

Stakeholder Opinion on the proposal to introduce ‘Treat and Referral’ into the Irish Emergency Medical Service.

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Title page

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ABSTRACT

Background: The Irish ambulance services have traditionally transported all patients following an emergency (112/999) call, regardless of acuity, to an ED. A proposal to introduce Treat and Referral, an established care pathway in some jurisdictions, is under active consideration in Ireland. This will present a significant change.

Stakeholder engagement is recognised as an essential component of management of such change. This study has conducted a multicentre, cross-sectional survey exploring opinions on the introduction of Treat and Referral among key Irish stakeholders; consultants in emergency medicine, paramedics and advanced paramedics.

Methods: Public-sector consultants in emergency medicine, registered paramedics and advanced paramedics, in Ireland at the time of the study, were invited to complete an on-line survey.

Results:

A significant finding was that 90% of both cohorts (EM consultants and PHECC practitioners) support written after-care instructions being given to referred patients, that > 83% agree that Treat and Referral will reduce unnecessary ambulance journeys and that 70% are in favour of their own family member being offered Treat and Referral. Consensus was reached between respondents that Treat and Referral would improve care and increase clinical judgement of practitioners. Differences

were identified in relation to the increased availability of ambulances locally, that only adults should be included, and that research was required to extend Treat and Referral beyond the index conditions. There was no consensus on whether GPs should be directly informed.

Conclusions: This study identified that the Irish healthcare practitioners surveyed are supportive of the introduction of Treat and Referral into Ireland. It also affords healthcare policymakers the opportunity to address the concerns raised, in particular the clinical level which will be targeted for inclusion in this extended scope of practice.

Key words:

Paramedic, consultant in emergency medicine, emergency departments, admission avoidance, prehospital care, treat and referral, treat and release.

Background

The international literature has identified that a significant proportion of patients transported to an emergency department (ED) by ambulance do not have life-threatening conditions^{1 2} and do not necessarily require an ambulance to get to an ED.^{3 4 5} The Health Service Executive report a 3.7% year on year increase in ED attendances in the 2018 annual report.⁶ Furthermore, pre-hospital emergency care practice has demonstrated safety and efficacy in managing some acute presentations alleviating the need for immediate ED care.^{7 8 9 10} Patients, carers and bystanders perceptions of clinical urgency, resulting in ambulance use, appear to be far greater than the actual clinical problem.^{5 11} The literature suggests that between 30% and 50% of patients attending ED could be appropriately treated in less emergent settings.¹²⁻¹⁵ Indeed one author has claimed that up to 80% of these inappropriate ED attenders could be treated adequately in a primary care setting.¹⁶

Currently, for all patients in Ireland, ambulance transport to an ED (or PCI centre) is the only option which can be offered by paramedics and advanced paramedics. 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 UK and Australian ambulance services which have transitioned to non-conveyance of selected patients.¹⁹⁻²¹

Drivers for the introduction of non-conveyancing strategies such as 'Treat and Refer' or 'Treat and Discharge' include improving patient quality of care, maximising the utility of ambulance services, easing ED workloads or responding to patient experience.²²⁻²⁵ Overcrowding in EDs is an international issue and ambulance

bypass is seen as a potential solution.^{26 27 28} The introduction of Treat and Referral 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). In recent years, disposition options for both clinical levels have been introduced by PHECC for ST elevation Myocardial Infarction, stroke and certain trauma presentations, permitting by-pass of the nearest ED in order to travel to a specialist centre.²⁹ Pre-hospital emergency care interventions have improved significantly over the decades and specific acute presentations can be definitively managed through these interventions, reducing the requirements for ongoing immediate acute care.^{30 31 32 33} The ability of paramedics to universally make decisions in relation to Treat and Referral, however, has not been established in the peer-reviewed literature.³⁴ Furthermore, the available evidence does not support practitioners below that of an Irish advanced paramedic making such decisions.^{35 36 37}

In a regional stakeholder study, to explore attitudes and perceptions of healthcare providers in relation to inappropriate attendance at the ED, Breen and McCann (2013)³⁸ surveyed doctors, nurses and paramedics in three hospitals in Ireland. This questioned *inter alia* whether; '*Ambulance staff should have the choice whether to transport a patient to the ED or the GP*'. Authorising ambulance personnel to decide on transporting the patient to a primary care facility or to an ED had significant support. While doctors and nurses were cautious, paramedics had a much greater proportion in favour; it is unclear from the research why this difference exists. Rice

(2016)³⁹ reported, in a survey of Dublin paramedics and advanced paramedics, that a significant majority agreed that alternative care pathways to the ED was a good idea. Exploration of the views of these groups and increased understanding for their differing perspectives is required.

