

Paper Reference	Year	Methodology	Context/Setting	Perspective	Key Outcomes	Key Messages
Rademaker AW, Powell DG, Read JH. [43]	1987	Qualitative with descriptive statistics. Cross-sectional study of Emergency Department attendances, customised data collection instrument collecting patient demographics. Clinical case note review.	EDs in Alberta, Canada. Variety of pre-hospital systems (fire service tasked, hospital switchboard tasked and private company tasked ambulances.)	Nurse/clinician assigned assessment of need and medical severity, after arrival at ED by various methods. 'Inappropriate' status assigned retrospectively following clinical assessment. Comparison of cities with paramedic & non-paramedic models.	Inappropriate use in 42% of transports, with unmet need (i.e. ambulance needed or indicated, but not used by patient) in 58% of cases. Both figures lower (34% and 48% respectively, $P < 0.001$) in cities with paramedic ambulance systems. No difference in unmet need or 'inappropriate use' between paramedic and non-paramedic systems in small cities and for older patients.	<ol style="list-style-type: none"> 1. Paramedic staffed ambulance systems are beneficial to the general population of ED users, reducing unmet need and inappropriate use. 2. Inappropriate use and unmet need appear to be lowest in the older age categories. 3. The strongest statistical evidence of difference between paramedic and non-paramedic systems with respect to unmet need and inappropriate use is seen in the group of patients who are discharged from the ED.
Gardner GL. [23]	1990	Qualitative with descriptive statistics. Patient interview pro-forma and case-note review. Simple descriptive statistics.	Emergency Department, Manchester, UK.	Emergency Department doctors retrospective opinions on medical urgency based on patient pro-forma facilitated questionnaire and clinical case note review.	<p>38% of ambulance calls were deemed 'unjustified'. 50% of calls for trauma causes were deemed unjustified, whereas 20% of calls for medical causes were deemed unjustified.</p> <p>No significant differences between age distributions, or 'place of incident' were found between calls deemed necessary and unnecessary, but the 'initiator of the call' and the 'patient opinion of the severity/illness' did exhibit significant variation.</p>	<ol style="list-style-type: none"> 1. The initiator of the ambulance call is important in determining how likely the ambulance is to be medically necessary, with teachers, friends and bystanders being less able to 'appropriately' judge. 2. An increase in the public education (particularly in schools and workplaces) of first aid skills may improve decision making for more minor trauma cases, avoiding panic and allowing more reasoned decision making. 3. Patients appear to be able to more appropriately assess the urgency of their condition if they rate it as 'life threatening' or rated themselves as in 'severe pain'.
Tanaka A, Takano T, Nakamura K. [33]	1994	Mixed methods. Secondary analysis of routinely collected database, simple descriptive statistics. Postal questionnaire of sample of general population regarding demographic factors and response to hypothetical 'non emergency' situations.	Tokyo, Japan. Contrasting wards.	Retrospective analysis of Fire Service records of ambulance transportation, compared with response to a postal survey of hypothetical 'non emergency' situations, sampling a cross-section of adults >65 years in two wards of Tokyo.	<p>Percentages of ambulance transports for minor problems, ambulance transports on Sundays and elderly people who would call ambulances for hypothetical 'non emergency' problems were highest in the ward with <i>per capita</i> fewer clinics, hospital beds and physicians.</p> <p>In both wards, percentages of elderly who would call an ambulance for hypothetical 'non emergency' problems were higher when living with other older</p>	<ol style="list-style-type: none"> 1. In areas where family support is weakening, elderly persons are more likely to 'inappropriately' use high-cost emergency ambulance services for a variety of conditions. Where attitudes to caring for elderly relatives were more positive, this was reduced. 2. Insufficient development of primary health care resources and systems is driving inappropriate ambulance use. Reorientation of health systems is required.

					persons and no younger family members.	
