National Institute for Health and Care Excellence

Chapter 2 Non-emergency telephone access and call handlers

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

NICE guideline <number>

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

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Disclaimer

Healthcare professionals are expected to take NICE guidelines fully into account when exercising their clinical judgement. However, the guidance does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of each patient, in consultation with the patient and, where appropriate, their guardian or carer.

Chapter 2 Non-emergency telephone access and call handlers

Contents

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Non-emergency telephone access to urgent or unscheduled care

2.1 Introduction

There are multiple telephone access points to the emergency care pathway which include NHS 111, NHS Direct, NHS 24 and 999. The access points are variable throughout the UK. NHS 111 replaced NHS Direct in England in 2013 after three pilots in the North east, East Midlands and East of England. NHS 111 includes out-of-hours GP services. NHS Direct exists in Wales, NHS 24 exists in Scotland and Northern Ireland does not have such a service. The out-of-hours GP services are separate to these services. All services are provided and can be accessed 24 hours a day. They also have websites that also provide basic medical advice. Patients are often unclear which service to use and therefore may end up using the emergency department when they may not need too. The Guideline Committee sought to determine whether or not multiple telephone access points improved patient outcomes and reduced demand on other health care services.

2.2 Review question: Does the addition of non-emergency telephone access to urgent or unscheduled care, to an emergency (for example, 999/112) service, improve patient outcomes and reduce demand on health care services?

For full details see review protocol in Appendix A.

Table 1: PICO characteristics of review question

Population	Adults and young people (16 years and over) with a suspected or confirmed AME.
Interventions	Multiple telephone access points to the emergency care pathway NHS 111 + 999 NHS direct + 999 NHS 24 + 999
Comparison	Single points of telephone access to the emergency care pathway: 999
Outcomes	Mortality (CRITICAL) Avoidable adverse events (CRITICAL) Quality of life (CRITICAL) Patient and/or carer satisfaction (CRITICAL) Time to first medical contact (IMPORTANT) Unplanned re-contact rates (CRITICAL) ED demand (reduction in number presenting to ED) (IMPORTANT) Rates of referral to 999 (ambulance service) (IMPORTANT)
Study design	Systematic reviews (SRs) of RCTs, RCTs, observational studies only to be included if no relevant SRs or RCTs are identified.

1 2.3 Clinical evidence

2   We searched for RCTs, observational and before-and-after studies comparing a single point of
3   telephone access to acute care with multiple points of access. No RCTs were identified by the search.

4   Three interrupted time-series before-and-after studies were included in the review[22,23,42]; these are
5   summarised in Table 2 below. Evidence from these studies is summarised in the GRADE clinical
6   evidence summary below (Table 3, Table 4 and Table 5). See also the study selection flow chart in
7   Appendix B, study evidence tables in Appendix D, forest plots in Appendix C, GRADE tables in
8   Appendix F and excluded studies list in Appendix G.

9   **Table 2:   Summary of studies included in the review**

Study	Intervention and comparison	Population	Outcomes	Comments
Munro 2000[22] Controlled before and after study	Before. Versus After NHS Direct pilot introduction.	Three England, UK pilot sites (Preston and Chorley, Milton Keynes and Northumbria) providing a service to about 1.3 Million people (number of calls within first/pilot year n=68,500).	Changes in trends (monthly) of: • ambulance services use • accident and emergency departments use.	Controlled before-and-after study using routine data, interrupted time-series; data reported per site not overall.
Munro 2005[23] Controlled before and after study	Before. Versus After NHS Direct (all of England) introduction.	During first 3 years of operation NHS Direct handled n=5,180,000 calls covering all of England, UK.	Changes in trends (monthly) of: • ambulance services use • accident and emergency departments use.	Controlled before-and-after study using routine data, interrupted time-series.
Turner 2013[42] Controlled before and after study	Before (NHS Direct). Versus After NHS 111 pilot introduction.	Four England, UK pilot sites (Nottingham, Luton, Lincolnshire, Durham and Darlington) providing a service to about 1.8 Million people (number of calls within first/pilot year n=251,190).	Changes in trends (monthly) of: • accident and emergency departments attendances • calls to 999 ambulance service • ambulance 999 incidents where an ambulance arrives at the incident scene.	Controlled before-and-after study using routine data, interrupted time-series. Indirect comparison: NHS Direct continued to operate as a national service within the pilot site areas; also not comparing to single point of access but rather 1 hotline to another of the same kind.

Table 3:   Clinical evidence summary: Before and after NHS Direct pilot introduction

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with before NHS Direct pilot	Risk difference with after NHS Direct pilot (95% CI)
Ambulance services use - Milton Keynes	68,500 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b] due to risk of bias, imprecision	Could not be calculated	Information not provided by the authors.	The mean ambulance services use after was 0.9% lower per month (2 lower to 0.2 higher)
Ambulance service use - Preston and Chorley	68,500 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b] due to risk of bias, imprecision	Could not be calculated	Information not provided by the authors.	The mean ambulance service use after was 0.1% lower per month (1.7 lower to 1.5 higher)
Ambulance service use - Northumbria	68,500 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b] due to risk of bias, imprecision	Could not be calculated	Information not provided by the authors.	The mean ambulance service after was 0.2% lower per month (1.2 lower to 0.8 higher)
A&E department use - Milton Keynes	68,500 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b] due to risk of bias, imprecision	Could not be calculated	Information not provided by the authors.	The mean A&E department use after was 0.5% higher per month (0.2 lower to 1.2 higher)
A&E department use - Preston and Chorley	68,500 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b] due to risk of bias, imprecision	Could not be calculated	Information not provided by the authors.	The mean A&E department use after was 0.1% lower per month (0.8 lower to 0.6 higher)
A&E department use - Northumbria	68,500 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b] due to risk of bias, imprecision	Could not be calculated	Information not provided by the authors.	The mean A&E department after was 0.2% higher per month (0.5 lower to 0.9 higher)

(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.

Table 4:   Clinical evidence summary: Before and after NHS Direct (all of England) introduction

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with before NHS Direct	Risk difference with after NHS Direct (95% CI)
Ambulance services use	5,180,000 (1 study)	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	Could not be calculated.	Information not provided by the authors.	The mean ambulance services after was 1.4% lower per year (2.3 to 0.5 lower)
A&E use	5,180,000 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b] due to risk of bias, imprecision	Could not be calculated.	Information not provided by the authors.	The mean A&E department use after was 0.86% higher per year (0.19 to 1.53 higher)

(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 one MID or by 2 increments if the confidence interval crossed both MIDs.

Table 5:   Clinical evidence summary: Before (NHS Direct) and after NHS 111 pilot introduction

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with before NHS 111 pilot	Risk difference with after NHS 111 pilot (95% CI)
ED attendances	251,190 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b, c] due to risk of bias, indirectness, imprecision	Could not be calculated.	Information not provided by the authors.	The mean emergency department attendances in after was 0.1% lower per month (3.8 lower to 3.6 higher)
Calls to 999 ambulance	251,190 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b, c] due to risk of bias, indirectness, imprecision	Could not be calculated.	Information not provided by the authors.	The mean calls to 999 after was 0.3% higher per month (3.1 lower to 3.7 higher)
Ambulance 999 incidents where an ambulance arrives at the incident scene	251,190 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b, c] due to risk of bias,	Could not be calculated.	Information not provided by the authors.	The mean ambulance 999 incidents where an ambulance arrives at the incident after was 2.9% higher per month (1 to 4.8 higher)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with before NHS 111 pilot	Risk difference with after NHS 111 pilot (95% CI)
		indirectness, imprecision			

(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 the evidence was based on indirect comparisons.

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

2.4 Economic evidence

Published literature

One economic evaluation was identified with the relevant comparison and has been included in this review[43]. This is summarised in the economic evidence profile below (Table 6) and the economic evidence tables in Appendix E.

One study[14] was excluded due to very serious limitations.

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

Table 6: Economic evidence profile: NHS 111 before and after

Study	Applicability	Limitations	Other comments	Incremental cost	Incremental effects	Cost effectiveness	Uncertainty
Turner 2012[43]	Partially applicable[a]	Potentially serious limitations [a]	Retrospective observational study Comparative costing Population: Patients within 4 pilot site areas using emergency and urgent care NHS services. Two comparators: 1) Usual care (999 and NHS Direct) 2) NHS 111 and usual care Time horizon: 2 years before and 1 year after introduction of NHS 111	After vs before: £10.00 (95% CI: £0.20, £19.80; p=NR)	n/a	n/a	Cost estimates sampled 10,000 times generating a probability of NHS 111 being cost saving of 21%. Implementation analysis undertaken removing estimated costs of NHS Direct and GP OOH telephone services and extrapolating for England. Generating a probability of being cost saving in this scenario to be 100% for estimated 4.3m annual calls and 93% for 7.8m annual calls.

Abbreviations: 95% CI: 95% confidence interval; NR: not reported; OOH: out-of-hours.

(a) Final report based only on observational analysis of pilot sites. The 4 pilot sites observed may not be representative of the entire system. No health outcomes were included in the study.

(b) NHS direct still available when NHS 111 introduced. Detailed costs were not available for inclusion in the analysis. Costs may have been double counted for call triage component, once for NHS 111 and for ambulance service. Large assumptions made around the savings made by NHS 111 replacing GP OOH and NHS Direct 0845.

2.5 Evidence statements

Clinical

Before and after NHS Direct:

- One study comprising 68,500 calls to NHS Direct evaluated the introduction of NHS Direct (non-emergency telephone access) in the 3 pilot sites for improving outcomes and reducing demand on health care services. The evidence suggested no difference in changes in trends of ambulance services use and accident and emergency department use (1 study, very low quality).

- One study comprising 5,180,000 calls to NHS Direct England evaluated the introduction of NHS Direct (non-emergency telephone access) for improving outcomes and reducing demand on health care services. The evidence suggested no difference in ambulance services use and accident and emergency department use (1 study, very low quality).

NHS Direct compared to NHS 111:

- One study comprising 251,190 calls to NHS 111 in the 4 pilot sites evaluated the introduction of NHS 111 compared to NHS Direct for improving outcome and reducing demand on healthcare services. The evidence suggested no difference in emergency department attendances and calls to 999 ambulance services. However, there was an increase in ambulance 999 incidents where an ambulance arrives at the incident scene after the introduction of NHS 111 (1 study, very low quality).

Economic
One cost analysis found that the introduction of NHS 111 to replace NHS direct and out of hours GP would be cost saving with a probability of 93-100% (directly applicable but potentially serious limitations).

1   ## **2.6   Recommendations and link to evidence**

2   Please see LETR on page 21.

1 **Call handlers**

2 **2.7 Introduction**

3 Emergency call handlers can be either clinically (i.e. Doctor, nurse, paramedic) or non-clinically
4 trained. For the latter group this may include providing additional clinical support or using algorithms
5 to aid decision making. There is no national standard that determines if an emergency call should be
6 answered by a clinical or non-clinical call handler. There is regional variation throughout the UK, not
7 only of the type of call handler but also of the service provided (ie. NHS 111 vs NHS Direct). Some call
8 handlers are clinically trained (i.e. NHS Direct Wales), whilst others (i.e. NHS 111 in England) are
9 predominantly non-clinically trained. There has been much controversy of NHS 111 since its
10 introduction in 2013, especially on whether or not calls are being answered by appropriate staff. The
11 Guideline Development Group sought to determine whether clinical call handlers would improve
12 outcomes for patients, utilise services appropriately and reduce admissions to selected patients with
13 non-life threatening Acute Medical Emergencies.

