National Institute for Health and Care Excellence

Final

Chapter 16 Emergency department opening hours

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

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Chapter 16 Emergency department opening hours

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16 Emergency department opening hours

16.1 Introduction

Emergency Departments are usually open 24 hours a day, but in recent years there is an increasing trend to close some at nights. Often in quieter, more rural units this is because there is very little demand at night; but it may also happen as part of service consolidation to assure patient safety.

The effect of limiting ED opening times may be minimal. It maybe that the demand is swept up elsewhere (for example, in other hospitals or by other healthcare providers, for example, GPs or other community carers); however, this maybe at the expense of longer journey times and possible worsening of the patient's condition. There could be further knock on effects to the ambulance service with vehicles being used for longer journeys not being able to respond to other emergency calls. However, the cost of keeping a 24 hour unit in all acute hospitals may be hugely expensive.

Therefore, closing ED's at night should only be considered if clinically safe and cost effective to the whole healthcare economy. The guideline committee wanted to know if any work had been done in this area to assure this, and in what circumstances this had been shown.

16.2 Review question: Is 24-hour open access to ED more clinically and cost effective compared with limited opening times to ED?

For full details see review protocol in Appendix A.

Table 1: PICO characteristics of review question

Population	Unselected populations of adults and young people (16 years and over) (including mixed populations of trauma/non-trauma) presenting to the ED. Strata: • Non-severely ill, • Severely ill.
Interventions	Restricted access with pre-planned diversion to other services. Restriction without pre-planned diversion (cannot go anywhere else in presenting hospital). Closure of an ED (without hospital closing).
Comparison	24 hour access to ED.
Outcomes	• Mortality (Critical) • Avoidable adverse events (Critical) • Quality of life (Critical) • Patient/carer satisfaction (Critical) • Ambulance transfer times (Important) • Number of ED presentations (Important) • Impact on other services as defined by the paper (each service reported separately) (for example, out of hours GP, ambulance services, other hospitals) (Critical) ○ capture case-mix effects on other services (type of patients) ○ number of admissions (to other hospitals)
Study design	Modelling paper; observational studies that meet the following criteria: • Conducted in a setting relevant to the UK. • n>200.

	• Preferably include studies with multivariate analysis with pre-defined confounders (to be assessed on a case by case basis depending on availability of evidence).

16.3 Clinical evidence

Four studies were included in the review; 1 controlled before-after study and 3 cohort studies,[7-9,11] these are summarised in Table 2 below. Evidence from these studies is summarised in the clinical evidence summaries below (Table 3 – Table 7). See also the study selection flow chart in Appendix B, forest plots in Appendix C, study evidence tables in Appendix D, GRADE tables in Appendix F and excluded studies list in Appendix G.

Table 2: Summary of studies included in the review

Study	Intervention and comparison	Population	Outcomes	Comments
Hansen 2011[7] Conducted in Denmark Controlled before and after study	1997 – 1999 (n=2300): 24-hour ED opening. 2000 – 2002 (n=2300): day time only ED opening. 2003 (n=2300): no ED service. Comparative cohort for each time-point was from a sample from the surrounding county (n=19,100).	10% sample of the population of a county in Denmark, which contains a small municipality in which the ED provision at the local hospital is being removed.	ED visits. Impact on other services: in-person GP consultations, telephone GP consultations, home visits by GPs and hospital admissions.	Nearest ED after closure was 30km away. Strata by gender. Multivariate analysis adjusted for age, cohabitation, education level, family income and the yearly trend to control for pre-existing trends in the use of health services. Sample size is 10% of total population for each time period. Average numbers throughout the analysis given.
Hsia 2012[8] Conducted in the USA Retrospective cohort study	Intervention (n=67,577): decrease in ED access as defined by an increase in driving time to the nearest ED. Comparison (n=693,827): no increase in driving time.	All AMI, stroke, sepsis, and asthma/COPD patients from 1999-2009 who are entered into the California Office of State-wide Health and Planning Development (OSHPD) Patient Discharge Data. This database contains patient level-data from non-federal hospitals in California. Exclusion: patients who were not admitted through the ED; patients whose admitted hospital is more than 100 miles	In-hospital mortality.	Driving distance was determined by using the patients mailing ZIP codes. The distance between each ZIP code to the nearest ED using the population centroid location of the ZIP code based on longitude and latitude coordinates (straight line distance), separately for each year. Multivariate analysis which controls for age, gender, race, insurance status, year of admission and standard Elixhauser comorbidities. Does not account for

Study	Intervention and comparison	Population	Outcomes	Comments
		away from their mailing address and patients who were not admitted to their nearest hospital.		restricted ED access versus full hospital closure. Level of original access not mentioned.
Liu 2014[9] Conducted in the USA Retrospective cohort study	Intervention (n=4,048,433): Hospital Service Area with an ED closure. Comparison (n=12,198,459): Hospital Service Area with no ED closures.	Hospital annual utilisation data files for the period 1999-2010 from the California Office of State-wide Health and Planning Development (OSHPD). Patient's characteristics and mortality from OSHPD Patient Discharge Data. Exclusions: admissions not made via the ED, patients under 18 and patient's ZIP code not in California.	In-patient mortality.	Geographic area affected by an ED closure defined as the Hospital Service Area (HSA). HSAs are groups of ZIP codes organised by the Dartmouth Atlas Project to reflect hospitalisation patterns of Medicare beneficiaries. Each hospital was assigned to an HSA using hospital ZIP codes and the 1999-2010 ZIP code-HSA crosswalk files from the Dartmouth Atlas Project. Multivariate analysis which controls for age, race, ethnicity, insurance coverage, median income of the patient's ZIP code, Elixhauser comorbidities, year of admission, case-mix index, hospital ownership and urban versus rural location. Patients were also clustered within hospitals since patients admitted to the same hospital will have correlated outcomes as a result of similar hospital and physician practice styles. Does not account for ED closure versus full hospital closure. Level of original access not mentioned.
Shen 2012[11] Conducted in the USA Retrospective cohort study	Interventions: decrease in ED access as defined by an increase in driving time to the nearest ED. Three strata: increase in driving time less than 10 minutes (n=141,746); increase in driving time 10-	All Acute Medical Infarction patients from 1996 – 2005 contained within the MedPAR database with 410.0x or 4.10.x1. Exclusion: patients who were not admitted through the ED (23%); patients whose admitted hospital is more than 100 miles away from	7-day mortality. 30-day mortality. 90-day mortality. 180-day mortality. 1-year mortality.	Driving distance was determined by using the patients mailing ZIP codes. The distance between each ZIP code to the nearest ED using the population centroid location of the ZIP code based on longitude and latitude coordinates (straight line distance), separately for each year. Multivariate analysis which

Study	Intervention and comparison	Population	Outcomes	Comments
	30 minutes (n=26,817) and increase in driving time greater than 30 minutes (n=3187). Comparison (n=1,418,613): no increase in driving time.	their mailing address or were admitted to hospitals whilst away from home (11%); ZIP codes that experienced multiple changes in distance to their closest ED during the study period (3%) and ZIP codes that do not have patients both before and after the access change occurred (1%).		controls for age, gender, race, comorbidities and urban or rural residence. Does not account for restricted ED access versus full hospital closure. Level of original access not mentioned.