Billittier AJ, Moscati R, Janicke D, Lerne A. [36]	1996	Qualitative, descriptive statistics. Prospective survey on those arriving to ED by ambulance. Survey completed by Emergency Physician, and then second survey on those deemed medically unnecessary by research assistant. Descriptive statistics (multivariate logistic regression).	Emergency Departments (Urban and Suburban) in New York, USA	Emergency Physician determination of medical necessity of ambulance transport to the ED at the time of clinical assessment.	11.3% of transports deemed medically unnecessary, associated with lower age (below 40 years) and medical insurance status (Medicaid). 39% of medically unnecessary transports had chosen ambulance transport due to lack of availability of alternative transport, with 82% willing to consider an alternative. 77% of medically 'unnecessary' patients had not called the ambulance themselves, and 17% reported someone other than a health professional recommended calling.	<ol style="list-style-type: none"> 1. Lower socioeconomic status, including insurance status and unemployment, is associated with medically unnecessary ambulance transportation. 2. The cost of operating alternative transportation methods (taxi, wheelchair van etc) is substantially less than an ambulance service, and as the majority of patients who did not clinically need an ambulance would consider this option, such a model may result in significant savings. 3. Despite a third of patients having a primary care physician, less than a quarter attempted to make contact. The advice of family, friends, bystanders and informal carers was significant in shaping the decision to use an ambulance, large proportion of ambulance calls were made on another's behalf.
Rucker DW, Edwards RA, Burstin HR et al. [16]	1997	Mixed methods. Cross-sectional study, self-administered demographic and health-status questionnaires (MOS-SF). Retrospective clinical case note review & coding. Descriptive statistics of results.	USA, five urban teaching hospital Emergency Departments receiving patients by ambulance transport.	Associations between self-reported demographics and health-status as ascertained by questionnaire of adult patients presenting to Emergency Department. Retrospective Emergency Department clinician-coded assessment of medical severity from clinical records. Sample of 6 clinical conditions included.	Emergency ambulance use (over all other methods of transport to ED) was associated with age >65 (OR 1.95), clinician-coded clinical severity (OR 3.11), poverty (OR 1.4), and worsening in general physical function (OR 1.05 for each point of a 12-point scale). Race, sex, education, Medicaid coverage frequency of ED use, living arrangements, primary care physician availability were not associated with emergency ambulance use.	<ol style="list-style-type: none"> 1. Ambulance use appears to be determined by a mixture of medical and socioeconomic factors. In particular there exists a complex relationship between income/education and type of medical insurance, which varies according to correction by physical function and geography. 2. Some of the use of ambulance services by patients with conditions of lower severity may be explained by worse global self-reported physical function.
Snooks H, Wriglet H, George S et al. [5]	1998	Systematically searched comprehensive literature review, 10 articles included, spanning 1977 to 1996.	All eligible global studies included including USA, UK, Ireland, Canada, and Norway.	Comprehensive review of published (and relevant unpublished) literature using keywords pertaining to ambulance use including keywords	Little variation in measures of 'inappropriateness' was seen across the studies with differing methodologies, ranging from 30% to 52%. Quantification of 'appropriateness'	<ol style="list-style-type: none"> 1. Assessment of 'appropriateness' of ambulances based on information only available after assessment overestimates inappropriate use and has limitations. 2. Appropriateness of ambulance use

				exploring assignment of (in)appropriateness and abuse/misuse.	was varied in terms of methodology, robustness, and frequently used a retrospective subjective clinician assessment. Objective scoring tools were sometimes rendered subjective by their application.	is less relevant than the appropriateness of the response to requests for help that the service receives. 3. Determination of patient type/condition (inc social needs alongside clinical needs) is required to understand workload and appropriate responses to it.
Palazzo FF, Warner OJ, Sadana A. [26]	1998	Mixed methods. Real-time and retrospective clinical case-coding, with simple descriptive statistics. Simple survey of some patients.	Emergency Department of a London (UK) Teaching Hospital	Real-time & retrospective assessment of 'appropriateness' of sample of patients transported by ambulance (after treatment). Clinically scored. Some patient-reported reasons for attending by ambulance.	53.7% of ambulance arrivals were deemed 'appropriate', 15.7% were 'inappropriate', and consensus was not achieved on 19% (11% excluded due data quality). Of the inappropriate attendances, 60% of patients believed they had a serious/life threatening condition, 16% were unaware of emergency GP services, and 8% wished to avoid a long delay in seeing the Emergency Department doctor.	1. Extrapolation of the study sample suggests 75,000 calls to London Ambulance Service each year may be 'unnecessary' using this method. 2. There is a need for public education and deterrents of ambulance use, in light of the high proportion who felt that a serious or life threatening condition was responsible for their symptoms or illness, when clinicians disagreed. 3. A clinician-led triage 'hot line' to appropriately dispatch ambulances according to clinical need may be a solution.