This study engaged consultants in emergency medicine, paramedics and advanced paramedics in Ireland in relation to the proposed introduction of Treat and Referral, as stakeholder buy-in is necessary for change management success.⁴⁰ General practitioners were engaged in a separate research exercise, which will be reported separately. Treat and Referral was defined as the process whereby a paramedic treats a patient, following a 112/999 incident, and offers a disposition other than ambulance transport to an ED.^{4 23} While Treat and Referral has been introduced in other jurisdictions for some time, there remain concerns in relation to this pathway among medical practitioners in these and other countries.^{41 42 18 43}

METHODS

On line anonymised questionnaire surveys were circulated to consultants in emergency medicine, paramedics and advanced paramedics to explore their perceptions and views of the introduction in Ireland of Treat and Referral options for patients who had recovered from hypoglycaemia or isolated seizure.

Ethical approval was obtained through the University Hospital Limerick Ethics Committee. Electronic surveys were constructed using an online survey tool (Survey Monkey). Consent was received from respondents through voluntary participation in the survey. The surveys were piloted, in paper form, to assist with face validity and a

number of iterations of the survey were developed to ensure appropriate wording and content.⁴⁴ Hypoglycaemia and seizure were the index presentations under consideration for Treat and Referral, as these presentations may be definitively managed in the pre-hospital environment.^{7 8 9 10 45 46}

The survey had seven domains: (1) demographics (2) experience with hypoglycaemia and seizure management (3) opinion on Treat and Referral introduction, (4) patients declining transport, (5) training / confidence in care management, (6) communication and (7) capacity assessment. The declining transport, communication and capacity assessment domains are reported on elsewhere. 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.

The population consisted of consultants in emergency medicine in the public sector in Ireland⁴⁷ and PHECC registered paramedics and advanced paramedics. The initial sample frame was defined by consultants and practitioners who had an e-mail address. 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.

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)⁴⁸ 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 on-line calculator.⁴⁹ Pearson's Chi square tests was used to identify statistically significant differences among cohorts. Statistical significance was taken at a level of $p < 0.05$.

RESULTS

Response rates differed between the clinical cohorts, $n = 375$ paramedics (27% of paramedics who received the survey), $n = 244$ advanced paramedics (80% of advanced paramedics who received the survey) and $n = 39$ (62% of consultants in emergency medicine who received the survey).

Representative stakeholder opinion was achieved across case-mix, ED attendance rates and geographical spread. Table 1 summarises respondents principal work setting by urban /rural mix

Table 1 Service area and clinical level of respondents

Service area	Paramedic	Advanced Paramedic	Emergency Medicine Consultant	Total
Totally urban	50	14	6	70 (10.6%)
Mainly urban	164	116	19	299 (45.5%)
Mainly rural	150	102	13	265 (40.3%)
Totally rural	11	12	1	24 (3.6%)
Total (response rate)	375 (27%)	244 (80%)	39 (62%)	658

A maximum distance of travel to ED was collapsed into two groups ≤ 20 Km and > 20 Km for analysis. No statistically significant difference was identified between all

three cohorts of respondents in relation to service area and travel time to ED. This also applied to the opinions on treat and referral.

Table 2 Geographical spread of EM Consultant respondents

Area	Respondents	Percentage per area
Dublin City	12	41.4%
Mid Leinster area	5	100.0%
North Eastern area	3	75.0%
Southern area	10	66.7%
Western area	9	64.3%
Total	39	58.2%

The majority of consultants (95%) report an ED attendance of > 30,000 per annum while the balance (5%) report attendance of 20,000 – 30,000 at their ED.

Respondents' opinion on 11 statements in relation to Treat and Referral was sought.

Table 3 summarises these responses. There was strong agreement on key statements. Particularly, that 'Treat and Referral will result in improved patient care'.

