Understanding variation in ambulance service non-conveyance rates: a mixed methods study

Alicia O'Cathain,[1]* Emma Knowles,[1] Lindsey Bishop-Edwards,[1] Joanne Coster,[1] Annabel Crum,[1] Richard Jacques,[1] Cathryn James,[2,3] Rod Lawson,[4,5] Maggie Marsh,[6] Rachel O'Hara,[1] Aloysius Niroshan Siriwardena,[7] Tony Stone,[1] Janette Turner[1] and Julia Williams[8,9]

[1]School of Health and Related Research (ScHARR), University of Sheffield, Sheffield, UK
[2]Yorkshire Ambulance Service NHS Trust, Wakefield, UK
[3]Association of Ambulance Chief Executives, London, UK
[4]Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, UK
[5]Medical Humanities Sheffield, University of Sheffield, Sheffield, UK
[6]Sheffield Emergency Care Forum, Sheffield, UK
[7]School of Health and Social Care, University of Lincoln, Lincoln, UK
[8]School of Health and Social Work, University of Hertfordshire, Hatfield, UK
[9]South East Coast Ambulance Service NHS Foundation Trust, Crawley, UK

*Corresponding author a.ocathain@sheffield.ac.uk

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Scientific summary

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Background

NHS England proposes a shift within the NHS to offer emergency and urgent care closer to patients' homes. The ambulance service in England has fulfilled this remit for a number of years by not conveying a large proportion of urgent calls to an emergency department. In 2015/16 ambulance services responded to nearly 11 million calls at a cost of around £1.8B. Around half of patients were not conveyed to an emergency department. Monthly Ambulance Quality Indicators (AQIs) show that 11% of calls ended in telephone advice and did not result in an ambulance being sent to the patient, and 38% of calls resulted in an ambulance being sent but the patient not being conveyed to an emergency department. Non-conveyance rates varied between ambulance services. For the 10 large ambulance services, the rate of calls ending in telephone advice varied between 5% and 17%, the rate of calls sent an ambulance but not conveyed to an emergency department varied between 23% and 51%, and overall non-conveyance rates varied between 40% and 68%.

Aim and objectives

The aim of the research was to explore reasons for variation in non-conveyance rates between ambulance services. The objectives were to:

1. explore the perceptions of ambulance service managers, paramedics and commissioners of factors affecting variation in different types of non-conveyance
2. identify the determinants of variation between ambulance services for different types of non-conveyance
3. identify the determinants of variation between services in rates of 24-hour recontact with the ambulance service
4. explore variation in the provision of telephone advice in three ambulance services with different rates of calls ending in telephone advice
5. assess the safety and appropriateness of non-conveyance in one ambulance service
6. explore the determinants of variation when patients call with breathing problems.

Setting

Ten of the 11 ambulance services in England, serving > 99% of the population.

Design

A sequential mixed methods study with five work packages (WPs) undertaken during 2015 and 2016.

Methods

(1) A qualitative interview study of managers and paramedics from each ambulance service, as well as commissioners, totalling 49 interviews undertaken in 2015. This was followed by four further WPs. (2) An analysis of 1 month of computer-aided dispatch (CAD) data from each ambulance service for November 2014, totalling 615,815 calls. Patient-level factors were available from CAD and linked census data for the area in which the call was made. Organisation-level data were available from coding the qualitative data

from the 49 interviews, summarising staff perceptions for each ambulance service. (3) A qualitative study using non-participant observation and staff interviews in three ambulance services with different published rates of calls ending in telephone advice, totalling 20 interviews and 120 hours of observation, undertaken in 2016. (4) An analysis of 6 months (January–June 2013) of routine data from one ambulance service linked to subsequent emergency department attendance, hospital admission and mortality data, totalling 42,796 non-conveyed calls. (5) A substudy of non-conveyance for breathing problems. Findings from different WPs were integrated using an adapted triangulation protocol.

Conceptual framework

Appleby's framework of causes of variation in health care was used to help identify the wide range of factors that might explain variation in non-conveyance rates between ambulance services. Factors within Appleby's framework address both demand for (e.g. population morbidity) and supply of (e.g. service configuration, clinical decision-making) health care. Some variation in non-conveyance rates between ambulance services may be warranted if it is attributable to variation in patient need (from the demand side of Appleby's framework). Some variation may be unwarranted if it is attributable to variation in preferences held by ambulance crews, commissioners or ambulance service managers (from the supply side of Appleby's framework). In addition, some variation may be modifiable by ambulance services, whereas some variation is outside the control of ambulance services.