Table 3: Clinical evidence summary: Day-time only ED versus 24 hour ED access

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Day-time only ED versus 24 hour ED access (95% CI)
Male ED visit rate	14485 (1 study) 2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male ED visits in the control group was 130 per 1000	The mean controlled change in the intervention group was 0 more per 1000 (20 fewer to 20 more)
Female ED visit rate	14244 (1 study) 2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female ED visits in the control group was 80 per 1000	The mean controlled change in the intervention group was 0 more per 1000 (10 fewer to 10 more)
Male admission rate	14485 (1 study) 2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male admissions in the control group was 170 per 1000	The mean controlled change in the intervention group was 10 more per 1000 (30 fewer to 50 more)
Female admission rate	14244 (1 study) 2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female admissions in the control groups was 190 per 1000	The mean controlled change in the intervention group was 20 fewer per 1000 (60 fewer to 20 more)
Male in-person GP consultation rate	14485 (1 study) 2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male in-person GP consultations in the control group was 2840 per 1000	The mean controlled change in the intervention group was 130 more per 1000 (260 fewer to 520 more)
Female in-person GP consultation rate	14244 (1 study) 2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female in-person GP consultations in the control group was 3530 per 1000	The mean controlled change in the intervention group was 20 fewer per 1000 (350 fewer to 310 more)
Male telephone GP consultations rate	14485 (1 study)	⊕⊖⊖⊖ VERY LOW[a] due to risk of	-	The mean final rate of male telephone GP consultations in the control group was	The mean controlled change in the intervention group was

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Day-time only ED versus 24 hour ED access (95% CI)
	2 years	bias		1970 per 1000	110 more per 1000 (260 fewer to 480 more)
Female telephone GP consultation rate	14244 (1 study) 2 years	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female telephone GP consultations in the control group was 3300 per 1000	The mean controlled change in the intervention group was 190 fewer per 1000 (640 fewer to 260 more)
Male home GP consultation rate	14485 (1 study) 2 years	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male home GP consultations in the control group was 150 per 1000	The mean controlled change in the intervention group was 30 more per 1000 (60 fewer to 120 more)
Female home GP consultation rate	14244 (1 study) 2 years	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female home GP consultations in the control group was 240 per 1000	The mean controlled change in the intervention group was 70 fewer per 1000 (170 fewer to 30 more)

Note: due to rounding data only accurate to the nearest 10 per 1000.

(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: ED closure versus 24 hour ED access

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with ED closure versus 24 hour ED access (95% CI)
Male ED visit rate	14485 (1 study) 1-2 years	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male ED visits in the control group was 130 per 1000	The mean controlled change in the intervention group was 10 fewer per 1000 (40 fewer to 20 more)
Female ED visit rate	14244	⨁⊖⊖⊖	-	The mean final rate of female ED visits in	The mean controlled change in the

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with ED closure versus 24 hour ED access (95% CI)
	(1 study) 1-2 years	VERY LOW[a] due to risk of bias		the control group was 80 per 1000	intervention group was 10 more per 1000 (10 fewer to 30 more)
Male admission rate	14485 (1 study) 1-2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male admissions in the control group was 170 per 1000	The mean controlled change in the intervention group was 20 fewer per 1000 (60 fewer to 20 more)
Female admission rate	14244 (1 study) 1-2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female admissions in the control group was 190 per 1000	The mean controlled change in the intervention group was 40 more per 1000 (40 fewer to 120 more)
Male in-person GP consultation rate	14485 (1 study) 1-2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male in-person GP consultations in the control group was 2840 per 1000	The mean controlled change in the intervention group was 30 more per 1000 (420 fewer to 480 more)
Female in-person GP consultation rate	14244 (1 study) 1-2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female in-person GP consultations in the control group was 3850 per 1000	The mean controlled change in the intervention group was 260 fewer per 1000 (610 fewer to 90 more)
Male telephone GP consultation rate	14485 (1 study) 1-2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male telephone GP consultations in the control group was 1970 per 1000	The mean controlled change in the intervention group was 310 more per 1000 (90 fewer to 710 more)
Female telephone GP consultation rate	14244 (1 study) 1-2 years	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female telephone GP consultations in the control group was 3300 per 1000	The mean controlled change in the intervention group was 350 fewer per 1000 (820 fewer to 120 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with ED closure versus 24 hour ED access (95% CI)
Male home GP consultation rate	14485 (1 study) 1-2 years	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of male home GP consultations in the control group was 150 per 1000	The mean controlled change in the intervention group was 40 more per 1000 (50 fewer to 130 more)
Female home GP consultation rate	14244 (1 study) 1-2 years	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	-	The mean final rate of female home GP consultations in the control group was 240 per 1000	The mean controlled change in the intervention group was 120 fewer per 1000 (230 to 10 fewer)

Note: due to rounding data only accurate to the nearest 10 per 1000.

(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 5: Clinical evidence summary: local ED closure versus no ED closure

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Local ED closure versus no ED closure (95% CI)
Mortality	16246892 (1 study) in-hospital	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias, indirectness	OR 1.05 (1.02-1.08)	Control group risk not provided	Absolute effect cannot be calculated

[a] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

[b] The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures

(a) Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.

(b) The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.

Table 6: Clinical evidence summary: Increased driving time to ED versus no increase in driving time to the ED

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Increased driving time to ED versus no increase in driving time to the ED (95% CI)
Mortality	785385 (1 study) in-hospital	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	OR 1.04 (0.99- 1.09)	Control group risk not provided	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.

(b) The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.

Table 7: Clinical evidence summary: Increased driving time to ED versus no increase in driving time to the ED

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Increased driving time to ED versus no increase in driving time to the ED (95% CI)
Increase in driving time: less than 10 minutes					
Mortality	1560359 (1 study) 7 days	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD -0.00 (-0.00- 0.00)	-	0 fewer per 1000 (from 5 fewer to 4 more)
Mortality	1560359 (1 study) 30 days	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.00 (-0.00- 0.01)	-	3 more per 1000 (from 3 fewer to 9 more)
Mortality	1560359 (1 study) 90 days	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias,	RD 0.00 (-0.00- 0.01)	-	5 more per 1000 (from 2 fewer to 12 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Increased driving time to ED versus no increase in driving time to the ED (95% CI)
		indirectness			
Mortality	1560359 (1 study) 180 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.01 (-0.00-0.01)	-	6 more per 1000 (from 1 fewer to 13 more)
Mortality	1560359 (1 study) 1 years	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.00 (-0.00-0.01)	-	4 more per 1000 (from 4 fewer to 11 more)
Increase in driving time: 10-30 minutes					
Mortality	1445430 (1 study) 7 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD -0.01 (-0.02-0.00)	-	6 fewer per 1000 (from 16 fewer to 3 more)
Mortality	1445430 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD -0.01 (-0.02-0.00)	-	10 fewer per 1000 (from 23 fewer to 3 more)
Mortality	1445430 (1 study) 90 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD -0.01 (-0.02-0.01)	-	6 fewer per 1000 (from 21 fewer to 8 more)
Mortality	1445430 (1 study) 180 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD -0.00 (-0.02-0.01)	-	3 fewer per 1000 (from 17 fewer to 12 more)
Mortality	1445430 (1 study) 1 years	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias,	RD -0.01 (-0.02-0.01)	-	7 fewer per 1000 (from 22 fewer to 8 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Increased driving time to ED versus no increase in driving time to the ED (95% CI)
		indirectness			
Increase in driving time: more than 30 minutes					
Mortality	1421800 (1 study) 7 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.02 (-0.01-0.05)	-	17 more per 1000 (from 15 fewer to 49 more)
Mortality	1421800 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.01 (-0.03-0.06)	-	12 more per 1000 (from 31 fewer to 56 more)
Mortality	1421800 (1 study) 90 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.03 (-0.02-0.08)	-	26 more per 1000 (from 24 fewer to 76 more)
Mortality	1421800 (1 study) 180 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.04 (-0.01-0.09)	-	45 more per 1000 (from 5 fewer to 95 more)
Mortality	1421800 (1 study) 1 years	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RD 0.06 (0.01-0.11)	-	57 more per 1000 (from 7 more to 106 more)

(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) The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.

16.4 Economic evidence

Published literature

No relevant health economic studies 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 economic evidence, unit costs were presented to the committee – see Chapter 41 Appendix I.