14 **2.8 Review question: Do non-clinical call handlers perform as**
15 **effectively as clinical call handlers?**

16 For full details see review protocol in Appendix A.

17 **Table 7: PICO characteristics of review question**

Population	Adults and young people (16 years and over) with a suspected or confirmed AME.
Intervention(s)	Non-clinical emergency call handlers using algorithms for decision making (with access to clinical advice): • NHS 111 (non-clinical call-handler led; different in different areas) • Other countries with non-clinical emergency call handlers. Non-clinical handlers with clinical support: • Ambulance service as indirect evidence • Emergency telephone number 999 (In UK initially not non-clinical) as indirect evidence • GP out of hours as indirect evidence (historical - prior to 2013). Clinical emergency call handlers (doctor, nurse, paramedic): • NHS direct (nurse-led service; ratio where clinicians higher than NHS 111) • Other countries with clinical emergency call handlers • Ambulance service as indirect evidence (calls diverted to ambulance service not ring-backs) • Emergency telephone number 999 (in UK initially non-clinical) as indirect evidence • GP out of hours as indirect evidence.
Comparison(s)	Each compared to each other.
Outcomes	• Mortality (Critical) • Adverse events (Critical) • Quality of life (Critical) • Patient/carer satisfaction (Critical) • Ambulance dispatches (Critical) • Referrals (numbers and appropriateness) to ED, GP and walk in centres, minor injury units (important)

	• Presentation (numbers and appropriateness) to ED, GP and walk in centres, minor injury units. (Critical)
Study design	Systematic reviews (SRs) of RCTs, RCTs, observational studies only to be included if no relevant SRs or RCTs are identified.

2.9 Clinical evidence

Three studies were included in the review; 1 pragmatic controlled trial, 1 prospective cohort study and 1 before-after study[5,38,42]. No RCTs were identified; these are summarised in Table 8 below. Evidence from these studies is summarised in the clinical evidence summary below (Table 9). 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 8:   Summary of studies included in the review

Study	Intervention and comparison	Population	Outcomes	Comments
Dale 2003[5] UK Pragmatic controlled trial	3 comparison groups: Nurse assessment with computerised decision support. Versus Paramedic assessment with computerised decision support. Versus Control (usual ambulance response). During intervention sessions, following ambulance despatch category C calls (non-serious problems) were passed to a nurse or paramedic for triage and advice. Computerised decision support was used to assist this process and to determine whether or not despatch of an emergency ambulance as indicated. During control sessions the calls received the usual ambulance response	n=1246 Patients for whom emergency calls were made to the ambulance services between April 1998 and May 1999 during 4 hour sessions sampled across all the days of the week between 0700 and 2300.	Ambulance dispatches.	Setting: ambulance services in London and the West Midlands. The nurse and paramedic group have been combined as clinical handlers in our analysis.

Study	Intervention and comparison	Population	Outcomes	Comments
	with no additional telephone assessment and advice.			
Smith 2001[38] USA Two phased prospective cohort study	Phase 1: All calls meeting study criteria were triaged by the 911 dispatcher and a BLS unit was dispatched. The call line was then forwarded to the nurse line in order to obtain permission to make a follow-up phone call. Nurses did not give advice at this time. Phase II: The 911 dispatcher triaged all calls meeting study criteria. Once the caller agreed, he or she was transferred directly to the nurse and BLS unit was not sent on these calls. The nurse assessed the callers medical situation using the nurse line protocols and provided care based on the recommended protocols.	A 911 service area in King County, Washington. During phase I: 1169 calls eligible for inclusion Phase II: 381 calls eligible for inclusion.	Patient satisfaction; ED attendance; Visit to clinic, primary care physician or other community resource.	Objective: to assess the effects of transferring non-urgent 911 calls to a telephone consulting nurse.
Turner 2013[42] UK Controlled before-and-after study using routine data, interrupted time-series	Before (NHS Direct). Versus After NHS 111 pilot introduction. NHS 111, a 24 hour, 7 day a week telephone service for non-emergency health problems, operated by trained non-clinical call	Participants were users of the emergency and urgent care systems in the 7 pilot and control sites recorded in routine service activity data as having accessed and used a range of emergency or urgent care services during the study periods.	Changes in trends (monthly) of: • accident and emergency departments attendances • calls to 999 ambulance service • ambulance 999 incidents where an ambulance arrives at the incident scene.	Objectives: to measure the impact of the urgent care telephone service NHS 111 on the emergency and urgent care system.

Study	Intervention and comparison	Population	Outcomes	Comments
	handlers with clinical support from nurse advisors, using NHS pathways software to triage calls to different services and home care. Duration: 2 years prior and 1 year after introduction of NHS 111.	Four England, UK pilot sites (Nottingham, Luton, Lincolnshire, Durham and Darlington) providing a service to about 1.8 Million people (number of calls within first/pilot year n=251,190).		

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Table 9:   Clinical evidence summary: Clinical call handlers (911 calls transferred to advice-line nurse) versus non-clinical call handlers (911 dispatcher and BLS unit to all 911 calls)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Non-clinical call handlers (911 dispatcher and BLS unit to all 911 calls)	Risk difference with Clinical call handlers (911 calls transferred to advice-line nurse) (95% CI)
Patient satisfaction	117 (1 study)	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, indirectness	RR 1.05 (0.93 to 1.19)	Moderate	
				906 per 1000	45 more per 1000 (from 63 fewer to 172 more)
ED attendance	117 (1 study)	⊕⊖⊖⊖ VERY LOW[a,b,c] due to risk of bias, indirectness, imprecision	RR 0.53 (0.26 to 1.06)	Moderate	
				313 per 1000	147 fewer per 1000 (from 232 fewer to 19 more)
Visit to clinic, primary care physician or other community resource	117 (1 study)	⊕⊖⊖⊖ VERY LOW[a,b,c] due to risk of bias, indirectness, imprecision	RR 1.08 (0.5 to 2.3)	Moderate	
				219 per 1000	18 more per 1000 (from 109 fewer to 285 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) Indirect comparisons.
(c) Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.

Table 10: Clinical evidence summary: Clinical call handlers (nurse or paramedic assessment with computer decision support) versus non-clinical call handlers (usual ambulance response)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Non-clinical call handlers (usual ambulance response)	Risk difference with Clinical call handlers (nurse or paramedic assessment with computer decision support) (95% CI)
Emergency ambulance required	1246 (1 study)	⊕⊕⊖⊖ LOW[a,b] due to risk of bias, indirectness	RR 0.48 (0.44 to 0.52)	Moderate	
				1000 per 1000	520 fewer per 1000 (from 480 fewer to 560 fewer)

(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) Study conducted in USA. Setting of the study and the processes were different from that of the services in the UK.

Table 11: Clinical evidence summary: Before (NHS Direct) and after NHS 111 pilot introduction

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with before NHS 111 pilot	Risk difference with after NHS 111 pilot (95% CI)
ED attendances	251,190 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b, c] due to risk of bias, indirectness, imprecision	Could not be calculated.	Information not provided by the authors.	The mean emergency department attendances after NHS 111 was 0.1% lower per month (3.8 lower to 3.6 higher)
Calls to 999 ambulance	251,190 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b, c] due to risk of bias, indirectness, imprecision	Could not be calculated.	Information not provided by the authors.	The mean calls to 999 after NHS 111 was 0.3% higher per month (3.1 lower to 3.7 higher)
Ambulance 999 incidents where an ambulance arrives at the incident scene	251,190 (1 study)	⊕⊖⊖⊖ VERY LOW[a, b, c] due to risk of bias, indirectness, imprecision	Could not be calculated.	Information not provided by the authors.	The mean ambulance 999 incidents where an ambulance arrives at the incident after NHS 111 was 2.9% higher per month (1 to 4.8 higher)

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(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 the evidence was based on indirect comparisons.*

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

2.10 Economic evidence

Published literature

No economic evaluations were found.

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

2.11 Evidence statements

Clinical

Clinical call handlers (911 calls transferred to advice-line nurse) versus non-clinical call handlers (911 Dispatcher and BLS unit to all 911 calls):

- One study comprising 117 people evaluated the role of non-urgent 911 calls to a telephone consulting nurse (clinical call handler) in adults and young people at risk of an AME, or with a suspected or confirmed AME. The evidence suggested that clinical call handlers may provide a benefit in improved patient and/or carer satisfaction (1 study, very low quality), reduced ED attendance satisfaction (1 study, very low quality) and increased visit to clinic, primary care physician or other community resource (1 study, very low quality).

Clinical call handlers (nurse or paramedic assessment with computer decision support) versus non-clinical call handlers (usual ambulance response):

- One study comprising 1246 people evaluated the role of nurse or paramedic assessment with computer decision support (clinical call handlers) in adults and young people at risk of an AME, or with a suspected or confirmed AME. The evidence suggested that clinical call handlers may provide a benefit in reduced emergency ambulance required (1 study, low quality).

Before (NHS Direct) and after NHS 111 pilot introduction:

- One study comprising 251,190 people evaluated the role of NHS111 in adults and young people at risk of an AME, or with a suspected or confirmed AME. The evidence suggested that there was no difference in emergency department attendances and calls to 999 ambulance services before and after NHS 111 (1 study, very low quality). However, there was an increase in ambulance 999 incidents where an ambulance arrives at the incident scene following the introduction of NHS 111 (1 study, very low quality).

Economic

No economic evaluations were included.

1 2.12 Recommendations and link to evidence

Recommendations	-
Research recommendation	**RR1. What is the most clinically and cost-effective use of clinical call handlers in a telephone advisory service in terms of (i) the ratio of clinical to non-clinical call handlers and (ii) point of access to clinical call handlers in the telephone advisory service pathway?**
Relative values of different outcomes	The review was in 2 parts. Firstly, the examination of non-emergency telephone access and then more specifically a review about clinical versus non-clinical call handlers. **Non-emergency telephone access** Mortality, quality of life, patient and/or carer satisfaction, adverse events and unplanned re-contact rates were considered to be critical outcomes. Time to first medical contact, ED demand (reduction in number presenting to ED) and rates of referral to 999 (ambulance service) were considered important outcomes. **Call handlers** Mortality, quality of life, patient and/or carer satisfaction, adverse events, ambulance dispatches and presentation (numbers and appropriateness) to ED, GP and walk in centres and minor injury units were considered by the committee to be critical outcomes. Referrals (numbers and appropriateness) to ED, GP and walk in centres, minor injury units were considered to be important outcomes.
Trade-off between benefits and harms	**Non-emergency telephone access** A total of 3 observational (before and after) studies were identified; 2 of which compared before and after the introduction of NHS Direct and the third compared NHS Direct with NHS 111. **Before and after NHS Direct:** One study comprising 68,500 calls to NHS Direct evaluated the introduction of NHS Direct (non-emergency telephone access) in 3 pilot sites. The evidence suggested no difference in ambulance services use or accident and emergency department use. The other study comprising 5,180,000 calls to NHS Direct England suggested no difference in ambulance services use or accident and emergency department use. The committee concluded that there was no evidence that the introduction of a non-emergency telephone line reduced the overall demand on health services. **NHS Direct compared to NHS 111:** One study comprising 251,190 calls to NHS 111 in 4 pilot sites suggested no difference in emergency department attendances and calls to 999 ambulance services. However, there was an increase in ambulance 999 incidents (when an ambulance arrives at the incident scene) after the introduction of NHS 111. The committee noted that as the study had been conducted during the pilot phase of NHS 111, these outcomes may have improved since; but no evidence was identified to support this. The committee noted that this study was indirect for the first part of this review as it was comparing 2 types of non-emergency telephone access. **Summary of evidence on non-emergency telephone access:** Evidence was only identified for ED demand and ambulance service referrals. No evidence was found for mortality, quality of life, unplanned re-contact rates, avoidable adverse events, patient and/or carer satisfaction and time to first medical contact. The committee noted that NHS 111 was currently available across the country. No

Recommendations	-
Research recommendation	**RR1. What is the most clinically and cost-effective use of clinical call handlers in a telephone advisory service in terms of (i) the ratio of clinical to non-clinical call handlers and (ii) point of access to clinical call handlers in the telephone advisory service pathway?**
	evidence was identified to suggest that the provision of this service should stop. The data identified was collected during the first year of implementation and the committee considered that it was reasonable to expect improvement in performance as time passes. The committee agreed that there was not enough evidence to make a recommendation about non-emergency telephone access.

Call Handlers

There was evidence from 3 studies for the comparison of clinical call handlers versus non-clinical call handlers. The committee felt that there was limited applicability of two of the three studies due to different country setting and old data which was not reflective of current ambulance and emergency services. The third study did not exactly compare clinical call handlers with non-clinical handlers -the comparisons were NHS 111 and NHS direct, where both the services had clinical call handlers but the proportion of clinical call handlers in NHS 111 is lower than in the preceding telephone service NHS Direct.

