Clinical presentations and practitioner levels appropriate for the introduction of ‘Treat and referral pathway(s)’ into the Irish Emergency Medical Service: A survey of Consultants in emergency medicine.

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ABSTRACT

Objectives: Overcrowding in emergency departments (EDs) is an international issue and ambulance bypass is seen as one element of the solution to a complex problem. Irish EDs are not immune to this healthcare crisis, which, together with increased off-load delays for ambulances, is one catalyst for the introduction of Treat and referral pathway(s) (paramedic non-ED disposition decision). The confidence of consultants in emergency medicine in
paramedics and advanced paramedics offering Treat and referral pathway(s) to patients presenting with hypoglycaemia or seizure was explored. Other specific clinical presentations were also investigated for suitability for Treat and referral pathway(s) and a consensus was sought on an upper age limit for such patients.

Methods: Public-sector consultants in emergency medicine in Ireland at the time of the study, were invited to complete an online survey. A 62% response was received from the targeted population.

Results: Confidence was expressed in advanced paramedics offering Treat and referral pathway(s) to patients with hypoglycaemia or seizure by the majority (78%) of respondents. However, confidence was reduced for paramedics (53%). Six of the twelve specific clinical presentations received clear support as suitable for Treat and referral pathway(s), with the remaining receiving reducing support and ‘falls in the elderly (without injury)’ was opposed. There was no consensus on an upper age limit for patients being offered Treat and referral pathway(s).

Conclusions: Support for the highest level of EMS practitioner in Ireland, advanced paramedic, to expand their scope of practice to include Treat and referral pathway(s) was identified. Clinical presentations have been identified that would be conducive to a treat and referral clinical care pathway. A trial implementation period may be essential to build confidence in the programme before a universal roll-out.
INTRODUCTION

Background

Overcrowding in emergency departments (EDs) is an international issue and ambulance bypass/diversion is seen as one element of the solution to a complex problem.\(^1\) Irish EDs are not immune to this healthcare crisis\(^2\), which, together with increased off-load delays for ambulances\(^3\), is a catalyst for the introduction of treat and referral pathway(s). Between 30\% and 50\% of patients attending ED could be appropriately treated in a less emergency setting.\(^4\)\(^5\)\(^6\) Indeed, up to 80\% of these inappropriate patients could be treated adequately in a primary care setting.\(^7\)

Greater than 50\% of patients transported to an ED by ambulance do not have life-threatening nor serious conditions\(^8\)\(^9\) and do not necessarily require an ambulance to get to an ED.\(^10\)\(^11\)\(^12\) Furthermore, pre-hospital emergency care practice has demonstrated safety and efficacy in managing specific acute presentations, thereby alleviating the need for immediate ED care.\(^13\)\(^14\)\(^15\)\(^16\)

Currently, paramedics and advanced paramedics are required to transport all patients in Ireland by ambulance to a hospital with acute services. Similarly, the traditional role of paramedics in North America has been to examine, treat, and then transport patients to an ED.\(^17\)\(^18\) This contrasts with the UK and Australian ambulance services, which have transitioned to non-conveyance of selected patients.\(^19\)\(^21\) With a focus on ED avoidance, the introduction of treat and referral pathway(s) in the UK was associated with a substantial reduction in ambulance service conveyance rates, from 90\% to 58\%, over a twelve-year period.\(^20\)
In Ireland, paramedics and advanced paramedics are regulated by the Pre-Hospital Emergency Care Council (PHECC), since 2006. In recent years, patient disposition options have been introduced by PHECC for ST-elevation Myocardial Infarction, stroke and certain trauma presentations, permitting by-passing of the nearest ED. The ability of paramedics to universally make decisions about treat and referral pathway(s), however, has not been definitively established. Furthermore, the available evidence does not support practitioners below that of an Irish advanced paramedic making such decisions.

The issue of not transporting patients to an ED, following a 112/999 call, has now become a critical consideration for emergency medical services (EMS) which needs to be reviewed. Patient disposition decisions by EMS practitioners would seem both necessary and appropriate. However, decisions to not transport patients to ED must include patient safety as a key consideration.

