

Emergency Department Models of Care Review

2018



Clinical **Excellence** Division Creating solutions for better healthcare

Emergency Department Models of Care Review, 2018

Published by the State of Queensland (Queensland Health), February 2018

DOI: 10.13140/RG.2.2.33805.64485



This document is licensed under a Creative Commons Attribution 3.0 Australia licence. To view a copy of this licence, visit creativecommons.org/licenses/by/3.0/au

© State of Queensland (Queensland Health) 2018

You are free to copy, communicate and adapt the work, as long as you attribute the State of Queensland (Queensland Health).

For more information contact:

Dr Chris May Healthcare Improvement Unit Clinical Excellence Division Queensland Health Level 2, 15 Butterfield St, Herston, QLD 4006 Email: chris.may@health.qld.gov.au

An electronic version of this document is available at: https://www.health.qld.gov.au/

An appropriate reference for this publication is:

Romeo, M and May, C. (2018). Emergency Department Models of Care Review, 2018. Brisbane, Qld: State of Queensland doi: 10.13140/RG.2.2.33805.64485

Disclaimer:

The content presented in this publication is distributed by the Queensland Government as an information source only. The State of Queensland makes no statements, representations or warranties about the accuracy, completeness or reliability of any information contained in this publication. The State of Queensland disclaims all responsibility and all liability (including without limitation for liability in negligence) for all expenses, losses, damages and costs you might incur as a result of the information being inaccurate or incomplete in any way, and for any reason reliance was placed on such information.

Abstract

Background: Prolonged waiting times and high patient volumes are longstanding problems in EDs is repeatedly reported across Australia and globally. As a result, there has been significant amount of work to re-design care processes to improve waiting times, operation and flow and crowding. The purpose of this review is to describe the scope of research that is available assessing the relationship between ED crowding and patient outcomes.

Methods: A scoping review was conducted using as data sources: Embase, Medline (incl. PubMed), CINAHL (via EBSCO), and the Cochrane library (via Wiley) and relevant emergency medicine and nursing journals for studies published in the past two decades that pertained to ED crowding and the patient outcomes. An iterative process was used to define the search strategy for the review. The data extraction (and quality assessment) tool were developed a priori.

Results : The search identified 5518 articles. Ninety-eight (98) were included in the review: 1 audit, 28 before after interventional studies, 9 case control, 19 prospective cohort, 23 retrospective cohort, 1 quasi experimental, 1 quasi randomised 13 RCT and 1 non- RCT of performance improvement data. In addition 11 systematic reviews were included. Methodologic quality was moderate with weaknesses in the reporting of study design and methodology. Overall 18 various outcome measures were analysis in the papers. All papers measured ED LOS, followed by wait time.

Of titles identified from the academic literature 98 were relevant with one-third of the papers from Australia followed by USA (28.5%) and (16%). The majority of the analysed triage, nursing scope of practice and fast track. Very few documents were found to investigate care coordination and various discharge streaming models.

Conclusions: ED congestion is a major patient safety concern associated with poor patient outcomes. Interventions and policies are needed to address this significant problem. This review details the patient outcomes associated with various models identified to address ED congestion. Study results are relevant to medical professionals and ED administrators as well as those seeking care in the ED.

Keywords: access block, patient flow, ED congestion, models of care, ED LOS, DNW and ED representation.

Introduction

Emergency department (ED) crowding is a worldwide issue in all heathcare systems and is associated with the increased incidence of several adverse outcomes.¹⁻⁶ A systematic review identified 71 unique measures and classified them according to a commonly used conceptual model of ED output.⁷ Although the etiologic of ED congestion is complicated, it can be divided into three aspects: the input, throughput and output of ED patients.

The input of patients (ED visits) has increased significantly over the past two decades and because modern EDs can diagnose and treat a much wider range of patients compared to 20 years ago, it is unlikely that the trend in patient visits will decline in the near future. The destination of patient disposition is mostly either home or stay at hospital. The process of ED admission is often difficult and patients need to wait and receive treatment in the ED. However, access block, excess block, output of patents is not an issue that can be easily tackled by the ED alone. In order to balance admissions and discharges, a larger scale of planning and coordination is needed. For example, health system administrations need to distribute available beds according to patient flows, different specialities, staffing changes and seasonal fluctuations.

Because patient input and output processes are often related to broader healthcare issues the throughput process is therefore left to be the main focus of researchers of ED congestion. An important indicator of the patient management process in the ED is length of stay (ED LOS). ED LOS has been identified as a cause as well as a result of ED congestion.

Method

Following compilation of themes and topics considered relevant to the field, searching was carried out in with the focus on ED throughput defined as the internal processes that promote of effect patient movement.⁸ This is an accepted stage for all scoping reviews as it seeks to establish optimal balance between sensitivity and specificity. This is important conceptually, to finalise the scope of the review and pragmatically, to ensure that the review is feasible within the available time and resources. A final search strategy was then developed to retrieve evidence relevant to the whole subject area. This final search aimed to identify slices of the evidence but was designed to be more focussed producing a higher yield of relevant papers and was therefore more time effective to review. The information specialist searched the electronic databases Embase, Medline (incl. PubMed), CINAHL (via EBSCO), the Cochrane library (via Wiley). Searches were conducted in August 2017 covering the period January 1997- August 2017.

Extracted titles and abstracts were screened by one reviewer on criteria noted in **Box 1**. Each title or abstract was reviewed and deemed relevant, no relevant or containing inadequate information for coding. To operational the brief peer-reviewed literature were included if they described the impact of the interventions on key performance indicators and outcomes, such as ED LOS, DNW and ED re-presentation rates. Studies that failed to discuss outcomes or the impact on ED flow and or hospital congestion were excluded from the review. Full text articles that met inclusion criteria were retrieved. Data extracted from the final articles included author, country, sampling, method/s and implications for practice.

Box 1: Search strategy and literature selection process.

Results

Box 2 depicts article elimination process. The initial search retrieved 5518 articles and or abstracts. All duplicates were removed. The title of each article was then screened for relevance. Titles that were not relevant to the key focus areas around ED throughput were excluded from the study. The remaining abstracts and full articles were then screened for potential inclusion in the review, based on inclusion and exclusion criteria. A total of 98 were included. The characteristics and findings of these papers are summarised in *Appendix 4*. These comprised a variety of method logical designs ranging from before and after studies (n=28),⁹⁻³⁴ RCTs (n=13),^{35 46} prospective cohort study/s (n=19) ⁴⁷ 71 and retrospective cohort study/s (n=22).⁷²⁻⁸⁷ The majority of papers of the studies included in the review were conducted in Australia (n=36),^{10 17 19 21 22 26 35 37} ^{38 44 47 50 54-56 61 63 63 68 73 75 75 98 081 83 88 99 0-92} the USA (n=28),^{11 12 18 20 23 25 27 - 31 34 36 41 43 45 57 58 65 66 82 84 85 93 - 97} UK $(n=16)^{13 24 42 46 53 60 64 67 69 71 76 89 99 - 102}$ and then Canada (n=8).^{14 -16 39 59 77 86 87} The remaining papers were categorised from other Europe (n=7), ^{33 48 49 52 72 103 104} Asia,⁷⁰ Africa⁵¹ and New Zealand.⁹ Most were single site studies (n=52).^{9-11 14-16 18 20 24-27 29 30 31 32 33 37 39 40-42 45 46 50 53 58 63-65 67 69 70 74-76 79 80 81 83 88 58 78 78 88 90 94 97 98 100 105}

3

From the database search the most predominately evaluated model of care is Triage with 30 papers identified ^{4 5 11 12 15 17 -18 21 22 24 25 27-30 32 33 34 39 40 46 47 51 58 59 65 69 70 72 84 96 97 99 100-102 followed by 23 papers categorised as Fast Track and Rapid Assessment studies. ^{9 13 15 19 21 26 32 48, 49 52 54 61 62 73-75 81 85 90} ^{103 105} studies. The database search also identified ^{16 17 21 38 50 53 56 60 63 67 76 79 80 83 88 89 91 92 94 98 104} papers which could be categorised as Nursing Scope of Practice.}

All papers (n=98) reported on EDLOS outcomes reported on included ED LOS. The majority of papers (n=87) also reported on wait time. $^{9-19}$ $^{21-23}$ $^{25-30}$ 32 $^{34-44}$ $^{46-49}$ 51 52 $^{54-59}$ $^{61-71}$ $^{73-77}$ 79 80 $^{82-87}$ $^{89-99}$ $^{101-105}$ followed turnaround time (n=41) $^{9-12}$ 16 24 26 29 31 35 39 41 43 44 749 $^{54-56}$ 60 61 63 64 $^{66-68}$ 71 75 76 79 80 83 $^{85-87}$ $^{91-93}$ 102 104 and left without being seen (LWBS)/ left without completing treatment (LWCT) (n=32). 1118192425 $^{28-30}$ 34 37 39 42 58 59 61 62 63 68 70 71 74 $^{83-85}$ 88 919596101104106 The characteristics and findings of these papers are summarised in *Appendix 2, 4 & 5*.