Richards JR, Ferrall SJ. [18]	1999	Mixed methods. Cross-sectional study, questionnaire completed by patients and Emergency Medical Services personnel. Descriptive statistics.	Urban Teaching Hospital, Level 1 Trauma Centre, USA.	Association of EMS provider's assessment on the medical urgency of the patients they brought to the Emergency Department by ambulance (along with EMS-staff reported clinical parameters) against patient reported perception of urgency and demographic factors.	43% of EMS providers assessed the ambulance requirement as clinically 'inappropriate', against only 22% of patients who felt their condition as a true emergency, despite 47% of the overall cohort having access to alternative transport. Characteristics associated with EMS perception of a true emergency were: male gender, age >51 years, higher education, chest pain or cardiac complains, shortness of breath and respiratory complains and Medicare insurance status. Characteristics associated with patient perception were: black ethnicity, higher education, shortness of breath and Medicare insurance.	1. 'Inappropriate' EMS use is a significant problem from both EMS providers determination and – to some extent – patient perspectives. This is despite access to alternative modes of transport. 2. Certain medical conditions/symptoms groups and demographic characteristics are associated with patient perception of 'true' medical emergency (and therefore 'necessary' ambulance use), by both EMS personnel and patients themselves, however the types of symptoms and their severity do not always seem to correlate.
Victor CR, Peacock JL, Chazot C et al. [42]	1999	Mixed methods. Retrospective review of	London Ambulance Service, UK.	Census of all routine incident forms across 64	Half of calls were made during GP working hours, with 70% of callers	1. Whilst majority of the calls were 'appropriate', some of the workload

		routinely collected data. Detailed workload questionnaire for sample of providers. Simple descriptive statistics.		ambulance stations for 1 week, coding of free text sections. Ambulance-staff completed workload questionnaire for same time period.	not trying to contact their GP before calling 999. Saturdays were busiest, Wednesdays quietest. Accidents were commonest (24% of calls). In 60% of cases the ambulance crew felt that the clinical condition required an ambulance, with the remainder suitable for primary care, social services or mental health services.	could be dealt with by other services. 2. More research needed to understand why people contact 999 service for non-emergency incidents, including 1.5% where there was no illness, and 5% where 'general assistance' was required. Social issues appear responsible in these cases. 3. More research needed to understand the views of GPs and other services in working with common workflows.
Marks PJ, Daniel TD, Afolabi O et al. [45]	2002	Quantitative. Clinical case-note review, routinely collected database (dispatch code) data, researcher-generated coding scheme	United Kingdom, Ambulance Service in Nottinghamshire.	Retrospective researcher assessment of appropriateness of ambulance dispatch to calls where no patient transport to hospital occurred, as determined from clinical case notes.	One quarter (26%) of 'non-transported' calls were assigned the highest dispatch priority at the time of call taking, using the AMPDS system. Falls accounted for 34% of non-transported calls, predominately elderly and predominantly coded as less urgent at the time of calling.	Falls in the elderly account for a high percentage of calls with no patient conveyance; referring into alternative pathways for this group may reduce workload. Limited flexibility of triage categories can create difficulties. The AMPDS triage system lacks specificity for problems of lower acuity, resulting in potentially unnecessary ambulance attendance.
Archer F, Morgans A, Allen F. [27]	2004	Qualitative. Self-administered surveys, discussion (focus) groups of emergency health workers, in-depth interviews with patients, discussion (focus) groups of health professionals.	Melbourne, Australia.	Perspectives of emergency service workers, emergency department health professionals and patients on the decision-process undertaken when calling for an ambulance, and the outcome of the call.	Non-medical factors were identified as important in the decision making process: the influence of bystanders, perception of the purpose of the emergency department and ambulance service. Decisions were based on subjectively perceived levels of pain and advice of laypersons. Patients were generally unaware of the medical skill level/service offered by ambulance professionals, citing a wish to drive themselves (or be driven by a friend/relative) as the biggest barrier to calling an ambulance. Medical professionals were often frustrated by poor decision making.	1. Patients make common errors in the decision-making process, relying heavily (and often incorrectly) on the advice of bystanders and laypersons (friends and relatives), which may over-ride their own decisions. 2. Patient perceptions of what constitutes an emergency differ from medical professionals' perceptions, which results in frustration amongst the medical profession. 3. Patient perceptions of the role of the ambulance service and the emergency department differ from those of medical professionals, suggesting public education programmes are needed to better communicate the respective roles of these services.