16.5 Evidence statements

Clinical

Restricted and closure of ED versus 24 hour ED access

One study conducted in Denmark reported gender stratified healthcare utilisation rates on in-person GP consultations, telephone GP consultations, home visits by GPs, ED visits and hospital admission. The evidence suggested that there was no difference in outcomes when ED hours were restricted (very low quality). When the ED was closed, the evidence suggested a reduction in GP telephone consultations, in-person consultation rates and home consultation rates amongst female patients, but not males. The evidence suggested there was no effect on ED visit rate or admission rat (very low quality).

Local ED closure versus no ED closure

One study set in the USA suggested a possible increase in mortality with ED closure compared to no ED closure (very low quality).

Increased driving time to ED versus no increase in driving time to the ED

One study set in the USA suggested a possible increase in mortality amongst patients with time-sensitive conditions when driving time to nearest ED was increased (very low quality). One study set in the USA suggested a possible increase in mortality amongst patients with time sensitive conditions when driving time to the nearest ED was increased more than 30 minutes (very low quality).

Economic

No relevant economic evaluations were identified.

16.6 Recommendations and link to evidence

Recommendations	-
Research recommendation	**RR8. What is the clinical and cost effectiveness of limiting emergency department opening hours, and what effect does this have on local healthcare provision and outcomes for people with medical emergencies?**
Relative values of different outcomes	Mortality, quality of life, avoidable adverse events, impact on other services and patient and/or carer satisfaction were considered by the committee to be critical outcomes. Ambulance transfer times and number of ED presentations were considered important outcomes.
Trade-off between benefits and harms	A total of 4 observational studies were identified. The evidence for restriction of ED opening hours was mixed. One study set in USA suggested a possible increase in mortality with ED closure compared to no ED closure. One study set in the USA suggested a possible increase in mortality amongst patients with time-sensitive conditions when driving time to nearest ED was increased (very low quality). Another study set in the USA suggested a possible increase in mortality amongst patients with time sensitive conditions when driving time to the nearest ED was increased more than 30 minutes (very low quality). Evidence from 1 study conducted in Denmark reported gender-stratified healthcare utilisation rates of in-person GP consultations, telephone GP consultations, home visits by GPs, ED visits and hospital admissions. Data were collected only from the sample population, and therefore the evidence did not take into account any overall impact on the services. The evidence suggested that there was no difference in outcomes when ED hours were restricted. However, after the ED was closed the evidence suggested a reduction in GP telephone consultations, in-person consultation rates and home consultation rates amongst female patients. The evidence suggested there was no effect on ED attendances or admission rates. No evidence was identified for avoidable adverse events, quality of life, patient and/or carer satisfaction, and ambulance transfer times. A positive or permissive recommendation to limit ED opening hours would require evidence showing that patient outcomes would not worsen and that health care utilisation would be reduced. The direction and quality of evidence currently identified would not permit such a recommendation, particularly as it was not directly applicable to the UK health system. The committee noted that a research protocol which fulfilled the requirements for the review question was currently being developed within the UK. Therefore, the committee considered a research recommendation would be the most appropriate until this evidence from this research was available.
Trade-off between net effects and costs	No economic studies were included. Unit costs of ED visits and alternative care services were provided to aid cost-effectiveness considerations (Chapter 14 Appendix I) . Further economic analysis could not be undertaken due to the quality of the evidence. Although 1 included study reported healthcare utilisation from a patient perspective, the study did not explore the impact on other EDs that would need to absorb the additional patients. Therefore, the full economic and resource impact could not be considered based on the outcomes of this study. Reducing the hours of or closing an ED could be cost-saving if it reduces overall

Recommendations	**-**
Research recommendation	**RR8. What is the clinical and cost effectiveness of limiting emergency department opening hours, and what effect does this have on local healthcare provision and outcomes for people with medical emergencies?**
	healthcare utilisation. This includes the impact on other EDs, alternative urgent care services and other emergency care resources such as ambulance services. This would only be cost-effective if it is clinically safe and those services that treat the redirected patients have the capacity to do so without a negative impact on their current service. The committee concluded that more research was needed to assess the cost impact and cost-effectiveness of limited ED opening hours.
Quality of evidence	The evidence was graded at very low quality. All evidence was downgraded for study design, whilst all but one was further downgraded for risk of bias. Three of the 4 studies were downgraded for indirectness as the evidence was combined for ED restriction, ED closure and full hospital closure. There were no economic studies included in the review.
Other considerations	The committee noted that there are very different reasons for ED closure and ED restriction. For example, in the UK, restriction in ED hours usually occurs when there is little demand for the service, such as overnight in smaller rural EDs. Closures typically occur in EDs when there is a consolidation of services in an area, such as in urban areas. However, overnight closures in EDs may also be due to workforce shortages. Closures would not normally occur where this would lead to an absence of ED provision in an area, as ED provision is an essential service. Often the closed EDs have been replaced by another facility such as an Urgent Care Centre. Currently, there is little research evidence to inform decision making about these closures. Distance to an ED is an important factor in acute medical emergencies and the committee discussed the importance of the first hour (the 'golden hour') when, in certain acute conditions, access to curative interventions is most likely to be effective (for example, stroke). The committee noted that an NIHR –funded trial is underway. This study is a large controlled interrupted time series study which aims to analyse both ED closure and restriction in ED hours. Furthermore, this study includes both healthcare utilisation outcomes and patient safety outcomes and would be directly applicable to the UK population.

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11 Shen YC, Hsia RY. Does decreased access to emergency departments affect patient outcomes? Analysis of acute myocardial infarction population 1996-2005. Health Services Research. 2012; 47(1 Pt 1):188-210

12 Sun BC, Mohanty SA, Weiss R, Tadeo R, Hasbrouck M, Koenig W et al. Effects of hospital closures and hospital characteristics on emergency department ambulance diversion, Los Angeles County, 1998 to 2004. Annals of Emergency Medicine. 2006; 47(4):309-316

13 Teljeur C, Barry J, Kelly A. The potential impact on travel times of closure and redistribution of A&E units in Ireland. Irish Medical Journal. 2004; 97(6):173-175

Appendices

Appendix A: Review protocol

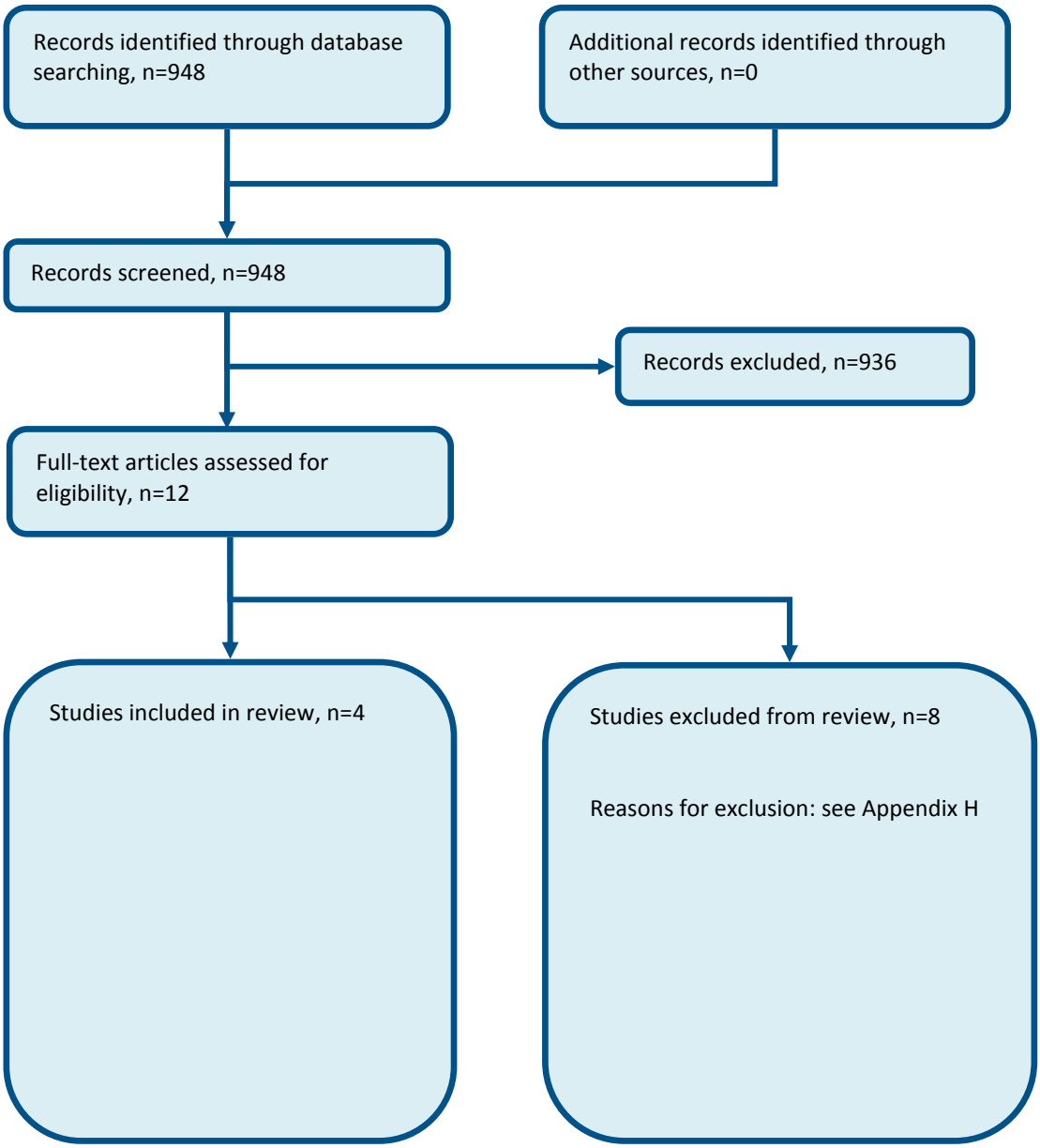
Table 8: Review protocol: ED opening hours