Sample size varied from 107 ³⁶ to 180,870 ²⁵. Twenty–seven (27) studies ^{9 10 14 19 21 24 27 32 33 35 44 48 52} ^{57 61 62 68 73 80 81 84 85 93 9597 100} were unclear as to the sample size.

Box 2: Article elimination process

Synthesis	Screening	Eligibility	Included
 Records identified through database searching after duplicates removed: (n=5300) Additional records identified through other sources: (n=218) 	 Records included: (n=5518) Records screened: (n=2924) Records excluded: (n=4594) 	 Full text articles assessed for eligibility: (n=2924) Full text artilces excluded with reasons: (n=2826) 	 Papers included in synthesis: (n=98 [plus 11: systematic reviews])

Discussion

This scoping review summarises the evidence on the effectiveness of a variety of models and interventions aimed to address congestion in the ED. As ED crowding worsens, it is important for departments to improve operations to promote patient throughput. This scoping review of the academic literature shows that few and often methodologically limited studies have been published concerning front end operational improvement strategies. Of those published only a handful noted the effects of these strategies on patient outcomes.

Patient streaming is a way of directing flow so that patients with minor injuries or illnesses can be seen in a separate area of the ED than patients with complex care requirements. The most common example of streaming minor presentations is fast track. Streaming has been reported to benefit all ED patients, not just those in fast track: with a number of studies in this review indicating were patients were seen by a doctor more quickly following implementation of streaming ED LOS was reduced as well as patients' who did not wait for treatment following streaming.

Triage systems have traditionally been used to ensure that the most urgent patients receive timely service. The majority of the studies included in this review have been able to demonstrate that triage systems can also have a positive effect on patient flow, as measured by waiting time and ED LOS. However not all triage systems are the same, and the types of services provided at triage may influence these outcomes. Triage systems may be relatively simple seeking only to put patient in order or priority or allocate appropriate services. Other more complex systems enable simple treatment to take place at the time of triage, which could potentially remove a patient from the que or increase efficiency of future treatment. The majority of papers that analysed **team triage** concluding that dedicating a senior doctor in triage reduced the wait time for patients to see a doctor, decreased LOS and lowered the proportion of left without being seen, leaving without completing treatment. However the impact of patient satisfaction was inconsistent across the studies identified. Triage systems may vary along the continuum until at some point the intervention become extensive enough that the process becomes assessment and treatment rather than triage.

Apart from triage, **Fast Track & Rapid Assessment** was the most studied intervention method supported by the strongest scientific evidence. By fast-tracking patients with less severe symptoms result in shorter wait times, ED LOS and fewer patients leaving without completing treatment or being seen. It has been reported that implementation of **computerised tracking systems and whiteboard systems** improves patient flow, shortens patient wait times, reduces left without being seen rates as well as improving patient and staff satisfaction as well as communication. Tracking systems (electronically) may be a useful addition to ED performance improvement initiatives not only to further streamline practices but also capture metrics and data to build on capacity and to continuously improve. Clearly, the use of these technologies together with other communication technologies in the ED setting and their effect on outcomes has yet to be fully explored.

In an attempt to address the growing ED population in the context of limited medical workforce, the adaption to the **scope of practice of nurses** in the ED is being presented as a staffing option. The results for the reviews included in this study suggest that the changing scope of the nurse, especially when dedicated to seeing minor treatment patients have improved wat time and ED LOS as well as improve patient satisfaction with little to no impact on quality of care. For the low acute patients in congested EDs as well as rural hospitals, the extension of the scope of practice for nurses may represent a viable and effective option allowing optimal use of limited physician resources and improving access to emergency care for the population.

In response to escalating workloads and waiting times and deteriorating patients, an attempt to shorten ED LOS, the scope of practice of nurses has expanded to allow **nurses to initiate investigations** and interventions including **blood tests, analgesia and x-rays**. The studies included in this review found that the majority of papers analysing nurse initiated analgesia, blood tests and x-rays found decrease to pain assessment, reduced length of stay and improved patient satisfaction.

Medical Assessment Units staffed by multi-disciplinary teams led by acute medical physicians have the potential to improve the quality and safety of care of a significant proportion of acutely ill patients presenting to hospital. Also, **Short Stay Units** have been co-located with many EDs to reduce LOS in the ED. These units accommodate patients requiring more time in the ED. The systematic reviews and the single study included in this scoping report show that short stay units and observation wards have the potential to benefit patients reduce LOS, improve efficiency of the ED.

5

Limitations

There are a number of limitations of the studies included in this review making definitive recommendations from the literature difficult to make. Given the time constraints of this scoping review, the strengths of this review include the comprehensive search strategy, eligibility criteria and standardised data extraction. The principal weakness of the review is the variability in study design and methodologic quality of included articles. The included papers varied in the quality of descriptions of methodology (ie: principally most studies were single site), outcomes assessment and reporting of measure specifications may have resulted in misclassification of measures. However the three measures with the most evidence of a link to quality – ED LOS, waiting time and/ or turnaround time- are relatively straightforward measures. Slight differences in data collection of reporting between studies likely would have not altered the conclusion of the review. It is also acknowledged that the results of this review are limited to the measures studied and that there may have bene better choice of measures and or evidence hierarchy assessment than those that have been identified. Finally the number of included studies did not undergo any quality assessment

Conclusions

Worldwide, ED congestion is a problem that is demanding hospital administrators and policy makers understand the complexity of front end hospital services and understand the impact of congestion has on a patient journey. The review indicates there is a plethora of literature available indicating the deleterious effects of ED congestion on patient outcomes. Improving access and flow is important with patient safety remaining of paramount importance.

The scoping report has evaluated key initiatives introduced to improve patient flow in EDs. Based on the papers reported, it seems that there is a significant body of models of care and strategies to manage ED congestion literature. The existing streaming, care processes and analysis of ED crowding is most frequently linked to quality of care measures such as the time of patients in the wait and their LOS in the ED.

The review identified that strategies are often limited in applicability from one institution to another. However there do appear to be some overarching alterations in behaviour and management that could serve to better assess, treat and flow patients through the ED. Useful strategies include improvements in triage (and registration), nurse initiated actions, fast track and point of care testing. The result of this review also highlight important gaps in knowledge with respect to the relative importance in knowledge with respect to the prioritisation of care processes and outcomes and the association between congestion and the quality of care in specific populations and settings. For example the majority of studies took place in large urban or suburban tertiary EDs. However the studies that included smaller EDs identified some differences in the link between crowding measures and quality between the ED settings. Also disparity in ED evaluation and treatment were identified based on factors including sex, ethnicity, and age. Finally the review highlights the need for the prioritisation of care process and outcomes to drive routine measurement to support quality improvement focused on crowding and quality of care.

The results of this review have important implications on future research on the measurement and alleviation of ED congestion. Further research, potentially incorporating a meta-analysis is needed to investigate the impact of various models of care designed for the admission and discharge

components of a patient journey from the ED. Innovations continue to emerge and each must be systematically and rigorously tested and evaluated.

Acknowledgements

The authors of this report have been wholly responsible for all data collection, analysis and interpretation and writing up of their work.

Contribution of Authors

Michele Romeo, Principal Project Officer, Healthcare Improvement Unit, Clinical Excellence Division

Undertook the proposal writing and design and ran the literature searches, undertook reference sifting and evidence syntheses for the review, data extraction into summary tables, contribution of writing the report, including the discussion and conclusions.

Dr Chris May, Healthcare Improvement Unit, Clinical Excellence Division.

Contributed to the plan and design of the proposal and contributed to the reports discussion and conclusions .