There was evidence from 1 prospective cohort study which examined the effects of transferring non-urgent 911 calls to a telephone consulting nurse (clinical call handler) compared to a 911 call dispatcher (non-clinical call handler). The evidence suggested that clinical call handlers may provide a benefit in improved patient and/or carer satisfaction, reduced ED attendance and increased visits to an urgent care clinic, primary care physician or other community resource. An increase in attendance to clinic and primary care was considered by the committee to be a good outcome in this instance as it indicated that patients were less likely to be going to ED and using the ambulance service. Subsequently, this would reduce the burden currently placed on these services. However, the committee noted the limited applicability of this evidence to the UK, as the study was conducted in the USA. The committee recognised that, due to international variation in legal and regulatory frameworks, the UK ambulance service is more likely than the US service to redirect patients to community care as an alternative to emergency departments.

There was evidence from 1 pragmatic controlled trial comparing nurse or paramedic assessment with computer decision support (clinical call handlers) with usual ambulance response (non-clinical call handlers) which suggested that clinical call handlers may provide a benefit in reduced emergency ambulance required. However, again, the committee discussed the limited applicability of this evidence, as the study was published some time ago and there have been significant changes in ambulance and emergency care services since this study was conducted.

There was evidence from 1 controlled before and after study which measured the impact of introducing NHS 111 after having had the NHS Direct service in place. The evidence suggested that there was no difference in emergency department attendances and calls to 999 ambulance services before and after NHS111. However, there was an increase in 999 incidents where an ambulance arrives at the incident scene following the introduction of NHS 111. The committee considered this to be a relevant negative impact of the intervention. The committee noted that this study suggested that the provision of a new service may increase demand by providing more access to, or reveal an unmet need for, that service.

No evidence was identified for the outcomes mortality, quality of life, adverse events and referrals to ED, GP and walk in centres and minor injury units.

The committee noted that the majority of the evidence evaluated the effectiveness

Recommendations	-
Research recommendation	**RR1. What is the most clinically and cost-effective use of clinical call handlers in a telephone advisory service in terms of (i) the ratio of clinical to non-clinical call handlers and (ii) point of access to clinical call handlers in the telephone advisory service pathway?**
	of clinical call handlers for low acuity calls (that is, calls for non-immediately life-threatening problems), and thus could not necessarily be generalised to all types of calls.
	The committee was aware that, although the evidence pointed in the direction of benefit associated with clinical call handlers, it was limited by its applicability due to setting and age. However, the committee considered that the benefits of clinical call handlers (for example, patient and/or carer satisfaction, fewer ambulance dispatches and fewer ED attendances), and the ability to provide telephone advice for patients with AMEs which are not immediately life-threatening meant that the use of clinical call handlers was likely to be beneficial to patients. However, the committee were aware that, in reality, clinical call handlers already support the providers of telephone advice, albeit that the ratio of clinical to non-clinical responders and the point at which clinical responders are accessed in the pathway varies. The current ratio for clinical to non-clinical call handlers within NHS 111 varies between aspirational targets of 1:4 in some regions and a much lower level in others due to varying Standard Operation Procedures (SOPS) and challenges in recruitment. It was recognised, and consistent with the evidence review, that the proportion of clinical call handlers in NHS 111 is lower than in the preceding telephone service NHS Direct. It was noted that NHS 111 is, as its core function, a sign-posting service, whereas NHS Direct also was a clinical advisory service. This sign-posting service facilitates access to further NHS services (for example, calling an urgent ambulance, advising attendance at the ED, making an appointment for subsequent GP review and so on).
	The committee agreed that early access to a clinical call handler would result in more appropriate alternative dispositions for some patients other than calling an ambulance and/or advising ED attendance. However, for these outcomes to be realised, then the clinical call handler would have to be the first point of contact for a far higher proportion of patients than is currently the case. The current initial point of contact is a non-clinical call handler who follows the NHS pathways algorithm which ends in a certain disposition or advises subsequent referral to a clinical call handler.
	Therefore, the committee agreed that the key issue is not whether clinical call handlers should support telephone advisory services (as they already do to varying degrees), but in what way their input can be maximised. It was decided that a research recommendation would be appropriate and this should focus on informing the configuration of a telephone service with respect to the proportion of clinical call handlers and at what point in the service they should be accessed.
Trade-off between net effects and costs	**Non-emergency telephone access**
	One economic evaluation was included, which looked at the introduction of NHS 111 to 4 pilot sites. NHS 111 was to replace NHS Direct and GP out-of-ours telephone services but at the time of the study both systems were operating in parallel
	The evidence showed that the implementation of NHS 111 had a total system impact cost of £10.00 per NHS 111 call. However, implementation analysis was undertaken to incorporate anticipated changes to the system, notably the replacement of NHS Direct and GP out-of-hours telephone services. The results of this analysis estimated the probability of NHS 111 being cost saving between 93% and 100%, dependent on the estimated number of annual calls.

Recommendations	-
Research recommendation	**RR1. What is the most clinically and cost-effective use of clinical call handlers in a telephone advisory service in terms of (i) the ratio of clinical to non-clinical call handlers and (ii) point of access to clinical call handlers in the telephone advisory service pathway?**
	The committee acknowledged the economic analysis but did not feel that any strong conclusions could be drawn, although they did feel NHS 111 is unlikely to be more costly than NHS Direct was. The reasons for the cost savings could be due to greater use of non-clinical call handlers rather than the move to a single non-urgent telephone service.
	For this review, we searched only for UK studies. However, we are aware that a single telephone access service for non-emergencies has been shown to be cost saving in Japan.[21]
	Call handlers
	The committee acknowledged that NHS 111 is likely to be less costly than NHS Direct, as noted above. They recognised that NHS 111 has a lower proportion of clinical staff and that this might be the driving force for the difference in cost, outweighing the potential additional cost from the apparent increase in ambulance service requirements reported in the study. The committee felt that a service with increased clinical handlers could potentially be beneficial due to the reported reduction in ambulance attendances at 999 incidents. This could be beneficial in terms of allowing ambulance and paramedic services to focus on treating patients considered to be more in need. However, they acknowledged that there was no evidence around critical clinical outcomes such as mortality and quality of life which are necessary to establish the overall clinical and cost-effectiveness of either intervention.
	There would also potentially be an opportunity cost for clinicians working as call handlers that could be working elsewhere in the healthcare system. Whilst clinicians may be able to close more phone calls in a given time period than when seeing patients face-to-face, there will always be a need for face-to-face services and therefore, if staffing the call centre impacts adversely on other frontline services then this does need to be taken into consideration in terms of patient safety and ability to respond.
	Although the committee felt that there was a benefit to an increased number of clinical call handlers, there was not enough clinical and economic evidence to reach a conclusion about its cost-effectiveness and hence make a recommendation.
Quality of evidence	**Non-emergency telephone access**
	Three before and after studies were identified by the search that analysed data routinely collected by ambulance services and EDs. Although the studies had large sample sizes, the evidence provided for ambulance service use and ED demand was considered to be very low quality due to limitation in the study design as well as risk of bias and imprecision. One of these studies was also considered indirect as it compared 1 non-emergency telephone number to another (that is, NHS 111 pilot introduction to NHS Direct).
	The economic evaluation was rated as directly applicable but with potentially serious limitations because NHS direct and out of hours doctor's numbers were available in parallel and therefore assumptions were made around the savings attributable to having a single service.
	Call Handlers
	The quality of the evidence was graded from low to very low; this was mainly due to the study type (observational), risk of bias, imprecision and indirectness. The

Recommendations	-
Research recommendation	**RR1. What is the most clinically and cost-effective use of clinical call handlers in a telephone advisory service in terms of (i) the ratio of clinical to non-clinical call handlers and (ii) point of access to clinical call handlers in the telephone advisory service pathway?**
	evidence was downgraded for indirectness as the studies did not focus on directly comparing clinical call handlers with non-clinical call handlers and also 1 study was conducted in a different setting where the processes were different from that of services in the UK.
Other considerations	**Non-emergency telephone access**
	Ambulance demand is affected by a range of variables, for example, initiatives within the ambulance services affecting use of services and at times of exceptional demand ambulance services may temporarily limit responses or not respond to lower acuity calls at all. It is not possible to identify whether initiatives such as this were being implemented during the time periods within the studies.
	The study time frames were 1 or 2 years prior to introduction of NHS Direct or NHS 111 and 1 to 3 years after implementation. The committee noted that the results may also be affected by seasonal variation, however, data for all studies had been analysed in 12 month periods. The variation in performance and outcomes of the interventions could also have been affected by other factors related to the passage of time between the 2 time points in the studies. The major difference between NHS 111 and NHS Direct are the proportion of clinicians involved in call handling, with smaller numbers of clinicians handling calls in NHS 111. This may explain some differences in outcomes between the 2 systems.
	The committee noted that NHS 111 was currently available across the country. No evidence was identified to suggest that the provision of this service should stop. The data identified was collected during the first year of implementation and the committee considered that it was reasonable to expect improvement in performance as time passes.
	The absence of a recommendation should not be interpreted as meaning that the service and its evaluation are unimportant. As a signposting service, NHS 111 provides a point of first contact with health services for all except emergency calls. The way the service is perceived, used, and developed are all critical to its success. As an established service subject to continuing improvement, comparison could be made with established services in other countries (for example, the French Service d'Aide Médicale d'Urgence [http://www.samu-de-france.fr/en]) as a learning and development exercise.
	There was 1 short-term observational study[2] which determined the effect of using experienced GPs to review the advice given by call handlers in NHS 111. This did not meet our protocol and was not included in the review. Of the 1474 call handler cases reviewed, the GPs sent the patients to an A&E department in 400 cases (27.1%), to a Minor Illness and Injury Unit in 76 cases (5.2%), to an out-of-hours clinic run by GPs in 589 cases (40%), and would have advised self-care or some alternative management in 409 cases (27.8%) cases. The authors reported that during the study, GPs advised a course of action other than A&E attendance in 1072 of 1474 cases reviewed, which could have resulted in a saving of £52,528 in A&E departments. This compared to the total cost of employing GPs for these sessions of £41,416.
	Call Handlers
	Currently patients are able to self-triage and decide whether their problem is life threatening and therefore whether to call 999 or NHS 111. NHS 111 calls are

Recommendations	-
Research recommendation	**RR1. What is the most clinically and cost-effective use of clinical call handlers in a telephone advisory service in terms of (i) the ratio of clinical to non-clinical call handlers and (ii) point of access to clinical call handlers in the telephone advisory service pathway?**
	answered by non-clinical call handlers who follow decision algorithms to help determine what advice to give the patient. They are supported by clinically trained healthcare professionals. The committee noted that the algorithms tend to be risk averse. Patients would generally prefer to speak to a clinician directly but the committee noted that the additional benefit that clinicians can provide is somewhat limited over the phone depending on the presenting condition. The Next steps on the NHS Five Year Forward view{NHSE2017C} plans to increase the proportion of 111 calls receiving clinical assessment from 22% to 30% plus by March 2018. The aim is that only patients who need to attend A&E or use the ambulance service are advised to do this. There will be a new NHS 111 online service that will start during 2017 which will let patients enter specific symptoms and receive tailored advice on management. {NHSE2017C} Further research may also need to take into account developments in web-based communication and artificial intelligence as alternatives to the current set-up of human respondents using clinical algorithms.

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1 Appendices

2 Appendix A: Review protocols

3 **Table 12:   Review protocol: Provision of non-emergency telephone access to acute care**

Review question: Does the addition of non-emergency telephone access to urgent or unscheduled care, to an emergency (for example, 999/112) service, improve patient outcomes and reduce demand on health care services?	
Rationale	There are too many access points for patients. Patients are confused about who they should call and where they should go. Patients therefore often end up going to ED when they may not need to. ED is being overused (the demand is too high).
Population	Adults and young people (16 years and over) with a suspected or confirmed AME.
Intervention	Multiple telephone access points to the emergency care pathway NHS 111 + 999 NHS direct + 999 NHS 24 + 999
Comparison	Single points of telephone access to the emergency care pathway: 999.
Outcomes	Mortality(CRITICAL) Avoidable adverse events (IMPORTANT) Quality of life (CRITICAL) Patient and/or carer satisfaction (IMPORTANT) Time to first medical contact (IMPORTANT) Unplanned re-contact rates(CRITICAL) ED demand (reduction in number presenting to ED) (IMPORTANT) Rates of referral to 999 (ambulance service) (IMPORTANT)
Exclusion	Routine care (for example, telehealth). Online advice Studies published prior to 1995.
Search criteria	The databases to be searched are: Medline, Embase, the Cochrane Library. Date limits for search: 1990. Language: English.
The review strategy	Systematic reviews (SRs) of RCTs, RCTs, observational studies only to be included if no relevant SRs or RCTs are identified. Evidence from before and after implementation studies from the following will be considered: • Different regions in UK where single point of access has been implemented. • International literature.
Analysis	Data synthesis of RCT data. Meta-analysis where appropriate will be conducted. Studies in the following subgroup populations will be included: Frail elderly In addition, if studies have pre-specified in their protocols that results for any of these subgroup populations will be analysed separately, then they will be included. The methodological quality of each study will be assessed using

Review question: Does the addition of non-emergency telephone access to urgent or unscheduled care, to an emergency (for example, 999/112) service, improve patient outcomes and reduce demand on health care services?
the Evibase checklist and GRADE.