Ahl C, Nystrom M, Jansson L. [25]	2005	Qualitative. Semi-structured interviews, qualitative content analysis at three-levels.	Ambulance Service covering town and rural areas in South Sweden.	Patient reported experiences after calling an ambulance – retrospective, within 3 months of contact.	Theme of 'making one's mind up' - the process of recognising need for immediate help, exhausting other options, accepting ambulance is safest and securest form of	1. Deciding to call an ambulance is often seen as a major decision for patients, often preceded by attempts to self-manage the situation (either alone or in consultation with trusted

					transport, and emphasising the need for urgent care. Theme of 'waiting for help' – experiencing the wait as long, being alone with one's feelings whilst waiting for help, avoiding responsibility by virtue of needing help.	others/care givers). 2. Definitions of 'inappropriate' ambulance use should not be based solely on health professional's medical perspective, but should take account of patient's reactions to experiencing a perceived serious health event. 3. Once the decision has been made to call, the experience of receiving ambulance care is accompanied with feelings of legitimacy and expectation of further care in the responsibility of another (the ambulance/hospital).
Patterson PD, Baxley EG, Probst JC et al. [21]	2006	Quantitative audit. Case-note review, using expert consensus coding strategy for clinical impression. Descriptive statistics, including regression models.	Emergency Department billing records, South Carolina, USA	Retrospective clinician impression of necessity of ambulance transport based on expert consensus of Emergency Medical Technician/Paramedic 'impression' codes in medical notes, clinical Emergency Department diagnosis codes, Emergency Department procedure codes.	16.4% of EMS transports to hospital classified as medically 'unnecessary', with ages 0-2 having highest proportion of unnecessary trips (26.6%). Multivariable regression models indicate higher odds of medically unnecessary transport with younger age, higher odds in rural rather than urban populations, higher odds in African-American populations than other race groups, higher odds if insured with Medicaid, and higher odds if behavioural problem suspected when compared with trauma.	1. Although medically 'unnecessary' transport in children is modest, dispatch-classified behaviour-related/conduct-related complaints show a high proportion of medically unnecessary transportations. 2. Race-based disparities exist even after correction for factors associated with socio-economic status.
Yarris LM, Moreno R, Schmidt TA et al. [35]	2006	Qualitative with descriptive statistics. Structured researcher-administered face-to-face survey. Cross-sectional convenience sample. Descriptive statistics of categorical, continuous, binary and Likert responses.	Level 1 Trauma Emergency Department in Oregon, USA	Adult patient-reported preferences, opinions and decision-making factors when transported by ambulance to an Emergency Department, at time of treatment.	The majority (78%) of attendees were willing to consider alternative transport to hospital, by either car (62%) or taxi (56%). Factors associated with willingness included being 18-65, unemployed, using ED for routine care and not being admitted. Race, gender, health insurance status and medical interventions en route were not associated with willingness.	1. The majority of patients attending ED would have considering getting there by a method other than emergency ambulance if such was offered (although safety and appropriateness of alternatives were not assessed). Patients chose ambulances due to a lack of access to suitable alternative transportation. 2. A substantial number of patients would consider alternative destination other than the ED, if they felt their need would be addressed.
Larkin GL, Claassen CA, Pelletier AJ, Camargo CA. [34]	2006	Quantitative. Retrospective analysis of National routinely	USA	Ambulance utilisation patterns on a national level according to	For patients with mental health presentations, nearly one third (31%) arrived at the emergency	1. Mental health problems remain an important and substantial use of ambulances for transport from the

		collected hospital/ambulatory care database.		principal condition and demographics of users.	department from the community by ambulance. Older age, self-pay insurance, urban location, regions outside the Southern US and triage classification as 'urgent' predicted ambulance use. Across all presentations, significantly higher ambulance use associated with mental health, older age, African-American ethnicity, Medicare/Self-Pay Insurance, urban location, region outside the Southern US, presenting at night between 0000 and 0800 hrs, injury related presentations, 'urgent' triage classification or ultimately requiring hospital admission.	community to emergency departments. 2. Ambulance service utilisation varies according to a variety of socio-demographic, geographic and temporal factors that show a complex relationship and sub-regional variation. 3. Health insurance status is a predictor of ambulance service use across the spectrum of physical and mental health presentations.