Data sharing statement

No new data have been created

References

- 1. Cameron PA. Hospital overcrowding: A threat to patient safety? Med J Aust. 2006;184(5):203-4.
- 2. Fatovich DM, Nagree Y, Sprivulis P. Access block causes emergency department overcrowding and ambulance diversion in Perth, Western Australia. Emerg Med J. 2005;22(5):351-4.
- 3. Toloo S, FitzGerald G, Aitken P, Ting J, Tippett V, Chu K. Emergency Health Services: Demand and service delivery models. Monograph 1: Literature review and activity trends. Brisbane: Queensland University of Technology; 2011.
- 4. Toloo S, Rego J, FitzGerald G, Aitken P, Ting J, Quinn J, et al. Emergency Health Services: Demand and service delivery models. Monograph 2: Queensland EHS users' profile. Brisbane: Queensland University of Technology, 2012.
- 5. FitzGerald G, Toloo G, Romeo M. Emergency healthcare of the future. Emergency Medicine Australasia. 2014;26:291–4.
- Toloo S, Rego J, FitzGerald G, Vallmuur K, Ting J. Emergency Health Services: Demand and service delivery models. Monograph 3: Patients' reasons and perceptions. Research Monograph. Brisbane: Queensland University of Technology, 2013.
- 7. Asplin BR, Magid DJ, Rhodes KV, Solberg LI, Lurie N, Camargo CA, Jr. A conceptual model of emergency department crowding. Ann Emerg Med. 2003;42(2):173-80.
- 8. Hwang U, McCarthy ML, Aronsky D, Asplin B, Crane PW, Craven CK, et al. Measures of crowding in the emergency department: A systematic review. Acad Emerg Med. 2011;18(5):527-38.
- 9. Ardagh M, Wells JE, Cooper K, Lyons R, Patterson R, O'Donovan P. Effect of a rapid assessment clinic on the waiting time to be seen by a doctor and the time spent in the department, for patients presenting to an urban emergency department: A controlled prospective trial. The New Zealand Medical Journal. 2002;115(1157).

- 10. Burke JA, Greenslade J, Chabrowska J, Greenslade K, Jones S, Montana J, et al. Two hour evaluation and referral model for shorter turnaround times in the emergency department. Emergency Medicine Australasia. 2017;29(3):315-23.
- 11. Chan TC, Killeen JP, Kelly D, Guss DA. Impact of rapid entry and accelerated care at triage on reducing emergency department patient wait times, lengths of stay, and rate of left without being seen. Ann Emerg Med. 2005;46(6):491-7.
- 12. Choi YF, Wong TW, Lau CC. Triage rapid initial assessment by doctor (TRIAD) improves waiting time and processing time of the emergency department. Emerg Med J. 2006;23(4):262-5.
- 13. Cooke MW, Wilson S, Pearson S, Cooke MW, Wilson S, Pearson S. The effect of a separate stream for minor injuries on accident and emergency department waiting times. Emergency Medicine Journal. 2002:28-30.
- 14. Copeland J, Gray A. A daytime fast track improves throughput in a single physician coverage emergency department. Canadian Journal of Emergency Medicine. 2015;17(6):648-55.
- 15. Darrab AA, Fan J, Fernandes CM, Zimmerman R, Smith R, Worster A, et al. How does fast track affect quality of care in the emergency department? Eur J Emerg Med. 2006;13(1):32-5.
- 16. Dewhirst S, Zhao Y, MacKenzie T, Cwinn A, Vaillancourt C. Evaluating a medical directive for nurse-initiated analgesia in the emergency department. International Emergency Nursing. 2017.
- 17. Finn J, Rae A, Gibson N, Swift R, Watters T, Jacobs I. Reducing time to analgesia in the emergency department using a nurse-initiated pain protocol: A before-and-after study. Contemporary Nurse. 2012;43(1):29-37.
- 18. Imperato J, Morris DS, Binder D, Fischer C, Patrick J, Sanchez LD, et al. Physician in triage improves emergency department patient throughput. Internal and emergency medicine. 2012;7(5):457-62.
- 19. Kwa P, Blake D. Fast track: Has it changed patient care in the emergency department? Emergency Medicine Australasia. 2008;20(1):10-5.
- 20. Lee-Lewandrowski E, Corboy D, Lewandrowski K, Sinclair J, McDermot S, Benzer TI. Implementation of a pointof-care satellite laboratory in the emergency department of an academic medical center: Impact on test turnaround time and patient emergency department length of stay. Archives of Pathology & Laboratory Medicine. 2003;127(4):456-60.
- 21. Patel PB, Vinson DR. Team assignment system: Expediting emergency department care. Annals of Emergency Medicine. 2005;46(6):499-506.
- 22. Richardson JR, Braitberg G, Yeoh MJ. Multidisciplinary assessment at triage: A new way forward. Emergency Medicine Australasia. 2004;16(1):41-6.
- 23. Wiler JL, Gentle C, Halfpenny JM, Heins A, Mehrotra A, Mikhail MG, et al. Optimizing emergency department frontend operations. Annals of Emergency Medicine. 2010;55(2):142-60.
- 24. Rogers T, Ross N, Spooner D. Evaluation of a 'see and treat'pilot study introduced to an emergency department. Accident and Emergency Nursing. 2004;12(1):24-7.
- 25. Rogg JG, White BA, Biddinger PD, Chang Y, Brown DF. A long◊term analysis of physician triage screening in the emergency department. Academic Emergency Medicine. 2013;20(4):374-80.
- 26. Sethuraman U, Kannikeswaran N, Chen X, Mahajan PV. Effect of a rapid assessment program on total length of stay in a pediatric emergency department. Pediatric Emergency Care. 2011;27(4):295-300.
- 27. Singer AJ, Viccellio P, Thode HC, Jr., Bock JL, Henry MC. Introduction of a stat laboratory reduces emergency department length of stay. Acad Emerg Med. 2008;15(4):324-8.
- 28. Soremekun OA, Biddinger PD, White BA, Sinclair JR, Chang Y, Carignan SB, et al. Operational and financial impact of physician screening in the ed. The American Journal of Emergency Medicine. 2012;30(4):532-9.
- 29. Soremekun OA, Capp R, Biddinger PD, White BA, Chang Y, Carignan SB, et al. Impact of physician screening in the emergency department on patient flow. The Journal of Emergency Eedicine. 2012;43(3):509-15.
- 30. Soremekun OA, Shofer FS, Grasso D, Mills AM, Moore J, Datner EM. The effect of an emergency department dedicated midtrack area on patient flow. Academic Emergency Medicine. 2014;21(4):434-9.
- 31. Theunissen B, Lardenoye S, Hannemann P, Gerritsen K, Brink P, Poeze M. Fast track by physician assistants shortens waiting and turnaround times of trauma patients in an emergency department. European Journal of Trauma & Emergency Surgery. 2014;40(1):87-91.
- 32. Tsai VW, Sharieff GQ, Kanegaye JT, Carlson LA, Harley J. Rapid medical assessment: Improving pediatric emergency department time to provider, length of stay, and left without being seen rates. Pediatr Emerg Care. 2012;28(4):354-6.
- 33. Vork JC, Brabrand M, Folkestad L, Thomsen KK, Knudsen T, Christiansen C. A medical admission unit reduces duration of hospital stay and number of readmissions. Dan Med Bull. 2011;58(8):A4298.
- 34. White BA, Brown DF, Sinclair J, Chang Y, Carignan S, McIntyre J, et al. Supplemented triage and rapid treatment (start) improves performance measures in the emergency department. The Journal of Emergency Medicine. 2012;42(3):322-8.