1 **Table 13: Review protocol: Call Handlers**

Review question	Do non-clinical call handlers perform as effectively as clinical call handlers
Guideline condition and its definition	Acute medical emergencies.
Review population	Adults and young people (16 years and over) with a suspected or confirmed AME.
Interventions and comparators: generic/class; specific/drug (All interventions will be compared with each other, unless otherwise stated)	Non-clinical emergency call handlers using algorithms for decision making (with access to clinical advice); NHS 111 (non-clinical call-handler led; different in different areas). Non-clinical emergency call handlers using algorithms for decision making (with access to clinical advice); Other countries with non-clinical emergency call handlers. Non-clinical handlers with clinical support; Ambulance service as indirect evidence. Non-clinical handlers with clinical support; Emergency telephone number 999 (In UK initially not non-clinical) as indirect evidence. Non-clinical handlers with clinical support; GP out of hours as indirect evidence (historical - prior to 2013). Clinical emergency call handlers (doctor, nurse, paramedic); NHS direct (nurse-led service; ratio where clinicians higher than NHS 111). Clinical emergency call handlers (doctor, nurse, paramedic); Other countries with clinical emergency call handlers. Clinical emergency call handlers (doctor, nurse, paramedic); Ambulance service as indirect evidence (calls diverted to ambulance service not ring-backs). Clinical emergency call handlers (doctor, nurse, paramedic); Emergency telephone number 999 (In UK initially non-clinical) as indirect evidence. Clinical emergency call handlers (doctor, nurse, paramedic); GP out of hours as indirect evidence.
Outcomes	- Mortality at Define (Dichotomous) CRITICAL - Adverse events at Define (Dichotomous) IMPORTANT - Quality of life at Define (Continuous) CRITICAL - Patient and/or carer satisfaction at Define (Continuous) CRITICAL - Referrals (numbers and appropriateness) to ED,GP and walk-in centres, minor injury units at Define (Dichotomous) IMPORTANT - Presentation (numbers and appropriateness) to ED, GP and walk-in centres, minor injury units at Define (Dichotomous) CRITICAL - Ambulance dispatches at Define (Dichotomous) CRITICAL
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. Setting.
Crossover study	Not permitted.

Minimum duration of study	Not defined.
Other exclusions	Non-OECD countries.
Sensitivity/other analysis	If studies have pre-specified in their protocols that results for any of these subgroup populations will be analysed separately, then they will be included in the subgroup analysis.
Subgroup analyses if there is heterogeneity	- Algorithm (Algorithm; No algorithm); May affect outcomes - Type of clinical call handler (Clinical call handlers- NHS Direct; Clinical call handlers-other countries with clinical emergency call handlers; Clinical call handlers- ambulance service; Clinical call handlers-emergency telephone number 999; Clinical call handlers - GP out of hours); May affect outcomes.
Search criteria	Databases: Medline, Embase, the Cochrane Library. Date limits for search: 1990. Language: English only.

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Appendix B: Clinical study selection

Figure 1: **Flow chart of clinical article selection for the review of the provision of non-emergency telephone access to acute care**

| Records identified through database searching, n=443 | Additional records identified through other sources, n=2 |

Records screened, n=445

Records excluded, n=418

Full-text articles assessed for eligibility, n=27

Studies included in review, n=3

Studies excluded from review, n=24

Reasons for exclusion: see Appendix H
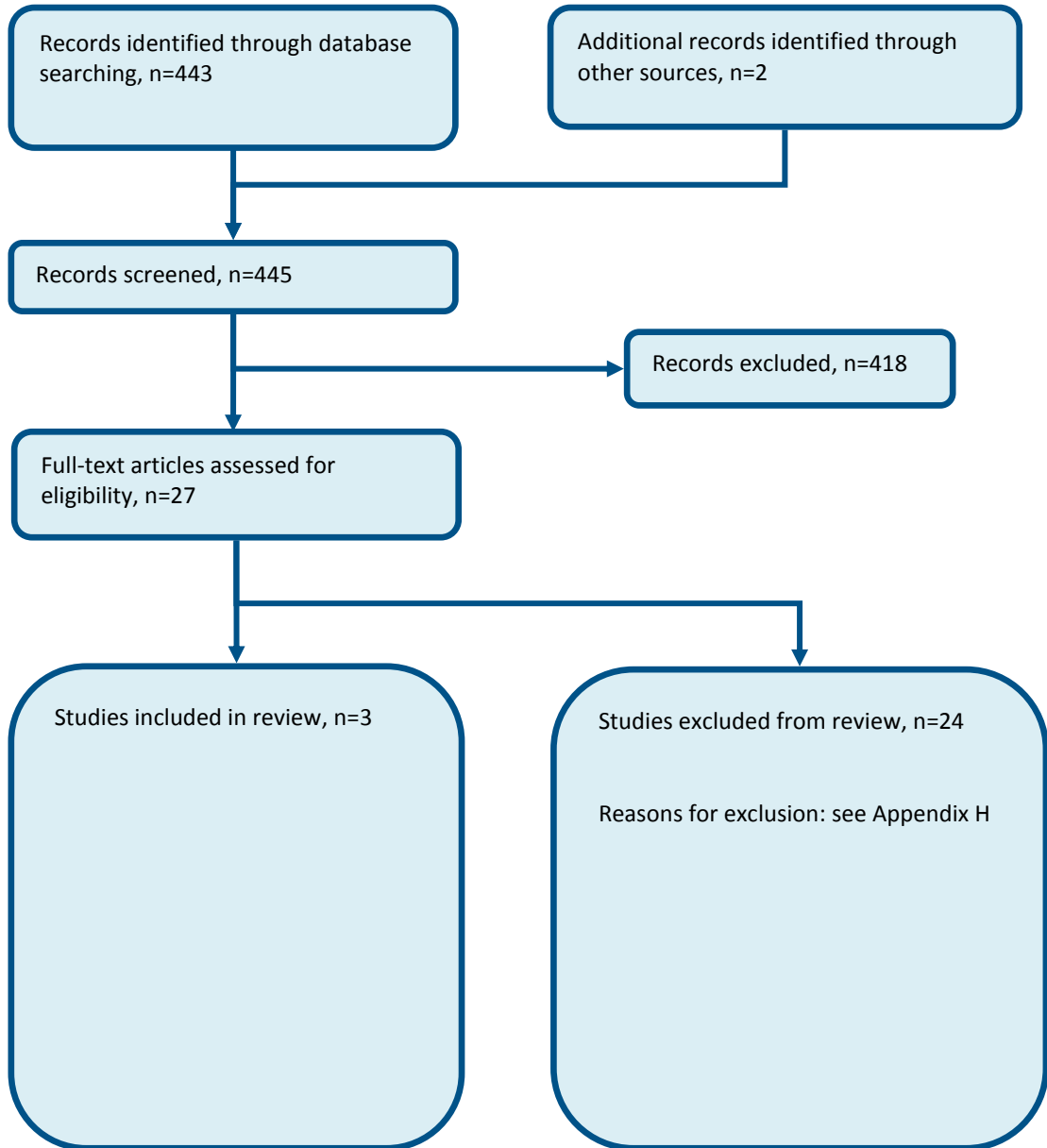
2
3

Figure 2: **Flow chart of clinical article selection for the review of Call Handlers**

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┌─────────────────────────────────┐     ┌─────────────────────────────────┐
│ Records identified through      │     │ Additional records identified   │
│ database searching, n=1655      │     │ through other sources, n=0      │
└─────────────────────────────────┘     └─────────────────────────────────┘

┌─────────────────────────────────┐
│ Records screened, n=1655        │
└─────────────────────────────────┘     ┌─────────────────────────────────┐
                                        │ Records excluded, n=1635        │
                                        └─────────────────────────────────┘
┌─────────────────────────────────┐
│ Full-text articles assessed for │
│ eligibility, n=20               │
└─────────────────────────────────┘

┌─────────────────────────────────┐     ┌─────────────────────────────────┐
│ Studies included in review, n=3 │     │ Studies excluded from review,   │
│                                 │     │ n=17                            │
│                                 │     │                                 │
│                                 │     │ Reasons for exclusion: see      │
│                                 │     │ Appendix H                      │
└─────────────────────────────────┘     └─────────────────────────────────┘
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Appendix C: Forest plots

C.1 Non-emergency telephone access

C.1.1 Before and after NHS Direct pilot introduction

Figure 3: Change in ambulance service use – Milton Keynes

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
1.1.1 New Subgroup					
Munro 2000	-0.9	0.5612	100.0%	-0.90 [-2.00, 0.20]	
Subtotal (95% CI)			**100.0%**	**-0.90 [-2.00, 0.20]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 1.60 (P = 0.11)					
Total (95% CI)			**100.0%**	**-0.90 [-2.00, 0.20]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 1.60 (P = 0.11)					
Test for subgroup differences: Not applicable					

Favours after NHS Direct Favours before NHS Direct

Figure 4: Change in ambulance service use – Preston and Chorley

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
1.2.1 New Subgroup					
Munro 2000	-0.1	0.8163	100.0%	-0.10 [-1.70, 1.50]	
Subtotal (95% CI)			**100.0%**	**-0.10 [-1.70, 1.50]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.12 (P = 0.90)					
Total (95% CI)			**100.0%**	**-0.10 [-1.70, 1.50]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.12 (P = 0.90)					
Test for subgroup differences: Not applicable					

Favours after NHS Direct Favours before NHS Direct

Figure 5: Change in ambulance service use – Northumbria

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
1.3.1 New Subgroup					
Munro 2000	-0.2	0.5102	100.0%	-0.20 [-1.20, 0.80]	
Subtotal (95% CI)			**100.0%**	**-0.20 [-1.20, 0.80]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.39 (P = 0.70)					
Total (95% CI)			**100.0%**	**-0.20 [-1.20, 0.80]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.39 (P = 0.70)					
Test for subgroup differences: Not applicable					

Favours after NHS Direct Favours before NHS Direct

Figure 6: Change in accident and emergency departments use – Milton Keynes

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
1.4.1 New Subgroup					
Munro 2000	0.5	0.3571	100.0%	0.50 [-0.20, 1.20]	
Subtotal (95% CI)			**100.0%**	**0.50 [-0.20, 1.20]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 1.40 (P = 0.16)					
Total (95% CI)			**100.0%**	**0.50 [-0.20, 1.20]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 1.40 (P = 0.16)					
Test for subgroup differences: Not applicable					

Favours after NHS Direct Favours before NHS Direct

Figure 7:   Change in accident and emergency department use – Preston and Chorley

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
1.5.1 New Subgroup					
Munro 2000	-0.1	0.3571	100.0%	-0.10 [-0.80, 0.60]	
Subtotal (95% CI)			**100.0%**	**-0.10 [-0.80, 0.60]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.28 (P = 0.78)					
Total (95% CI)			**100.0%**	**-0.10 [-0.80, 0.60]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.28 (P = 0.78)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS Direct   Favours before NHS Direct

1

Figure 8:   Change in accident and emergency department use – Northumbria

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
1.6.1 New Subgroup					
Munro 2000	0.2	0.3571	100.0%	0.20 [-0.50, 0.90]	
Subtotal (95% CI)			**100.0%**	**0.20 [-0.50, 0.90]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.56 (P = 0.58)					
Total (95% CI)			**100.0%**	**0.20 [-0.50, 0.90]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.56 (P = 0.58)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS Direct   Favours before NHS Direct

