 year. Concurrent medication/care: n/a. (n=5476) Intervention 5: Pre-AMAU establishment. Patients (excluding patients admitted to CCU) were directly admitted to any available 'on-call' bed from ED. Duration: 1 year. Concurrent medication/care: n/a.
Funding	Funding not stated.

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: ASSESSMENT AND MANAGEMENT THROUGH THE AMU AT ANY PART IN THE CLINICAL PATHWAY THAT IS, DIRECT TO AMU FROM GP OR VIA ED. versus DIRECT ADMISSION TO A GENERAL MEDICAL WARD FROM ED OR BY GP REFERRAL (IN THE ABSENCE OF AMU IN HOSPITAL).

Protocol outcome 1: Mortality during the study period.

- Actual outcome: In-hospital mortality 4 years post-AMAU versus pre-AMAU; Summary OR 0.28 [0.23, 0.35] (adjusted for acute illness severity, Charlson Co-Morbidity Index, modified APACHE II score, number of admissions, acute or non-acute ward, age, gender and major disease categories); Risk of bias: High ; Indirectness of outcome: No indirectness. Protocol outcome 1: Mortality during the study period - Actual outcome: In-hospital mortality 3 years post-AMAU versus pre-AMAU; Summary OR 0.73 [0.60, 0.90] (adjusted for acute illness severity, Charlson Co-Morbidity Index, modified APACHE II score, number of admissions, acute or non-acute ward, age, gender and major disease categories); Risk of bias: All domain - high, Selection - high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness Protocol outcome 1: Mortality during the study period - Actual outcome: In-hospital mortality 2 years post-AMAU versus pre-AMAU; Summary OR 1.20 [0.98, 1.48] (adjusted for acute illness severity, Charlson Co-Morbidity Index, modified APACHE II score, number of admissions, acute or non-acute ward, age, gender and major disease categories); Risk of bias: All domain - high, Selection - high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness Protocol outcome 1: Mortality during the study period - Actual outcome: In-hospital mortality 1 year post-AMAU versus pre-AMAU; Summary OR 1.81 [1.47, 2.22] (adjusted for acute illness severity, Charlson Co-Morbidity Index, modified APACHE II score, number of admissions, acute or non-acute ward, age, gender and major disease categories); Risk of bias: All domain - high, Selection - high, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life during the study period; Number of outliers/ boarders during the study period; A&E 4 hour waiting target met during the study period; Number of discharges within 48-72 hours during the study period; Number of readmissions (within 7 – 30 days) during the study period; Patient and/or carer satisfaction during the study period; Direct discharges or zero day admissions during the study period; Carer satisfaction during the study period; Mortality during the study period; Length of stay during the study period.

Appendix E: Economic evidence tables

No studies were identified.

Appendix F: GRADE tables

Table 7: Clinical evidence profile: Initial admission to AMU compared to Initial admission to routine medical ward

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Initial admission to AMU	Initial admission to other ward	Relative (95% CI)	Absolute		
All-cause in-hospital mortality (follow-up 30 days)												
1	observational studies	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	-	OR 0.64 (0.59 to 0.69)	-	⊕OOO VERY LOW	CRITICAL

[1] All non-randomised studies automatically downgraded due to selection bias. Studies may be further downgraded by 1 increment if other factors suggest additional high risk of bias, or 2 increments if other factors suggest additional very high risk of bias

Table 8: Clinical evidence profile: post-AMAU compared to Admission pre-AMAU

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Admission post-AMAU	Admission pre-AMAU	Relative (95% CI)	Absolute		
In-hospital all-cause mortality (1 year post-AMAU versus pre-AMAU)												
1	observational studies	serious[2]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	-	OR 1.81 (1.47 to 2.23)	-	⊕OOO VERY LOW	CRITICAL
In-hospital all-cause mortality (2 year post-AMAU versus pre-AMAU)												

1	observational studies	serious[2]	no serious inconsistency	no serious indirectness	serious[1]	None	-	-	OR 1.2 (0.98 to 1.47)	-	⊕OOO VERY LOW	CRITICAL
In-hospital all-cause mortality (3 year post-AMAU versus pre-AMAU)												
1	observational studies	serious[2]	no serious inconsistency	no serious indirectness	serious[1]	None	-	-	OR 0.73 (0.6 to 0.89)	-	⊕OOO VERY LOW	CRITICAL
In-hospital all-cause mortality (4 year post-AMAU versus pre-AMAU)												
1	observational studies	serious[2]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	-	OR 0.28 (0.23 to 0.34)	-	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.
[2] All non-randomised studies automatically downgraded due to selection bias. Studies may be further downgraded by 1 increment if other factors suggest additional high risk of bias, or 2 increments if other factors suggest additional very high risk of bias

Table 9: Clinical evidence profile: Admission post-AAU compared to Admission pre-AAU

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Admission post-AAU**	**Admission pre-AAU**	**Relative (95% CI)**	**Absolute**		
In-hospital all-cause mortality												
1	observational studies	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	None	111/2652 (4.2%)	122/2652 (4.6%)	RR 0.91 (0.71 to 1.17)	4 fewer per 1000 (from 13 fewer to 8 more)	⊕OOO VERY LOW	CRITICAL
Length of hospital stay (Better indicated by lower values)												
1	observational studies	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	None	2652	2652	-	MD 0.8 lower (1.3 to 0.3 lower)	⊕OOO VERY LOW	CRITICAL

[1] All non-randomised studies automatically downgraded due to selection bias. Studies may be further downgraded by 1 increment if other factors suggest additional high risk of bias, or 2 increments if other factors suggest additional very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.