- 35. Asha SE, Chan ACF, Walter E, Kelly PJ, Morton RL, Ajami A, et al. Impact from point-of-care devices on emergency department patient processing times compared with central laboratory testing of blood samples: A randomised controlled trial and cost-effectiveness analysis. Emerg Med J. 2014;31(9):714-9.
- 36. Bronstein LR, Gould P, Berkowitz SA, James GD, Marks K. Impact of a social work care coordination intervention on hospital readmission: A randomized controlled trial. Social work. 2015;60(3):248-55.
- 37. Caplan GA, Williams AJ, Daly B, Abraham K. A randomized, controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after discharge of elderly from the emergency department—the deed ii study. Journal of the American Geriatrics Society. 2004;52(9):1417-23.
- 38. Chang E, Daly J, Hawkins A, McGirr J, Fielding K, Hemmings L, et al. An evaluation of the nurse practitioner role in a major rural emergency department. Journal of Advanced Nursing. 1999;30(1):260-8.
- 39. Cheng I, Lee J, Mittmann N, Tyberg J, Ramagnano S, Kiss A, et al. Implementing wait-time reductions under Ontario government benchmarks (pay-for-results): A cluster randomized trial of the effect of a physician-nurse supplementary triage assistance team (MRDNSTAT) on emergency department patient wait times. BMC Emergency Medicine. 2013;13(1):17.
- 40. Davis RA, Dinh MM, Bein KJ, Veillard AS, Green TC. Senior workoup assessment and treatment team in an emergency department: A randomised control trial. Emergency Medicine Australasia. 2014;26(4):343-9.
- 41. Farkouh ME, Smars PA, Reeder GS, Zinsmeister AR, Evans RW, Meloy TD, et al. A clinical trial of a chest-pain observation unit for patients with unstable angina. New England Journal of Medicine. 1998;339(26):1882-8.
- 42. Hendriksen H, Harrison RA. Occupational therapy in accident and emergency departments: A randomized controlled trial. Journal of Advanced Nursing. 2001;36(6):727-32.
- 43. Kendall J, Reeves B, Clancy M. Point of care testing: Randomised controlled trial of clinical outcome. BMJ. 1998;316(7137):1052-7.
- Loten C, Attia J, Hullick C, Marley J, McElduff P. Point of care troponin decreases time in the emergency department for patients with possible acute coronary syndrome: A randomised controlled trial. Emerg Med J. 2010;27(3):194-8.
- 45. Murray RP, Leroux M, Sabga E, Palatnick W, Ludwig L. Effect of point of care testing on length of stay in an adult emergency department. The Journal of Emergency Medicine. 1999;17(5):811-4.
- 46. Subash F, Dunn F, McNicholl B, Marlow J. Team triage improves emergency department efficiency. Emergency Medicine Journal. 2004;21(5):542-4.
- 47. Asha SE, Ajami A. Improvement in emergency department length of stay using an early senior medical assessment and streaming model of care: A cohort study. Emergency Medicine Australasia. 2013;25(5):445-51.
- 48. Aksel G, Bildik F, Demircan A, Keles A, Kilicaslan I, Guler S, et al. Effects of fast-track in a university emergency department through the national emergency department overcrowding study. J Pak Med Assoc. 2014;64(7):791-7.
- 49. Bouman Al, Hemmen B, Evers SM, van de Meent H, Ambergen T, Vos PE, et al. Effects of an integrated 'fast track' rehabilitation service for multi-trauma patients: A non-randomized clinical trial in the Netherlands. PLoS One. 2017;12(1):e0170047.
- 50. Boyd RJ, Stuart P. The efficacy of structured assessment and analgesia provision in the paediatric emergency department. Emerg Med J. 2005;22(1):30-2.
- 51. Bruijns SR, Wallis LA, Burch VC. Effect of introduction of nurse triage on waiting times in a South African emergency department. Emerg Med J. 2008;25(7):395-7.
- 52. Bucheli B, Martina B. Reduced length of stay in medical emergency department patients: A prospective controlled study on emergency physician staffing. European Journal of Emergency Medicine. 2004;11(1):29-34.
- 53. Byrne G, Richardson M, Brunsdon J, Patel A. An evaluation of the care of patients with minor injuries in emergency settings. Accident and Emergency Nursing. 2000;8(2):101-9.
- Fry M, Fong J, Asha S, Arendts G. A 12-month evaluation of the impact of transitional emergency nurse practitioners in one metropolitan emergency department. Australasian Emergency Nursing Journal. 2011;14(1):4-8.
- 55. Fry M, Holdgate A. Nurse◊initiated intravenous morphine in the emergency department: Efficacy, rate of adverse events and impact on time to analgesia. Emergency Medicine Australasia. 2002;14(3):249-54.
- 56. Fry M, Ryan J, Alexander N. A prospective study of nurse initiated panadeine forte: Expanding pain management in the ed. Accident and Emergency Nursing. 2004;12(3):136-40.
- 57. Gordon BD, Flottemesch TJ, Asplin BR. Accuracy of staff-initiated emergency department tracking system timestamps in identifying actual event times. Annals of Emergency Medicine. 2008;52(5):504-11.
- 58. Han JH, France DJ, Levin SR, Jones ID, Storrow AB, Aronsky D. The effect of physician triage on emergency department length of stay. The Journal of Emergency Medicine. 2010;39(2):227-33.
- 59. Holroyd BR, Bullard MJ, Latoszek K, Gordon D, Allen S, Tam S, et al. Impact of a triage liaison physician on emergency department overcrowding and throughput: A randomized controlled trial. Academic Emergency

9

Medicine. 2007;14(8):702-8.

- 60. Lindley-Jones M, Finlayson B. Triage nurse requested x rays—are they worthwhile? Emergency Medicine Journal. 2000;17(2):103-7.
- 61. Lutze M, Ratchford A, Fry M. A review of the transitional emergency nurse practitioner. Australasian Emergency Nursing Journal. 2011;14(4):226-31.
- 62. O'Brien D, Williams A, Blondell K, Jelinek GA. Impact of streaming 'fast track' emergency department patients. Australian Health Review. 2006;30(4):525-32.
- 63. Parris W, McCarthy S, Kelly A, Richardson S. Do triage nurse-initiated x-rays for limb injuries reduce patient transit time? Accident and emergency nursing. 1997;5(1):14-5.
- 64. Rooney KD, Schilling UM. Point-of-care testing in the overcrowded emergency department--can it make a difference? Crit Care. 2014;18(6):692.
- 65. Russ S, Jones I, Aronsky D, Dittus RS, Slovis CM. Placing physician orders at triage: The effect on length of stay. Ann Emerg Med. 2010;56(1):27-33.
- 66. Rydman RJ, Isola ML, Roberts RR, Zalenski RJ, McDermott MF, Murphy DG, et al. Emergency department observation unit versus hospital inpatient care for a chronic asthmatic population: A randomized trial of health status outcome and cost. Medical care. 1998;36(4):599-609.
- 67. Sakr M, Kendall R, Angus J, Saunders A, Nicholl J, Wardrope J. Emergency nurse practitioners: A three part study in clinical and cost effectiveness. Emergency Medicine Journal. 2003;20(2):158-63.
- 68. Shetty A, Gunja N, Byth K, Vukasovic M. Senior streaming assessment further evaluation after triage zone: A novel model of care encompassing various emergency department throughput measures. Emergency Medicine Australasia. 2012;24(4):374-82.
- 69. Terris J, Leman P, O'connor N, Wood R. Making an impact on emergency department flow: Improving patient processing assisted by consultant at triage. Emergency Medicine Journal. 2004;21(5):537-41.
- 70. Travers JP, Lee FC. Avoiding prolonged waiting time during busy periods in the emergency department: Is there a role for the senior emergency physician in triage? European Journal of Emergency Medicine. 2006;13(6):342-8.
- 71. Wanklyn P, Hosker H, Pearson S, Belfield P. Slowing the rate of acute medical admissions. Journal of the Royal College of Physicians of London. 1997;31(2):173-6.
- 72. Burstrom L, Nordberg M, Ornung G, Castren M, Wiklund T, Engstrom ML, et al. Physician-led team triage based on lean principles may be superior for efficiency and quality? A comparison of three emergency departments with different triage models. Scand J Trauma Resusc Emerg Med. 2012;20:57.
- 73. Combs S, Chapman R, Bushby A. Evaluation of fast track. Accident & Emergency Nursing. 2007;15(1):40-7.
- 74. Considine J, Kropman M, Stergiou HE. Effect of clinician designation on emergency department fast track performance. Emerg Med J. 2010;27(11):838-42.
- 75. Considine J, Lucas E, Martin R, Stergiou HE, Kropman M, Chiu H. Rapid intervention and treatment zone: Redesigning nursing services to meet increasing emergency department demand. International Journal of Nursing Practice. 2012;18(1):60-7.
- 76. Cooper MA, Lindsay GM, Kinn S, Swann IJ. Evaluating emergency nurse practitioner services: A randomized controlled trial. Journal of advanced nursing. 2002;40(6):721-30.
- 77. Ducharme J, Alder RJ, Pelletier C, Murray D, Tepper J. The impact on patient flow after the integration of nurse practitioners and physician assistants in 6 Ontario emergency departments. Canadian Journal of Emergency Medicine. 2009;11(5):455-61.
- 78. Elder E, Johnston ANB, Crilly J. Improving emergency department throughput: An outcomes evaluation of two additional models of care. International Emergency Nursing. 2016;25:19-26.
- 79. Fry M. Triage nurses order x-rays for patients with isolated distal limb injuries: A 12-month ed study. Journal of Emergency Nursing. 2001;27(1):17-22.
- 80. Fry M, Jones K. The clinical initiative nurse: Extending the role of the emergency nurse, who benefits? Australasian Emergency Nursing Journal. 2005;8(1):9-12.
- 81. leraci S, Digiusto E, Sonntag P, Dann L, Fox D. Streaming by case complexity: Evaluation of a model for emergency department fast track. Emergency Medicine Australasia. 2008;20(3):241-9.
- 82. McNaughton C, Self WH, Jones ID, Arbogast PG, Chen N, Dittus RS, et al. ED crowding and the use of non-traditional beds. Am J Emerg Med. 2012;30(8):1474-80.
- 83. Patel H, Celenza A, Watters T. Effect of nurse initiated x-rays of the lower limb on patient transit time through the emergency department. Australasian Emergency Nursing Journal. 2012;15(4):229-34.
- 84. Paulson DL. A comparison of wait times and patients leaving without being seen when licensed nurses versus unlicensed assistive personnel perform triage. Journal of Emergency Nursing. 2004;30(4):307-11.
- 85. Sanchez M, Smally AJ, Grant RJ, Jacobs LM. Effects of a fast-track area on emergency department performance. The Journal of emergency medicine. 2006;31(1):117-20.