Campbell NC, Iverson L, Farmer J et al. [28]	2006	Qualitative. Focus groups and semi-structured interviews with patients, using case vignettes to stimulate discussion regarding decision making. Inductive thematic analysis and 'conversation analysis'-style sequence analysis of transcripts.	Urban and rural general practice, Scotland, UK	Patient-reported decision making factors when assessing how and when to consult medical advice according to different levels of perceived medical urgency. Focus on routine and out-of-hours primary care, references to ambulance use during out-of-hours perceived emergencies.	Anticipated waiting times for appointments impacted on consulting intentions, especially if the severity of the underlying problem was uncertain. A variety of strategies developed by patients included early 'just in case' booking of appointments, being assertive, demanding visits or using out-of-hours services. Making a decision to consult out-of-hours was shaped by perceptions of urgency, which was itself influenced by personal opinions about the out-of-hours service (including how competent it was to deal with the described problem appropriately). Many would default to an emergency ambulance or emergency department, but less so if they were rurally located.	1. Patients develop their own strategies to get around barriers to accessing health services when perceived urgency dictates, although these strategies may not always be the most appropriate when viewed from an objective clinical perspective. 2. There are differences between urban and rural areas, with patients from rural areas more often delaying consulting with anyone until their routine, preferred provider is available, and more commonly electing not to present to emergency departments or call an ambulance due to rurality.
Kawakami C, Ohshige K, Kubota K, Tochikubo O. [32]	2007	Qualitative with descriptive statistics. Self-administered structured questionnaire, hypothetical non-	Yokohama, Japan. (Random resident selection).	Public perceptions of the financial worth of ambulance responses to a variety of hypothetical 'non-urgent' cases.	Men, the elderly and those without a car were more likely to call an ambulance in a medically unnecessary circumstance. Higher household income and previous experience of the primary	1. Socioeconomic factors including age, gender, household income and access to own transport show a relationship with the threshold for calling an ambulance in a medically unnecessary circumstance, increasing

		emergency case vignettes and dichotomous choice method. Descriptive statistics of categorical responses. Probit model of choice.			emergency medical centre had negative effects on the decision to call an ambulance.	use by 10-20%. 2. Demands for an ambulance do not decrease consistently with increases in hypothetical price paid by the user, suggesting decisions are more complex than monetary cost assessment alone.
Hjalte L, Suserud B, Herlitz J et al. [19]	2007	Qualitative with simple descriptive statistics. Retrospective review of routinely collected ambulance dispatch database. Questionnaire of medical need administered at scene of ambulance response.	Sweden.	Perception of medical need as assessed by Emergency Medical Technicians and registered nurses across three rural and metropolitan samples in the same ambulance service.	Percentage of patients not requiring medical intervention (and therefore deemed 'unnecessary') varied by condition: 42% for abdominal/urinary symptoms, 18% for chest pain, 17% for trauma/accidents. Over half (55%) of patients assessed as not having medical need for an ambulance could have travelled by car or taxi, whereas the remainder needed to be transported in a vehicle in which they could lie down.	1. Significant percentage of patients did not require any pre-hospital interventions at scene or en route to hospital, suggesting 'unnecessary' use of fully equipped and staffed ambulance as a method of transport. 2. Clearer criteria for the use of fully equipped and staffed emergency ambulances are required, appropriately highlighting individuals who need to travel on a stretcher but do not require emergency interventions or advanced skills during the journey.