This study engaged Consultant in emergency medicine (hereafter referred to as EM consultants) in Ireland about the proposed introduction of treat and referral pathway(s), as stakeholder buy-in is necessary for change management success. Treat and referral was defined as the process whereby a paramedic treats a patient, following a 112/999 incident, and offers a patient disposition other than ambulance transport to an ED. While treat and referral pathway(s) has been introduced in other jurisdictions for some time, including the
UK and Australia, there remain concerns with this pathway among medical practitioners in these and other countries.\textsuperscript{34, 35, 18, 36}

The objective of this study was to elicit the views of EM consultants on their confidence in PHECC practitioners to select appropriate patients, to identify the upper age limit and clinical presentations suitable for a treat and referral care pathway. The New South Wales Ambulance Service, Clinical Assessment & Referral (CARE) programme \textsuperscript{37} offers treat and referral pathway(s) to patients presenting with a range of clinical presentations. This programme is ongoing for over twelve years with positive outcomes. The ‘CARE’ clinical presentations were used as a template for the study.

**METHODS**

On line anonymised questionnaire surveys were circulated to consultants in emergency medicine to explore their perceptions and views of the introduction in Ireland of treat and referral pathway(s).

Ethical approval was obtained through the University Hospital Limerick Ethics Committee. An electronic survey was constructed using an online survey tool (Survey Monkey) with 45 items. To assist with face validity the survey was piloted, in paper form, amongst ED nurses due to the low numbers of ED consultants in Ireland. Feedback from the pilot resulted in updating the wording and content. The SRQR reporting guidelines were used to frame the research.\textsuperscript{38}

The survey had four domains: (1) demographics, (2) hypoglycaemia and seizure management, (3) opinion on treat and referral presentations, (4) confidence in care management. A combination of question types was utilised, including dichotomous, ordinal
polytomous (5-point Likert scales [1 = strongly disagree to 5 = strongly agree]) and open-ended questions. All survey responses were anonymised.

The total population, at the time of the survey, consisted of sixty-seven EM consultants in the public sector in Ireland. The initial sample frame was defined by consultants whose e-mail address was established. An invitation to respond to the survey was sent through e-mail followed by reminder e-mails. A delivery receipt was requested with the e-mails sent. The final sample size was therefore determined by e-mails delivered verified by a delivery receipt.

Data was downloaded into an Excel spreadsheet (Microsoft). The data was coded for and imported into, IBM SPSS Statistics 20 software for analysis. Cross-tabulation and frequency distribution were used to interpret the quantitative data. A thematic approach was used to analyse free text. Median values were used to interpret the results for the Likert scales. For analysis, the Likert scale was collapsed into a trichotomous scale (disagree, neutral, agree). Jeong (2016) established that reliability or validity of the questionnaire is not reduced as a result of this conversion. Confidence intervals were calculated at 95% using an online calculator. Pearson's Chi-square and Fisher’s exact tests were calculated, using IBM SPSS version 20, to identify statistically significant differences. Statistical significance was taken at a level of $p < 0.05$.

Patient and Public Involvement included direct interaction with patient focus groups and seeking patient and family member’s opinion on the introduction of treat and referral pathway(s) into Ireland. This is reported on elsewhere.

RESULTS
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The response rates were n = 39 (62% of EM consultants who received the survey). The demographics of respondents identified ED attendance rates, urban/rural population and geographical spread. Table 1 and Figure 1 summarises respondents principal work setting by urban/rural mix and geographical area.

| Service area       | EM consultant |
|--------------------|---------------|
| Totally urban     | 6 (15.3%)     |
| Mainly urban      | 19 (48.7%)    |
| Mainly rural      | 13 (33.3%)    |
| Totally rural     | 1 (2.5%)      |
| Total              | 39            |

The majority (n=34, 94.9%) reported an ED attendance of >30,000 per annum, while the remainder (n=2, 5.1%) reported attendance of 20,000 – 30,000 at their ED. The maximum distance of travel to ED was collapsed into two groups ≤ 20 Km and > 20 Km for analysis.
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Confidence in PHECC practitioners by EM consultants

Hypoglycaemia and seizure were the index presentations under consideration for treat and referral pathway(s), as these presentations may be definitively managed in the pre-hospital environment. EM consultants agreed that the current treatment of hypoglycaemic and seizure by paramedics or advanced paramedics is generally very good. The current treatment of seizures by paramedics and the treatment of both hypoglycaemia and seizures by advanced paramedics did not elicit any negative response and had a median of 4 from a 5-point Likert scale. One area of weakness was identified when 8.3% of EM consultants indicated that they were not satisfied with the treatment of hypoglycaemia by paramedics, see figure 2.