Review question	Is 24-hour open access to ED more clinically and cost effective compared with limited opening times to ED?
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.
	Adults and young people (16 years and over).
	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)	Access to ED; 24 hour access to ED. Access to ED; undefined 'usual' access to ED. Reduced access to ED; restricted access with pre-planned diversion to other services. Reduced access to ED; restricted access without pre-planned diversion. Reduced access to ED; ED closure (without hospital closure).
Outcomes	- Impact on other services as defined by the paper during the study period (Dichotomous) CRITICAL - Quality of life during the study period (Continuous) CRITICAL - Patient/carer satisfaction during the study period (Dichotomous) CRITICAL - Mortality during the study period (Dichotomous) CRITICAL - Avoidable adverse events during the study period (Dichotomous) CRITICAL - Number of ED presentations 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.
Crossover study	Not permitted.
Minimum duration of study	Not defined.
Other exclusions	Major trauma centres. Walk in centres. Minor injury units. Urgent care centres co-located in EDs, unless an unselected population presenting with emergencies can access the service. Whole hospital closing. Non-OECD country.
Population stratification	Unselected population. Severely ill patients. Non-severely ill patients.
Reasons for stratification	If a population is selected in the study in may be that severely ill patients (such as those with acute myocardial infarction) will be affected by a restriction in ED opening hours to a greater degree. Trauma patients are excluded from the scope so studies which purposely select them will be excluded.

Review question	Is 24-hour open access to ED more clinically and cost effective compared with limited opening times to ED?
Subgroup analyses if there is heterogeneity	- UK versus non-UK (UK; Non-UK); effects may be different in this subgroup. - Rural versus urban (Rural; Urban); effects may be different in this subgroup. - Planned diversion to other hospital versus non-planned diversion for example, straight to AMU (Planned diversion; Non-planned diversion); effects may be different in this subgroup.
Search criteria	Databases: Medline, Embase, the Cochrane Library. Date limits for search: 1990. Language: English.

Appendix B: Clinical article selection

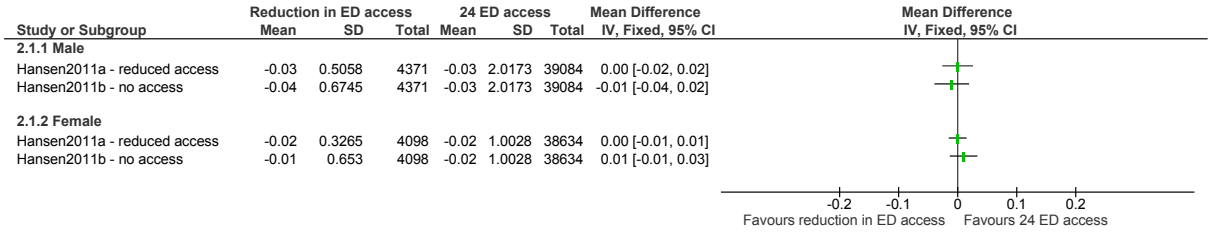
Figure 1: Flow chart of clinical article selection for the review of ED opening hours



Appendix C: Forest plots

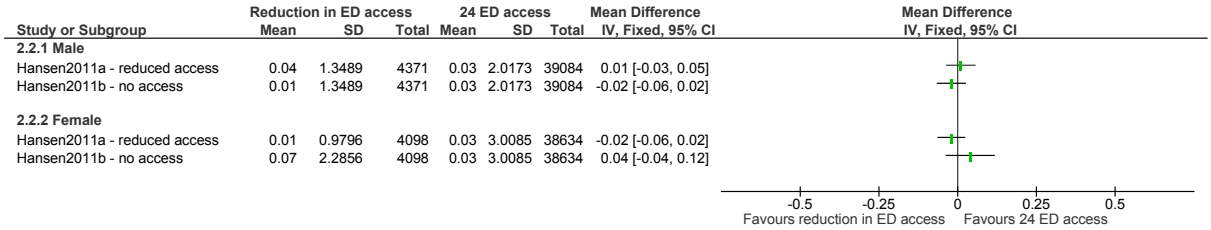
C.1 Gradual closure of ED versus 24 hour ED access

Figure 2: ED visit rate



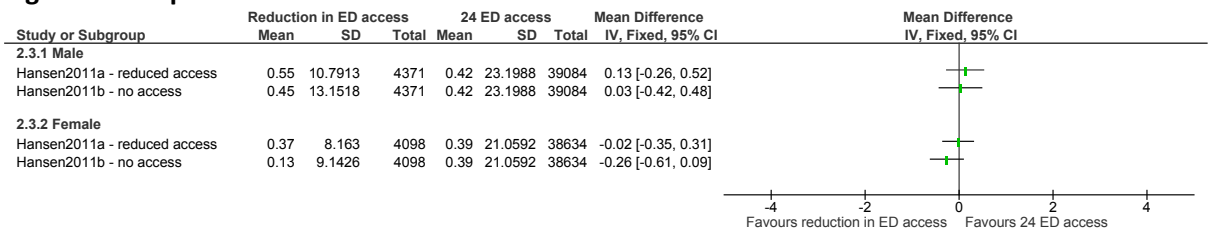
Note: adjusted for age, cohabitation, education level, family income, and the yearly trend to control for pre-existing trends in the use of health services.

Figure 3: Admission rate



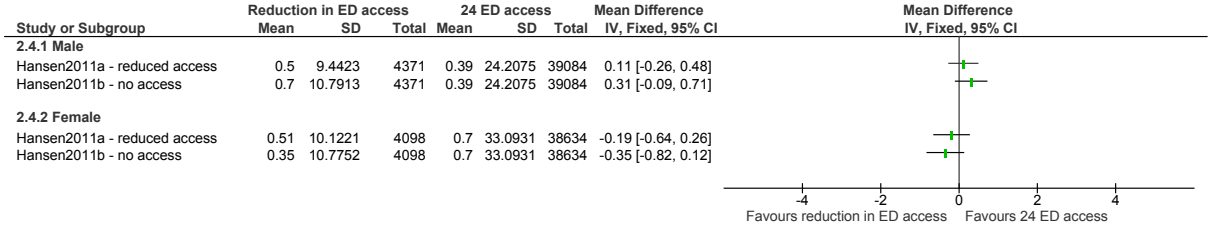
Note: adjusted for age, cohabitation, education level, family income, and the yearly trend to control for pre-existing trends in the use of health services.