2   **C.1.2   Before and after NHS Direct introduction (all of England)**

Figure 9:   Change in ambulance service use

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
2.1.1 New Subgroup					
Munro 2005	-1.4	0.4592	100.0%	-1.40 [-2.30, -0.50]	
Subtotal (95% CI)			**100.0%**	**-1.40 [-2.30, -0.50]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 3.05 (P = 0.002)					
Total (95% CI)			**100.0%**	**-1.40 [-2.30, -0.50]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 3.05 (P = 0.002)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS Direct   Favours before NHS Direct

3

Figure 10: Change in accident and emergency department use

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
2.2.1 New Subgroup					
Munro 2005	0.86	0.3418	100.0%	0.86 [0.19, 1.53]	
Subtotal (95% CI)			**100.0%**	**0.86 [0.19, 1.53]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 2.52 (P = 0.01)					
Total (95% CI)			**100.0%**	**0.86 [0.19, 1.53]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 2.52 (P = 0.01)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS Direct   Favours before NHS Direct

C.1.3   Before and after NHS 111 pilot introduction

Figure 11: Change in emergency department attendance

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
3.1.1 New Subgroup					
Turner 2013	-0.1	1.8878	100.0%	-0.10 [-3.80, 3.60]	
Subtotal (95% CI)			100.0%	-0.10 [-3.80, 3.60]	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.05 (P = 0.96)					
Total (95% CI)			100.0%	-0.10 [-3.80, 3.60]	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.05 (P = 0.96)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS 111   Favours before NHS 111

Figure 12: Changes in calls to 999 ambulance services

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
3.2.1 New Subgroup					
Turner 2013	0.3	1.7347	100.0%	0.30 [-3.10, 3.70]	
Subtotal (95% CI)			100.0%	0.30 [-3.10, 3.70]	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.17 (P = 0.86)					
Total (95% CI)			100.0%	0.30 [-3.10, 3.70]	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.17 (P = 0.86)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS 111   Favours before NHS 111

Figure 13: Change in 999 incidents where an ambulance arrives at the incident scene

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
3.3.1 New Subgroup					
Turner 2013	2.9	0.9694	100.0%	2.90 [1.00, 4.80]	
Subtotal (95% CI)			100.0%	2.90 [1.00, 4.80]	
Heterogeneity: Not applicable					
Test for overall effect: Z = 2.99 (P = 0.003)					
Total (95% CI)			100.0%	2.90 [1.00, 4.80]	
Heterogeneity: Not applicable					
Test for overall effect: Z = 2.99 (P = 0.003)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS 111   Favours before NHS 111

C.2   Call handlers

C.2.1   Clinical call handlers (911 calls transferred to advice-line nurse) versus Non-clinical call handlers (911 dispatcher and BLS unit to all 911 calls)
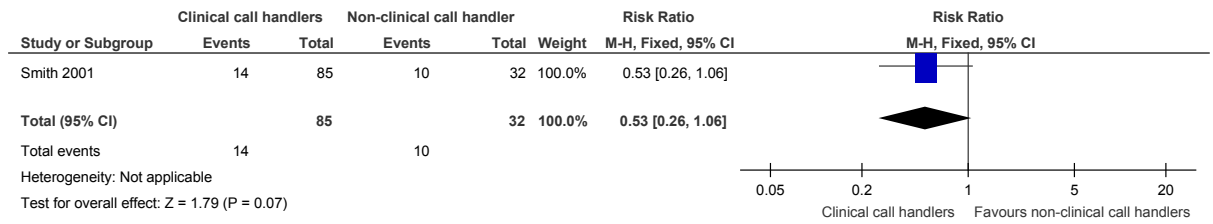
Figure 14: Patient satisfaction

Study or Subgroup	Clinical call handlers Events	Total	Non-clinical call handler Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI	Risk Ratio M-H, Fixed, 95% CI
Smith 2001	81	85	29	32	100.0%	1.05 [0.93, 1.19]	
Total (95% CI)		85		32	100.0%	1.05 [0.93, 1.19]	
Total events	81		29				
Heterogeneity: Not applicable							
Test for overall effect: Z = 0.81 (P = 0.42)							

0.5   0.7   1   1.5   2
Clinical non-clinical call handlers   Favours clinical call handlers

Figure 15: ED attendance

	Clinical call handlers		Non-clinical call handler			Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI		M-H, Fixed, 95% CI
Smith 2001	14	85	10	32	100.0%	0.53 [0.26, 1.06]		
Total (95% CI)		85		32	100.0%	0.53 [0.26, 1.06]		
Total events	14		10					
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.79 (P = 0.07)								

0.05 0.2 1 5 20

Clinical call handlers   Favours non-clinical call handlers

1

Figure 16: Visit to clinic, primary care physician or other community resource

	Clinical call handlers		Non-clinical call handler			Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI		M-H, Fixed, 95% CI
Smith 2001	20	85	7	32	100.0%	1.08 [0.50, 2.30]		
Total (95% CI)		85		32	100.0%	1.08 [0.50, 2.30]		
Total events	20		7					
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.19 (P = 0.85)								

0.2 0.5 1 2 5

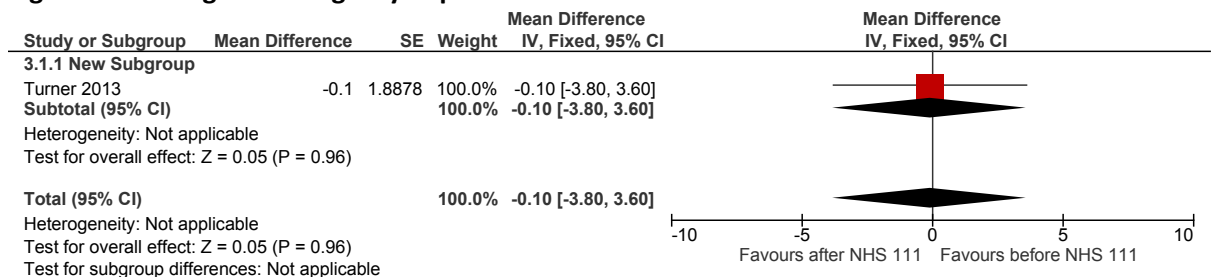Favours non-clinical call handlers   Favours clinical call handlers

2 C.2.2 Clinical call handlers (nurse or paramedic assessment with computer decision support) vs.
3 Non-clinical call handlers (usual ambulance response)

Figure 17: Emergency ambulance required

	Clinical call handlers		Non-Clinical call handlers			Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI		M-H, Fixed, 95% CI
Dale 2003	305	635	611	611	100.0%	0.48 [0.44, 0.52]		
Total (95% CI)		635		611	100.0%	0.48 [0.44, 0.52]		
Total events	305		611					
Heterogeneity: Not applicable								
Test for overall effect: Z = 17.75 (P < 0.00001)								

0.2 0.5 1 2 5

Favours Clinical call handlers   Favours Non-Clinical call handlers

4 C.2.3 Before (NHS Direct) and after NHS 111 pilot introduction

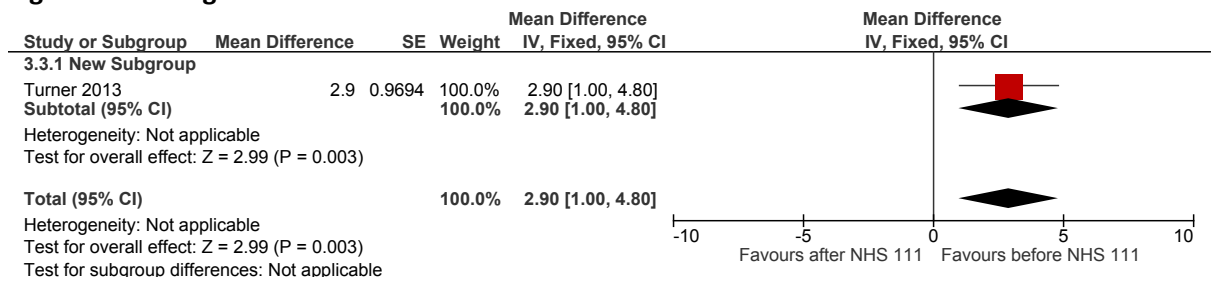### Figure 18: Change in emergency department attendance

				Mean Difference		Mean Difference
Study or Subgroup	Mean Difference	SE	Weight	IV, Fixed, 95% CI		IV, Fixed, 95% CI
3.1.1 New Subgroup						
Turner 2013	-0.1	1.8878	100.0%	-0.10 [-3.80, 3.60]		
Subtotal (95% CI)			100.0%	-0.10 [-3.80, 3.60]		
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.05 (P = 0.96)						
Total (95% CI)			100.0%	-0.10 [-3.80, 3.60]		
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.05 (P = 0.96)						
Test for subgroup differences: Not applicable						

-10 -5 0 5 10

Favours after NHS 111   Favours before NHS 111

5

Figure 19: Changes in calls to 999 ambulance services

				Mean Difference	Mean Difference
Study or Subgroup	Mean Difference	SE	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
3.2.1 New Subgroup					
Turner 2013	0.3	1.7347	100.0%	0.30 [-3.10, 3.70]	
Subtotal (95% CI)			**100.0%**	**0.30 [-3.10, 3.70]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.17 (P = 0.86)					
Total (95% CI)			**100.0%**	**0.30 [-3.10, 3.70]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 0.17 (P = 0.86)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS 111   Favours before NHS 111

1

Figure 20: Change in 999 incidents where an ambulance arrives at the incident scene

				Mean Difference	Mean Difference
Study or Subgroup	Mean Difference	SE	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
3.3.1 New Subgroup					
Turner 2013	2.9	0.9694	100.0%	2.90 [1.00, 4.80]	
Subtotal (95% CI)			**100.0%**	**2.90 [1.00, 4.80]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 2.99 (P = 0.003)					
Total (95% CI)			**100.0%**	**2.90 [1.00, 4.80]**	
Heterogeneity: Not applicable					
Test for overall effect: Z = 2.99 (P = 0.003)					
Test for subgroup differences: Not applicable					

-10   -5   0   5   10
Favours after NHS 111   Favours before NHS 111

2

3

4

5

Appendix D: Clinical evidence tables

D.1   Non-emergency telephone access

Study	Impact of NHS Direct on demand trial: Munro 2000[22]
Study type	Controlled before and after study.
Number of studies (number of participants)	1 (n=68,500).
Countries and setting	Conducted in United Kingdom; setting: the study was confined to examining the 3 sites of the first wave of NHS direct - covering Preston and Chorley, Milton Keynes, and Northumbria - which have been operational since March 1998.
Line of therapy	1st line.
Duration of study	1 year before and 1 year after introduction of NHS Direct pilot.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	UK.
Subgroup analysis within study	Not applicable.
Inclusion criteria	Any calls made to NHS Direct during the study period.
Exclusion criteria	n/a.
Recruitment/selection of patients	The 3 sites initially provided a service to about 1.3 million people, which did not change during the period of this study. The authors used the call logs created by the decision support software in use at each site to determine the number and characteristics of calls to NHS Direct. The authors sought routine data on activity in the year before and after the introduction of NHS Direct from the ambulance services, accident and emergency departments, and general practitioner cooperatives in the study areas.
Age, gender and ethnicity	Age: n/a. Gender (M:F): n/a. Ethnicity: n/a.
Further population details	-
Extra comments	Outcomes presented per trial site as data has not been merged by authors.
Indirectness of population	No indirectness.
Interventions	(n=68,500) Intervention 1: Non-emergency telephone access to the emergency care pathway. NHS Direct as introduced in 1998. Duration: 1 year before introduction. Concurrent medication/care: replacing the previous system. (n=68,500) Intervention 2: Multiple access points to the emergency care pathway – 999 + introduction of NHS direct

| | in 3 pilot sites. Duration: 1 year after introduction. Concurrent medication/care: n/a. |
| Funding | Academic or government funding |

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: NHS DIRECT + 999 versus 999.

Protocol outcome 1: Rates of referral to 999 (ambulance service).
- Actual outcome for UK: Ambulance services (changes in trends of service use) - Milton Keynes at 1 year after introduction of NHS Direct; Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Key confounders: not mentioned, before and after study
MD (CI): -0.90% (-2.00, 0.20).
- Actual outcome for UK: Ambulance services (changes in trends of service use) - Preston and Chorley at 1 year after introduction of NHS Direct; Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Key confounders: not mentioned, before and after study

MD (CI): -0.10% (-1.70, 1.50).
- Actual outcome for UK: Ambulance services (changes in trends of service use) - Northumbria at 1 year after introduction of NHS Direct; Risk of bias: Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Key confounders: not mentioned, before and after studyMD (CI): -0.20% (-1.20, 0.80).

