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3 **Identifying consensus on the inclusion of patient-level emergency department**
4 **characteristics in a classification of potentially redirectable visits to sub-acute**
5 **care: A modified Delphi consensus study**
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ABSTRACT

Background

No patient classification has been developed to estimate how many ED patient transports are potentially suitable for paramedic redirection to sub-acute care centres. We examined the consensus for patient characteristics to classify paramedic transported ED visits who have a high probability of being primary care-like and potentially redirectable to a sub-acute care centre.

Methods

We conducted a modified Delphi study to assess expert consensus on nine characteristics of ED paramedic transported patients. An expert Delphi committee was constructed of emergency and primary care physicians using purposive sampling. Experts rated whether each characteristic was useful to be included in a classification index to identify potentially redirectable visits retrospectively, as well as characteristic details (e.g., upper and lower bounds). Consensus was considered 75% agreement.

Results

Sixteen experts participated in the study. Following two rounds, consensus was achieved on eight of nine characteristics (88.9%). Four characteristics were determined as useful to classify potentially redirectable ED visits: age (81%), triage acuity (100%), specialist consult in the ED (94%) and ED visit outcome (81%). Specifications of each characteristic were refined to: young and middle-aged adults with a non-emergent triage acuity, did not receive a specialist physician consult in the ED and discharged from the ED.

Interpretation

Strong consensus was achieved to specify a classification system for potentially redirectable ED visits. These results will be combined with knowledge of which sub-acute care centres could conduct the main physician interventions to retrospectively identify ED visits that could have been suitable for paramedic redirection for further research.

Keywords

Paramedicine, community medicine, primary care, ambulance, emergency medical services, emergency department, epidemiology.

Study registration: ID ISRCTN22901977.

BACKGROUND

The majority of patients transported by Ontario paramedics to the emergency department (ED) have non-emergent conditions.(1) Sub-acute community-based care centres may be appropriate ED alternatives when patients do not require emergency healthcare, and have an association with increased continuity of care, shorter wait times, and fewer healthcare costs per visit.(2,3) Moreover, redirection of specific patient cohorts could be an important strategy to reduce ED overcrowding, whilst providing equivalent patient-centred care.(4–6) Paramedic redirection has been difficult to implement; there is a lack of validated patient classifications to identify redirection suitability in the prehospital field reliably.(4,5,7) Various epidemiological classifications describe ED visits that could have been potentially preventable, but their translation to paramedic practices is problematic; paramedic redirection is not incorporated and large heterogeneity exists in objectives, inclusion criteria or clinician scope of practice.(1,8–10) Lastly, identification of patient cohorts potentially suitable for ED redirection is challenging to determine prior to the ED visit, when diagnostics, services rendered and outcome of the visit are unknown.(4,5,7)

To inform prospective paramedic redirection research, a retrospective epidemiological classification is needed first to identify and examine ED visits where redirection could have been appropriate. The specific parameters of which clinical and non-clinical features are useful to retrospectively identify potentially redirectable patient cohorts in ED data are not known.(11) Knowledge of useful patient characteristics to classify potentially redirectable ED visits could be helpful to provide a concise depiction of patients for further investigation regarding care needs, services required and redirection feasibility. Particularly, ED visits determined to have been

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3 potentially suitable for redirection could permit study of their prehospital clinical presentations
4 following linkage between paramedic and ED data resources.(12–14)
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8 Our objective was to determine consensus on a set of ED visit patient characteristics that
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10 could be useful to retrospectively identify ED patient visits that had a high probability of being
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12 primary care-like and could have been potentially redirectable to sub-acute centres by
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14 paramedics. We hypothesized that all patient characteristics included in this study will achieve
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16 consensus by an expert physician committee.
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21 **METHODS**

22 **Study Design**

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25 We used a modified Delphi study design to establish and examine consensus on which
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27 patient characteristics are useful to consider when determining primary care-like ED visits that
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29 are potentially redirectable by paramedics to sub-acute care. All patient characteristics included
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31 are routinely collected in each ED visit and stored in the National Ambulatory Care Reporting
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33 System (NACRS) ED database. Combining useful ED patient characteristics identified in this
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35 study could identify a retrospective patient cohort of potentially redirectable ED visits with high
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37 internal validity.
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44 **Participants**