Figure 4: In-person GP consultation rate



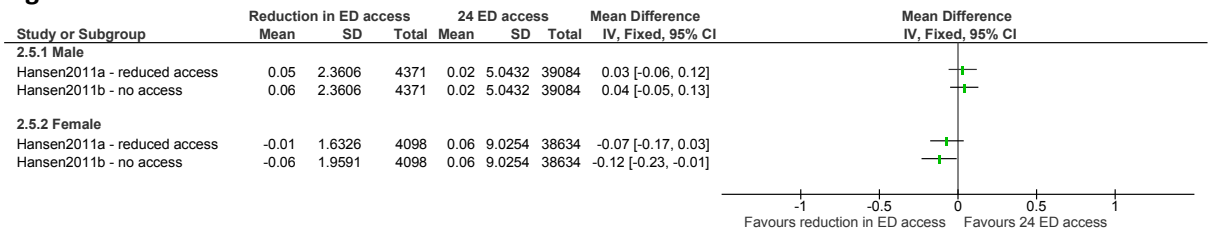
Note: adjusted for age, cohabitation, education level, family income, and the yearly trend to control for pre-existing trends in the use of health services.

Figure 5: Telephone GP consultation rate



Note: adjusted for age, cohabitation, education level, family income, and the yearly trend to control for pre-existing trends in the use of health services.

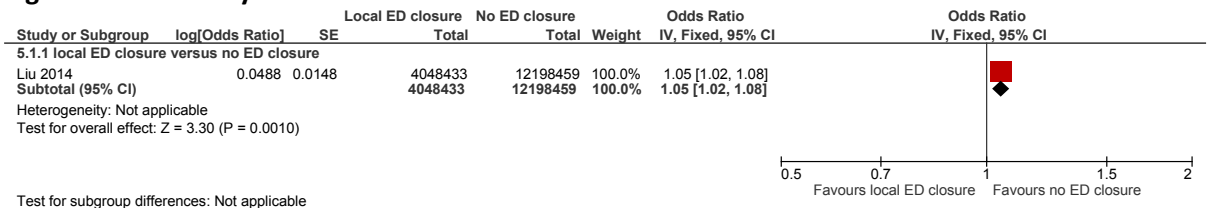
Figure 6: GP home consultation rate



Note: adjusted for age, cohabitation, education level, family income, and the yearly trend to control for pre-existing trends in the use of health services.

C.2 Local ED closure versus no ED closure

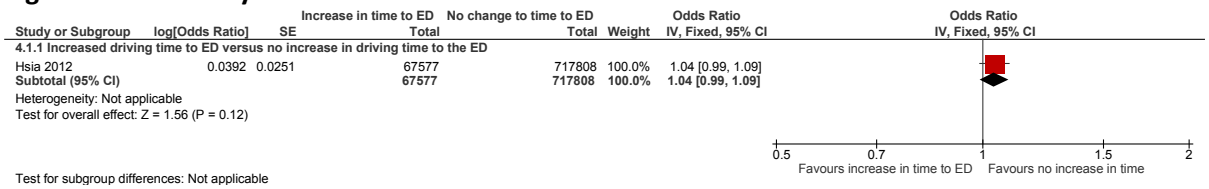
Figure 7: Mortality



Note: adjusted for age, race, ethnicity, insurance coverage, median income of the patient's ZIP code, Elixhauser comorbidities, year of admission, case-mix index, hospital ownership, urban vs rural location, and clustering within hosptial.

C.3 Increased driving time to ED versus no increase in driving time to the ED

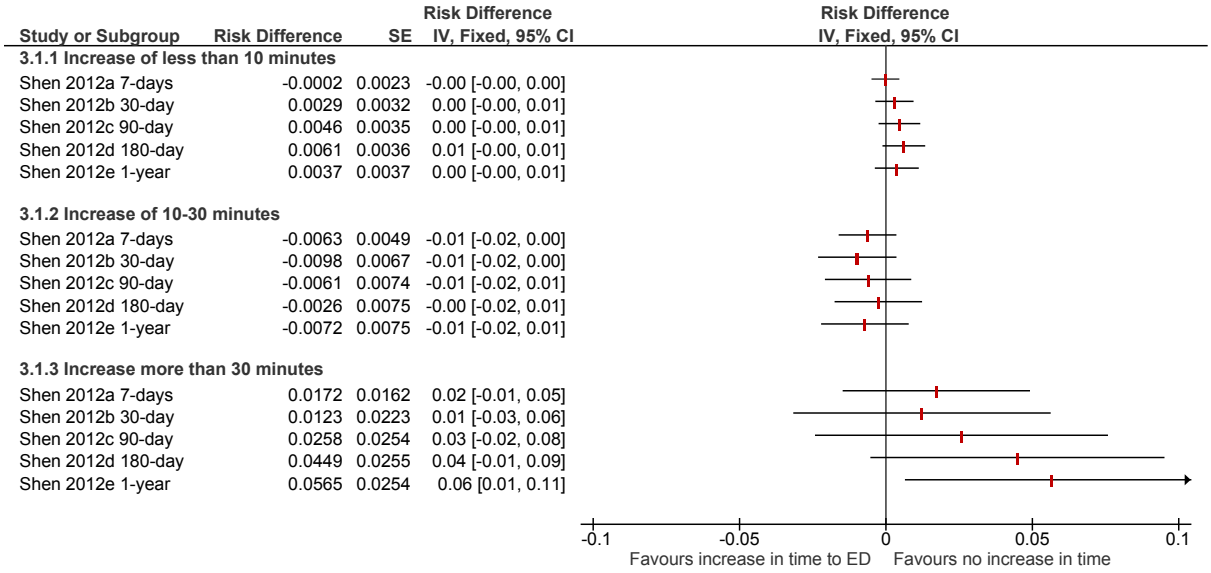
Figure 8: Mortality



Note: adjusted for age, gender, race, insurance status, year of admission, and standard Elixhauser comorbidities.

C.4 Increased driving time to ED versus no increase in driving time to the ED

Figure 9: Mortality



Note: adjusted for age, gender, race, comorbidities and urban or rural residence.

Appendix D: Clinical evidence tables

Study	Hansen 2011[7]
Study type	Controlled before and after.
Number of studies (number of participants)	1 (n=~28,729).
Countries and setting	Conducted in Denmark; setting: a small municipality in which the ED provision at the local hospital is being removed compared to the rest of the county.
Line of therapy	Not applicable.
Duration of study	Intervention time: 5 years.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Unselected population.
Subgroup analysis within study	Stratified then randomised: male/female strata.
Inclusion criteria	Have 1 of randomly selected dates of birth (37/365).
Exclusion criteria	Deceased persons and emigrants.
Recruitment/selection of patients	Sample drawn from the National Person Registry based on the individual person identification number assigned to all Danish residents.
Age, gender and ethnicity	Age - Other: not reported. Gender (M:F): not reported. Ethnicity: not reported.
Further population details	1. Rural versus urban: rural (nearest ED following closure 30 Km away). 2. UK versus non-UK: non-UK (Denmark).
Indirectness of population	No indirectness.
Interventions	(n=2300) Intervention 1: Access to ED - 24 hour access to ED. Access to the ED for 24 hours a day at the local hospital. Duration: 2 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear. (n=2300) Intervention 2: Reduced access to ED - restricted access without pre-planned diversion. ED hours reduced to 'day-time' only. Duration: 2 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear. Comments: No definition on what the day hours were.

Study	Hansen 2011[7]
	(n=2300) Intervention 3: Reduced access to ED - ED closure (without hospital closure). Full ED closure. Duration: 1 year. Concurrent medication/care: local hospital remained open. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear.
Funding	Academic or government funding (Danish Health Research Council, Sygekassernes Helsefond, and Aarhus University Research Foundation).