Porter A, Snooks H, Youren A et al. [29]	2007	Qualitative. Facilitated focus groups of paramedics, thematically analysed according to modified-framework analysis principles.	UK, Ambulance Service.	Views of ambulance paramedics on the process, policy and expectations surrounding the clinical decision to not convey a patient to hospital in the absence of urgent clinical need (or patient agreement), after an emergency call for help.	Situations where conveyance was not required were broadly classified into elderly patients with no ongoing medical needs (e.g. falls) and calls where conveyance was clinically inappropriate after assessment - "rubbish" calls. Risk minimisation for both the crew and the patient was important in both. The patient's wishes (autonomy), the perceived clinical risk and the perception of the patient's capacity were key elements of non-conveyance decisions. However, crews felt the complexities of these assessments were not always clearly supported in the Ambulance Trusts' formal policies.	1. There are mismatches between policy and the complex practicalities of non-conveyance decision making, which requires a number of hard-to-measure factors to be considered. Crews may feel exposed, unsupported or angry by these expectations which are unsupported by formal policy. 2. Friends, relatives and carers become involved in a <i>de facto</i> shared decision making process during non-conveyance discussions, which often involved an element of negotiation. However, many elements of the established shared decision making healthcare models are absent in the emergency pre-hospital setting, rendering these models of limited value. 3. There is sometimes confusion around what a patient is <i>actually</i> asking for when they request an ambulance, particularly if they refuse conveyance, which can leave ambulance crews in a difficult

						decision about how to support their urgent care needs without leaving themselves open to criticism.
Moll van Charante EP, van Steenwijk-Opdam PCE, Bindels PLE. [41]	2007	Quantitative. Prospective cross-sectional analysis of demographic and clinical data of patients presenting to Out-Of-Hours co-operative, customised data-collection instrument. Retrospective analysis of routinely collected Emergency Department hospital data for direct comparison.	Out-of-hours co-operative in Ijmuiden, Netherlands.	Nurse and GP/GP trainee assigned clinical codes for presenting problems, diagnosis and clinical management. Comparison of management/follow-up between Emergency Department self-referrals, GP referrals and ambulance service referrals.	GPs handled 88% of all out-of-hours contacts, with outcomes split between telephone advice (41.7%), consultation at the OOH centre (47.5%) and a home visit (10.7%). Women and children under 5 were more likely to attend OOH co-ops. Self referral represented majority of ED attendances (43%), most commonly young adult males with traumatic injuries. Those brought to ED by ambulance tended to be older, with complaints related most commonly to chest pain, syncope, shortness of breath or trauma.	<ol style="list-style-type: none"> 1. GP out-of-hours co-operatives handle a substantial majority of the out-of-hours treatment contacts in this context. 2. Within the out-of-hours demand, self-referrals to Emergency Department constitute a small group of patients who – in general – appropriately select this treatment location. GP-referrals and ambulance service-referrals appeared to be ‘appropriate’ in this context, viewed from a clinical perspective, and select more appropriately than self-referrals.
Benger JR, Jones V. [31]	2008	Qualitative with descriptive statistics. Semi-structured questionnaire, descriptive statistics of categorical responses. Free-text replies analysed thematically – no further detail.	UK Emergency Department Teaching Hospital, Inner City, South West England	Patient-reported actions leading up to attending Emergency Department	Direct attendance to Emergency Department more common when help sought by bystanders. 28.5% of patients attended ED directly without seeking advice from any other urgent care channel, with 79% of these dialling 999 for an ambulance.	<ol style="list-style-type: none"> 1. Majority of patients who attended ED or dialled 999 and resulted in hospital admission for acute illness had attempted to seek professional help from primary care in the first instance. 2. Patients who attended ED directly by ambulance more likely to have had an ambulance called on their behalf by a bystander, or when they become ill in a public place. 3. Unfamiliarity with the arrangements for out-of-hours primary care is one factor driving the shift towards Emergency Department Care.
Zakariassen E, Hansen EH, Hunskar S. [39]	2009	Quantitative. Cross-sectional analysis of routinely collected dataset. Descriptive statistics.	National sample of Emergency Primary Healthcare Districts, Norway.	Analysis of National prospectively established database commissioned to record patients’ ways of contacting ‘emergency primary health care services’, including coded level of urgency and records of first-actions taken by callers. Analysis of those contacts coded as ‘red’ (potentially life-	2.3% of contacts to the emergency primary health care providers were coded as potentially life-threatening conditions. Of these, in 48% of cases a doctor and ambulance were simultaneously called out. 65% of the calls coded as potentially life-threatening were initiated by the patient, next-of-kin or a health professional.	<ol style="list-style-type: none"> 1. GP-based emergency primary health care services constitute an important part of the emergency system, and handle a small but significant number (estimated 42,500 based on study population scaling) of potentially life-threatening conditions annually. 2. Good co-operation between primary and secondary health services is required to delivery good emergency care, as a substantial

				threatening emergency) responses.		number of patients choose to opt to telephone the emergency primary health services rather than the Emergency Medical Communication Centres with potentially life-threatening problems.