Appendix G: Excluded clinical studies

Table 10: Studies excluded from the clinical review

Study	Exclusion reason
Ahmed 2010[1]	Inappropriate comparison
Anpalahan 2002[2]	Incorrect outcomes
Aplin 2014[3]	Univariate analysis. Multivariate analysis identified for intervention of interest
Armitage 2002[4]	No n numbers. Univariate analysis. Multivariate analysis identified for intervention of interest
Aslam 2011[5]	Incorrect interventions
Beckett 2009[6]	No relevant outcomes
Bon 2014[7]	Incorrect interventions
Boyle 2008[8]	Inappropriate comparison
Boyle 2012[10]	Inappropriate comparison
Boyle 2012[9]	Inappropriate comparison
Brady 2015	Incorrect population and intervention. Incorrect study design-survey. The aim of the project was to improve the quality of care for patients with AKI admitted to the AMU.
Brand 2010[11]	Univariate analysis. Multivariate analysis identified for intervention of interest
Brims 2011[12]	Incorrect outcomes
Byrne 2011[13]	Narrative review
Chang 2008[14]	Incorrect interventions. No relevant outcomes
Conway 2014[16]	Inappropriate multivariate analysis. Pre-AMU, post-AMU analysis not possible
Conway 2015	Incorrect intervention. Not AME. Retrospective assessment of the impact of the introduction of a national healthcare target on patient and institutional outcomes.
Csepanyi 1980[17]	Incorrect interventions
Dasgupta 1980[18]	Incorrect interventions
Elder 2016	Incorrect intervention. The study assessed the impact of incorporating a physician at triage and the implementation of a medical assessment unit on ED patient throughput.
Fallon 2015	Incorrect intervention. The aim of the study was to report on the characteristics and outcomes for older patients reviewed at the AMU (acute medical assessment units)
Hanlon 1997[19]	Incorrect interventions. No relevant outcomes
Hassan 2003[20]	Narrative review
Hinkle 2007[21]	No relevant outcomes
Jamdar 2010[22]	Inappropriate comparison
Lang 2015	Incorrect intervention. The study aimed to determine effect of a 7 day consultant acute physician model on patient waiting times.
Lawson 1972[23]	Incorrect interventions
Leykum 2010[24]	<24hr observation unit. Univariate analysis. Multivariate analysis identified for intervention of interest
Macdonald 2004[26]	Inappropriate comparison
Mcgowan 2003[28]	Inappropriate comparison. Incorrect interventions

Study	Exclusion reason
Mclaren 1999[29]	Univariate analysis. Multivariate analysis identified for intervention of interest
Moloney 2005[31]	Outcomes of interest reported again elsewhere[27]
Moloney 2006[30]	Outcomes of interest reported again elsewhere[32]
Moloney 2007[32]	Univariate analysis. Multivariate analysis identified for intervention of interest
Moore 2006[33]	Inappropriate comparison
Moseley 2013[34]	Inappropriate comparison
Munshi 2002[35]	No relevant outcomes
Ong 2012[39]	Low n number (n=89)
O'Shaughnessy 2000[38]	Incorrect interventions
Polednak 2000[40]	Incorrect interventions
REID2016 [41]	Systematic review- checked for relevant references. Studies in the review already considered for inclusion in our evidence review
Roberts 2010[42]	Incorrect interventions
RUSHTON2016 [44]	Scoping review- checked for relevant references
Schull 2012[45]	>50% virtual wards; >50% ED don't use dedicated staff. Univariate analysis. Multivariate analysis identified for intervention of interest
Scott 2009[46]	Systematic review –checked for relevant references
Sinclair 2003[47]	Literature review
St Noble 2008[48]	Univariate analysis. Multivariate analysis identified for intervention of interest
Suthers 2012[49]	Univariate analysis. Multivariate analysis identified for intervention of interest
Traub 2015	Incorrect intervention. The study estimated the effect of rapid medical assessment (RMA) on length of stay of different patient groups.
Tripp 2012[50]	No relevant outcomes
Van der Linden 2013[51]	Virtual, temporary AMU. Univariate analysis. Multivariate analysis identified for intervention of interest
Vork 2011[52]	Inappropriate comparison
Walters 2009[53]	Narrative review
Wanklyn 1997[54]	Inappropriate comparison
Watts 2011[55]	Low n number (n=30)
Wood 2000[56]	Incorrect interventions
Yates 2009[57]	Low n number (n=60)

Appendix H: Excluded economic studies

No studies were excluded.