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**Can ‘Treat and Release’ protocols be implemented safely
in Paramedic-based pre-hospital care systems?**

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Background

Increasing demand for Emergency Medical Services (EMS) and rising levels of Emergency Department (ED) overcrowding have driven many healthcare systems to reevaluate the role which pre-hospital care plays in the larger context of emergency medicine. These factors have prompted many ambulance systems to implement processes intended to identify patients for whom ED treatment is not appropriate. In the UK, a landmark NAO report found that ambulance services must increasingly be “recognised as having a wider role, as a conduit to other NHS services and in ensuring patients can access the facilities they need” (National Accounting Office, 2011, p 6).

Such systems have the potential to reduce the load placed on EDs, improve patient outcomes, and reduce total healthcare spending by directing patients to the most appropriate forms of medical care (Alpert et al., 2013). One juncture at which a patient may be judged as not requiring ED care is at the point of evaluation by a pre-hospital care team at the scene of the incident. The overriding concern present in implementing such a process is avoiding the problem of under-triage; that is to say maintaining a high level of sensitivity in regards to the presence of conditions necessitating ED care.

Internationally, pre-hospital care methodologies vary widely; from systems utilizing ambulance personnel with a relatively low level of training as found in Anglo-American systems, to those relying on highly trained staff to respond directly to the scene of emergencies as typified by continental European systems. As may be expected, formalized processes for providing definitive treatment on-scene and/or referral of patients to non-emergency department care exist to a far greater extent in the latter (Arnold, 1999). The question at hand is whether and how the former system may realize the benefits of appropriate patient steering while retaining the cost effectiveness inherent in the use of practitioners operating within a narrower scope of practice.

Purpose

This paper will review the available literature on the topic of pre-hospital triage and synthesize the results of studies characterizing the ability of Paramedics in Anglo-American prehospital care systems to appropriately classify patients as not requiring transport to an ED.

Methods

An initial hand-searching and review of bibliographies was performed to establish a list of relevant search terms to be applied in the systematic review. Parallel searches in PubMed and CINAHL were performed based on the established list of relevant terms, with Table 1 below detailing the results of these searches. A snowball search of the bibliographies of the included papers was performed to identify additional relevant articles. Each article was reviewed fully upon determining relevance based on title and abstract. An article was included in the systematic review if it:

- 1) Described an implementation of- or an existing process for pre-hospital determination of the necessity for ambulance transport to an Emergency Department using a quantitative outcome measure in a system using providers with 2 or fewer years of formal education, OR:
- 2) Characterized the theoretical capability of staff to determine the necessity for ambulance transport to an Emergency Department (or an indicator for the need thereof) using a quantitative outcome measure in a system using providers with 2 or fewer years of formal education

A publication date of 2000 or later was used as an inclusion criterion to preferentially capture recent articles. Upon reaching the limit of relevant peer-reviewed articles specified for this assignment, the search was terminated. As such, this paper does not constitute a comprehensive review of the available literature, although a large majority of the relevant articles known to the author were included using this search procedure. Due to the low overall robustness of studies in this field as noted by Bounes et al. (2013), a criterion specifying randomized or even comparative study designs was not applied.

Table 1

Search term	Database	Hits	Read abstracts	Read Articles	Articles included in review
prehospital non-transport	Pubmed	6	3	2	2
"treat and release"	Pubmed	45	4	1	1
paramedic* triage	Pubmed	286	13	7	6
"treat and discharge"	Pubmed	0	0	0	0
prehospital non-transport	Cinahl	5	0	0	0
"treat and release"	Cinahl	18	1	1	1
"treat and discharge"	Cinahl	10	1	1	1
Snowball Search	N/A	N/A	6	1	1

Results

Twelve articles met the criteria for inclusion in this review and are presented below in Table 2 in order of publication date. The Objective, Design, patient study Population and the level and number of practitioners involved in the Study group was documented. The underlying primary Outcome measure was recorded The Sensitivity and Specificity were found to be a common measure of decision accuracy and are reported here along with the general impression of the researcher under Finding. Where it is possible to infer a measure of sensitivity based on subsequent hospital admission and/or ED treatment, this is presented as well with no corresponding measure of specificity.