Brown LH, Hubble MW, Cone DC et al. [44]	2009	Systematic search and meta-analysis of studies reporting US paramedic's ability to determine medical necessity. Primary outcome: negative predictive value of paramedic determinations. Meta-analysis using random effects model.	Studies involving US paramedics.	Paramedic determination of medical necessity for ambulance transport, compared against reference of physician opinion, hospital admission, and composite of physician opinion and clinical condition.	Five studies included. Negative predictive values ranged from 0.61 to 0.997, model aggregate of 0.912 (0.707-0.978).	1. Data do not support the practice of paramedics determining medically necessity (and therefore necessity of transport) 'at the scene', with implications for Emergency Medical Services systems. There is considerable variation across a small number of studies.
Tangerlini N, Pletcher MJ, Covec MA et al. [17]	2010	Quantitative. Secondary analysis of routinely collected data and case-notes. Retrospective case-control design. Descriptive statistics – regression model.	Fire-service based Emergency Medical Service, Urban area, California USA.	Analysis of demographic and clinical factors recorded on patient clinical record charts by Paramedics, associated with transport to hospital of adults >65 years old.	Factors associated with increased ambulance use: Male gender; black ethnicity; homelessness; increasing number of medical problems and medications; patients with asthma and no primary care physician. Factors showing no association with increased ambulance use: alcohol, substance misuse, psychiatric disorders.	1. Homelessness is strongly associated with ambulance use in the elderly (8 times greater in cases than controls). 2. Medical illness frequency and medication numbers, particularly when the patient does not have a primary care clinician, are associated with increased emergency ambulance use. 3. Providing housing to homeless elderly, and providing primary care clinicians to elderly with multiple medical diagnoses (particularly asthma) may reduce requirement for emergency ambulance transport in this setting.
Knowles E, O'Cathain A, Nicholl J. [37]	2011	Mixed methods. Telephone-administered qualitative questionnaire. Descriptive statistics	City in Central England.	Public perceptions of urgent and emergency care systems – random dialling telephone sample, respondents who had self-reported urgent care service use in the preceding three months.	Majority of users of urgent and emergency care (59%) contacted a GP in the first instance. Two-thirds of users (68%) contacted more than one service during their most recent urgent care event, with a mean of two services contacted per event. Satisfaction with all services diminished when four or more services are contacted per event.	1. The majority of patients experienced a 'system' of care, rather than a single service to meet their perceived urgent care need. 2. Longer care pathways (involving more services) result in lower levels of patient satisfaction. 3. People move 'along' pathways of services usually because they are informed to contact an alternative service to meet their needs, but in a minority of cases because they are

						not satisfied with the response received from the previous.
Patton GG, Thakore S. [40]	2012	Case note review audit.	Scottish Emergency Department Teaching Hospital, Urban and Remote Population	Emergency Department Consultant opinion on appropriateness of ambulance transport to Emergency Department through case note review.	70%/68% of ambulance attendances (from patient report form and Emergency Department notes) were classified as 'appropriate'. Patients who called for their own ambulance, and those called for after triage by NHS24 had higher rate of 'inappropriate' classification than 'appropriate' classification.	<ol style="list-style-type: none"> 1. Approximately ¼ (74-80%) of those attendances deemed inappropriate were deemed to be suitable for primary care management by Emergency Department Consultant. 2. Reducing inappropriate ambulance transports to the ED could reduce departmental work load by 11%. 3. Opening up access for ambulance service to other parts of the healthcare system rather than patient education alone could reduce ED workload.
Kirkby HM, Roberts LM. [30]	2012	Mixed methods. Qualitative with descriptive statistics - online self-administered questionnaire. Descriptive statistics including regression modes.	United Kingdom - general adult population.	Decision-making perspectives of general UK population, as invited by emailed forwarded to contacts of the research team.	<p>Almost all participants identified need for ambulance when it was required according to case vignettes, but less so for a stroke vignette (74.8%).</p> <p>No participant characteristics were identified that were predictive of 'inappropriately' calling an ambulance once confounding was corrected for, although having received first aid training was negatively associated in some vignettes.</p>	<ol style="list-style-type: none"> 1. Majority of participants would call appropriately for an ambulance in genuine emergency. 2. High levels of 'inappropriate' calls to ambulance services as defined by clinician input to hypothetical vignettes, particularly for early labour. Lower rates if participant had received first aid training. 3. Public need educating that needing to go to hospital urgently and needing an ambulance are different concepts, need for nationwide First Aid training.
