Table 1: Summary of published studies regarding non-conveyed patients and alternatives to transportation to A&E for 999 patients with non-urgent problems

Lead Author (reference)	**Year of publication**	**Location**	**Study design**	**Key findings**	**Authors' Conclusions**
Current practice: non-transportation					
Jaslow [9]	1997	Cities across the USA	Telephone survey of urban EMS systems to determine use of EMS-initiated refusal policies, involvement of physicians in the decision-making process and presence or absence of alternatives to EMS transport.	100% response rate was achieved. 17% (n = 34) of EMS providers have policies which allow refusal of EMS transportation, 21 of these do not require physician approval for the decision. 7 of the 34 have a formalised alternative transport programme in place. Nationwide, only 19 (10%) of cities have any alternative transportation, usually minivan or taxi.	Few EMS systems have policies that allow refusal of transportation to hospital, which may be due to the lack of alternative means of transportation available.

Non-conveyed: patient characteristics					
Goldberg [10]	1990	Chicago	Retrospective review of claims against large metropolitan EMS system.	Over the 12 year period, the EMS system responded to over 2 million calls of which 60 resulted in a claim being made against the service.	More than one third of the claims have been settled with the majority involving no monetary or nominal out-of-court settlement. During the study period, the rate of claims appeared to be increasing.
Soler [11]	1985	Florida	Retrospective review of malpractice claims against 1 EMS system.	Over ten years, 265060 incidents were attended. 16 claims were filed for 11 of these incidents.	The two greatest problems identified were inadequate record keeping and patients who did not fit clearly into any one protocol for treatment.

Selden [12]	1991	Anchorage, Alaska	Retrospective review of prehospital documentation for 'no-patient runs'	Of 11,780 callouts, 23% (n = 2698) were evaluated but not transported by their paramedic attendant. Calls were shorter, and patients older than those transported. Calls were more likely to be at night and were most frequently for minor trauma, blunt head trauma and no illness/injury. Patient disposition was: released to friends/relatives (39.1%); presumed alone (35.5%); to police (18.2%); or other medical care (7.3%)	This paper describes the patient population of calls ending in no transportation and the authors conclude that other EMS systems should monitor their 'no-patient runs' in a similar way to ensure quality of care, and low medico-legal risk.

Stark [13]	1990	Oregon	Retrospective review of patients who initially refused care to describe the group and to determine eventual prehospital disposition.	For 10% of calls (n = 169) within the study period the base physician was contacted because the patient was refusing care. Of these, 53% were left at scene against medical advice, 28% were taken to hospital, 13% were left with a friend and 5% had other outcomes.	The authors conclude that further research is required, but that statutes may need to be developed that allow police to apply protective custody for patients judged to have impaired mental capacity if litigation is to be avoided.
Holroyd [15]	1988	Various locations, USA	Case studies	Based on two case histories, case conference contributors discussed the risks of non-transportation, medical control issues, competence to decide upon treatment and the role of family and friends.	The contributors conclude that capacity and conservative approach to treatment must be balanced. Direct physician contact should be sought, meticulous documentation should be kept and 'a spirit of creativity and compromise' is required.
Dernocoeur [16 *]	1982	N/K	Case studies	Discussion based on case histories	N/K

Berne [17*]	1986	N/K	Case studies	Discussion based on case histories	N/K
Non-conveyance: appropriateness and outcomes					
Selden [19]	1990	Anchorage	Retrospective review of documentation in consecutive patients who were evaluated by paramedics but not transported to hospital.	Criteria for appropriate release were met in 65% of the 2698 patients included. Criteria not documented in inappropriate releases were: risks of refusing care; vital signs; mental status; lack of impairment and history. One inappropriate release was believed to have been associated with patient complications.	Services should consider implementing standardised criteria for documentation which could improve care, reduce inappropriate release and be more likely to meet medico-legal requirements.

Sucov [20]	1992	Pittsburgh	Review and telephone follow up of patients who refused transportation to hospital.	5% (n = 188) of patients attended during the study period refused transportation. 94 of these responded to follow up, of whom 6 were admitted to hospital within 3 days of EMS attendance; a further 31 contacted or saw their regular physician.	Telephone follow up was not considered adequate to track the outcomes of these patients. Determination of competency by crews was not well documented. As a number of patients who refuse transportation then require hospital admission, all EMS systems should have clinical protocols for the management of patients who refuse treatment and/or transportation.

Burstein [21]	1996	New York	Telephone follow up of patients who refused medical assistance and transport to hospital (RMA)	199 patients responded (62% of those recruited), of whom 95 sought further medical care within 1 week. 13 of these were admitted to hospital, 6 with respiratory or cardiac complaints. 1 patient died.	Due to the number of RMA patients that seek further medical assistance for serious problems, the authors conclude that efforts should be made to keep numbers in this group to a minimum.
Socransky [22]	1998	Milwaukee	Retrospective review of the prehospital and hospital notes of paramedic attended patients with hypoglycaemia	Over the 7 month study period, 571 cases met the inclusion criteria. Of these, 412 refused transportation and 159 were taken to hospital. 63 of these were admitted, with 1 death from prolonged hypoglycaemia. Rates of relapse (within 48 hours) were not different between the groups.	Prehospital management of patients with hypoglycaemia in this system appears to be effective and efficient. All EMS providers should consider training EMS providers in the management of hypoglycaemic patients.