Results

A number of potential causes of variation were explored.

Data inaccuracy (modifiable by ambulance services)

Monthly AQIs for calls ending in telephone advice and calls not resulting in conveyance to an emergency department once an ambulance is sent are reported on the NHS England website for each ambulance service. During interviews, some managers in ambulance services expressed concerns about the potential inaccuracies in these reported statistics and about whether or not the variation between ambulance services was real. When compiling our 1 month of routine CAD data, we identified differences between ambulance services in their application of national guidance to calculate the AQIs. These related to the inclusion and exclusion of NHS 111 calls and calls made by health-care professionals on behalf of patients. These differences accounted for little of the variation between ambulance services. We also found that ambulance data were complex and that there was likely to be further variation in how AQIs are calculated that could not be identified by our research team. This was a particular concern for calls ending in telephone advice whereby historical AQI data show sudden changes in rates for some services that are likely to be related to changes in the way the AQI was calculated within individual services. We identified that each service used a different CAD system and concluded that this was likely to increase the potential for variation in calculations of AQIs. Our non-participant observation of delivery of telephone advice in three ambulance services identified variation in service delivery that is likely to affect non-conveyance rates. We concluded that data inaccuracy could potentially explain a considerable amount of variation in rates of telephone advice between ambulance services but that there was also likely to be variation in practice.

Patient-level factors (largely unmodifiable by ambulance services)

Different types of non-conveyance had different determinants. Patients who were sent an ambulance and not conveyed to an emergency department (called 'discharge at scene') were more likely to be adults, to be male, to have suffered a fall, to have called for an ambulance out of hours, to live in an area of social deprivation and to be classified as non-emergency at the time of their call. They were also more likely to have been attended to by an advanced paramedic [odds ratio 1.39, 95% confidence interval (CI) 1.35 to 1.43]. Telephone-advice-only rates were higher for children and young adults, calls made out of hours, calls related to abdominal pain, and calls relating to patients living in areas with low rates of long-term

sickness and high rates of social deprivation. Adjusting for these factors did not explain the variation in non-conveyance rates between ambulance services.

Organisational characteristics (modifiable by ambulance services)

Work force

After adjustment for the patient-level factors described above, rates of discharge at scene were higher in ambulance services for which more calls were attended by an advanced paramedic (odds ratio 1.05, 95% CI 1.04 to 1.07), about which interviewees in our qualitative study perceived that advanced paramedics had an established and valued role within their ambulance service and about which paramedics spoke positively about being able to access these advanced paramedics for advice and referral (odds ratio 1.84, 95% CI 1.45 to 2.33).

There was no quantitative workforce data for calls ending in telephone advice only. In our qualitative non-participant observation within three clinical hubs – in which telephone advice is offered – we observed variation in the clinical disciplines of staff and their motivations for undertaking this type of work. In the services with higher rates of telephone advice, there was a variety of skill-mix and the motivation expressed by staff working in these clinical hubs was largely about facilitating demand management. In the service with a low rate of telephone advice, the motivation expressed by staff working in the clinical hub was more likely to be related to reducing risk to patients who were not sent an ambulance.

Opportunity or risk?

After adjustment for the patient-level factors described above, rates of discharge at scene were lower in services for which interviewees in our qualitative study perceived their ambulance service managers to be risk averse towards non-conveyance (odds ratio 0.78, 95% CI 0.63 to 0.98). In our qualitative study, at the service with one of the lowest rates of non-conveyance, the risk of non-conveyance was paramount in their narratives. This was in contrast to interviewees at the service with the highest non-conveyance rate, who described being highly motivated to undertake non-conveyance. They described it as historically embedded within their service and having open communication with frontline staff about the opportunities and risks involved in the endeavour.