- 86. Seow H, Brazil K, Sussman J, Pereira J, Marshall D, Austin PC, et al. Impact of community based, specialist palliative care teams on hospitalisations and emergency department visits late in life and hospital deaths: A pooled analysis. BMJ. 2014;348:g3496.
- 87. Yoon P, Steiner I, Reinhardt G. Analysis of factors influencing length of stay in the emergency department. Canadian Journal of Emergency Medicine. 2003;5(3):155-61.
- 88. Considine J, Martin R, Smit D, Jenkins J, Winter C. Defining the scope of practice of the emergency nurse practitioner role in a metropolitan emergency department. International Journal of Nursing Practice. 2006;12(4):205-13.
- 89. Considine J, Martin R, Smit D, Winter C, Jenkins J. Emergency nurse practitioner care and emergency department patient flow: Case–control study. Emergency Medicine Australasia. 2006;18(4):385-90.
- 90. Considine J, Kropman M, Kelly E, Winter C. Effect of emergency department fast track on emergency department length of stay: A case-control study. Emergency Medicine Journal. 2008;25(12):815-9.
- 91. Kelly A-M, Brumby C, Barnes C. Nurse-initiated, titrated intravenous opioid analgesia reduces time to analgesia for selected painful conditions. Canadian Journal of Emergency Medicine. 2005;7(3):149-54.
- 92. Kocher KE, Meurer WJ, Desmond JS, Nallamothu BK. Effect of testing and treatment on emergency department length of stay using a national database. Acad Emerg Med. 2012;19(5):525-34.
- 93. Aronsky D, Jones I, Lanaghan K, Slovis CM. Supporting patient care in the emergency department with a computerized whiteboard system. Journal of the American Medical Informatics Association. 2008;15(2):184-94.
- 94. Blank FS, Santoro J, Maynard AM, Provost D, Keyes M. Improving patient safety in the ED waiting room. Journal of Emergency Nursing. 2007;33(4):331-5.
- 95. Boger E. Electronic tracking board reduces ed patient length of stay at Indiana hospital. Journal of Emergency Nursing. 2003;29(1):39-43.
- 96. Nestler DM, Fratzke AR, Church CJ, Scanlan-Hanson L, Sadosty AT, Halasy MP, et al. Effect of a physician assistant as triage liaison provider on patient throughput in an academic emergency department. Acad Emerg Med. 2012;19(11):1235-41.
- 97. Partovi SN, Nelson BK, Bryan ED, Walsh MJ. Faculty triage shortens emergency department length of stay. Academic Emergency Medicine. 2001;8(10):990-5.
- 98. Freij R, Duffy T, Hackett D, Cunningham D, Fothergill J. Radiographic interpretation by nurse practitioners in a minor injuries unit. Emergency Medicine Journal. 1996;13(1):41-3.
- 99. George S, Read S, Westlake L, Williams B, Fraser-Moodie A, Pritty P. Evaluation of nurse triage in a British accident and emergency department. BMJ. 1992;304(6831):876-8.
- 100. Goodacre S, Mason S, Kersh R, Webster A, Samaniego N, Morris F. Can additional experienced staff reduce emergency medical admissions? Emergency Medicine Journal. 2004;21(1):51-3.
- 101. Mallett J, Woolwich C. Triage in accident and emergency departments. Journal of Advanced Nursing. 1990;15(12):1443-51.
- 102. Tachakra S, Deboo P. Comparing performance of ENPS and SHOS.: Emergency Nurse. 2001;9(7):36-9.
- 103. Kilic Y, Agalar F, Kunt M, Cakmakci M. Prospective, double-blind, comparative fast-tracking trial in an academic emergency department during a period of limited resources. European Journal of Emergency Medicine. 1998;5(4):403-6.
- 104. Muntlin Å, Carlsson M, Säfwenberg U, Gunningberg L. Outcomes of a nurse-initiated intravenous analgesic protocol for abdominal pain in an emergency department: A quasi-experimental study. International Journal of Nursing Studies. 2011;48(1):13-23.
- 105. Dinh M, Walker A, Parameswaran A, Enright N. Evaluating the quality of care delivered by an emergency department fast track unit with both nurse practitioners and doctors. Australasian Emergency Nursing Journal. 2012;15(4):188-94.
- 106. Blank L, Coster J, O'Cathain A, Knowles E, Tosh J, Turner J, et al. The appropriateness of, and compliance with, telephone triage decisions: A systematic review and narrative synthesis. Journal of Advanced Nursing. 2012;68(12):2610-21.
- 107. Abdulwahid MA, Booth A, Kuczawski M, Mason SM. The impact of senior doctor assessment at triage on emergency department performance measures: Systematic review and meta-analysis of comparative studies. Emerg Med J. 2016;33(7):504-13.
- 108. Carter AJ, Gould JB, Vanberkel P, Jensen JL, Cook J, Carrigan S, et al. Offload zones to mitigate emergency medical services (ems) offload delay in the emergency department: A process map and hazard analysis. CJEM. 2015;17(6):670-8.
- 109. Crawford K, Morphet J, Jones T, Innes K, Griffiths D, Williams A. Initiatives to reduce overcrowding and access block in Australian emergency departments: A literature review. Collegian. 2014;21(4):359-66.
- 110. Daly S, Campbell DA, Cameron PA. Short-stay units and observation medicine: A systematic review. Med J Aust.

2003;178(11):559-63.

- 111. Elder E, Johnston AN, Crilly J. Systematic review of three key strategies designed to improve patient flow through the emergency department. Emergency Medicine Australasia. 2015;27(5):394-404.
- 112. Oredsson S, Jonsson H, Rognes J, Lind L, Göransson KE, Ehrenberg A, et al. A systematic review of triage-related interventions to improve patient flow in emergency departments. Scandinavian journal of trauma, resuscitation and emergency medicine. 2011;19(1):43.
- 113. Rowe BH, Villa-Roel C, Guo X, Bullard MJ, Ospina M, Vandermeer B, et al. The role of triage nurse ordering on mitigating overcrowding in emergency departments: A systematic review. Acad Emerg Med. 2011;18(12):1349-57.
- 114. Scott I, Vaughan L, Bell D, Scott I, Vaughan L, Bell D. Effectiveness of acute medical units in hospitals: A systematic review. International Journal for Quality in Healthcare. 2009;21(6):397-407.
- 115. Wiler JL, Griffey RT, Olsen T. Review of modeling approaches for emergency department patient flow and crowding research. Acad Emerg Med. 2011;18(12):1371-9.
- 116. Wylie K, Crilly J, Toloo GS, FitzGerald G, Burke J, Williams G, et al. Review article: Emergency department models of care in the context of care quality and cost: A systematic review. Emerg Med Australas. 2015;27(2):95-101.
- 117. Harding KE, Taylor NF, Leggat SG. Do triage systems in healthcare improve patient flow? A systematic review of the literature. Australian Health Review. 2011;35(3):371-83.
- 118. Gouin S, Macarthur C, Parkin PC, Schuh S. Effect of a pediatric observation unit on the rate of hospitalization for asthma. Annals of Emergency Medicine. 1997;29(2):218-22.
- 119. Mabrook AF, Dale B. Can nurse practitioners offer a quality service? An evaluation of a year's work of a nurse led minor injury unit. Emergency Medicine Journal. 1998;15(4):266-8.
- 120. Rodi SW, Grau MV, Orsini CM. Evaluation of a fast track unit: Alignment of resources and demand results in improved satisfaction and decreased length of stay for emergency department patients. Quality Management in Healthcare. 2006;15(3):163-70.
- 121. Capp R, Soremekun OA, Biddinger PD, White BA, Sweeney LM, Chang Y, et al. Impact of physician-assisted triage on timing of antibiotic delivery in patients admitted to the hospital with community-acquired pneumonia (CAP). J Emerg Med. 2012;43(3):502-8.
- 122. Aksel G, Bildik F, Demircan A, Keles A, Kilicaslan I, Guler S, et al. Effects of fast-track in a university emergency department through the national emergency department overcrowding study. J Pak Med Assoc. 2014;64(7):791-7.
- 123. Carter AJ, Chochinov AH. A systematic review of the impact of nurse practitioners on cost, quality of care, satisfaction and wait times in the emergency department. Canadian Journal of Emergency Medicine. ;9(4):286-95.