![Quality of care provision is very good](chart.png)

**Figure 2**, EM consultants’ opinion on current care provision for hypoglycaemia and seizure by paramedics and advanced paramedics

EM consultant confidence in practitioners selecting patients for treat and referral pathway(s) by clinical level.

Paramedics
When results are collapsed into three groups (disagree, neutral and agree), a small majority (n = 19, 52.8%) expressed confidence in paramedics having the clinical judgement to select patients for treat and referral pathway(s). A sizeable minority (n = 11, 30.6%) did not express an opinion and the remainder (n = 6, 16.7%) expressed no confidence in paramedics to perform this function, see Figure 3. This result finding is reinforced as 41.7% (n=15) also agreed that they would be happy for a family member to be offered treat and referral pathway(s) by paramedics. When cross-tabulated there is no statistical difference between both findings (p = 0.179).

![Figure 3, EM consultant confidence in paramedics selecting patients for treat and referral pathway(s)](image)

A follow-up question permitted EM consultant respondents to outline, in free text, training that may help improve clinical judgement of paramedics. Five EM consultant respondents inserted free text. Only one specified training requirements, ‘need to be at AP level’. The other respondents expressed a lack of confidence in the general paramedic population, although not excluding all. Operational issues such as the reducing numbers of GPs was identified as possible barriers to the introduction of treat and referral pathway(s). Also, the reduction of ED journeys was not envisaged.

Advanced paramedic
When results are collapsed into three groups (disagree, neutral and agree), a sizeable majority (n = 28, 77.8%) expressed confidence in advanced paramedics having the necessary clinical judgement to select patients for treat and referral pathway(s). A small minority (n = 6, 16.7%) did not express an opinion and the remainder (n = 2, 5.6%) expressed no confidence in advanced paramedics to perform this function, see Figure 4. This result finding is reinforced as 69.4% (n=25) also agreed that they would be happy for a family member to be offered treat and referral pathway(s) by advanced paramedics, however when cross-tabulated there is a statistically significant difference between both findings (p = < 0.001).

Figure 4. EM consultant confidence in advanced paramedics selecting patients for treat and referral pathway(s)

A follow-up question permitted EM consultant respondents to outline, in free text, training that may help improve clinical judgement of advanced paramedics. Two responses were received, one indicated support for treat and referral pathway(s) provided that a high level of training and clinical audit was available. The second expressed a negative opinion indicating that “ECG training has not increased STEMI detection rates”, implying that training was not the only answer.

When questions relating to both clinical levels, confidence in paramedics and confidence in advanced paramedics, were cross-tabulated the results indicated a statistically significant
difference between confidence levels; $\chi^2(16, 36) = 58.689$, $p < 0.001$. The clear confidence in advanced paramedic over paramedic ability to select suitable patients for treat and referral pathway(s) is highly significant.

The scale for the items relating to confidence in PHECC practitioners had a very high level of internal consistency as determined by a Cronbach’s alpha of 0.833.

Clinical presentations suitable for treat and referral pathway(s)

EM consultant’s opinion on the CARE clinical conditions being offered treat and referral pathway(s) demonstrated that the clinical conditions listed had $\geq50\%$ agreement, except for ‘falls in the elderly without injury’, for which 50% disagreed. The scale for these clinical presentations had a very high level of internal consistency, as determined by a Cronbach’s alpha of 0.883. Toothache received the highest support (94.5%) for treat and referral pathway(s) introduction, with mild bronchospasm controlled by salbutamol receiving just 50% support (Table 2).