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: 24 HOUR ACCESS TO ED versus RESTRICTED ACCESS WITHOUT PRE-PLANNED DIVERSION.

Protocol outcome 1: Impact on other services as defined by the paper during the study period.
- Actual outcome for Unselected male population: In-person GP consultations per person during the intervention period; MD 0.13 (95%CI -0.26 to 0.52); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Adjusted for age, cohabitation, educational level and family income- Actual outcome for Unselected female population: In-person GP consultations per person during the intervention period; MD- 0.02 (95%CI -0.35 to 0.31); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected male population: Telephone GP consultations per person during the intervention period; MD 0.11 (95%CI -0.26 to 0.48); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Unselected female population: Telephone GP consultations per person during the intervention period; MD -0.19 (95%CI -0.64 to 0.26); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected male population: Home visits by GPs per person during the intervention period; MD 0.03 (95%CI -0.06 to 0.12); Risk of bias: Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: Home visits by GPs per person during the intervention period; MD -0.07 (95%CI -0.17 to 0.03); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Unselected male population: Number of hospital admissions per person during the intervention period; MD 0.01 (95%CI -0.03 to 0.05); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: Number of hospital admissions per person during the intervention period; MD -0.02 (95%CI -0.06 to 0.02); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
Protocol outcome 2: Number of ED presentations during the study period.
- Actual outcome for Unselected male population: Number of ED presentations per person during the intervention period; MD 0.00 (95%CI -0.02 to 0.02); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: Number of ED presentations per person during the intervention period;

Study	Hansen 2011[7]
MD 0.00 (95%CI -0.01 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: 24 HOUR ACCESS TO ED versus ED CLOSURE (WITHOUT HOSPITAL CLOSURE) Protocol outcome 1: Impact on other services as defined by the paper during the study period. - Actual outcome for Unselected male population: In-person GP consultations per person during the intervention period; MD 0.03 (95%CI -0.42 to 0.48); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: In-person GP consultations per person during the intervention period; MD -0.26 (95%CI -0.61 to 0.09); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected male population: Telephone GP consultations per person during the intervention period; MD 0.31 (95%CI -0.09 to 0.71); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: Telephone GP consultations per person during the intervention period; MD -0.35 (95%CI -0.82 to 0.12); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected male population: Home visits by GPs per person during the intervention period; MD 0.04 (95%CI -0.05 to 0.13); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: Home visits by GPs per person during the intervention period; MD -0.12 (95%CI -0.23 to -0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected male population: Number of hospital admissions per person during the intervention period; MD -0.02 (95%CI -0.06 to 0.02); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: Number of hospital admissions per person during the intervention period; MD -0.04 (95%CI -0.04 to 0.12); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness Protocol outcome 2: Number of ED presentations during the study period. - Actual outcome for Unselected male population: Number of ED presentations per person during the intervention period; MD -0.01 (95%CI -0.04 to 0.02); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Unselected female population: Number of ED presentations per person during the intervention period; MD 0.01 (95%CI -0.01 to 0.03); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life during the study period; Patient and/or carer satisfaction during the study period; Mortality during the study period; Avoidable adverse events during the study period.

Study	Hsia 2012[8]
Study type	Retrospective cohort study.
Number of studies (number of participants)	1 (n=761,404).
Countries and setting	Conducted in USA; setting: all non-federal hospitals in California.
Line of therapy	Not applicable.
Duration of study	Intervention time: 10 years.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Severely ill patients: time-sensitive conditions (AMI, Stroke, Sepsis, and COPD).
Subgroup analysis within study	Not applicable.
Inclusion criteria	AMI, Stroke, Sepsis and COPD patients.
Exclusion criteria	Patients who were not admitted through the ED; patients whose admitted hospital is more than 100 miles away from their mailing address and patients who were not admitted to their nearest hospital.
Recruitment/selection of patients	Patient level-data from the California Office of State-wide Health and Planning Development (OSHPD) Patient Discharge Data.
Age, gender and ethnicity	Age - Mean (SD): Group 1: 18-44 - 7.3%, 45-64 - 25.5%, 65-74 - 20.9%, 75-84 - 28.1%, >84 - 18.3%; Group 2: 18-44 - 8.0%, 45-64 - 28.5%, 65-74 - 20.5%, 75-84 - 26.0%, >84 - 17.1%; Gender (M:F): 125:147. Ethnicity: Group 1: White - 66.5%, Black - 7.5%, Hispanic - 15.2%, Other - 9.0%, Unknown - 1.7%; Group 2: White - 59.2%, Black - 14.1%, Hispanic - 17.7%, Other - 7.9%, Unknown - 1.1%.
Further population details	1. Rural versus urban: Not applicable/Not stated/Unclear 2. UK versus non-UK: non-UK (USA).
Indirectness of population	The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures or whole hospital closures.
Interventions	(n=693,827) Intervention 1: Access to ED - undefined 'usual' access to ED. No increase in driving time to the nearest ED. Duration: 10 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear. (n=67,577) Intervention 2: Reduced access to ED - restricted access without pre-planned diversion. Increase in driving time to the nearest ED. Duration: 10 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear.

Study	Hsia 2012[8]
Funding	Academic or government funding (NIH/NCRR/OD UXSF-CTSI, Robert Wood Johnson Foundation, NIH/NHLBI).
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: UNDEFINED 'USUAL' ACCESS TO ED versus RESTRICTED ACCESS WITHOUT PRE-PLANNED DIVERSION. Protocol outcome 1: Mortality during the study period. - Actual outcome for severely ill patients: Mortality at in-hospital; OR 1.04 (95%CI 0.99 to 1.09); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Impact on other services as defined by the paper during the study period; Quality of life during the study period; Patient and/or carer satisfaction during the study period; Avoidable adverse events during the study period; Number of ED presentations during the study period.

Study	Liu 2014[9]
Study type	Retrospective cohort study.
Number of studies (number of participants)	1 (n=162,468,92).
Countries and setting	Conducted in USA; setting: all non-federal hospitals in California.
Line of therapy	Not applicable.
Duration of study	Intervention time: 11 years.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Unselected population.
Subgroup analysis within study	Not applicable.
Inclusion criteria	All admissions.
Exclusion criteria	Admissions not made via the ED, patients under 18 and patient's ZIP code not in California.
Recruitment/selection of patients	Patient level-data from the California Office of State-wide Health and Planning Development (OSHPD) Patient Discharge Data.
Age, gender and ethnicity	Age - Mean (SD): Group 1: 18-44 - 20.0%, 45-64 - 28.4%, 65-74 - 16.7%, 75-84 - 21.3%, >84 - 13.7%; Group 2: 18-44 - 22.6%, 45-64 - 31.4%, 65-74 - 15.5%, 75-84 - 18.4%, >84 - 12.1%; Gender (M:F): 841:727. Ethnicity: Group 1: White - 59.3%, Black - 9.2%, Hispanic - 21.1%, Other - 8.8%, Unknown - 1.6%; Group 2: White - 50.2%, Black - 13.0%, Hispanic - 25.0%, Other - 10.5%, Unknown - 1.3%.
Further population details	1. Rural versus urban: Not applicable/Not stated/Unclear 2. UK versus non-UK: non-UK (USA).