Appendices

Appendix 1: Abbreviations

Abbreviation	Description
A&E	accident and emergency
ACS	acute coronary syndromes
ADL	activities of daily living
AHR	after-hours referrals
AMAU	acute medical admissions unit
AMU	assessment medical unit
AMU	acute medical unit
ATS	Australasian triage scale
BA study	before and after study
ССТ	clinical controlled trial
CGA	comprehensive geriatric assessment
CI	confidence interval
CIN	clinical initiatives nurse
ст	computed tomography
CTAS	Canadian emergency department triage and acuity scale
DDR	direct discharge rates
DFT	discharge facilitation team
DNA	did not arrive
DNW	did not wait
DR	doctor
ECG	electrocardiogram
ED	emergency department
ED NPC	emergency department nurse practitioner candidate
EDTU	emergency department treatment units
EHR	electronic health record
EMS	emergency medical service
EMW	emergency medicine ward
EP	emergency physician
EPIX	emergency physician-initiated x-ray
ES	emergency services
нітн	hospital in the home
Hr/s	hour/s
ICU	intensive care unit
КРІ	key performance indicators
LOE	level of evidence
LOS	length of stay

Abbreviation	Description
LWBS	left without being seen
LWCA	left without complete assessment
MAPU	medical assessment and planning units
MATS	minor accident treatment service
MAU	medical assessment unit
MIN	minute
MIU	minor injury unit
MO	medical officer
NHSD	NHS direct
NHSDW	NHS direct wales
NI	nurse initiated
NIPP	nurse initiated pain protocol intervention
NP	nurse practitioner
0C	office care
OR	odds ratio
от	occupational therapist
ow	observation ward
PACS	patient acuity score
PAT	physician assisted triage
PED	paediatric emergency department
PHIL	paediatric health information line
PIT	physician at triage
PIT	physician initiated
РОСТ	point of care testing
POST	patient off stretcher times
RAP	rapid assessment program
RCT	randomised controlled trial
REACT	rapid entry and accelerated care at triage
RITZ	rapid intervention and treatment zone
RITZ	rapid intervention and treatment zone
RMA	rapid medical assessment program
RN	registered nurse
RR	readmission rates
RTT	rapid triage and treatment
SAW	surgical admission ward
SC	self-care
SHD	Swedish healthcare direct
SSU	short stay unit
SWAT	senior work up assessment and treatment
TAS	telephone advice system

Abbreviation	Description
TENP	transitional emergency nurse practitioners
TLP	triage liaison physicians
TLP	triage liaison physicians
TLP	triage liaison physicians
TRIAD	triage rapid initial assessment by doctor
TTA	time to analgesia
UAP	unlicensed assistive personnel
WR LOS	waiting room length of stay
WT	wait time

Appendix 2: Summary of main characteristics of included studies

Characteristic	Number of included Studies
Country	
Australia	36
Asia	1
Canada	8
Denmark	1
Italy	1
New Zealand	1
South Africa	1
Sweden	2
Switzerland	1
Turkey	2
United Kingdom	16
United States of America	28
Study Design	
Audit	1
BA Study	28
Case Control	9
Non RCT	1
Prospective	19
Quasi Experiential	1
Quasi Randomised	1
RCT	13
Retrospective	23
Survey	2
Plus: Systematic Reviews	11
Setting	
Care Coordination	3

Characteristic	Number of included Studies
Fast Track (incl Rapid Assessment)	23
Medical Assessment Unit	4
Non-traditional beds	1
Nursing Scope of Practice	21
Physician Assistants & ED Scribes	4
Point of Care Testing	7
Short Stay Units	1
Streaming	4
Triage	30
Variables Measured	
Did Not Wait	15
Disposition	20
ED Length Of Stay	98
Left Without Being Seen/ Left Without Completing Treatment	32
NEAT	7
Quality: Patient Satisfaction	27
Quality: Staff Satisfaction	8
Rate: Discharge	12
Rate: Mortality	11
Rate: Re-Attendance	12
Time To: Pain Relief, X-Ray, Antibiotics	18
Time To: Decision To Admit	25
Time To: Discharge	17
Time To: Dr / Be Seen	33
Total time: Treatment	20
Total time: Triage	30
Total time: Turnaround	41
Total time: Wait	87

Appendix 3: Summary of primary papers reviewed and also included within a systematic review paper

Author	Abdulwahid (2016) ¹⁰⁷	Carter (2015) ¹⁰⁸	Crawford (2014) 109	Daly (2003) 110	Elder (2015) 111	Harding (2011) ¹¹⁷	Oredsson (2011) ¹¹²	Rowe (2011)	Scott (2009) ¹¹⁴	Wiler (2011) 115	Wiley (2015) 116
Ardagh (2002) ⁹										✓	
Aronsky (2008)93	\checkmark										
Asha (2013) ⁴⁷			\checkmark								
Blank (2007)94										\checkmark	
Boger (2003) ⁹⁵					\checkmark						
Boyd (2005) ⁵⁰											
Bruijns (2008) ⁵¹											
Bucheli (2004)52	\checkmark										\checkmark
Burnstrom (2012) ⁷²		✓			✓						
Byrne(2000)53										\checkmark	
Chan (2005)11		\checkmark									
Chang (1999) ³⁸	\checkmark				\checkmark						
Cheng (2013) ³⁹	\checkmark					\checkmark		\checkmark		\checkmark	
Choi (2006)12		\checkmark									
Considine (2006) ⁸⁹		✓			√						
Considine (2006) ⁸⁸							\checkmark				
Considine (2008) ⁹⁰			\checkmark								
Considine (2012) ⁷⁵							\checkmark			~	✓
Cooke (2002) ¹³					\checkmark						
Cooper (2002) ⁷⁶										\checkmark	\checkmark
Darrah (2006)15	✓										
Davis (2014)40											
Dinh (2012)105					\checkmark						\checkmark
Ducharme (2009) ⁷⁷				✓							
Farkouh (1998) ⁴¹											
Finn (2012) ¹⁷		✓									
Freij (1996)98			✓								
Fry (2001) ⁷⁹					\checkmark						
Fry (2005) ⁸⁰											
Fry (2011) ⁵⁴											\checkmark
George (1992) ⁹⁹											
Goodacre (2004) ¹⁰⁰										~	~