A significant finding was that 90% of both cohorts (EM consultants and PHECC practitioners) support written after-care instructions being given to referred patients, that > 83% agree that Treat and Referral will reduce unnecessary ambulance journeys and that 70% are in favour of their own family member being offered Treat and Referral. The scale for these statements had a good level of internal consistency as determined by a Cronbach's alpha of 0.671.

'Limiting Treat and Referral to hypoglycaemia and seizure until research demonstrates it is safe to do so' had a slight majority of PHECC practitioners (51%) in agreement and a majority of EM consultants (69%) in agreement. The PHECC practitioners' opinion was statistically significantly different to that of the EM consultants ($p = 0.013$). This suggests that evidence-based medicine was progressively more strongly supported as clinical levels increased.

'Treat and Referral will increase ambulance availability for emergencies locally' had a significant majority of PHECC practitioners (84%) in agreement but only a small majority of EM consultants (56%) were in agreement. There was a highly statistically significant difference between PHECC practitioners and EM consultants on this statement ($p < 0.001$).

The clinical level at which PHECC practitioners should have Treat and Referral within their scope of practice has a difference of opinion. 'That Treat and Referral should only be available for advanced paramedics' was strongly opposed by the paramedic cohort ($n = 249, 70\%$), while supported by a minority of advanced paramedics ($n = 91, 39\%$) and a small majority of EM consultants ($n = 20, 57\%$). There is a highly statistical difference between PHECC practitioners and EM consultants on this statement ($p < 0.001$).

'That Treat and Referral should only be available for paramedics with several years-experience' was supported by a minority of paramedic respondents ($n = 144, 41\%$), a small majority of advanced paramedic respondents ($n = 124, 53\%$) and a minority of EM consultant respondents ($n = 17, 47\%$). There is no statistical difference between PHECC practitioners and EM consultants on this statement ($p = 0.525$).

These two statements demonstrate divergence of opinion on what clinical level is appropriate for Treat and Referral to be included in the scope of practice. There is a higher mean support for paramedics with experience than advanced paramedics only (47% V 36%) across the three cohorts, however paramedic respondents may have an expected personal bias, expressing a view to not restrict their scope of practice. No strong majority exists among EM consultants in favour of experienced practitioners.

'Limiting Treat and Referral to adult patients' was supported by PHECC practitioners (57%) whereas a minority of EM consultant respondents supported this restriction (47.2%). There is a statistical difference between PHECC practitioners and EM consultants on this statement ($p = 0.005$). This finding among PHECC practitioners was anticipated as research suggests that providing emergency care for paediatric patients can evoke anxiety and discomfort among pre-hospital practitioners.⁵⁰

'GPs shall be informed through e-mail following Treat and Referral for their patient' has little support from PHECC practitioners (48%) while EM consultants supported it by a large majority (89%). There is a highly statistical difference between PHECC practitioners and EM consultants on this statement ($p < 0.001$).

Finally, the mean score agreeing or strongly agreeing across all 11 statements was 67% for EM consultants and 63% for PHECC practitioners and the collective median was 3.6 from a 5-point Likert scale. This demonstrates a majority are in support of the 11 statements which suggest that they are in favour of the introduction of treat and referral.