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47 Twenty emergency and primary care physicians were recruited to participate in the study
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49 from differing regions across Ontario. Selection of experts were based on their participation in a
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51 parallel modified Delphi study that determined appropriateness of an ED physician intervention
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53 to be conducted in specified sub-acute care centres instead of the ED.(11) These physicians were
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3 previously screened for their expertise and met the inclusion criteria of: currently practicing,
4 practicing in Ontario, and exhibited at least one of (a) leadership role in paramedic practice
5 oversight, (b) extensive medical experience (15 years or greater) or (c) holding an academic
6 faculty appointment.(11) Physicians were originally recruited using purposive sampling, and
7 were balanced between emergency and primary care medicine.(11) Recruited physicians were
8 sent a study package describing this study's objectives and methods when invited to participate.
9 We determined *a priori* the Delphi expert committee should be composed of at least fourteen
10 physicians, greater than the generally accepted minimum of twelve participants.(15,16) Consent
11 was obtained in writing prior to any data collection. Physicians were provided a \$75 e-gift card
12 at the completion of the study for their participation.
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28 **Data Source**

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30 We generated a list of all available patient characteristics in the NACRS ED database for
31 inclusion consideration in the exercise. Nine characteristics were selected for inclusion in the
32 modified Delphi rounds based on scientific literature, inclusion as a variable in other ED patient
33 classification systems, clinical judgement and availability of data in NACRS.(8–10,17,18)
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42 **Delphi Process**

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44 The modified Delphi method is a consensus strategy to systematically analyze the
45 judgements of experts in a specified field.(19) Modified Delphi studies provide practical
46 applications of questionnaires to engage experts individually while yielding results as aggregate
47 consensus that is greater than any expert individually.(16) Iterations (or rounds) often involve
48 inviting input, tabulating consensus and re-presenting items that reached consensus and remain
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discrepant for additional consideration. In each round, experts were posed questions related to the usefulness of patient characteristics to classify ED visits that are primary care-like and potentially redirectable to sub-acute care centres by paramedics. When experts rated a patient characteristic as useful, each were asked to rate which parameters of the characteristic would specify the ED with a high specificity to the study's objective. Standardized definitions of each patient characteristic were provided to minimize unintended or heterogeneous interpretations. Consensus was evaluated through two rounds of expert ratings as further rounds are unlikely to result in differing ratings when items of the subsequent rounds are minimal and could not be modified.(20). The structure and content of the questionnaires used are shown in *Table 1*.

Table 1: List of patient characteristics included in a modified Delphi consensus exercise to be evaluated for suitability as an indicator of being potentially redirectable to sub-acute centres by paramedics.

Modified Delphi Questionnaire	
1. Determining Consensus on Patient Characteristics:	
Question: Do you think (<i>patient characteristic</i>) is a useful characteristic to consider when determining if an ED visit is both primary care-like and potentially redirectable to sub-acute care centres by paramedics?	
Possible Answers: Yes, No.	
2. Determining Specific Parameters of a Useful Patient Characteristic:*	
Question: If so, what specific parameters of (<i>patient characteristic</i>) suggest a visit is primary care-like and potentially redirectable to sub-acute care centres by paramedics?	
Possible Answers: Parameters provided by expert selection; plausible answers below.	
Patient Characteristic	Parameter Specification
Age, years	18, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105 Other
Sex	Only male Only female

Triage Acuity, CTAS	1 – Resuscitation 2 – Emergent 3 – Urgent 4 – Less Urgent 5 – Non-Urgent
Main Diagnostic Category, ICD-10^{a,b}	Endocrine, nutrition and metabolic disorders Mental and behavioural disorders Diseases of the nervous system Diseases of the circulatory system Diseases of the respiratory system Diseases of the digestive system Diseases of the skin and subcutaneous tissue Diseases of the musculoskeletal system and connective tissue Diseases of the genitourinary system Diseases of the blood involving immune system Diseases of the eye, adnexa, ear and mastoid process Traumatic injuries (consequences of external causes) Symptoms, signs and abnormal clinical and laboratory findings Factors influencing health status and contact with health services Pregnancy, childbirth and the puerperium Conditions originated in the perinatal period Congenital malformations, deformations and chromosomal abnormalities Infectious diseases Morbidity and mortality Neoplasms and cancer
Comorbidities^c	Hypertension Diabetes Asthma Chronic obstructive pulmonary disease Rheumatoid arthritis Bowel disease Cancer
Specialist Consult Performed in ED	Include only visits that received a specialist consult in the ED Include only visits that did not receive a specialist consult in the ED
Outcome of ED Visit	Discharged Admitted to hospital Transfer to another acute care facility directly from ED Left after triage, no medical assessment
Time from Triage to ED Outcome	Less than 30 minutes Less than 1 hour Less than 1.5 hours Less than 2 hours Less than 2.5 hours Less than 3 hours

Return to ED within 30 Days or Less, days	5, 10, 15, 20, 25, 30	Should not have returned within 30 days of initial ED visit
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Note: CTAS = Canadian Acuity and Triage Scale, ED = emergency department

* Parameter specification posed only to experts that answered 'Yes' to the consensus question.