| Clinical condition                        | Disagree | Neutral | Agree  | CI 95\% = |
|------------------------------------------|----------|---------|--------|-----------|
|                                          |          |         |        | (±10.2%)  |
| Toothache                                | 2.8%     | 2.8%    | 94.5%  | 84.3% - 100% |
| Pepper (Oleoresin) spray                 | 2.8%     | 13.9%   | 83.4%  | 73.2% - 93.6% |
| Minor wounds (not requiring suturing)   | 16.7%    | 8.3%    | 75.0%  | 64.8% - 85.2% |
| Epistaxis (controlled by pressure)       | 8.3%     | 19.4%   | 72.3%  | 62.1% - 82.5% |
| Palliative care (DNAR)                   | 13.9%    | 13.9%   | 72.2%  | 62.0% - 82.4% |
| Non injured following trauma (RTC)       | 16.7%    | 11.1%   | 72.2%  | 62.0% - 82.4% |
| Tazer (stun) gun                          | 22.2%    | 22.2%   | 55.6%  | 45.4% - 65.8% |
| Soft tissue limb injury (excluding hand) | 27.8%    | 16.7%   | 55.5%  | 45.3% - 65.7% |
| Vomiting & diarrhoea (tolerating PO fluids) | 30.6%    | 16.7%   | 52.8%  | 42.6% - 63.0% |
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| Clinical Presentation                                      | Number | Percent  |
|------------------------------------------------------------|--------|----------|
| Minor closed head injury (excluding LoC)                    | 38.9%  | 8.3%     |
| Mild bronchospasm (controlled by salbutamol)                | 33.3%  | 16.7%    |
| Falls in elderly (without injury)                           | 50.0%  | 11.1%    |

No statistical difference was identified between the opinion on the suitability of the listed clinical presentations for treat and referral pathway(s) and either the geographical region or service area (p > 0.05).

**Age groups for treat and referral pathway(s)**

The Medical Advisory Committee within PHECC decided an age limit of ≥18 and ≤60 years for treat and referral pathway(s) for research purposes. Restricting treat and referral pathway(s) to ‘adults (≥18 years) only’ was supported by a minority (47.2%) of EM consultants.

In a follow-up question, the EM consultants were requested to select from defined upper age limits. The largest consensus (47.2%) opted for no restriction on the upper age limits. However, the majority (52.8%) specified an age limit for adults but without consensus on the specific upper age limit. The largest group specified the upper adult age as ‘≤60 years’ (22.2%), which is similar to the outcome of the Neely Conference (USA)\(^{43}\) (Table 3).

**Table 3** EM consultants view on appropriate adult age profile for treat and referral pathway(s)

| Age Group       | Number | Percent |
|-----------------|--------|---------|
| All age groups  | n = 17 | 47.2%   |
| ≤ 60 years      | n = 8  | 22.2%   |
| ≤ 65 years      | n = 6  | 16.7%   |
| ≤ 70 years      | n = 4  | 11.1%   |
| ≤ 80 years      | n = 1  | 2.8%    |
| Total           | n = 36 | 100.0%  |

The consultants’ opinion on ‘adults only’ and ‘upper age limits’ were cross-tabulated and the majority were in favour of no age restrictions for paediatrics or adults (Figure 5).
DISCUSSION

In this study, EM consultants were surveyed to elicit their opinion about treat and referral pathway(s) issues including; confidence in PHECC practitioners to select patients, the upper age limit and the suitability of specific clinical presentations for treat and referral pathway(s) care pathway. While Emergency Medical Technicians have been used successfully in research for treat and referral pathway(s) concern was raised about the clinical acumen of some PHECC practitioners to select appropriate patients for a treat and referral clinical care pathway. This was also identified by Leikkola et al, where decision making concerning non-conveyance was reported as being more difficult for lower clinical levels. This current study identified reduced confidence among EM consultants in paramedics compared to advanced paramedics in this regard. As with any new process, our data would suggest prudence in the implementation of treat and referral pathway(s), commencing with the higher clinical level of advanced paramedic initially.
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A definitive agreement on an upper age limit was not identified. While age does not define health status, there is a direct correlation between increasing age and poorer health. Upper age limits of ≥70 years for patients following falls and not conveyed to ED have found them to be a vulnerable population who are likely to benefit from a routine onward referral process. An upper cut-off age will, therefore, have to be agreed before implementing treat and referral pathway(s).

EM consultants give clear support to 6/12 of the CARE (NSW) list of presentations that could be considered for treat and referral pathway(s) in Ireland. Five of 12 conditions were supported by a majority. ‘Falls in the elderly without injury’ was not supported for treat and referral pathway(s). This concern is supported by Barnard et al who identified 33.6% of non-conveyed patients following falls re-contacted the ambulance service within 24 hours. Similarly, Deasy (2018) identified that low-level falls (<2 meters) account for 51% of major trauma mechanism in Ireland. Falls in the elderly without injury represent a small minority (0.006%) of 112/999 calls in Ireland.