Table 3. Survey statements on Treat and Referral

Text	Median score (range)	PHECC practitioner agree/ strongly agree (CI 95%)	EM Consultant Agree/ strongly agree (CI 95%)	Statistical difference between PHECC practitioners and EM Consultants
T&R will result in improved patient care.	4 (1 - 5)	66.5% (±3.5%)	61.1% (±10.2%)	p = 0.346
T&R will increase clinical judgement skills.	4 (1 - 5)	73.5% (±3.5%)	61.1% (±10.2%)	p = 0.023
T&R will reduce unnecessary ambulance journeys.	4 (1 - 5)	87% (±3.5%)	83.3% (±10.2%)	p = 0.053
T&R will result in increased ambulance availabilities for emergencies locally.	4 (1 - 5)	83.9% (±3.5%)	55.6% (±10.2%)	p < 0.001
T&R should only be available as an advanced paramedic intervention.	2 (1 - 5)	22.6% (±3.5%)	57.2% (±10.2%)	p = 0.001
T&R should only be available as an intervention to paramedics with several years' experience.	3 (1 - 5)	45.4% (±3.5%)	47.2% (±10.2%)	p = 0.525
T&R should only be available for adult patients (18 and over).	4 (1 - 5)	57.2% (±3.5%)	47.2% (±10.2%)	p = 0.005
I would be happy for a family member to be offered T&R by a paramedic or advanced paramedic following an acute event.	4 (1 - 5)	69.6% (±3.5%)	69.4% (±10.2%)	p = 0.567
Patients offered T&R should be given specific written after-care instruction, similar to head injury advice leaflet given by emergency department staff.	4 (1 - 5)	88.2% (±3.5%)	91.7% (±10.2%)	p = 0.744
Patients offered T&R should be limited to specific conditions such as hypoglycaemia and isolated seizure until research demonstrates it is a safe clinical practice.	4 (1 - 5)	50.6% (±3.5%)	69.4% (±10.2%)	p = 0.013
Patients offered Treat and Referral will require their GP to be informed about the episode through e-mail or ordinary mail by the treating paramedic or advanced paramedic.	3 (1 - 5)	47.5% (±3.5%)	88.9% (±10.2%)	p < 0.001
Mean	3.6	62.9%	66.6%	

DISCUSSION

In this study the healthcare stakeholders, EM consultants and PHECC practitioners, have been surveyed to elicit their opinion in relation to the introduction of Treat and Referral into Ireland. The results demonstrate that the majority view from all

concerned was in favour of this proposal. This confirms and expands the findings of regional based Irish studies.^{38 39} However, it is noteworthy that differences of opinion, between and among healthcare practitioners, were identified across several areas of the survey.

Improvements in patient care following the introduction of Treat and Referral has to be measured through clinical audit incorporating structure, process and/or outcome measures.⁵¹ Treat and referral effectiveness is currently measured in the literature by 'repeat episodes within 72 hours'^{52 53 54 55} and 'patient satisfaction'.^{56 57}

Whereas, a large percentage of consultants in emergency medicine and PHECC practitioners expressed the view that Treat and Referral will improve patient care, clinical audit will be required to demonstrate any improved care.

While Emergency Medical Technicians have been used successfully in research for Treat and Referral⁵⁵, concern was raised in this study about the clinical acumen of some PHECC practitioners (paramedics compared to advanced paramedics) to select appropriate patients for a Treat and Referral clinical care pathway. This was also identified in the literature where decision making in relation to non-conveyance was reported as being more difficult for lower clinical levels.¹¹ The clinical level at which Treat and Referral will be introduced, has identified divergences of opinion in this research. The majority agree that it should not be restricted to advanced paramedics only, however a majority of EM consultants agree that it should be while concern is evident among paramedics at limiting their scope of practice. As with any new process this study would suggest prudence in the implementation of Treat and Referral, commencing with the higher clinical level of advanced paramedic initially.

The literature is silent on whether the GP should be informed following Treat and Referral being offered to their patients. A highly significant difference of opinion exists between PHECC practitioners and EM consultants in relation to this issue ($p < 0.001$). It would appear prudent for GPs to be informed about an acute event following a Treat and Referral disposition to ensure continuity of ongoing health management. Consensus was reached in relating to offering Treat and Referral to an own family member where the majority were in favour. This suggests personal confidence in the process.

The support for an evidence-based model was demonstrated in that the majority were in favour of restricting Treat and Referral to the index presentations, hypoglycaemia and seizure, until research demonstrated the safety and efficacy of introducing other clinical conditions. Support for evidence-based medicine was progressively more strongly supported by the higher clinical levels. This may be reflective of the low level of exposure to research education in paramedic training programmes⁵⁸ and provides an opportunity for intervention. Adults only being offered Treat and Referral is consistent with other findings.⁵⁰

Study Limitations

A low response rate (27%) was noted among paramedics, which contrasts with the high response rates on the other groups. This may reflect a paramedic view of limited relevance to their role or other reasons for non-engagement. No conclusions can therefore be drawn from this study about the representativeness of paramedic

views described here. Nonresponse bias was an issue as ~50% of delivered e-mails were not opened, verified by no read receipt received.