Mechem [23]	1998	Philadelphia	Prospective, descriptive short term follow up of diabetic patients treated for hypoglycaemia who refused transportation to hospital.	103 of 132 patients recruited to the study were contacted by telephone. 94 had no recurrence of symptoms; 9 patients had a recurrence of hypoglycaemia and called 911 again, 8 of whom were taken to hospital and 3 were admitted. The remaining patient refused transportation again.	The practice of treating and releasing most hypoglycaemic insulin-dependent diabetic patients who return to normal mental status after dextrose administration appears to be generally safe. Patients should be advised of the risks of recurrent hypoglycaemia.

Zachariah [18]	1992	Texas	Retrospective review and telephone follow up of non-transported patients	93 patients followed up (59% response rate); 60 sought further care from physician: 15 were admitted to hospital, including 2 patients to ITU, and 2 who died. Crews refused or agreed to not transport in 50 cases	Serious and fatal outcomes identified in non-transported patients; patients refused or who agreed with crew to stay at home were more likely to be hospitalised.
Cone [8]	1995	Philadelphia	Retrospective review of documentation concerning calls for which the patient refused treatment or transportation, and follow up of these patients through their medical records and by telephone.	81 calls were included, of which medical advice was sought in only 23 cases. Call documentation was inadequate in 27 of the cases. Follow up was obtained for 54 patients (67%), of whom 37 sought no further care; 7 saw their own physician within a few days of the 911 call, 10 were seen in an ED resulting in 7 admissions.	Documentation was better when medical advice was sought. Some patients who initially refuse care may be ill and eventually hospitalised. Further research may inform the development of the role of medical control.

Goldberg [10]	1990	Chicago	Retrospective review of claims against large metropolitan EMS system.	Over the 12 year period, the EMS system responded to over 2 million calls of which 60 resulted in a claim being made against the service.	More than one third of the claims have been settled with the majority involving no monetary or nominal out-of-court settlement. During the study period, the rate of claims appeared to be increasing.
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Field triage and diagnosis by paramedics					
Hunt [24]	1999	Missouri	Comparison of paramedic decision about necessity to transport with ED physician decision based on the same criteria.	58% of eligible patients were included. Paramedics judged 29% of transports to be unnecessary, compared to 30% judged by physicians, with agreement in 76% of cases. Paramedics undertriaged 11% of cases compared to the physician decision.	Paramedics and physicians agreed that a significant proportion of patients did not need transportation, although agreement about which cases was not high. The undertriage rate was low but criteria need to be refined before implementation could be recommended.

Sasser [25]	1998	North Carolina	Non-interventional survey comparing the assessment of need for transportation by paramedics following transportation and ED physicians following initial assessment.	Participation rate was low (15% of 3347 eligible cases were included) Agreement was 0.68, with assessors disagreeing in 164/509 cases.	Disagreement existed between paramedics and ED physicians which could lead to some patients being denied transportation when they need to attend the hospital if this were to be implemented as practice.

Hauswald [26]	1998	Albuquerque, New Mexico	Prospective survey and medical record review. Comparison of paramedic and ED diagnosis and treatment.	Agreement between paramedic and ED chart reviewer was low for both ambulance transport (kappa = .47) and need for ED treatment (kappa = .32). Paramedics recommended alternate transportation for 95/176 patients, of whom 21 were judged to have needed ambulance transport, including opioid overdose, first time seizures and sepsis. They recommended non-ED care for 76 patients, of whom 32 were assessed as needing ED care including child abuse and active labour.	Paramedics will need further training before they can safely determine which patients do not need ambulance transport or ED care.

Ferrall [27]	1998	Sacramento, California	Prospective study of patients taken to hospital by emergency ambulance. Paramedics were asked to assess need for transportation and to predict disposition of patients.	Paramedics judged 190/406 patients to have not required transportation to hospital and correctly predicted disposition for 79% of the cases.	Paramedics can predict patient disposition with reasonable accuracy.

Schmidt [29]	2000	Oregon	Prospective observational assessment of scene categorisation of patients to transportation alternatives (shadow) and an associated retrospective EMS chart review.	Sensitivity and specificity for being assessed as needing ambulance transportation against need for advanced life support during transportation were: 95% and 33% respectively. 23 patients categorised as not needing transportation had events in the ambulance warranting ambulance transport.	Up to 11% of patients determined on scene not to need ambulance transportation experienced a critical event. EMS systems need to determine an acceptable level of undertriage. Further research is required to assess whether better adherence to protocols might increase safety.

Santoro [30]	1998	Boston	Comparison of paramedic and physician diagnosis following patient evaluation. Independent review by 4 raters to assess agreement	157 cases were included, in 124 cases there was agreement between paramedic and physician, in 17 they disagreed but this was judged to be unlikely to have harmed the patient, in the remaining 10 cases disagreement about diagnosis was judged to have been potentially harmful to the patient.	Generally agreement was high, although in 6% of cases disagreement could have led to an adverse outcome. The authors conclude that the safety of out of hospital care needs to be more formally assessed.