Limitations
First, a relatively low response rate was noted among EM consultants resulting in a wide confidence interval (± 10.2%). Second, the study instruments have not been validated elsewhere. Finally, the limitations of anonymous electronic surveys may preclude the identification of other barriers or facilitators among respondents. Nonresponse bias was an issue as ~40% of delivered e-mails were not opened, verified by no read receipt received.
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The study focused on ED stakeholders directly involved in the provision of emergency care. However, other health care professionals, who may be requested to accept referrals, such as GPs and diabetes and epilepsy specialists, were not consulted.

CONCLUSION

The findings suggest that the EM consultants surveyed are, in the main, supportive of treat and referral pathway(s) being introduced, however more information is required to confirm this view.

Support for the highest level of EMS practitioner in Ireland, advanced paramedic, to expand their scope of practice to include treat and referral pathway(s) was identified which is comparable to that reported in the literature. However, this confidence was reduced when paramedics were considered. Clinical presentations have been identified that would be conducive to a treat and referral clinical care pathway. No consensus was reached on an upper age limit.

The complexity of treat and referral pathway(s) and the possibility to formalise protocols and/or to select appropriate patient conditions will affect the confidence of healthcare policymakers in entrusting PHECC practitioners to safely implement it. A trial implementation period may be essential to build confidence in the programme before a universal roll-out.
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References
1. Boyle A, Abel G, Raut P, et al. Comparison of the International Crowding Measure in Emergency Departments (ICMED) and the National Emergency Department Overcrowding Score (NEDOCS) to measure emergency department crowding: pilot study. *Emergency medicine journal : EMJ* 2016;33(5):307-12. doi: 10.1136/emermed-2014-203616
2. Hickey F. IAEM slams official responses to worsening Emergency Department crowding crisis: Irish Association for Emergency Medicine, 2016.
3. Wenman K. Review of pre-hospital emergency care services to ensure high quality in the assessment, diagnosis, clinical management and transporting of acutely ill patients to appropriate healthcare facilities: Health Information and Quality Authority, 2014.
4. Billings J, Parikh, Nina, Mijanovich, Tod. Emergency Department Use: The New York Story. *Issue Brief* 2000. www.cmwf.org.
5. Schaefer RA, Rea TD, Plorde M, et al. An emergency medical services program of alternate destination of patient care. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2002;6(3):309-14. [published Online First: 2002/07/12]
6. Gratton MC, Ellison SR, Hunt J, et al. Prospective determination of medical necessity for ambulance transport by paramedics. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2003;7(4):466-9.
7. Patton GG, Thakore S. Reducing inappropriate emergency department attendances--a review of ambulance service attendances at a regional teaching hospital in Scotland. *Emergency medicine journal : EMJ* 2013;30(6):459-61. doi: 10.1136/emermed-2012-201116
8. Snooks H, Foster T, Nicholl J. Results of an evaluation of the effectiveness of triage and direct transportation to minor injuries units by ambulance crews. *Emergency medicine journal : EMJ* 2004;21(1):105-11.
9. Raatiniemi L, Brattebo G. The challenge of ambulance missions to patients not in need of emergency medical care. *Acta anaesthesiologica Scandinavica* 2018;62(5):584-87. doi: 10.1111/aas.13103
10. Beillon LM, Suserud BO, Karlberg I, et al. Does ambulance use differ between geographic areas? A survey of ambulance use in sparsely and densely populated areas. *The American journal of emergency medicine* 2009;27(2):202-11. doi: 10.1016/j.ajem.2008.01.012
11. Alpert A, Morganti KG, Margolis GS, et al. Giving EMS flexibility in transporting low-acuity patients could generate substantial Medicare savings. *Health Aff (Millwood)* 2013;32(12):2142-8. doi: 10.1377/hlthaff.2013.0741
12. Booker MJ, Shaw AR, Purdy S. Why do patients with ‘primary care sensitive’ problems access ambulance services? A systematic mapping review of the literature. *BMJ open* 2015;5(5):e007726. doi: 10.1136/bmjopen-2015-007726
13. Khunti K, Fisher H, Paul S, et al. Severe hypoglycaemia requiring emergency medical assistance by ambulance services in the East Midlands: A retrospective study. *Primary care diabetes* 2013;7(2):159-65. doi: 10.1016/j.pcd.2013.01.001 [published Online First: 2013/02/05]
14. Osborne A, Taylor L, Reuber M, et al. Pre-hospital care after a seizure: Evidence base and United Kingdom management guidelines. *Seizure : the journal of the British Epilepsy Association* 2015;24:82-7. doi: 10.1016/j.seizure.2014.09.002
15. Dickson JM, Taylor LH, Shewan J, et al. Cross-sectional study of the prehospital management of adult patients with a suspected seizure (EPIC1). BMJ open 2016;6(2):e010573. doi: 10.1136/bmjopen-2015-010573