The study instruments have not been validated elsewhere. The limitations of anonymous electronic surveys may preclude the identification of other barriers or facilitators among respondents.

The study focused on clinical 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 in this study.

CONCLUSION

This stakeholder engagement identified that the healthcare practitioners surveyed are, in the main, supportive of the introduction of Treat and Referral into Ireland. It also provides an opportunity to address minority concerns by healthcare policy makers, in particular the clinical level which will be targeted for inclusion in this extended scope of practice.

There appears to be no appetite for paediatric inclusion in Treat and Referral at this time. Ongoing clinical audit will be essential to evidence patient safety.

In introducing Treat and Referral into Ireland, defining appropriate structure, process and outcome measurements will ensure the confidence of healthcare policy makers in entrusting PHECC practitioners to safely implement it. The support, identified through this survey, should be harnessed to assist this process and a smooth

implementation of this practice, wholly consistent with the central tenant of near patient treatment in current Irish health care Policy 'Sláintecare'.⁵⁹

Abbreviations used

ED	Emergency Department
GP	General Practitioner
PCI	Percutaneous Coronary Intervention
PHECC	Pre-Hospital Emergency Care Council
T&R	Treat and Referral
UK	United Kingdom

Declarations

Ethics approval and consent to participate

Ethical approval was received from the Ethics Committee of Mid-Western Regional Hospital

Consent for publication

Not applicable

Availability of data and materials

The datasets during and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

Brian Power (BP) principal author, Prof Gerard Bury (GP) and Prof John Ryan (JR)

BP designed the survey, collected and analysed the data and wrote the journal article.

GP as the principal PhD supervisor oversaw the project and edited the manuscript

JR as a PhD supervisor edited the manuscript

All authors have read and approved the manuscript

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References

1. 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.
2. 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
3. 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
4. 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
5. 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
6. Health Service Executive. HSE Annual Report and Financial Statements 2018. <https://www.hse.ie/eng/services/publications/corporate/hse-annual-report-and-financial-statements-2018.pdf>: Health Service Executive, 2019.
7. 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]
8. 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
9. 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
10. 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
11. 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
12. Billings J, Parikh, Nina, Mijanovich, Tod. Emergency Department Use: The New York Story. *Issue Brief* 2000. www.cmwf.org.
13. 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]
14. 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.
15. Weinick RM, Burns RM, Mehrotra A. Many emergency department visits could be managed at urgent care centers and retail clinics. *Health Aff (Millwood)* 2010;29(9):1630-6. doi: 10.1377/hlthaff.2009.0748
16. 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/emered-2012-201116
17. Cain E, Ackroyd-Stolarz S, Alexiadis P, et al. Prehospital hypoglycemia: 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. Snooks 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. Deasy C, Ryan D, O'Donnell C, et al. The impact of a pre-hospital medical response unit on patient care and emergency department attendances. *Irish medical journal* 2008;101(2):44-6.
 23. Minhas R. A prehospital treat-and-release protocol for supraventricular tachycardia. *Canadian Journal of Emergency Medicine* 2014;15
 24. Tohira H, Williams TA, Jacobs I, et al. The impact of new prehospital practitioners on ambulance transportation to the emergency department: a systematic review and meta-analysis. *Emergency medicine journal : EMJ* 2014;31(e1):e88-94. doi: 10.1136/emj-2013-202976
 25. Keene T, Davis, Megan, Brook, Carol Characteristics and outcomes of patients assessed by paramedics and not transported to hospital: A pilot study. *Australasian Journal of Paramedicine* 2015;12(2)
 26. 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/emj-2014-203616
 27. Hickey F. IAEM slams official responses to worsening Emergency Department crowding crisis: Irish Association for Emergency Medicine, 2016.
 28. 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.
 29. Pre-Hospital Emergency Care Council. Clinical Practice Guidelines, 2017 Edition - Advanced Paramedic. Naas: Pre-Hospital Emergency Care Council, 2017.
 30. O'Meara P. The rural and regional ambulance paramedic: moving beyond emergency response. Australia: School of Public Health, Charles Sturt University, Bathurst, 2006.
 31. 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.
 32. 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.
 33. National Institute for Health and Care Excellence (UK). Paramedics with enhanced competencies. London: National Institute for Health and Care Excellence, 2017.
 34. Kirkland SW, Soleimani A, Rowe BH, et al. A systematic review examining the impact of redirecting low-acuity patients seeking emergency department care: is the juice worth the squeeze? *Emergency medicine journal : EMJ* 2019;36(2):97-106. doi: 10.1136/emj-2017-207045