Protocol outcome 2: ED demand (reduction in number presenting to ED).
- Actual outcome for UK: Accident and emergency departments (changes in trends of service use) - Milton Keynes at 1 year after introduction of NHS Direct; Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Key confounders: not mentioned, before and after study
MD (CI): 0.50% (-0.20, 1.20).
- Actual outcome for UK: Accident and emergency departments (changes in trends of service use) - Preston and Chorley at 1 year after introduction of NHS Direct; Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Key confounders: not mentioned, before and after study
MD (CI): -0.10% (-0.80, 0.60).
- Actual outcome for UK: Accident and emergency departments (changes in trends of service use) - Northumbria at 1 year after introduction of NHS Direct; Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Key confounders: not mentioned, before and after study
MD (CI): 0.20% (-0.50, 0.90).

| Protocol outcomes not reported by the study | Quality of life; Avoidable adverse events; Patient and/or carer satisfaction; Unplanned re-contact rates; Mortality. |

Study	Impact of NHS Direct on out-of-hours care trial: Munro 2005[23]
Study type	Controlled before and after study.
Number of studies (number of participants)	1 (n=5,180,000).
Countries and setting	Conducted in United Kingdom; setting: NHS Direct was introduced across England and Wales in 4 discrete waves (March 1998, March 1999, December 1999 and November 2000). The authors assumed that all NHS Direct sites in each wave started at the same time. They allocated each cooperative, ambulance service and ED to a wave, using information from Department of Health press releases and from NHS Direct sites themselves. Services in Scotland, which had no helpline during the period examined, were allocated to 'wave 5'.
Line of therapy	1st line.
Duration of study	3 years after introduction of NHS Direct.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	UK.
Subgroup analysis within study	Not applicable.
Inclusion criteria	All calls received.
Exclusion criteria	n/a.
Recruitment/selection of patients	The authors sent a postal survey to all GP cooperatives, ambulance services, and emergency departments in England, Wales and Scotland, asking each to provide the number of patient contacts (patient calls, 999 ambulance journeys or first attendances, respectively) made each month between April 1997 and March 2001.Ambulance data were provided separately for each health authority served. Data on NHS Direct call volumes during this period were obtained from published figures.
Age, gender and ethnicity	Age: n/a. Gender (M:F): n/a. Ethnicity: n/a.
Further population details	-
Indirectness of population	No indirectness.
Interventions	(n=5,180,000) Intervention 1: Non-emergency telephone access to the emergency care pathway. NHS Direct first 3 years after introduction. Duration: 3 years. Concurrent medication/care: n/a. Comments: data for England only. (n=5,180,000) Intervention 2: Multiple access points to the emergency care pathway – 999 + system available before introduction of NHS Direct. Duration: 3 years. Concurrent medication/care: n/a.
Funding	Academic or government funding (Department of Health)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: NHS DIRECT +999 versus 999.	

Protocol outcome 1: Rates of referral to 999 (ambulance service).
- Actual outcome for UK: Ambulance service use (change in trend); Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness
MD (CI): -1.40% (-2.30, -0.50).

Protocol outcome 2: ED demand (reduction in number presenting to ED).
- Actual outcome for UK: Emergency Departments use (change in trend); Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - High, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness
MD (CI): 0.86% (0.19, 1.53).

Protocol outcomes not reported by the study	Quality of life; Avoidable adverse events; Patient and/or carer satisfaction; Unplanned re-contact rates; Mortality.

Study	Impact of urgent care telephone service NHS 111 pilot sites trial: Turner 2013[42]
Study type	Controlled before and after study.
Number of studies (number of participants)	1 (n=251,190).
Countries and setting	Conducted in United Kingdom; setting: pilot sites were established in 4 geographical areas defined by primary care trusts, the healthcare commissioning organisations operating in England in 2010. Durham and Darlington is an urban area with a population of around 606,000; Nottingham is a city of around 300,000 with a large ethnic minority population; Luton is a city of around 200,000 with a large ethnic minority population; and Lincolnshire is a largely rural area with a city, a population of 700,000. Sites were chosen by English Department of Health.
Line of therapy	1st line.
Duration of study	2 years before and 1 year after introduction of NHS 111 pilot.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	Users of the emergency and urgent care systems in the 7 pilot and control sites recorded in routine service activity data as having accessed and used a range of emergency or urgent care services during the study period.
Exclusion criteria	n/a
Recruitment/selection of patients	Call handling was provided by an ambulance service in 1 site and NHS Direct in 3 sites. In all sites NHS 111 could be accessed by dialling '111' or indirectly where GP out-of-hours call-handling services were routed to 111.
Age, gender and ethnicity	Age: n/a. Gender (M:F): n/a. Ethnicity: 2 areas with large ethnic minority populations; 1 urban area; 1 largely rural area.
Further population details	-
Extra comments	Calls to 111 are answered and assessed by trained non-clinical call handlers using the NHS Pathways assessment system. If needed calls can be transferred for additional assessment and advice from an onsite trained nurse. During the course of the evaluation NHS Direct continued to operate as a national service within the pilot site areas.
Indirectness of population	Serious indirectness of intervention: NHS Direct continued to operate within pilot sites.
Interventions	(n=251,190) Intervention 1: Non-emergency telephone access to the emergency care pathway. Introduction of NHS 111 to 4 pilot sites in England, chosen by the DoH. Call handling was provided by an ambulance service in 1 site and NHS Direct in 3 sites. In all sites NHS 111 could be accessed directly by dialling '111' or indirectly where general practice out-of-hours call-handling services were routed to NHS 111. Calls to NHS 111 are answered and assessed by trained non-clinical call handlers using the NHS pathways system. If needed calls can be transferred for additional assessment and advice from an onsite trained nurse. At the end of the assessment callers are matched to the most

	appropriate service available at the time of their call from a range of services within the callers' locality using an electronic directory of services linked to the assessment system. This can include ED, urgent care centre, walk-in centre, minor injury unit, GP out-of-hours service, in hours GP, community services or home care. Referrals can be made to some services by NHS 111 at the time of the call, for example, direct dispatch of an emergency ambulance, appointment booking and transfer of the call to another telephone-based service. Duration: 2 years prior and 1 year after introduction of NHS 111. Concurrent medication/care: NHS Direct number still available to call in these areas during piloting. (n=251,190) Intervention 2: Multiple access points to the emergency care pathway – 999 + NHS Direct + 999. Duration: 2 years prior and 1 year after introduction of NHS 111. Concurrent medication/care: whatever services were available locally within the areas before NHS 111 was trialled.
Funding	Academic or government funding (Department of Health).

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: NHS 111+ 999 versus NHS DIRECT + 999.

Protocol outcome 1: ED demand (reduction in number presenting to ED).
- Actual outcome for UK: change in ED attendances; Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: Serious indirectness, Comments: NHS Direct was still in operation in the trial sites after introduction of NHS111; Blinding details: not possible
MD (CI): -0.10% (-3.80, 3.60).

Protocol outcome 2: Rates of referral to 999 (ambulance service).
- Actual outcome for UK: Changes in calls to 999 ambulance services; Risk of bias: Very high; Indirectness of outcome: No indirectness.
MD (CI): 0.30% (-3.10, 3.70).
- Actual outcome for UK: Change in 999 incidents where an ambulance arrives at the incident scene; Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: Serious indirectness, Comments: NHS Direct was still in operation in the trial sites after introduction of NHS111; Blinding details: not possible

MD (CI): 2.90% (1.00, 4.80).

Protocol outcomes not reported by the study	Quality of life; Avoidable adverse events; Patient and/or carer satisfaction; Unplanned re-contact rates; Mortality.

1

2

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D.2   Call handlers

Study	Dale 2003[5]
Study type	Pragmatic controlled trial.
Number of studies (number of participants)	1 (n=1246).
Countries and setting	Conducted in United Kingdom; setting: Conducted across 2 ambulance service sites covering the whole of Greater London, Birmingham, Coventry, the Black Country, and South Staffordshire; a total population of about 10 million.
Line of therapy	1st line.
Duration of study	Intervention time: 1 year.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis..
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	All 911 calls identified by call takers using priority despatch protocols as presenting with Category C (non-serious) problems were entered in to the trial, with the exception of hoax calls, alarm calls, and calls prioritised as potentially life threatening (category A) calls or serious calls (category B).
Exclusion criteria	Callers with comprehension/language difficulties that prevented adequate assessment by the call taker, as well as children under the age of 2 years, as these would have been automatically assigned the higher category A or B priority by the call taker.
Recruitment/selection of patients	Patients for whom emergency calls were made to the ambulance services between April 1998 and May 1999 during 4 hour sessions sampled across all the days of the week between 0700 and 2300.
Age, gender and ethnicity	Age - Mean (SD): Age, mean (SD): nurse group 44.5 (27.7); Paramedic group 44.4 (29.4); control group 49.1 (28.5). Gender (M: F): Men: women: nurse group (146/214); Paramedic group (107/168); control (265/346). Ethnicity: not stated.
Further population details	-
Extra comments	Patients in the intervention and control groups did not differ by sex, but there was a significant difference between groups for age; controls being on average about 5 years older (p=0.033). There were significant differences between paramedic and control groups (x2=46.4, df=4, p<0.001) and between paramedic and control groups (x2=61.4, df=4, p<0.001) for case mix. Patients in the intervention groups were less likely to have problems related to falls and accidents, but had a greater proportion in the 'sick unknown' category.
Indirectness of population	No indirectness.
Interventions	(n=635) Intervention 1: Clinical emergency call handlers (doctor, nurse, paramedic) - NHS direct (nurse-led service;

Study	Dale 2003[5]
	ratio where clinicians higher than NHS 111). n=635 calls (360 assessed by nurses, 275 by paramedics). Ambulances were dispatched to all calls at the commencement of prioritisation by the call taker, in accordance with existing ambulance service procedure at the time. Once identified, category C calls received a type of response dependent on the session to which they were allocated, either control or intervention. During intervention sessions, following ambulance despatch category C calls (non-serious problems) were passed to a nurse or paramedic for triage and advice. Computerised decision support was used to assist this process and to determine whether or not despatch of an emergency ambulance as indicated. If the patient was triaged as not requiring an ambulance, the caller was offered advice and asked whether they still wished an ambulance to attend. If the caller stated that they were happy to follow the advice, ambulance despatch was cancelled. The decision to cancel was never made without the patients' agreement. A total of 16 nurses and 10 paramedics participated in the study. Nurses were recruited from NHS services in London and the West Midlands that at the time of the study used the clinical decision support system for the assessment and triage of out of hours or NHS Direct calls. Paramedics were only available for the study in London, and they were recruited using the ambulance services internal vacancy bulletin. Duration: 1 year. Concurrent medication/care: n/a. (n=611) Intervention 2: Non-clinical emergency call handlers using algorithms for decision making (with access to clinical advice) - NHS 111 (non-clinical call-handler led; different in different areas). Duration: 1 year. Concurrent medication/care: n/a.
Funding	Academic or government funding.

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CLINICAL CALL HANDLERS (911 calls transferred to advice-line nurse) versus NON-CLINICAL CALL HANDLERS (911 dispatcher and BLS unit to all 911 calls).

Protocol outcome 1: Ambulance dispatches- Actual outcome: Ambulance required at End of follow-up; Group 1: 305/635, Group 2: 611/611; Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Other 2 - Low, Other 3 - Low; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study	Mortality at end of follow-up; Adverse events at end of follow-up; Quality of life at end of follow-up; Patient and/or carer satisfaction at end of follow-up; Presentation (numbers and appropriateness) to ED, GP and walk-in centres, minor injury units at end of follow-up; Referrals (numbers and appropriateness) to ED,GP and walk-in centres, minor injury units at end of follow-up.