Table 2

Citation	Objective	Design	Population (Sample Size)	Study group	Outcome	Quality	Finding (Sens/Spec)
Hale and Sipprell, 2000	To evaluate the ability of Emergency Medical Technicians–Basic to identify wounds repairable in the field or requiring tetanus prophylaxis	Prospective, descriptive convenience sample study with no control group	Patients presenting to a Minnesota ED with lacerations from March 1, 1998 to September 1, 1998 (n = 164)	11 EMT-B volunteers with one hour of special training	Kappa statistic agreement with blinded MD assessment	3	Supportive (100/94)
Pointer et al., 2001	To determine whether paramedics using written guidelines can accurately triage patients in the field	Prospective, descriptive convenience sample study with no control group	Patients transported by EMS to a California ED from July 1998 to January 1999 (n = 1180)	54 Paramedics with 1/2 hour of special training	Sensitivity/Specificity as compared to blinded MD assessment	2	Opposing (89.7/36.5)
Schmidt et al., 2001	To evaluate emergency medical technicians' ability to safely apply protocols to assign transport options	Prospective, descriptive convenience sample study with no control group	Patients contacting 911 in a county in Oregon September, 1998 to August, 1999 (n = 656)	Paramedics with no special training	Sensitivity/Specificity as compared to ED chart criteria standard	3	Neutral (90/25)
Hauswald, 2002	To determine whether paramedics can safely decide which patients do not require ambulance transport or ED care	Prospective, descriptive convenience sample study with no control group	Patients transported to a New Mexico ED during November, 1997 (n = 183)	Paramedics with no special training	Kappa statistic agreement with ED chart criteria standard	3	Opposing
Lerner et al., 2003	To determine whether paramedics can safely treat and discharge insulin-dependent diabetic patients experiencing uncomplicated hypoglycemic events	Prospective, observational case series with no control group	Patients contacting 911 with Altered Mental Status in New York with diabetes history and glucose <80 mg/dL with full recovery on scene from August 1995 to January 1998 (n = 36)	Paramedics receiving one training session	Prevalence of complications following discharge	3	Supportive

Snooks et al., 2004	To evaluate triage and transportation to a minor injury unit by emergency ambulance crews	Cluster-randomized controlled trial	Patients contacting 999 with minor injuries meeting study criteria in London (n = 473)	55 Ambulance crews	Patient satisfaction, job-cycle time, adverse outcomes	2	Supportive
Haines et al., 2006	To describe the outcome of pediatric patients subject to EMS initiated non-transport	Prospective, observational case series with no control group	Pediatric patients classified as not requiring ambulance transport by ALS ambulance crew and left on scene (n = 704)	Paramedics with no special training with guidance from on-line medical control	Hospital admission rate and patient satisfaction 72 hours after EMS contact	3	Supportive (97.6/-)
Levine et al., 2006	to determine whether paramedics accurately predict which patients will require admission to the hospital	Prospective, descriptive convenience sample study with no control group	Patients transported to a Colorado ED from June 18 to July 18, 2001 (n = 932)	136 Paramedics with no special training	Sensitivity/Specificity as compared to subsequent hospital ward/ICU admission	3	Opposing (89/62)
Knapp et al., 2009	To determine if paramedics using transport guidelines can identify patients who can be safely transported by taxi.	Prospective, observational case series with no control group	Patients classified as not requiring ambulance transport by ALS ambulance crew and directed to ED via taxi from June 2005 to December 2006 (n = 93)	28 Paramedics with > 1 year of experience and receiving 2 hours of special training	Admission rate and emergent treatment of patients transported by taxi	3	Neutral (90/-)
Cummins et al., 2013	To determine whether Advanced Paramedics can accurately predict the requirement for hospital admission	Prospective, descriptive convenience sample study with no control group	Patients transported to an ED in Mid-West Ireland by an Advanced paramedic over a 6 month period (n = 748)	17 Advanced Paramedics with no special training	Concordance between AP prediction of admission and subsequent hospital admission	3	Neutral (77/65)
Krumperman et al., 2015	To compare compliance with follow-up instructions and patient satisfaction in a system utilizing an on-scene vs. a telephone based triage system	Retrospective, comparative cohort study of two distinct EMS systems	Patients contacting 911 in a Southern US state and referred to non-ED services by telephone nurse or an ambulance on Scene during heterogeneous time periods (Ambulance n = 374, Telephone n = 216)	Not described	Rates of patient satisfaction and compliance with instruction	4	Neutral
Minhas et al., 2015	To evaluate the impact, paramedic adherence, and patient re-presentation rates of a treat-and release protocol for uncomplicated Supraventricular Tachycardia	Retrospective, descriptive cohort study	Patients presenting to EMS with SVT in Alberta, Canada from September 1, 2010 to September 30, 2012 (n = 229)	Paramedics with no special training	Prevalence of re-presentation to EMS/ED within 72 hours, rate of paramedic adherence to protocol	3	Supportive