Author	Abdulwahid (2016) 107	Carter (2015) ¹⁰⁸	Crawford (2014) 109	Daly (2003) 110	Elder (2015) 111	Harding (2011) ¹¹⁷	Oredsson (2011) 112	Rowe (2011)	Scott (2009) ¹¹⁴	Wiler (2011) 115	Wiley (2015)
Gordon (2008)57				√							
Gouin (1997) ¹¹⁸	✓				✓			\checkmark			
Han (2010) ⁵⁸											
Hendriksen (2001) ⁴²	✓					✓	~			✓	✓
Holyroyn (2007)59										\checkmark	
leraci (2008) ⁸¹	✓				\checkmark						
Imperato (2012) ¹⁸											
Kelly (2005) ⁹¹							✓				
Kilic (1998) ¹⁰³			\checkmark								
Kocher (2012) ⁹²							\checkmark				
Kwa (2008) ¹⁹							\checkmark				
Lee-Lewandrowski (2003) ²⁰											
Lindley- Jones (2000) ⁶⁰											
Lutze (2011) ⁶¹		\checkmark									\checkmark
Malbrook (1998) ¹¹⁹											
Mallett (1990) ¹⁰¹					\checkmark						
Muntin (2011) ¹⁰⁴							✓				
Murray (1999) ⁴⁵							\checkmark				
O'Brien (2006) ⁶²			✓		\checkmark		✓				
Parris (1997)63						\checkmark				\checkmark	
Partovi (2001)97	\checkmark						✓				
Patel (2005) ²¹					✓						
Patel (2012)83											
Paulson (2004) ⁸⁴						✓	✓	\checkmark			
Richardson (2004) ²²											
Rodi (2006) ¹²⁰		\checkmark			\checkmark		✓				\checkmark
Rogers (2004) ²⁴	✓										
Rogg (2013) ²⁵				\checkmark							
Rydman (1998) ⁶⁶		\checkmark			✓						
Sakr (2003)67							✓			~	
Sanchez (2006) ⁸⁵			✓								
Sethuraman (2011) ²⁶	✓		✓		\checkmark						
Shetty (2012)68							✓				
Singer (2008)27	✓										

Author	Abdulwahid (2016) 107	Carter (2015) ¹⁰⁸	Crawford (2014) 109	Daly (2003) 110	Elder (2015) 111	Harding (2011) ¹¹⁷	Oredsson (2011) 112	Rowe (2011)	Scott (2009) ¹¹⁴	Wiler (2011) 115	Wiley (2015)
Soremekun (2012) ²⁹	✓										
Soremekum (2012) ¹²¹	\checkmark										
Soremekum (2014) ³⁰						\checkmark	~	√		✓	
Subash (2004)46		\checkmark									
Tachakra (2001) ¹⁰²					✓	\checkmark		✓			
Terris (2004) ⁶⁹	\checkmark				\checkmark	\checkmark	\checkmark	✓		\checkmark	
Travers (2006) ⁷⁰			✓								
Tsai (2012) ³²									\checkmark		
Wanklyn (1997) ⁷¹	\checkmark										
White (2012) ³⁴											
Wiler (2010) ²³					\checkmark						\checkmark

Appendix 4: Data extraction of systematic literature review of studies reporting on models of care to address ED congestion and manage patient flow.

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from	more than 85% of the subjects initially allocated to groups The study provides both point measures and measures of	variability for at least one key outcome	Did Not Wait Disnosition	ED Length of Stay I eft Without Reino Sean or completion treatment		Rate: Discharge Rate: Re-attendance	Rate: Mortality Quality: Patients satisfaction	Quality: Staff Satisfaction Time to: enclosed of much articletice	Time to: Decision to admit	Time to: Discitatige Time to: Dr/ Be seen	I reatment Lime Triage time	Turn around time Wait time
		0 0											(
Bronstein, 2006, USA ³⁶	Impact of a social work care coordination intervention on hospital readmission: a randomised controlled trial.	Care Co- ordination Team	RCT of patients (n=107) receiving the social worker intervention after hospital discharge over 40 month study period.	Determine whether there is a significant difference within 30 readmission rates between patients receiving usual care post discharge and those receiving intervention health professional.	Study suggest that social workers can play an integral role in post hospitalisation care coordination/ Social workers are uniquely trained in facilitation and team building which are essential to the emerging demand for inter-professional collaborative teams in healthcare coordination. Although social worker's contributions to healthcare are well established their roles in care coordination and some other aspects of healthcare delivery need further clarification.								~								V
Caplan, 2004, Australia ³⁷	A randomised, controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after discharge of elderly from the emergency department – the DEED II study.	Care Co- ordination Team	RCT (n=739) over 18 month period of patients aged 75 and older discharged home from the ED who received coordinated/ implemented recommendations compared to a group who received usual care: single site.	Determine the effects of CGA and multidisciplinary intervention on elderly patients sent home from the ED.	CGA and multidisciplinary intervention can improve health outcomes of older people at risk of deteriorating health and admission to hospital. Patients aged 75 and older should be referred for CGA after an ED visit.								√ √	/							~
Seow, 2014, Canada ^{®6}	Impact of community based, specialist palliative care teams on hospitalisations and emergency department visits late in life and hospital deaths: a pooled analysis.	Care Co- ordination Team	Retrospective cohort study (n=6218) patients who received specialist palliative care teams over 2 year study period compared to those who received usual care.	To determine the pooled effect of exposure to one of 11 specialist palliative care teams providing services in patients' homes.	Community based specialist palliative care teams, despite variation in team composition and geographies, were effective at reducing acute care use and hospital deaths at the end of life.								~	·	✓ ✓	~					√ √
Fast Track																					
Ardagh, 2002, NZ ⁹	Effect of a rapid assessment clinic on the waiting time to be seen by a doctor and the time spent in the department, for patients presenting to an urban emergency department: a controlled prospective trial.	Rapid assessment	BA study comparing implementation of RAC over 5 week study period: single site.	To test the hypothesis that triaging certain ED patients through RAC improves WTs, ED LOS for all patients presenting to the ED.	The rapid management of patients with problems which do not require prolonged assessment or decision making is beneficial not only to those patients, but also to other patients sharing the same, limited resources. During the five control weeks a total of 2204 patients attended the ED. There was no significant difference in the distribution across triage categories between the RAC and non-RAC periods. The WTs to be seen by a doctor show no difference at Triage 2 and 3 and a difference of several minutes for								~				v	 ✓ 	~	V	 ✓

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	Did Not Wait	Uisposition ED Length of Stay	Left Without: Being Seen or completing treatment NFAT	Rate: Discharge	kate: ke-attendance Rate: Mortality	Quality: Patients satisfaction	udanty. Start Saustacuon Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit	nime to: Disonarge Time to: Dr/ Be seen	Treatment Time Triage time	Turn around time Wait time
					Triage 4 and 5 categories. The times patients spent in the ED also show no difference for Triage 2 and 3 and about 20 to 25 minutes advantage for RAC-week patients in Triage categories 4 and 5.																
Askel, 201, Turkey ¹²²	Effects of fast-track in a university emergency department through the National Emergency Department Overcrowding Study.	Fast Track	The prospective cross sectional study over 13 day study period of FT area in a hospital.	Determine whether FT area a high impact solution for the problem of ED overcrowding and to find the effects of FT of patient satisfaction, costs, WTs of patients in triage area and total LOS.	Owing to FT, overcrowding in the emergency department was lessened. It also improved effectiveness and quality measures.							~		~		v v		v v	/ ✓		~
Bucheli, 2004, Switzerland ⁵²	Reduced length of stay in medical emergency department patients: a prospective controlled study on emergency physician staffing.	Fast Track	Prospective cohort study of implementation of internal medicine residents during evening shift.	Evaluate whether the addition of a physician would decrease the total ED LOS review the effect of implementing an additional physician in the patient management process of a medical ED as a single measure.	An additional physician significantly reduced the LOS of medical emergency department outpatients LOS ED outpatients was significantly reduced in the prospective analysis of the medical ED patient management process with the implementation of an additional physician working on the evening shift.							V									✓
Combs, 2007, Austalia ⁷³	Evaluation of fast track.	Fast Track	Retrospective cohort study over 1 year study period of data throughout the change process and demonstration of effectiveness of implementing FT into the ED.	Evaluate the effectiveness of introduction FT in the ED.	Following the implementation of FT, the "DNW" rate decreased over a 12-month period from 10% to 5.4%, without a detrimental impact on treatment times for the patients with serious illnesses and injuries. Furthermore, FT resulted in patients with minor injuries or illnesses being seen, treated and discharged within 2 hours of presentation. Indeed the journey time decreased for all Emergency Department patients. As a result of FT, the Emergency Department waiting area is less congested and staff morale has increased. A further consequence of FT is that nurses are providing more advanced clinical services to patients.							~					~			~	V
Considine, 2012, Australia ⁷⁵	Rapid intervention and treatment zone: Redesigning nursing services to meet increasing emergency department demand.	Rapid assessment	Cohort study of data from audit of patient records (n=193)from a 3-month period evaluating emergency nurses' role in a specific ED demand management system: RITZ: single site.	Evaluation of the role of ED nurses in a specific ED demand management system.	Designation and qualifications of RITZ nurses made little difference to WTs and ED LOS. There were disparities between documented and observed nursing practice, so further evaluation of emergency nursing care should use a multi-method approach. Specific documentation and communication systems for areas of the ED that manage large volumes of patients with low complexity problems warrant further research to determine the balance between safe patient care and optimizing patient throughput.							~									