Study	Smith 2001[38]

Study	Smith 2001[38]
Study type	Two phased prospective cohort study.
Number of studies (number of participants)	1 (n=550).
Countries and setting	Conducted in USA; setting: emergency medical services.
Line of therapy	1st line.
Duration of study	7 months.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	All emergency medical non-urgent 911 calls, in Kings County, Washington.
Exclusion criteria	n/a.
Recruitment/selection of patients	-
Age, gender and ethnicity	The age range for patients was 2 months to 100 years old. 39 (29%) patients were aged 0-10 years, 16 (12%) patients 11-20 years, 23 (17%) patients 21-30 years, 19 (14%) patients 31-40 years, 13 (10%) patients 41-50 years, 6 (5%) patients 51-60 years, 1 (1%) patient 61-70 years, and 16 (12%) patients more than 70 years. 61 (46%) patients were male and 72 (54%) patients were female.
Further population details	Not stated.
Extra comments	-
Indirectness of population	No indirectness.
Interventions	(n=169) 1: Phase 1: All calls meeting study criteria were triaged by the 911 dispatcher and a BLS unit was dispatched. The call line was then forwarded to the nurse line in order to obtain permission to make a follow-up phone call. Nurses did not give advice at this time. There was no delay in the on-scene treatment of the patient by the BLS personnel-as the nurses did not give any advice at this time. The nurse contacted the patient for follow-up by telephone within 72 hours. (n=381) 2: Phase II: The 911 dispatcher triaged all calls meeting study criteria. Once the caller agreed, he or she was transferred directly to the nurse and BLS unit was not sent on these calls. The nurse assessed the callers medical situation using the nurse line protocols and provided care based on the recommended protocols. Once the interaction was completed, the nurse obtained permission to call the person back in 72 hours for follow-up.

Study	Smith 2001[38]
	The nurses documented both the triage guidelines for care (nurse protocols) and call tracking (what the nurse recommended). Options for care included instructions for self-care at home, referral to a primary care provider, referral to urgent care clinics. All cases where the nurse triage guidelines recommended an ED evaluation or referral to 911 were returned directly to 911 for a BLS response.
Funding	Medic One Foundation and Premera Blue Cross.

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CLINICAL CALL HANDLERS (NURSE/PARAMEDIC) versus NON-CLINICAL CALL HANDLERS (USUAL AMBULABE RESPONSE).

Protocol outcome 1: Patient satisfaction End of follow-up.
- Actual outcome: Patient satisfaction; Phase 1:29/32: n=32, Phase 2:81/85; n=85; Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness

Protocol outcome 2: ED attendance at End of follow-up.
- Actual outcome: ED attendance; Phase 1: 10/32; n=32, Phase 2: 14/85; n=85; Risk of bias: All domain – very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness

Protocol outcome 2: Presentation (numbers and appropriateness) to GP and walk in centres, minor injury units at End of follow-up.
- Actual outcome: Visit to clinic, primary care physician or other community resource; Phase 1: 7/32; n=32, Phase 2: 20/85; n=85; Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study	Mortality at end of follow-up; adverse events at end of follow-up; Quality of life at end of follow-up; Ambulance dispatches at end of follow-up; Referrals (numbers and appropriateness) to ED, GP and walk in centres, minor injury units at end of follow-up.

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Study	Turner 2013[42]
Study type	Controlled before and after study.
Number of studies (number of participants)	1 (n=251,190).
Countries and setting	Conducted in United Kingdom; setting: pilot sites were established in 4 geographical areas defined by primary care trusts, the healthcare commissioning organisations operating in England in 2010. Durham and Darlington is an urban area with a population of around 606,000; Nottingham is a city of around 300,000 with a large ethnic minority population; Luton is a city of around 200,000 with a large ethnic minority population; and Lincolnshire is a largely rural area with a city, a population of 700,000. Sites were chosen by English Department of Health.

Study	Turner 2013[42]
Line of therapy	1st line.
Duration of study	2 years before and 1 year after introduction of NHS 111 pilot.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	Users of the emergency and urgent care systems in the 7 pilot and control sites recorded in routine service activity data as having accessed and used a range of emergency or urgent care services during the study period.
Exclusion criteria	n/a.
Recruitment/selection of patients	Call handling was provided by an ambulance service in 1 site and NHS Direct in 3 sites. In all sites NHS 111 could be accessed by dialling '111' or indirectly where GP out-of-hours call-handling services were routed to 111.
Age, gender and ethnicity	Age: n/a. Gender (M:F): n/a. Ethnicity: 2 areas with large ethnic minority populations; 1 urban area; 1 largely rural area.
Further population details	-
Extra comments	Calls to 111 are answered and assessed by trained non-clinical call handlers using the NHS Pathways assessment system. If needed calls can be transferred for additional assessment and advice from an onsite trained nurse. During the course of the evaluation NHS Direct continued to operate as a national service within the pilot site areas.
Indirectness of population	Serious indirectness of intervention: NHS Direct continued to operate within pilot sites.
Interventions	(n=251,190) Intervention 1: Non-emergency telephone access to the emergency care pathway. Introduction of NHS 111 to 4 pilot sites in England, chosen by the DoH. Call handling was provided by an ambulance service in 1 site and NHS Direct in 3 sites. In all sites NHS 111 could be accessed directly by dialling '111' or indirectly where general practice out-of-hours call-handling services were routed to NHS 111. Calls to NHS 111 are answered and assessed by trained non-clinical call handlers using the NHS pathways system. If needed calls can be transferred for additional assessment and advice from an onsite trained nurse. At the end of the assessment callers are matched to the most appropriate service available at the time of their call from a range of services within the callers' locality using an electronic directory of services linked to the assessment system. This can include ED, urgent care centre, walk-in centre, minor injury unit, GP out-of-hours service, in hours GP, community services or home care. Referrals can be made to some services by NHS111 at the time of the call, for example, direct dispatch of an emergency ambulance, appointment booking and transfer of the call to another telephone-based service. Duration: 2 years prior and 1 year after introduction of NHS 111. Concurrent medication/care: NHS Direct number still available to call in these areas during piloting.

Study	Turner 2013[42]
	(n=251,190) Intervention 2: Multiple access points to the emergency care pathway – 999 + NHS Direct + 999. Duration: 2 years prior and 1 year after introduction of NHS 111. Concurrent medication/care: whatever services were available locally within the areas before NHS 111 was trialled.
Funding	Academic or government funding (Department of Health).

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: NHS DIRECT + 999 (BEFORE CLINICAL CALL HANDLERS) versus NHS 111+ 999 (AFTER CLINICAL CALL HANDLERS).

Protocol outcome 1: ED demand (reduction in number presenting to ED).
- Actual outcome for UK: change in ED attendances; Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: Serious indirectness, Comments: NHS Direct was still in operation in the trial sites after introduction of NHS111; Blinding details: not possible
MD (CI): -0.10% (-3.80, 3.60).

Protocol outcome 2: Rates of referral to 999 (ambulance service).
- Actual outcome for UK: Changes in calls to 999 ambulance services; Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: Serious indirectness, Comments: NHS Direct was still in operation in the trial sites after introduction of NHS111; Blinding details: not possible
MD (CI): 0.30% (-3.10, 3.70).
- Actual outcome for UK: Change in 999 incidents where an ambulance arrives at the incident scene; Risk of bias: Very high; Indirectness of outcome: No indirectness.
MD (CI): 2.90% (1.00, 4.80).

Protocol outcomes not reported by the study	Quality of life at end of follow-up; Avoidable adverse events at end of follow-up; Patient and/or carer satisfaction at end of follow-up; Unplanned re-contact rates at end of follow-up; Mortality at end of follow-up.

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Appendix E: Health economic evidence tables

Study	[Turner 2012 [43]]				
Study details	**Population & interventions**	**Costs**	**Health outcomes**	**Cost effectiveness**	
Economic analysis: CC (health outcome: n/a) **Study design:** Retrospective service analysis with multivariate regression **Approach to analysis:** Analysis of establishing NHS 111 service in 4 pilot sites and changes in costs in urgent and emergency system **Perspective:** UK NHS **Follow-up:** 2 years before and 1 year after introduction of NHS 111 **Discounting:** Costs: n/a; Outcomes: n/a	**Population:** Patients within 4 pilot site areas (Nottingham, Luton, Lincolnshire, Durham and Darlington) using emergency and urgent care NHS services. **Cohort settings:** Start age: n/a Male: n/a **Intervention 1:** Usual care (999 and NHS Direct) **Intervention 2:** NHS 111	**Total costs (mean per patient):** Intervention 1: n/a Intervention 2: n/a Incremental (2–1): £10.00 (95% CI: £0.20, £19.80; p=NR) **Currency & cost year:** 2011 UK pounds **Cost components incorporated:** Total system impact cost per NHS 111 call: ED activity, ambulance calls, ambulance incidents, NHS direct, WIC/UCC/OOH services, NHS 111	n/a	**Analysis of uncertainty:** All sites impact analysis was undertaken with estimates being sampled 10,000 times to quantify uncertainty. This produced a probability of NHS 111 being cost saving of 21%. The probability of NHS 111 being cost saving varied across the observed pilot sites from 7% in Lincolnshire to 81% in Luton. Implementation analysis was undertaken to incorporate other anticipated system changes, such as the replacement of 0845 service offered by NHS direct. Cost estimates of NHS Direct and GP OOH telephone services being replaced by NHS 111 calculated for analysis. The number of calls observed at the pilot sites was extrapolated for the whole of England. Using the estimated costs, implementation analysis was carried out based on the removal of NHS Direct and GP OOH telephone services. The results found the probability of NHS 111 being cost saving in this scenario to be 100% for estimated 4.3m annual calls and 93% for 7.8m annual calls.	
Data sources					
Health outcomes: n/a. **Quality-of-life weights:** n/a. **Cost sources:** PSSRU, NHS direct core contract, NHS reference costs, department of health.					
Comments					

Source of funding: Policy Research Programme in the Department of Health. **Applicability and limitations:** Final report based only on observational analysis of pilot sites. The 4 pilot sites observed may not be representative of the entire system. NHS direct still available when NHS 111 introduced. Detailed costs were not available for inclusion in the analysis. Costs may have been double counted for call triage component, once for NHS 111 and for ambulance service. Large assumptions made around the savings made by NHS 111 replacing GP OOH and NHS Direct 0845. No health outcomes were included in the study.

Overall applicability[(a)]: Partially applicable   **Overall quality[(b)]:** Potentially serious limitations

Abbreviations: 95% CI: 95% confidence interval; CC: comparative costing; n/a: not applicable NR: not reported; OOH: out-of-hours; PSSRU: personal social services research unit; UCC: urgent care centre; WIC: walk in centre.
(a) Directly applicable/Partially applicable/Not applicable.
(b) Minor limitations/Potentially serious limitations/Very serious limitations.

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Appendix F: GRADE tables

F.1 Non-emergency telephone access

Table 14: Clinical evidence profile: Before and after NHS Direct pilot introduction

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	After NHS Direct pilot	Before NHS Direct pilot	Relative (95% CI)	Absolute		
Ambulance services use - Milton Keynes (Better indicated by lower values)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	68,500	-	Could not be calculated	MD 0.9 lower (2 lower to 0.2 higher)	⊕○○○ VERY LOW	IMPORTANT
Ambulance service use - Preston n Chorley (Better indicated by lower values)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	68,500	-	Could not be calculated	MD 0.1 lower (1.7 lower to 1.5 higher)	⊕○○○ VERY LOW	IMPORTANT
Ambulance service use - Northumbria (Better indicated by lower values)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	68,500	-	Could not be calculated.	MD 0.2 lower (1.2 lower to 0.8 higher)	⊕○○○ VERY LOW	IMPORTANT
A&E use - Milton Keynes (Better indicated by lower values)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	68,500	-	Could not be calculated.	MD 0.5 higher (0.2 lower to 1.2 higher)	⊕○○○ VERY LOW	IMPORTANT
A&E use - Preston n Chorley (Better indicated by lower values)												
1	observational	very	no serious	no serious	serious[2]	none	68,500	-	Could not be	MD 0.1 lower (0.8	⊕○○○	IMPORTAN

| | studies | serious[1] | inconsistency | indirectness | | | | | calculated. | lower to 0.6 higher) | VERY LOW | T |

A&E use - Northumbria (Better indicated by lower values)

| 1 | observational studies | very serious[1] | no serious inconsistency | no serious indirectness | serious[2] | none | 68,500 | - | Could not be calculated. | MD 0.2 higher (0.5 lower to 0.9 higher) | ⊕◯◯◯ VERY LOW | IMPORTANT |

[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.