^a International Statistical Classification of Diseases and Related Health Problems 10th Revision, categorized by diagnostic chapter.

^b Represents primary diagnosis category of emergency department visit.

^c Diagnosed diseases prior to ED visit.

Round 1 was distributed to all experts for their individual ratings. After completing Round 1, data were extracted to analyze consensus of each characteristic and parameter. A general feedback form was distributed to all experts reporting the aggregated results of Round 1 to aid their considerations for characteristic ratings in Round 2 (i.e., reported percent agreement). Round 2 was constructed with only the characteristics that did not receive consensus in Round 1, and distributed for a second round of ratings. We determined *a priori* ratings of Round 2 would serve as the final consensus results, as further rounds are unlikely to change consensus and participation rates diminish when items on subsequent rounds are minimal.

Data Analysis

We determined *a priori* a characteristic must receive 75% agreement or greater to achieve consensus. Each characteristic was considered independent from one another during ratings. All available subcategorizations of each parameters specification as reported in NACRS were included in the study. Demographic statistics of the expert Delphi committee were reported using frequency and proportion. We used *CheckMarket*, an electronic survey software to collect all data. All data were stored with the investigators via *CheckMarket's* secure and encrypted program.

Ethics Approval and Consent to Participate

This study received a research ethics board exemption waiver from the Hamilton Integrated Research Ethics Board; review reference 2020-11451-GRA. All participants provided written consent prior to study initiation.

RESULTS

Sixteen physicians agreed to participate in this study. Three declined due to current workload, and one did not respond. Experts were invited from August 1, 2021 to August 11, 2021, and the modified Delphi rounds occurred between August 11, 2021 and September 21, 2021. The expert Delphi committee was mostly male (75%) and acknowledged their primary practicing field as emergency medicine (81%). The expert's length of practice was spread evenly throughout the Delphi committee with a range from less than five years to thirty-or-greater years, with the largest groups of five-to-nine years (25%) and thirty-or-greater years (25%).

Approximately one-third of the expert committee are Medical Directors responsible for medical oversight of paramedic practices in Ontario. Characteristics of the committee are shown in *Table 2*.

Table 2: Demographic characteristics of the expert committee in the modified Delphi consensus exercise.

Characteristic	Modified Delphi Committee, N=16; n, (%)
Sex	
Male	12 (75%)
Female	4 (25%)
Primary medical practice	
Emergency medicine	13 (81%)
Family medicine	2 (13%)
Both	1 (6%)
Length of practice, years	

Less than 5	2 (13%)
5 to 9	4 (25%)
10 to 14	1 (6%)
15 to 19	2 (13%)
20 to 24	1 (6%)
25 to 29	2 (13%)
30 or greater	4 (25%)
Medical director, Ontario paramedic practices	5 (31%)

Table 3 shows the results of the consensus modified Delphi exercise. In Round 1 of the modified Delphi exercise, seven of nine patient characteristics achieved consensus. The two characteristics that did not receive consensus were reposed in Round 2, resulting in one characteristic reaching consensus and one characteristic not. All sixteen experts completed the Round 1 questionnaire, and fifteen completed Round 2. The patient characteristics identified as useful characteristics to consider in a classification were: age (81%), triage acuity (100%), specialist consult performed in the ED (94%) and outcome of the ED visit (81%). Patient characteristics determined not useful to classify ED visits were: sex (100%), comorbidities (75%), time parameter from triage to ED outcome (88%) and return to ED within 30 days or less (80%). The characteristic ‘main diagnostic category’ did not receive consensus following two rounds.