16. Villani M, Nanayakkara N, Ranasinha S, et al. Utilisation of emergency medical services for severe hypoglycaemia: An unrecognised health care burden. Journal of diabetes and its complications 2016 doi: 10.1016/j.jdiacomp.2016.04.015

17. Cain E, Ackroyd-Stolarz S, Alexiadis P, et al. Prehospital hypoglycaemia: the safety of not transporting treated patients. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors 2003;7(4):458-65. [published Online First: 2003/10/29]

18. Neeki MM, Dong F, Avera L, et al. Alternative Destination Transport? The Role of Paramedics in Optimal Use of the Emergency Department. The western journal of emergency medicine 2016;17(6):690-97. doi: 10.5811/westjem.2016.9.31384

19. Gray JT, Wardrope J. Introduction of non-transport guidelines into an ambulance service: a retrospective review. Emergency medicine journal : EMJ 2007;24(10):727-9. doi: 10.1136/emj.2007.048850 [published Online First: 2007/09/29]

20. Snoooks HA, Kingston MR, Anthony RE, et al. New models of emergency prehospital care that avoid unnecessary conveyance to emergency department: translation of research evidence into practice? TheScientificWorldJournal 2013;2013:182102. doi: 10.1155/2013/182102

21. Tohira H, Fatovich D, Williams TA, et al. Is it Appropriate for Patients to be Discharged at the Scene by Paramedics? Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors 2016;20(4):539-49. doi: 10.3109/10903127.2015.1128028

22. Pre-Hospital Emergency Care Council. Clinical Practice Guidelines, 2017 Edition - Advanced Paramedic. Naas: Pre-Hospital Emergency Care Council, 2017.

23. O'Meara P. The rural and regional ambulance paramedic: moving beyond emergency response. Australia: School of Public Health, Charles Sturt University, Bathurst, 2006.

24. Raven S, Tippett, V., Ferguson, J., Smith, S. An exploration of expanded paramedic healthcare roles for Queensland. Queensland: Australian Centre for Prehospital Research James Cook University, 2006.

25. Kizer K, Shore, K., Moulin, A. Community Paramedicine: A Promising Model for Integrating Emergency and Primary Care. USA: Institute for Population Health Improvement, UC Davis Health System, 2013.

26. National Institute for Health and Care Excellence (UK). Paramedics with enhanced competencies. London: National Institute for Health and Care Excellence, 2017.

27. Millin MG, Brown LH, Schwartz B. EMS provider determinations of necessity for transport and reimbursement for EMS response, medical care, and transport: combined resource document for the National Association of EMS Physicians position statements. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors 2011;15(4):562-9. doi: 10.3109/10903127.2011.598625

28. Zachariah BS, Bryant D, Pepe P, et al. Follow-up and Outcome of Patients who Decline or are Denied Transport by EMS. Prehosp Disaster Medicine 1992;7(4):359 - 63.

29. Norberg G, Wireklint Sundstrom B, Christensson L, et al. Swedish emergency medical services' identification of potential candidates for primary healthcare: Retrospective patient record study. Scandinavian journal of primary health care 2015;33(4):311-7. doi: 10.3109/02813432.2015.1114347
Power, Ryan, Bury. Clinical presentations and practitioner levels appropriate for the introduction of ‘treat and referral pathway(s)’ into the Irish Emergency Medical Service: A survey of Consultants in emergency medicine. https://doi.org/10.32378/ijp.v5i1.233

30. Snooks H, Kearsley N, Dale J, et al. Towards primary care for non-serious 999 callers: results of a controlled study of “Treat and Refer” protocols for ambulance crews. *Quality and Safety in Health Care* 2004;13(6):435-43.