Study	Liu 2014[9]
Indirectness of population	The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures or whole hospital closures.
Interventions	(n=12198459) Intervention 1: Access to ED - undefined 'usual' access to ED. Hospital Service Area with no ED closures - geographic area affected by an ED closure defined as the Hospital Service Area (HSA). HSAs are groups of ZIP codes organised by the Dartmouth Atlas Project to reflect hospitalisation patterns of Medicare beneficiaries. Duration: 11 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear. Comments: Each hospital was assigned to a Hospital Service Area using hospital ZIP codes and the 1999-2010 ZIP code-HSA crosswalk files from the Dartmouth Atlas Project. (n=4048433) Intervention 2: Reduced access to ED - ED closure (without hospital closure). Hospital Service Area with no ED closures - geographic area affected by an ED closure defined as the Hospital Service Area (HSA). HSAs are groups of ZIP codes organised by the Dartmouth Atlas Project to reflect hospitalisation patterns of Medicare beneficiaries. Duration: 11 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU. Comments: does not account for ED closure versus full hospital closure. Level of original access not mentioned.
Funding	Academic or government funding (National Center for Advancing Translational Sciences, National Institutes of Health to the University of California San Francisco, and the Robert Wood Johnson Foundation).
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: UNDEFINED 'USUAL' ACCESS TO ED versus ED CLOSURE (WITHOUT HOSPITAL CLOSURE). Protocol outcome 1: Mortality during the study period. - Actual outcome for Unselected population: Mortality at in-hospital; OR 1.05 (95%CI 1.02 to 1.07); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Impact on other services as defined by the paper during the study period; Quality of life during the study period; Patient and/or carer satisfaction during the study period; Avoidable adverse events during the study period; Number of ED presentations during the study period.

Study	Shen 2012[11]
Study type	Retrospective cohort study.
Number of studies (number of participants)	1 (n=156,354,6)

Study	Shen 2012[11]
Countries and setting	Conducted in USA; setting: all Medicare and Medicaid hospitals in the USA.
Line of therapy	Not applicable.
Duration of study	Intervention time: 9 years.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Severely ill patients: Myocardial Infarction population.
Subgroup analysis within study	Not applicable.
Inclusion criteria	Diagnosis code of 410.0x or 4.10.x1.
Exclusion criteria	Patients who were not admitted through the ED (23%); patients whose admitted hospital is more than 100 miles away from their mailing address or were admitted to hospitals whilst away from home (11%); ZIP codes that experienced multiple changes in distance to their closest ED during the study period (3%) and ZIP codes that do not have patients both before and after the access change occurred (1%).
Recruitment/selection of patients	All Acute Medical Infarction patients from 1996 – 2005 contained within the MedPAR database.
Age, gender and ethnicity	Age - Mean (SD): Group 1: 78.56 (7.87); Group 2: 78.43 (7.85); Group 3: 78.33 (7.80); Group 1: 77.53 (7.66). Gender (M:F): 49:51. Ethnicity: White: 87%; African American: 9%; Other non-white: 4%.
Further population details	1. Rural versus urban: Not applicable/Not stated/Unclear (author states: patients who experience large increase in driving time are mostly in rural communities). 2. UK versus non-UK: non-UK (USA).
Indirectness of population	The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures or whole hospital closures.
Interventions	(n=141,861,3) Intervention 1: Access to ED - undefined 'usual' access to ED. No increase in driving time to the nearest ED. Duration: 9 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear. (n=141746) Intervention 2: Reduced access to ED - restricted access without pre-planned diversion. Increase in driving time to the nearest ED less than 10 minutes. Duration: 9 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear. (n=26817) Intervention 3: Reduced access to ED - restricted access without pre-planned diversion. Increase in driving time to the nearest ED 10-30 minutes. Duration: 9 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not

Study	Shen 2012[11]
	applicable/Not stated/Unclear. (n=3187) Intervention 4: Reduced access to ED - restricted access without pre-planned diversion. Increase in driving time to the nearest ED over 30 minutes. Duration: 9 years. Concurrent medication/care: not applicable. Further details: 1. Planned diversion to other hospital versus non-planned diversion for example, straight to AMU: Not applicable/Not stated/Unclear.
Funding	Academic or government funding (Robert Wood Johnson Foundation, the National Institute of Health/National Center for Research Resources, University of California, San Francisco Clinical and Translational Science).

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: UNDEFINED 'USUAL' ACCESS TO ED versus RESTRICTED ACCESS WITHOUT PRE-PLANNED DIVERSION.

Protocol outcome 1: Mortality during the study period.
- Actual outcome for Severely ill patients: Mortality at 7 days; RD 0.01 (95%CI 0 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Severely ill patients: Mortality at 30 days; RD 0 (95%CI 0 to 0); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Severely ill patients: Mortality at 90 days; RD 0 (95%CI 0 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Severely ill patients: Mortality at 180 days; RD 0 (95%CI 0 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Severely ill patients: Mortality at 1 year; RD 0 (95%CI 0 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: UNDEFINED 'USUAL' ACCESS TO ED versus RESTRICTED ACCESS WITHOUT PRE-PLANNED DIVERSION.

Protocol outcome 1: Mortality during the study period.
- Actual outcome for Severely ill patients: Mortality at 7 days; RD 0 (95%CI -0.02 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Severely ill patients: Mortality at 30 days; RD -0.01 (95%CI -0.02 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Severely ill patients: Mortality at 90 days; RD -0.01 (95%CI -0.02 to 0); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness
- Actual outcome for Severely ill patients: Mortality at 180 days; RD -0.01 (95%CI -0.02 to 0.01); Risk of bias: All domain - High, Selection - High, Blinding - Low,

Study	Shen 2012[11]
Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Severely ill patients: Mortality at 1 year; RD -0.01 (95%CI -0.02 to 0); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: UNDEFINED 'USUAL' ACCESS TO ED versus RESTRICTED ACCESS WITHOUT PRE-PLANNED DIVERSION. Protocol outcome 1: Mortality during the study period. - Actual outcome for Severely ill patients: Mortality at 7 days; RD 0.04 (95%CI -0.01 to 0.09); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Severely ill patients: Mortality at 30 days; RD 0.06 (95%CI 0.01 to 0.11); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness. - Actual outcome for Severely ill patients: Mortality at 90 days; RD 0.01 (95%CI -0.03 to 0.06); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness - Actual outcome for Severely ill patients: Mortality at 180 days; RD 0.03 (95%CI -0.02 to 0.08); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness- Actual outcome for Severely ill patients: Mortality at 1 year; RD 0.02 (95%CI -0.01 to 0.05); Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Impact on other services as defined by the paper during the study period; Quality of life during the study period; Patient and/or carer satisfaction during the study period; Avoidable adverse events during the study period; Number of ED presentations during the study period.

Appendix E: Economic evidence tables

No relevant health economic studies were identified.

Appendix F: GRADE tables

Table 9: Clinical evidence profile: Day-time only ED versus 24 hour ED access

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Day-time only ED	Control	Relative (95% CI)	Absolute		
Male ED visit rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	13%	-	0 fewer per 1000 (from 20 fewer to 20 more)	⊕OOO VERY LOW	CRITICAL
Female ED visit rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	8%	-	0 more per 1000 (from 10 fewer to 10 more)	⊕OOO VERY LOW	CRITICAL
Male admission rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	17%	-	10 more per 1000 (from 30 fewer to 50 more)	⊕OOO VERY LOW	CRITICAL
Female admission rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	19%	-	20 fewer per 1000 (from 60 fewer to 20 more)	⊕OOO VERY LOW	CRITICAL
Male in-person GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	284%	-	130 more per 1000 (from 260 fewer to 520 more)	⊕OOO VERY LOW	CRITICAL

Female in-person GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	353%	-	20 fewer per 1000 (from 350 fewer to 310 more)	⊕OOO VERY LOW	CRITICAL
Male telephone GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	197%	-	310 more per 1000 (from 90 fewer to 710 more)	⊕OOO VERY LOW	CRITICAL
Female telephone GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	330%	-	190 fewer per 1000 (from 640 fewer to 260 more)	⊕OOO VERY LOW	CRITICAL
Male home GP consultation rate (follow-up 1 to 2 years)												
1	Non-randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	15%	-	30 more per 1000 (from 60 fewer to 120 more)	⊕OOO VERY LOW	CRITICAL
Female home GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	None	-	24%	-	70 fewer per 1000 (from 170 fewer to 30 more)	⊕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.
Note: due to rounding data only accurate to the nearest 10 per 1000