External factors within wider emergency and urgent care systems (partly modifiable by ambulance services)

The ambulance service is one of many services in a wider emergency and urgent care system, consisting of hospitals providing acute and emergency care, community services providing nursing care, mental health services, general practice in and out of hours, other primary care services such as walk-in centres and NHS 111, nursing homes and social care services. Most of these services, including ambulance services, are commissioned by Clinical Commissioning Groups (CCGs). Interviewees in the qualitative study described how pressures on some of these services increased demand for ambulance services and limited the ability to discharge at scene. In addition, differences in the availability of services and ambulance crew knowledge of the availability of services in different CCG areas or groups of CCGs affected the ability of crews to discharge at scene. Interviewees described how initiatives that increased ambulance crew members' confidence that other services would visit any patient left at home, and take over their care, could increase rates of discharge at scene. Initiatives interviewees described as facilitating discharge at scene included a single point of access service that identified relevant services for ambulance crews, formal pathways allowing ambulance crews to refer patients directly to specialist services, and informal relationships with local services in some areas. Interviewees described how CCG support for non-conveyance in terms of facilitating connectivity between the ambulance service and other services in the emergency and urgent care system could facilitate discharge at scene, as could financial investment in initiatives to increase non-conveyance. These issues did not explain variation between ambulance services in the quantitative analysis. However, there was wide variation in non-conveyance rates by localities within ambulance services that could have been caused by these emergency and urgent care system factors.

National priorities (non-modifiable by ambulance services)

Interviewees in the qualitative study described how their first priority was to meet the challenging response-time targets set nationally. Some services appeared to focus all their resources on meeting this target, whereas others identified as priorities both meeting response times and increasing non-conveyance as the most appropriate response for some patients.

Safety and appropriateness

Data to explore variation between ambulance services in rates of subsequent use of services after non-conveyance were not available. In a single ambulance service, data linkage allowed identification of future events of recontact with the ambulance service within 24 hours, emergency department attendance, hospital admission and mortality for non-conveyed patients. A minority of calls ending in telephone advice were linked (24%, 2521/10,634), whereas the majority of discharge at scene calls were linked (85%, 43,108/50,894). After the removal of patients who were dead at scene, and patients dying of end-of-life causes, the recontact rate with the ambulance service within 1 day of being discharged at scene was 5.9% and within 3 days was 9.0%; emergency department attendance within 3 days was 12.7%, hospital admission within 3 days was 6.3% and the mortality rate within 3 days was 0.30% (129/42,796) or between 2 and 3 people per 1000 discharged at scene. Over half the deaths were in elderly people: 42% (54/129) of deaths were in people aged 81–90 years and 12% (16/129) of deaths were in people aged > 90 years.

Breathing problems

A total of 11% (47,737/434,494) of 999 calls from the 10 ambulance services were for breathing problems. It was the sixth most common reason for calls ending in telephone advice and the fifth most common reason for calls discharged at scene. Factors explaining variation were generally similar to non-conveyance for all conditions.

Conclusions

Variation in non-conveyance rates between ambulance services in England could be reduced by addressing variation in the availability of advanced paramedics and how they are used within services, and perceptions of the risk associated with non-conveyance within ambulance service management.

Implications for health care

Non-conveyance occurs in a context in which ambulance services are judged largely by their ability to meet response-time targets as demand for their service increases. Requiring ambulance services to shift their focus from transporting emergency cases to hospital to dealing with emergency and urgent cases in ways that are more clinically appropriate – including non-conveyance – is relatively recent in the history of ambulance provision. Many processes vary between ambulance services and these are likely to contribute to variation in non-conveyance rates. Some of these processes have been identified as explaining variation in non-conveyance rates between ambulance services and others highlight the considerable amount of variation in practice, which is surprising for a national service. There is variation in CAD systems, triage software, staff skill-mix, the type of work staff undertake and how ambulance services are commissioned in practice. There is an opportunity for more standardisation of processes between ambulance services to reduce unwarranted variation in non-conveyance rates.

Recommendations for research (numbered in priority order)

We recommend that researchers:

1. Create a linked data set for all ambulance services in the UK, linking routine ambulance service data with Hospital Episode Statistics and Office for National Statistics data on emergency department attendances, hospital admissions and mortality to compare the safety and appropriateness of different non-conveyance rates in operation in different ambulances services.

2. Measure the cost-effectiveness of undertaking telephone advice within clinical hubs and undertaking discharge at scene.
3. Seek patients' and their families' views of non-conveyance, including episodes in which patients experience subsequent events such as hospital admission within 3 days. During this research, consideration can be given to the need for, and consequences of, educating the public about when to call 999 and about different types of non-conveyance.
4. Undertake more national research on the ambulance service because this is a large and important service in NHS emergency and urgent health-care provision.
5. Establish a national patient and public involvement group for ambulance research to facilitate national research on ambulance services.

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