31. O’Hara R, Johnson M, Siriwardena AN, et al. A qualitative study of systemic influences on paramedic decision making: care transitions and patient safety. *J Health Serv Res Policy* 2015;20(1 Suppl):45-53. doi: 10.1177/1355819615458472

32. Barry S, Dalton, R. and Eustace-Cook, J. Understanding Change in Complex Health Systems. Trinity College Dublin: Trinity College, 2018.

33. Minhas R. A prehospital treat-and-release protocol for supraventricular tachycardia. *Canadian Journal of Emergency Medicine* 2014;15

34. Coates D, Rawstorne S, Benger J. Can emergency care practitioners differentiate between an avoided emergency department attendance and an avoided admission? *Emergency medicine journal : EMJ* 2012;29(10):838-41. doi: 10.1136/emermed-2011-200484 [published Online First: 2012/02/16]

35. Cummins NMD, M. Garavan, C. Landymore, E. Mulligan, N. O’Donnell, C. Can advanced paramedics in the field diagnose patients and predict hospital admission? *Emergency medicine journal : EMJ* 2013;30(12):1043-7. doi: 10.1136/emermed-2012-201899

36. Snooks HA, Dale J, Hartley-Sharpe C, et al. On-scene alternatives for emergency ambulance crews attending patients who do not need to travel to the accident and emergency department: a review of the literature. *Emergency medicine journal : EMJ* 2004;21(2):212-5. [published Online First: 2004/02/28]

37. Ambulance Service of New South Wales. Clinical Assessment & Referral (CARE). CARE Clinical Pathways. Sydney: Ambulance Service of New South Wales, 2008.

38. O’Brien BC, Harris IB, Beckman TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med* 2014;89(9):1245-51. doi: 10.1097/ACM.0000000000000388

39. Guéret M. Irish Medical Directory 2012 - 2013. Dublin: Irish Medical Directory 2012.

40. Jeong HJ LW. The level of collapse we are allowed: Comparison of different response scales in Safety Attitudes Questionnaires. *Biometrics & Biostatistics International Journal* 2016;4(4): 00100. doi: 10.15406/bbij.2016.04.00100

41. MacCorr Research Solutions. Sample size calculator Toronto, Ontario Canada: MacCorr Research; 2018 [Available from: http://www.macorr.com/sample-size-calculator.htm2018.

42. Lerner EB, Billittier Aft, Lance DR, et al. Can paramedics safely treat and discharge hypoglycemic patients in the field? *The American journal of emergency medicine* 2003;21(2):115-20. doi: 10.1053/ajem.2003.50014 [published Online First: 2003/04/03]

43. Cone DC, Schmidt TA, Mann NC, et al. Developing research criteria to define medical necessity in emergency medical services. *Prehospital Emergency Care* 2004;8(2):116-25.

44. Strote J, Simons R, Eisenberg M. Emergency medical technician treatment of hypoglycemia without transport. *The American journal of emergency medicine* 2008;26(3):291-5. doi: 10.1016/j.ajem.2007.05.030 [published Online First: 2008/03/25]

45. Leikkola P, Mikkola R, Salminen-Tuomaala M, et al. Non-conveyance of patients: Challenges to decision-making in emergency care. *BMC Nurs* 2016;4:9. doi: 10.5430/cns.v4n4p31
Power, Ryan, Bury. Clinical presentations and practitioner levels appropriate for the introduction of ‘treat and referral pathway(s)’ into the Irish Emergency Medical Service: A survey of Consultants in emergency medicine. https://doi.org/10.32378/jip.v5i1.233

46. Fealy GM, Treacy M, Drennan J, et al. A profile of older emergency department attendees: findings from an Irish study. Journal of advanced nursing 2012;68(5):1003-13. doi: 10.1111/j.1365-2648.2011.05800.x [published Online First: 2011/08/13]

47. Tiedemann A, Mikolaizak AS, Sherrington C, et al. Older fallers attended to by an ambulance but not transported to hospital: a vulnerable population at high risk of future falls. Australian and New Zealand journal of public health 2013;37(2):179-85. doi: 10.1111/1753-6405.12037

48. Barnard S, Appleby-Flemming, J., Black, B., Peters, M., Robinson, C. National Ambulance Non-Conveyance Audit (NANA) Report. London: National Ambulance Service Clinical Quality Group (NASCQG), 2014.

49. Deasy Cea. MAJOR TRAUMA AUDIT National Report 2016. Dublin: Health Service Executive, 2018.