When experts rated patient characteristics useful to classify ED visits that are primary care-like and potentially redirectable by paramedics, each supplied a parameter specification to constrain a characteristics range based on their expert judgement. Of the thirteen experts that rated age as a useful patient characteristic, all rated the lowest age provided (18 years) appropriate for the lower boundary, and the upper boundary ranged from 50 years to ‘no upper limit’. The largest selection for the upper age was 70 years. Triage acuity was rated by all as useful, with all rating CTAS 5 as the lowest acuity for the lower boundary. All experts selected

an upper acuity boundary as CTAS 4 (100%), with CTAS 3 rated as the upper boundary from a smaller proportion (37.5%). Nearly all found specialist consult in the ED a useful characteristic to include, with all rating that only ED visits which did not receive an ED specialist physician consult as useful to consider for the classification. Lastly, the majority of experts that rated the outcome of the ED visit as useful selected discharged from ED as useful for this classification, with the other options not suitable (admitted to hospital, transfer to another acute care facility directly from ED and left after triage no medical assessment).

Table 3: Results of a two-round modified Delphi exercise to establish which patient characteristics are important to consider when classifying if an ED visit was primary care-like and potentially redirectable to sub-acute care centres by paramedics.

Characteristic	Round 1, <i>n</i> (%) ^a		Round 2, <i>n</i> (%) ^{a,b}		Consensus	Specification of parameters from Expert Committee, (<i>n</i>) ^c
	Yes	No	Yes	No		
Age, years	13 (81)	3 (19)	-	-	Useful	Lowest age -18 (13) Highest age – 50 (1), 55(1), 65(2), 70(4), 75(3), no upper limit (2)
Sex	0 (0)	16 (100)	-	-	Not Useful	Not useful to include and/or specify.
Triage Acuity, CTAS	16 (100)	0 (0)	-	-	Useful	Lowest acuity - CTAS 5 (16) Highest acuity – CTAS 4 (10), CTAS 3 (6)
Main Diagnostic Category, ICD-10 ^d	9 (56)	7 (44)	10 (67)	5 (33)	No Consensus	Consensus was not reached amongst the Delphi committee.
Comorbidities	4 (25)	12 (75)	-	-	Not Useful	Not useful to include and/or specify.
Specialist Consult Performed in ED	15 (94)	1 (6)	-	-	Useful	Include only visits that did not receive a specialist consult in the ED (15)
Outcome of ED Visit	13 (81)	3 (19)	-	-	Useful	Discharged from ED (13) Admitted to Hospital (1) Transfer to another acute care facility directly from ED (1) Left after triage, no medical assessment (6)
Time from Triage to ED Outcome	2 (12)	14 (88)	-	-	Not Useful	Not useful to include and/or specify.
Return to ED within 30 Days or Less	7 (44)	9 (56)	3 (20)	12 (80)	Not Useful	Not useful to include and/or specify.

^a Consensus set at 75% agreement of all experts.
^b 15 of the 16 experts participated in Round 2.
^c Only experts that answered 'Yes' to the consensus question were included to specify parameters.
^d Category did not receive consensus following Round 2.

INTERPRETATION

Strong consensus was found by an emergency and primary care physician committee for a set of patient characteristics that may be useful to determine ED visits that were primary care-like and potentially redirectable by paramedics to sub-acute care centres. Patient age, triage acuity, specialty consult in the ED and outcome of the ED visit are useful characteristics to specify inclusion criteria in an epidemiological classification system.

Our results were both consistent and unique to alike published classifications that propose to identify preventable ED visits retrospectively. Our lowest triage acuity parameter was consistent with similar classifications, though triage acuity was not included as a parameter in many classifications.(9) Age was incorporated into only a small number of similar classifications, but when included had an upper boundary of 75 years or lower.(8,21) Classifications that incorporated the outcome of an ED visit included only patients to those that were discharged from the ED, and must not have been hospitalized, admitted or died in ED, a finding consistent with our study.(9) Some classifications included the main diagnostic or presenting complaint as an identifier, though our study results could not achieve consensus on whether this is an important determining factor.(8,10,22,23) Some classifications cited only ED visits arriving by self-referral or walk-in as eligible, a deviation from the objective of our study to construct a classification specifically to examine paramedic transported patients.(24) Given the abundant exclusion of paramedic transported patients from published classifications, our research contributes a focus on an under-integrated patient cohort of potentially preventable ED classifications.