Table 10: Clinical evidence profile: ED closure versus 24 hour ED access

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**ED closure**	**Control**	**Relative (95%**	**Absolute**		

									CI)			
Male ED visit rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	13%	-	10 fewer per 1000 (from 40 fewer to 20 more)	⊕OOO VERY LOW	CRITICAL
Female ED visit rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	8%	-	10 more per 1000 (from 10 fewer to 30 more)	⊕OOO VERY LOW	CRITICAL
Male admission rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	17%	-	20 fewer per 1000 (from 60 fewer to 20 more)	⊕OOO VERY LOW	CRITICAL
Female admission rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	19%	-	40 more per 1000 (from 40 fewer to 120 more)	⊕OOO VERY LOW	CRITICAL
Male in-person GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	284%	-	30 more per 1000 (from 420 fewer to 480 more)	⊕OOO VERY LOW	CRITICAL
Female in-person GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	385%	-	260 fewer per 1000 (from 610 fewer to 90 more)	⊕OOO VERY LOW	CRITICAL
Male telephone GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	197%	-	310 more per 1000 (from 90 fewer to 710 more)	⊕OOO VERY LOW	CRITICAL

Female telephone GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	330%	-	350 fewer per 1000 (from 820 fewer to 120 more)	⊕OOO VERY LOW	CRITICAL
Male home GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	15%	-	40 more per 1000 (from 50 fewer to 130 more)	⊕OOO VERY LOW	CRITICAL
Female home GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	24%	-	120 fewer per 1000 (from 230 fewer to 10 more)	⊕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.
Note: due to rounding data only accurate to the nearest 10 per 1000

Table 11: Clinical evidence profile: ED closure versus 24 hour ED access

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**ED closure**	**Control**	**Relative (95% CI)**	**Absolute**		
Male ED visit rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	13%	-	10 fewer per 1000 (from 40 fewer to 20 more)	⊕OOO VERY LOW	CRITICAL
Female ED visit rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	8%	-	10 more per 1000 (from 10 fewer to 30 more)	⊕OOO VERY	CRITICAL

											LOW	
Male admission rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	17%	-	20 fewer per 1000 (from 60 fewer to 20 more)	⊕OOO VERY LOW	CRITICAL
Female admission rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	19%	-	40 more per 1000 (from 40 fewer to 120 more)	⊕OOO VERY LOW	CRITICAL
Male in-person GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	284%	-	30 more per 1000 (from 420 fewer to 480 more)	⊕OOO VERY LOW	CRITICAL
Female in-person GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	385%	-	260 fewer per 1000 (from 610 fewer to 90 more)	⊕OOO VERY LOW	CRITICAL
Male telephone GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	197%	-	310 more per 1000 (from 90 fewer to 710 more)	⊕OOO VERY LOW	CRITICAL
Female telephone GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	330%	-	350 fewer per 1000 (from 820 fewer to 120 more)	⊕OOO VERY LOW	CRITICAL
Male home GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	15%	-	40 more per 1000 (from 50 fewer to 130 more)	⊕OOO VERY LOW	CRITICAL

Female home GP consultation rate (follow-up 1 to 2 years)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	-	24%	-	120 fewer per 1000 (from 230 fewer to 10 more)	⊕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.
Note: due to rounding data only accurate to the nearest 10 per 1000.

Table 12: Clinical evidence profile: local ED closure versus no ED closure

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Local ED closure versus no ED closure**	**Control**	**Relative (95% CI)**	**Absolute**		
Mortality - local ED closure versus no ED closure (follow-up in-hospital)												
1	observational studies	no serious risk of bias[2]	no serious inconsistency	serious[1]	no serious imprecision	none	4,048,433	12,198,459	OR 1.05 (1.02 to 1.08)	-	⊕OOO VERY LOW	CRITICAL

[1] The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.
[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 13: Clinical evidence profile: Increased driving time to ED versus no increase in driving time to the ED

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Increased driving time to ED versus no increase in driving time to the ED**	**Control**	**Relative (95% CI)**	**Absolute**		
Mortality (follow-up in-hospital)												

1	observational studies	no serious risk of bias[2]	no serious inconsistency	serious[1]	no serious imprecision	none	67577	693,827	OR 1.04 (0.99 to 1.09)	-	⊕OOO VERY LOW	CRITICAL

[1] The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.
[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 14: Clinical evidence profile: Less than 10 minutes increased driving time to ED versus no increase in driving time to the ED

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Increased driving time**	**Control**	**Relative (95% CI)**	**Absolute**		
Mortality (follow-up 7 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	141,746	1,418,613	RD -0.00 (0.00-0.00)	0 fewer per 1000 (from 5 fewer to 4 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 30 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	141,746	1,418,613	RD 0.00 (-0.00-0.01)	3 more per 1000 (from 3 fewer to 9 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 90 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	141,746	1,418,613	RD 0.00 (-0.00-0.01)	5 more per 1000 (2 fewer to 12 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 180 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	141,746	1,418,613	RD 0.01 (-0.00-0.01)	6 more per 1000 (1 fewer to 13 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 1 year)												

1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	141,746	1,418,613	RD0.00 (-0.00-0.01)	4 more per 1000 (from 4 fewer to 11 more)	⊕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] The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.

Table 15: Clinical evidence profile: 10-30 minutes increased driving time to ED versus no increase in driving time to the ED

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Increased driving time**	**Control**	**Relative (95% CI)**	**Absolute**		
Mortality (follow-up 7 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	26,817	1,418,613	RD -0.01 (-0.02-0.00)	6 fewer per 1000 (from 16 fewer to 3 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 30 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	26,817	1,418,613	RD -0.01 (-0.02-0.00)	10 fewer per 1000 (from 21 fewer to 8 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 90 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	26,817	1,418,613	RD -0.01 (-0.02-0.01)	6 fewer per 1000 (from 21 fewer to 8 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 180 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	26,817	1,418,613	RD -0.00 (-0.02-0.01)	3 fewer per 1000 (from 17 fewer to 12 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 1 year)												

1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	26,817	1,418,613	RD -0.01 (-0.02-0.01)	7 fewer per 1000 (from 22 fewer to 8 more)	⊕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] The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.

Table 16: Clinical evidence profile: Over 30 minutes increased driving time to ED versus no increase in driving time to the ED

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Increased driving time**	**Control**	**Relative (95% CI)**	**Absolute**		
Mortality (follow-up 7 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	3187	1,418,613	RD 0.02 (-0.01-0.05)	17 more per 1000 (from 15 fewer to 49 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 30 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	3187	1,418,613	RD 0.01 (-0.03-0.06)	12 more per 1000 (from 31 fewer to 56 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 90 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	3187	1,418,613	RD 0.03 (-0.02-0.08)	26 more per 1000 (from 24 fewer to 76 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 180 days)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	3187	1,418,613	RD 0.04 (-0.01-0.09)	45 more per 1000 (from 5 fewer to 95 more)	⊕OOO VERY LOW	CRITICAL
Mortality (follow-up 1 year)												

1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	3187	1,418,613	RD 0.06 (0.01-0.11)	57 more per 1000 (from 7 to 106 more)	⊕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] The majority of evidence did not differentiate between a reduction in ED opening hours, ED closures, or whole hospital closures.

Appendix G: Excluded clinical studies

Table 17: Studies excluded from the clinical review

Study	Exclusion reason
Anon 2015[1]	Protocol only
Congdon 2001[2]	Statistical model: no interventions/outcomes of interest
El sayed 2012[5]	Incorrect intervention: Consolidation of 2 EDs to a single site
Fisher 2000[6]	Study design (descriptive)
Mitchell 2008[10]	Study design (descriptive)
Shen 2016	No extractable data
Sun 2006[12]	Whole hospital closing
Teljeur 2004[13]	Statistical model: no interventions/outcomes of interest

Appendix H: Excluded health economic studies

No health economic studies were excluded from this review.