Treat and Release					

Hauswald[28]	1999	Albuquerque, New Mexico	Prospective survey and linked medical record review. Crews were trained in new protocols. Subsequent hypothetical paramedic triage decisions were compared with ED physician review of notes to determine whether actual diagnosis required treatment in the ambulance. Protocol compliance was also reviewed.	Protocol was followed in 156/190 cases. Disagreement was high, but was mainly for patients overtriaged to ambulance transportation when they did not need it. 13 of 20 patients triaged to 'alternate transportation' needed the ambulance. Following the protocol would have eliminated 9 of these, but the other included ectopic pregnancy, pericarditis and multiple abdominal trauma.	Only 11% of patients were triaged to alternate transportation but over half of these were mistriaged. Even if protocols are improved and followed, most patients will require ambulance transportation.

Wolford [33]	1996	Michigan	Prospective evaluation of criteria for Treat and Release for hypoglycaemia. Shadow intervention only.	In comparison to ED treatment, T&R criteria showed sensitivity of 41% and specificity of 88%. 29% of patients were identified as suitable for treat and release according to the criteria used, of these 2 received additional treatment and 3 others were admitted.	Criteria do identify hypoglycaemia patients for field release with high specificity, but some patients who require inpatient care may also be identified incorrectly. Criteria require further refinement
Thompson [34]	1991	Illinois	Development of criteria for treat and release of hypoglycaemic patients. Retrospective application of criteria to a further sample of cases.	The criteria successfully selected 19 of 23 patients who had been discharged from the ED for prehospital release. No patients were selected for prehospital release that required additional major intervention or hospital admission.	A larger prospective study recommended to confirm results.

Billitier [35]	1998	Buffalo, New York	Prospective observational study of treat and release of patients with resolved hypoglycaemia, with on-line medical approval	34 patients were recruited to the study and given release instructions rather than transportation to hospital. All were followed up by telephone after 24 hours: 91% reported no complications, 2 self treated following recurrence of symptoms and 1 had been found unresponsive and was admitted to a long term care facility for hypoglycaemic encephalopathy. 85% of patients were very satisfied with not having been transported to the ED.	Patients with hypoglycaemic events generally preferred release without transportation to hospital. A randomised sample is necessary to determine the complication rate compared to controls.

Simonson [36]	1993	Arizona	Retrospective review of ED records for patients with seizure who were brought in by ambulance. Costing of care provided and figures extrapolated to US population.	Of 37,440 patients treated within a six month period in the ED, 204 were seizure patients who arrived by ambulance. 18 cases were for uncomplicated grand mal seizures in a managed epileptic, and cost an average of $812 per patient. For the USA this would translate to $270 million per year.	These unnecessary transports and treatment in ED are costly, although impact on a single health care budget may appear small.

Holbrook [37]	1994	Atlanta, Georgia	Comparison of shadow triage decisions made by paramedics following training to use algorithmic protocols with need determined by medical record review.	29% of calls were correctly categorised by paramedics as BLS-delayed or EMS initiated refusal.	An urban 911 system could be improved by implementation of a medically controlled algorithmic-driven programme for crews to triage minor emergency patients to other responses.

Snooks [5]	2001	London	Controlled trial of Treat and Refer training and protocols. Comparison of processes and outcomes of care of intervention and control groups. Semi structured interviews with stakeholders and focus groups with crews.	Conveyance rates were similar in intervention and control groups (93/251, 37.1% vs 195/537, 36.3%) but intervention group job cycle times were longer (53.0 vs 47.4 minutes). 3 non-conveyed patients admitted to hospital within 14 days were judged to have been left inappropriately at home. Intervention patients were at least as satisfied with their care as control group patients. Stakeholders were positive but cautious about the initiative. Crews reported improved job satisfaction but greater need for support to change practice.	Operational, safety and change management issues were identified within this trial. Introducing Treat and Refer protocols to the ambulance service is a complex clinical and service development, and further testing is required before widespread implementation can be recommended.

Triage and transportation to alternative receiving unit					

Schaefer [38]	2002	Seattle	Cohort study with matched historical controls. During the intervention period crews could offer transportation to a non-ED destination. Patients were followed up by interview and cases taken to an alternate destination were reviewed by the study physician.	Of 1016 patients meeting study eligibility criteria, 453 were taken to ED, 81 to a medical clinic and 482 were taken elsewhere or not transported. This represented a drop in patients taken to ED, compared to historical controls (44.6% vs. 51.8%, p = .001); and a rise in numbers taken to a clinic (8.0% vs. 4.5%, p = .001) or home care (47.4% vs. 43.7%, p = .043). No adverse events were identified following transportation to an alternative destination, although 5 patients were taken to clinic and transferred to the ED. All responding patients (42/81) reported satisfaction with their care.	The programme resulted in a modest decrease in conveyance to ED, was safe and satisfactory to patients. However, non-urgent use of ED facilities is complex.