35. 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
36. Tohira H, Fatovich D, Williams TA, et al. Which patients should be transported to the emergency department? A perpetual prehospital dilemma. *Emergency medicine Australasia : EMA* 2016;28(6):647-53. doi: 10.1111/1742-6723.12662
37. Knowles E, Bishop-Edwards L, O'Cathain A. Exploring variation in how ambulance services address non-conveyance: a qualitative interview study. *BMJ open* 2018;8(11):e024228. doi: 10.1136/bmjopen-2018-024228
38. Breen BM, McCann M. Healthcare providers attitudes and perceptions of 'inappropriate attendance' in the Emergency Department. *International emergency nursing* 2013;21(3):180-5. doi: 10.1016/j.ienj.2012.08.006
39. Rice F. Attitudes to the introduction of "Treat and Refer" protocols, following the introduction of Individual Health Identifiers (IHIs) whereby EMS staff could refer patients to appropriate alternative care pathways rather than transport patients directly to hospital Emergency Departments (EDs). University College Dublin, 2016.
40. Barry S, Dalton, R. and Eustace-Cook, J. Understanding Change in Complex Health Systems. Trinity College Dublin: Trinity College, 2018.
41. Coates D, Rawstorne S, Bengler 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]
42. 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
43. 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]
44. Burns KE, Duffett M, Kho ME, et al. A guide for the design and conduct of self-administered surveys of clinicians. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne* 2008;179(3):245-52. doi: 10.1503/cmaj.080372
45. Lerner EB, Billittier AJt, 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]
46. Kaufmann MA, Nelson DR, Kaushik P, et al. Hypoglycemia Emergencies: Factors Associated with Prehospital Care, Transportation Status, Emergency Department Disposition, and Cost. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2019;23(4):453-64. doi: 10.1080/10903127.2018.1528322
47. Guéret M. Irish Medical Directory 2012 - 2013. Dublin: Irish Medical Directory 2012.
48. 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
49. MaCorr Research Solutions. Sample size calculator Toronto, Ontario Canada: MaCorr Research; 2018 [Available from: <http://www.macorr.com/sample-size-calculator.htm>2018].
50. Fowler J, Beovich, B, Williams, B. Improving paramedic confidence with paediatric patients: A scoping review. *Australasian Journal of Paramedicine* 2017;15(1)

51. El Sayed MJ. Measuring quality in emergency medical services: a review of clinical performance indicators. *Emergency medicine international* 2012;2012:161630. doi: 10.1155/2012/161630
52. Mechem CC, Barger J, Shofer FS, et al. Short-term outcome of seizure patients who refuse transport after out-of-hospital evaluation. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine* 2001;8(3):231-6. [published Online First: 2001/03/07]
53. Anderson S, Hogskilde PD, Wetterslev J, et al. Appropriateness of leaving emergency medical service treated hypoglycemic patients at home: a retrospective study. *Acta anaesthesiologica Scandinavica* 2002;46(4):464-8.
54. Carter AJ, Keane PS, Dreyer JF. Transport refusal by hypoglycemic patients after on-scene intravenous dextrose. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine* 2002;9(8):855-7. [published Online First: 2002/08/03]
55. 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]
56. Swain AH, Al-Salami M, Hoyle SR, et al. Patient satisfaction and outcome using emergency care practitioners in New Zealand. *Emergency Medicine Australasia* 2012;24(2):175-80.
57. Haines CJ, Lutes RE, Blaser M, et al. Paramedic initiated non-transport of pediatric patients. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2006;10(2):213-9. doi: 10.1080/10903120500541308
58. Cone DC. Knowledge translation in the emergency medical services: a research agenda for advancing prehospital care. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine* 2007;14(11):1052-7. doi: 10.1197/j.aem.2007.06.014
59. Shorthall R. Committee on the Future of Healthcare - Sláintecare Report. Dublin: Houses of the Oireachtas, 2017.