Morgans A, Burgess S. [22]	2012	Comprehensive literature review.	Electronic search of global citation databases.	Definition and measurement of concept of 'inappropriate' emergency healthcare utilisation through literature review.	'Inappropriate' users of Emergency Services are divided in to two cohorts: those not experiencing a health emergency, and those who do not seek healthcare when they should. The literature suggests many patients try to avoid acute services if possible. Medical classification of urgency based on physiological measures contrasts with patient-based determination of urgency defined by psycho-social factors.	<ol style="list-style-type: none"> 1. It is a patient's right to access emergency healthcare when they feel the need, and the responsibility of healthcare workers and systems to prioritise needs, and provide treatment to all patients. This creates complexity around whose responsibility it is to determine 'inappropriateness' and for what reason. 2. The point of access into the health system during an acute event provides an opportunity to selectively educate patients and carers to change help-seeking behaviours.
Durant E, Fahimi J. [20]	2012	Quantitative. Secondary analysis of routinely collected database,	Analysis of USA National Database (NHAMCS) 1997-2008	Retrospective determination of acuity of medical condition	Increasing age, non-private housing, Medicare/Medicaid (public) insurance status, and	<ol style="list-style-type: none"> 1. Vulnerable populations disproportionately use ambulances for low acuity conditions, principally

		multivariate logistic regression.		based on arrival triage scores, for a sample of adults transported to Emergency Department by Ambulance.	arrival between 11pm and 6:59am were associated with ambulance use. Ambulance use was positively associated with psychiatric, toxicological and psychological presentations. Patients arriving to ED by ambulance were more likely to receive lab tests, radiographic imaging and be admitted to hospital.	the homeless, non-privately housed and those who have public medical insurance. 2. Strong association exists between ambulance use for low-acuity conditions and psychiatric/mental health conditions, which may be because of the management challenges rather than the clinical need this group present. 3. Among patients with low-acuity conditions who arrive by ambulance, there is a higher rate of laboratory tests, diagnostic imaging and hospital admission, representing a target for more appropriate resource use.
Booker MJ, Simmonds RL, Purdy S. [24]	2013	Qualitative. Semi-structured interviews, thematic analysis (constant comparative methodology).	UK Ambulance Service, South West England.	Patient and carer views, after calling ambulance (transported & non-transported).	Superordinate theme of 'patient and carer anxiety in urgent-care decision making'. Four subthemes: 'perceptions of ambulance based urgent care', 'contrasting perceptions of community based urgent care', 'influence of previous urgent care experiences in decision making' and 'lay assessment of medical risk'.	1. Many calls to 999 based on fundamental misconceptions of what other urgent care can provide. 2. Patient and carer anxiety about serious illness drives ambulance calls, seen as 'least risky' strategy. 3. Callers with care responsibilities often default to the most immediate route into care, or that which is perceived as the 'least risky' option, which is often 999 ambulance
Togher FJ, O'Cathain A, Phung V et al. [38]	2014	Qualitative. Semi-structured face-to-face and telephone interviews, thematic framework analysis of verbatim transcripts.	United Kingdom, Ambulance Service (East Midlands), mix of urban and rural populations across five counties	Perspectives of recent ambulance service adult users (variety of 'hear and treat', 'see and treat' and 'see and convey' responses).	Ambulance service users reported anxiety about their health, and valued reassurance about their advice, treatment and care. Professional behaviour of staff, good communication (including feeling listened to and being kept informed), a short wait for help and continuity during transfers between services/locations were perceived as delivering reassurance.	1. Users call services with a range of clinical conditions and a range of urgency, but value similar aspects of their care from the ambulance service, with most value attributed to actions that reduce anxiety. 2. Performance and quality metrics should include reference to the levels of anxiety felt by service users, and address processes which offer reassurance. 3. As the majority of ambulance contacts are unplanned, the values that patients place on aspects of the ambulance service may be unique to pre-hospital care systems.