The majority of useful patient characteristics had large agreement amongst the physician committee on parameter specification. The upper age limit differed amongst experts, showing

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3 their hesitancy to include the geriatric cohort in plausibly redirecting patients from the ED. High
4 agreement was recognized in the lower age limit (18 years), indicating experts were content with
5 redirecting patients that likely will not have as numerous or complex conditions as older age
6 groups. Specifying triage acuity was largely consistent by including the most non-emergent
7 acuities (CTAS 4 and 5), with relatively a third of experts indicating urgent (CTAS 3) acuities
8 could be appropriate. The low number of experts rating urgently triaged patients suitable may
9 exemplify a conservative approach to withhold making clinical judgements on ED visits that
10 potentially could require acute care, though the majority of urgently triaged ED visits do not.⁽²⁵⁾
11 High agreement was also observed in specifying discharge as the ED outcome, and not having
12 received a specialist consult during the visit. These specifications acknowledge that patients
13 should be stable to be discharged home/their place of residence, and should not exceed the scope
14 of practice of an attending emergency physician. The main diagnostic category did not receive
15 consensus, an important finding that implies some experts desired to understand the condition of
16 the ED visit prior to making a judgement on redirection suitability. A plausible explanation for
17 this result is the diagnostic categories of ICD-10 are too broad to make generalizations on
18 appropriateness as determined by the physicians. Given broad diagnostic categories do not
19 predict acuity or severity of illness, the indecision of its utility to incorporate into a classification
20 remains in question. Though knowledge of diagnostic categories was important to some experts,
21 comprehension of the main intervention received during the ED visit ought to contribute more
22 beneficial evidence to make a judgement on redirection.

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49 While this study contributes to evolving conceptual frameworks intended to
50 comprehensively categorize patients potentially suitable for redirection, the absence of a
51 validated patient classification remains. For instance, patient characteristics alone may not be
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3 sufficient classifying features to make determinations on which patients could have been
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5 potentially redirected. Inclusion of the physician intervention is an important element missing
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7 from our study that is core to developing a redirection patient classification, though is minimally
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9 included in published classifications.(8,9,23,26) Further understanding and inclusion of a sub-
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11 acute centre's capacity to provide equivocal medical care to the ED may also be needed, and
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13 should be incorporated into any patient classification aiming to identify redirectable ED visits
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15 retrospectively.
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19 The results of this study will support the construction of an epidemiological patient
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21 classification to retrospectively identify paramedic transported ED visits that may have been
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23 suitable for redirection in ED databases for further study. This patient classification will be
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25 constructed using the results of this study and knowledge of which sub-acute care centres could
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27 conduct a specified primary-care intervention.(1,11) Data linkage of paramedic medical reports
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29 to ED data resources for ED visits that meet this classifications inclusion criterion will identify
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31 which patients presentations to examine prior to hospital arrival, an important component to
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33 inform prospective redirection research and direct clinical guideline development.(1) Future
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35 research is required to externally validate our results and determine the generalizability of our
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37 study in differing ED datasets.
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44 **Limitations**

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46 The expert Delphi committee was comprised mostly of emergency physicians, a
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48 limitation of purposive sampling to recruit physicians. Recruitment was balanced between
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50 emergency and primary care physicians but enrollment rates left a slight imbalance with a higher
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52 proportion of emergency physicians. However, emergency physicians were well equipped to
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3 make determinations in this study, and we do not anticipate this impacting the results. Individual
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5 judgements may be subjective based on an expert's own clinical experiences, formal training or
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7 approach to patient care, though this limitation was minimized by providing detailed definitions
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9 of each patient characteristic and using a robust Delphi methodology to reduce effects subjective
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11 outliers. Only patient characteristics that were available in NACRS had the potential to be
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13 included in this study. Using ED visit characteristics retrospectively limits the translation of our
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15 results to direct paramedic practices, however translation of these findings into paramedic medic
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17 reports would make a useful application for prehospital translation.
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24 **CONCLUSION**

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26 Patient characteristics were identified to assist classifying ED visits that may have been
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28 primary care-like and potentially redirectable by paramedics to sub-acute care centres. Though
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30 patient features alone cannot make determinations on patient suitability for a redirection
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32 classification, these variables contribute to ongoing efforts to identifying eligibility criteria of
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34 patients encountered by paramedics for further epidemiological study. Combining the results of
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36 this research along with knowledge of where the main ED intervention could be conducted may
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38 be helpful to analyze who, when and where potentially redirectable patients could be transported
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40 for care other than the ED.
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Completing Interests

None declared.

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Contributions

Ryan P. Strum and Andrew P. Costa led the conceptualization of the study methodology. Ryan P. Strum conducted the modified Delphi exercise, analyzed and interpreted results, and drafted and revised the manuscript. All authors made contributions to the design of the study, methods, interpretation and manuscript, and agreed to be accountable for all aspects of this manuscript.

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Data Sharing

All aggregate data herein are accessible to other interested parties by application to the corresponding author.

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