Analysis

The almost exclusively observational nature of research in this field results in a generally low level of evidence quality. The only two comparative studies included were Snooks et al. (2004) which relied on a pseudo-randomization method and Krumperman et al. (2015) which was double-downgraded due to severe problems relating to unadjusted heterogeneity between the investigated study populations and insufficient description of the investigated EMS systems. Pointer et al. (2001) was upgraded due to the study's exhaustive methodological considerations, relatively large study population, and graduated analysis.

As noted previously, two types of studies were included in this paper – those involving clinical interventions and those addressing the hypothetical abilities of pre-hospital practitioners. Interventional studies most frequently describe their effectiveness in terms of subsequent patient interaction with the healthcare system and satisfaction measures. Lerner et al., (2003) for instance tracked adverse events following discharge, while Haines et al., (2006) followed up with patients 72 hours after discharge to determine hospital admission rates. Of the interventional studies in this analysis, only Snooks et al. (2004) included a control group, likely owing to the technical and ethical difficulties involved in randomizing or pseudo-randomizing pre-hospital care. As such, information as to the relative effectiveness of a given protocol can be gained only by replicating the circumstances of other studies. No such replicative studies were identified.

The most common method of assessing the theoretical effectiveness of pre-hospital triage is by comparison with a “gold standard” which typically takes the form of either a case-by-case review by a panel of clinical subject matter experts, as found in for instance Pointer et al., (2001), or comparison with a set of in-hospital treatment criteria as typified by Schmidt et al., (2001). While expert review may theoretically produce more accurate results in relation to the “true” need for transport by ambulance, they result in an analysis which is more difficult to replicate elsewhere owing to the subjectivity inherent in such a process.

Another pattern can be detected in the results of this analysis relating to the breadth of the protocols involved. Several studies investigated the application of protocol sets containing a large number of individual patient conditions, or on the general need for a given patient to access emergency department care (Pointer et al., 2001, Schmidt et al., 2001, Hauswald, 2002, Levine et al., 2006, Haines et al., 2006, Knapp et al., 2009, Cummins et al., 2013). With the exception of Haines et al., (2006), which investigated a relatively small set of

pediatric protocols, these studies were generally opposed to the implementation of such protocols on safety grounds, finding a collective average sensitivity of 88.9%. Among studies evaluating the implementation of a single protocol or procedure the findings are generally supportive (Hale and Sipprell, 2000, Lerner et al., 2003, Snooks et al., 2004, Minhas et al., 2015), though outcome measures are too heterogeneous to allow aggregation.

Discussion

It is important to note that the criteria applied in this paper have excluded a number of key articles dealing with pre-hospital care practitioners with higher levels of training operating within Anglo-American systems, particularly in the UK. Mason et al., (2007) for instance, support the ability of Paramedic Practitioners to significantly reduce ED attendance and improve satisfaction in a cluster-randomized trial. One option for addressing the lack of a satisfactory level of sensitivity found in trials utilizing a broad set of protocols is thus to increase the level of training given to personnel authorized to execute Treat and Release protocols, or integrating hospital-based staff in the EMS system. This would in essence constitute moving towards a continental European model of pre-hospital healthcare delivery.

Another solution inferred from the results of this review may be to implement Treat and Release protocols on an individual basis over a period of time, rather than as a package or blanket option as found in the opposing studies. A successive rollout of individual treatment protocols may facilitate more focused training and careful evaluation of outcomes. Tools to improve adherence to those protocols could result in higher rates of protocol adherence. Minhas et al. (2015) describes a computer-based checklist resulting in a 72% protocol compliance rate as compared to the 57% found by Lerner et al. (2013).

While studies relying on expert review to determine medical necessity in studies of ambulance non-transport are informative per se, objective outcome criteria are necessary to permit the meta-analysis required to establish the relative effectiveness of protocols across studies. Such a standard outcome measure seems to be emerging in the form of subsequent hospital admittance rates and/or ED treatments; however the specific criteria applied vary widely between studies. Adoption of industry standard quality assurance practices, demands for compliance with legislation and/or requirements of population based insurance reimbursement schemes have the potential to drive research towards certain standardized measures. Until such measures are adopted, it will remain difficult to establish consensus as to the best approach to implementing prehospital treat and release protocols.

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