Table 15: Clinical evidence profile: Before and after NHS Direct (all of England) introduction

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	After NHS Direct England	Before NHS Direct England	Relative (95% CI)	Absolute		
Ambulance services use (Better indicated by lower values)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	5,180,000	-	Could not be calculated.	MD 1.4 lower (2.3 to 0.5 lower)	⊕◯◯◯ VERY LOW	IMPORTANT
A&E use (Better indicated by lower values)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	5,180,000	-	Could not be calculated.	MD 0.86 higher (0.19 to 1.53 higher)	⊕◯◯◯ VERY LOW	IMPORTANT

[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.

Table 16:   Clinical evidence profile: Before and after NHS 111 pilot introduction

No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	After NHS 111 pilot	Before NHS 111 pilot	Relative (95% CI)	Absolute	Quality	Importance
			Quality assessment				**No of patients**		**Effect**			
ED attendances (Better indicated by lower values)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	251,190	-	Could not be calculated.	MD 0.1 lower (3.8 lower to 3.6 higher)	⊕○○○ VERY LOW	IMPORTANT
Calls to 999 ambulance (Better indicated by lower values)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	251,190	-	Could not be calculated.	MD 0.3 higher (3.1 lower to 3.7 higher)	⊕○○○ VERY LOW	IMPORTANT
Ambulance 999 incidents where an ambulance arrives at the incident scene (Better indicated by lower values)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	251,190	-	Could not be calculated.	MD 2.9 higher (1 to 4.8 higher)	⊕○○○ VERY LOW	IMPORTANT

[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 the evidence was based on indirect comparisons.
[3] Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.

F.2 Call handlers

Table 17: **Clinical evidence profile: Clinical call handlers (911 calls transferred to advice-line nurse) versus non-clinical call handlers (911 dispatcher and BLS unit to all 911 calls)**

	Quality assessment						No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Clinical call handlers (911 calls transferred to advice-line nurse)	Non-clinical call handlers (911 dispatcher and BLS unit to all 911 calls)	Relative (95% CI)	Absolute		
Patient satisfaction												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	81/85 (95.3%)	90.6%	RR 1.05 (0.93 to 1.19)	45 more per 1000 (from 63 fewer to 172 more)	⊕OOO VERY LOW	CRITICAL
ED attendance												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	14/85 (16.5%)	31.3%	RR 0.53 (0.26 to 1.06)	147 fewer per 1000 (from 232 fewer to 19 more)	⊕OOO VERY LOW	CRITICAL
Visit to clinic, primary care physician or other community resource												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	very serious[3]	none	20/85 (23.5%)	21.9%	RR 1.08 (0.5 to 2.3)	18 more per 1000 (from 109 fewer to 285 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] Indirect comparisons.

[3] Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.

Table 18:   Clinical evidence profile: Clinical call handlers (nurse or paramedic assessment with computer decision support) versus non-clinical call handlers (usual ambulance response)

	Quality assessment						No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Clinical call handlers (nurse or paramedic assessment + computer decision support)	Non-clinical call handlers (usual ambulance response)	Relative (95% CI)	Absolute		
Emergency ambulance required												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	305/635 (48%)	100%	RR 0.48 (0.44 to 0.52)	520 fewer per 1000 (from 480 fewer to 560 fewer)	⊕⊕⊕O MODERATE	CRITICAL

[1] 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.

Table 19:   Clinical evidence profile: Before (NHS Direct) and after NHS 111 pilot introduction

	Quality assessment						No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	After NHS 111 pilot	Before NHS 111 pilot	Relative (95% CI)	Absolute		
ED attendances (Better indicated by lower values)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	serious[3]	None	251,190	-	Could not be calculated.	MD 0.1 lower (3.8 lower to 3.6 higher)	⊕OOO VERY LOW	CRITICAL
Calls to 999 ambulance (Better indicated by lower values)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	serious[3]	None	251,190	-	Could not be calculated.	MD 0.3 higher (3.1 lower to 3.7 higher)	⊕OOO VERY	CRITICAL

											LOW	
Ambulance 999 incidents where an ambulance arrives at the incident scene (Better indicated by lower values)												
1	observational studies	serious[1]	no serious inconsistency	serious[2]	serious[3]	None	251,190	-	Could not be calculated.	MD 2.9 higher (1 to 4.8 higher)	⊕◯◯◯ 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 the evidence was based on indirect comparisons.
[3] 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 20: Studies excluded from the clinical review of non-emergency telephone access

Study	Exclusion reason
Anderson 2015C [2]	Inappropriate intervention. No comparison group- observational study to determine the effect of using experienced GPs to review the advice given by call handlers in NHS 111. No relevant protocol outcomes in the study (reported-percentage of calls where an outcome other than A&E attendance was recommended by the GP)
Bunn 2004[3]	Incorrect comparisons. Cochrane review. The review aimed to assess the effects of telephone consultation on safety, service usage and patient satisfaction and to compare telephone consultation by different health care professionals (e.g. nurse led telephone consultation versus doctor led telephone consultation; NHS Direct versus face-to-face contact; telephone consultation followed by face-to face contact versus face-to-face contact).
Cabrita 2004[4]	Incorrect intervention. Observational study to investigate the impact of an emergency medical services call on the management of acute myocardial infarction.
Geffner 2012[9]	Incorrect intervention. Prospective study of patients admitted to a hospital for transient or established stroke. The study aimed to find about stroke patients: who decides to seek medical help, where they go, how long it takes to contact the health system and to arrive at the ED.
Hsia 2011[10]	Incorrect intervention. Incorrect study design. Community survey and In-hospital stroke patients' survey. The study aimed to understand reasons for delay in seeking acute stroke care in the catchment area of a large urban community hospital and in the same hospital.
Knowles 2012[12]	Incorrect study design. No comparisons. Telephone survey of members of the general population to describe patients' experiences and views of an emergency and urgent care system in England.
Knowles 2016[13]	Incorrect study design- controlled before and after population survey
Lesneski 2010[16]	Incorrect intervention. A descriptive comparative study design used to examine factors associated with individuals delaying treatment after experiencing symptoms of an AMI.
Maatta 2010[17]	Incorrect intervention. Observational study conducted in an emergency medical communication centre and in emergency medical service. The study compared the key performance criteria before and after the dispatching centre reform.
Marklund 2007[18]	Incorrect intervention. The study aimed to evaluate a telephone nurse triage model in terms of appropriateness of referrals to the appropriate level of care, patient's compliance with given advice and costs.
Meischke 1995[19]	Incorrect intervention. Telephone interview of patients hospitalised with suspected AMI. The study aimed to determine the reasons patients with suspected acute MI delay seeking medical care or do not call 911.
Mellon 2014[20]	Incorrect interventions. An interrupted time series design to detect behaviour change following the introduction of the first Irish F.A.S.T campaign in suspected presentations of stroke to 2 Emergency Departments.
O'Cathain 2014[25]	Incorrect study design. No comparison. Cross-sectional postal survey to explore users' acceptability of NHS 111 in 4 pilot sites in England.
Patton 2013[29]	Incorrect intervention. A retrospective review of ambulance attendances

Study	Exclusion reason
	to the ED in a hospital over 7 non-consecutive days. The study aimed to identify if patients presenting by ambulance could be seen and treated more appropriately in other parts of the health service.
Payne 2001[30]	No comparison. Routinely collected data from NHS Direct in South East London for its first year of operation. The study provided detailed analysis of the activity and the relationship between patient characteristics and outcome over the first year of operation of NHS Direct.
Pereira 2012[31]	Incorrect study type (survey); incorrect intervention (angioplasty). The objective of this study was to re-evaluate the basic Portuguese performance indicators for primary angioplasty.
Rawles 1998[32]	Incorrect intervention. No comparisons. Prospective observational study to determine call to needle times and consider how best to provide timely thrombolytic treatment for patients with acute myocardial infarction.
Rosamond 1998[35]	Incorrect intervention. No comparisons. Prospective registry of patients presenting to the ED with signs and symptoms of stroke. The study aimed to assess the determinants of pre-hospital delay for patients with presumed acute cerebral ischemia in order to provide the background necessary to develop interventions to shorten such delays.
Schroeder 2000[37]	Incorrect intervention. Prospective study of individuals arriving at emergency departments with stroke symptoms. The study investigated the association between the use of emergency medical services and delay time among individuals with stroke symptoms and examines the predictors of emergency medical services use.
Swor 2000[39]	Incorrect intervention. Observational study to describe the characteristics of persons who recognised out-of-hospital cardiac arrests and to assess the impact of their actions on survival.
Turner 2011[41]	Interim report of Turner 2012 and Turner 2013 containing no relevant data
Turner 2012[43]	Final report of Turner 2011 and Turner 2013 containing no relevant data
Waalewijn 2001[44]	Incorrect intervention. Prospective study. All bystander witnessed circulatory arrests resuscitated by emergency medical service personnel were recorded. The objective of the study was to analyse the functioning of the first 2 links of the chain of survival: 'access' and 'basic CPR'.
Zerwic 2007[47]	Incorrect intervention. The purpose of this exploratory study was to examine the knowledge of stroke symptoms and risk factors in patients who have had a stroke and examine factors contributing to longer patient delay times during stroke.

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2 **Table 21: Studies excluded from the clinical review of call handlers**

Study	Exclusion reason
Andersen 2006[1]	Incorrect interventions. Study examined the accuracy of dispatch of the mobile emergency care unit to acute coronary syndrome cases.
Dale 2004[6]	Inappropriate comparison. Study assesses the safety of nurses and paramedics compared to each other in offering telephone assessment, triage and advice. Both interventions were clinical call

	handlers.
Dumont 2013[7]	Incorrect interventions. Study analyses the impact of diverting off-hour calls to Emergency Medical Dispatch Centres (EMDC) on time delays and revascularisation procedures for patients with ST-segment elevation myocardial infarction (STEMI).
Forslund 2006[8]	Incorrect interventions. Qualitative analysis. Study describes registered nurses and emergency operators experience of working together at an emergency dispatch centre.
Infinger 2013 [11]	Retrospective review of advice-line nurse calls already triaged as low acuity. No comparison group.
Leopardi 2013[15]	Incorrect interventions. Retrospective analysis to determine the ability of a dispatch staffed by emergency ambulance nurses to detect pre-hospital need for physician intervention.
Nicholl 1998[24]	Incorrect interventions. Health Technology Assessment. Assessment of costs and benefits of paramedic skills in pre-hospital trauma care.
O'cathain 2002[26]	Incorrect interventions. Study determines the acceptability of an emergency medical dispatch system to people who call 999 to request an ambulance.
O'cathain 2003[27]	Incorrect interventions. Study examines consistency of triage outcomes by NHS Direct using 4 types of computerised decision support software.
Palma 2014[28]	Incorrect interventions. The purpose of the study was to analyse factors associated with registered nurse under-triage of emergency medical services calls subsequently found to be associated with deaths.
Reilly 2006[33]	Incorrect interventions. The purpose of the study was to assess the relationship between dispatches of a cardiac nature in a Medical Priority Dispatch (MPD) system, and the actual clinical diagnosis as determined by an emergency department physician.
Renier 1995[34]	Inappropriate comparison. Intervention group: Emergency medical dispatcher (EMD)+ General Practitioner dispatcher (GPD)- presence of a stand-by GP versus Control group: EMD+GPD - No stand-by GP. The difference between the groups is the presence of a "stand-by GP"
Roth 2006[36]	Inappropriate comparison. Comparison between nurses and physicians in telephonic triage and consultations. Both interventions were clinical call handlers.
Turnbull 2012[40]	Incorrect comparison. Study examines the skills and expertise required and used by non-clinical call-handlers doing telephone

	triage and assessment
Turner 2012[43]	Incorrect study design. Report- Controlled before and after population survey prior to the launch of NHS 111 and 12 months later.
Wheeler 2015[45]	Narrative review-checked references
Wilson 2002[46]	Systematic review-checked references

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1 # Appendix H: Excluded health economic studies

2 **Table 22: Studies excluded from the health economic review of non-emergency telephone access**

Study	Exclusion reason
Lambert 2013[14]	This study was excluded due to methodological limitations with the study design. The study was not based on observed differences between services and rather elicited a hypothetical observed difference from patient surveys. It was felt this method had significant biases that could have large impact on the results.

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