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The provins were similar at baseline regarding the most	important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	ATS Did Not Wait	Disposition	ED Length of Stay Left Without: Being Seen or completing treatment	rate: Utschange Rate: Re-attendance	Rate: Mortality Ouality: Patients satisfaction	Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibotics Time to: Decision to admit	Time to: Discharge Time to: Dr/ Be seen	Treatment Time	Triage time	Turn around time Wait time	
Considine, 2008, Australia ⁹⁰	Effect of emergency department fast track on emergency department length of stay: a case-control study	Fast Track	Pair matched case control design in a public teaching hospital of patients treated by the ED FT over 3 month period compared with patients treated by the usual ED process (n=822): single site.	To measure the impact of ED fast tract on ED LOS for non-admitted patients without compromising WTs and ED LOS for other ED patients.	Median ED LOS for non-admitted patients was 132 minutes (interquartile range (IQR 83–205.25) for controls and 116 minutes (IQR 75.5–159.0) for cases (p=0.01). Fast-track patients had a significantly higher incidence of discharge within 2 h (53% vs 44%, p=0.01) and 4 h (92% vs 84%, p,0.01).									~				~	•	✓		~	
Considine, 2010, Australia ⁷⁴	Effect of clinician designation on emergency department fast track performance.	Fast Track	Retrospective audit of patients (n=8714) managed in the FT area of a hospital over 12 month study period: single site.	To examine the effect of clinician designation on ED FT performance.	Clinician designation does impact on WTs and, to a lesser extent, ED LOS for patients managed in ED FT systems. Future research should focus on obtaining a better understanding of the relationship between clinician expertise, time-based performance measures and quality of care indicators.									 ✓ 								~	
Cooke, 2002, UK ¹³	The effect of a separate stream for minor injuries on accident and emergency department waiting times.	Fast Track	BA study of patients attending ED (n=13 918) over 10 week study period measuring impact of implementation of separate stream system.	Evaluation whether a separate stream for minor injuries can produce an improvement in the number of trauma patients waiting over an hour of about 30%.	New patients (13918) were seen during the 10 week study period; 7117 (51.1%) in the first five week period and 6801 (49.9%) in the second five week period when a separate stream was operational. Recorded time to see a doctor ranged from 0–850 minutes. Comparison of the two five week periods demonstrated that the proportion of patients waiting less than 30 and less than 60 minutes both improved (p<0.0001). The relative risk of waiting more than one hour decreased by 32%. The improvements in WTs were not at the expense of patients with more urgent needs.									✓								~	
Copeland, 2015, Canada ¹⁴	A Daytime Fast Track Improves Throughput in a Single Physician Coverage Emergency Department.	Fast Track	BA study investigating implementation of single physician coverage FT over two year study period: single site.	To determine if implementation of an ED FT in a single physician coverage setting would improve WTs for low-acuity patients without negatively impacting those of higher acuity.	Implementation of FT in a medium volume community hospital with single physician coverage can improve patient throughout by decreasing WT and LOS without negatively impacting high acuity patients.	,							× ·	~		√ √	<i>.</i> √					~	
Darrab, 2006, Canada¹⁵	How does fast track affect quality of care in the emergency department?	Fast Track	BA study comparing impact of implementation of FT in an ED over 1 week period (n=368): single site.	The study was to determine whether a dedicated FT for less urgent patients; the time to assessment for urgent patients, the LOS for less urgent patients, and the left-without- being-seen rate.	A dedicated FT for CTAS 4/5 patients can reduce the LOS and the left-without-being-seen rate with no impact on CTAS 3 patients seen in the main emergency department.									~		~						~	

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was conceated The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from	more than 85% of the subjects initially allocated to groups The sturk nonvides both noint measures and measures of	vice during for at least one key outcome	AIS Did Not Wait	Disposition FD I enorth of Stav	Left Without: Being Seen or completing treatment NF∆T	Rate: Discharge	kate: Ke-attendance Rate: Mortality	Quality: Patients satisfaction On alther Staff Satisfaction	wamy. Jam Jamaton Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit Time to: Discharge	Time to: Dr/ Be seen	rreatriert. Inne Triage time	Turn around time Wait time
Dinh ¹⁰⁵	Evaluating the quality of care delivered by an emergency department fast track unit with both nurse practitioners and doctors	Fast Track	Observational cohort study (n=320) over 1 year study period of outcome of patients to FT: single site.	Report quality of care delivered by ED FT where both doctors and emergency nurses treated patients.	Patients received high quality of care in this FT unit where both nurse practitioner and doctors treated patients. Emergency nurse practitioners were associated with higher patient satisfaction. FT unit such as these that manage all low complexity emergency patients delivery high quality care. Combining medical and nap experience may be the optimal model of care in Australian FT units.							V	V				✓		√ √	✓	•	~
Fry, 2011, Australia⁵⁴	A 12-month evaluation of the impact of Transitional Emergency Nurse Practitioners in one metropolitan Emergency Department.	Fast Track	Prospective observational study over 12 month study period of patients managed TENP (n=5249): single site.	The aim of this study were to: describe patient demographics and conditions managed within the TENP model; examine the efficiency and safety of TENP management; and evaluate the impact of the TENP role on the delivery of emergency services.	The study provides evidence that TENPs can enhance emergency service delivery outcomes and provide comparable, safe, timely, efficient patient care and management. Greater capacity building of this workforce is needed to meet future service demands.)							√ √							V		√ √
leraci, 2008, Australia ⁸¹	Streaming by case complexity: evaluation of a model for emergency department Fast Track.	Fast Track	Retrospective before after interventional study comparing implementation of a FT: single site.	To evaluate a patient flow streaming system within a teaching hospital's ED, using functional principles to separate patients into two streams on the basis of complexity rather than acuity, severity or disposition.	Key features in the success of the system included use of dedicated senior staff for FT patients, and quarantining of clinical resources. The ED aiming to improve their WTs and throughput should consider using complexity as a key criterion for triaging patients into separate streams. A low-complexity patient stream in the ED provides an ideal focus for advanced nursing practice.								V			/ √						
Kilic, 1998, Turkey ¹⁰³	Prospective, double-blind, comparative fast-tracking trial in an academic emergency department during a period of limited resources.	Fast Track	Quasi randomised study (n=273): FT was used every other day during the daytime for a month.	Determine the effectiveness of FT in an ED.	The study was relatively small with 143 patients in the study group and 126 patients in the control group. WT was significantly reduced with FT.	-						~	~									~
Kwa, 2008, Australia ¹⁹	Fast track: has it changed patient care in the emergency department?	Fast Track	BA study of all patients dyeing a 6 month period to evaluate the impact of a FT area.	To determine whether the introduction of a designated fast- track area altered the time to care and patient flow in an Australian mixed adult and paediatric ED.	During its operational hours, FT managed 14.9% of all patients presenting to the ED. There was a significant increase in the proportion of all ATS 4 patients seen within their target times (77.8% to 79.9%, p < 0.001). There was a trend towards improved performance in ATS categories 2, 3 and 5. Median patient WTs were significantly decreased in ATS 4 (24 to 22 min, p < 0.001) and ATS 5 (27 to 25 min, p < 0.05). No deterioration in performance or WT for ATS 1 was shown. There was a decreasing trend in								~	✓		~			~	~		~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was conceated The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from	more than 85% of the subjects initially allocated to groups The study provides both point measures and measures of	variability for at least one key outcome	ATS Did Not Wait	Disposition	ED Lengtn of Stay Left Without: Being Seen or completing treatment	NEAT	rate: Discriarge Rate: Re-attendance	Rate: Mortality Quality: Definitions	oudiny. Fauerius sausiacutori Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics Time to: Designe to admit	Time to: Decision to admit	Time to: Dr/ Be seen Treatment Time	Triage time	Turn around time	Wait time
					the proportion of patients who DNW to be assessed by a doctor in ATS categories 4 and 5. These improvements occurred despite a 12% increase in patient attendances and no change in medical staffing levels.																			
Lutze,2011, Australia ⁶¹	A review of the transitional emergency nurse practitioner.	Fast Track	Prospective cohort study of two hospital sites over 2 consecutive years for a three month period.	Explore the TENP model as it applied to practice working across two urban ED to identify the demographic characteristics of the TENP managed patients and if TENP patients were appropriately, safely and timely managed.	NPs have demonstrated significant impact on patient outcomes and timely service. Transitional NP roles have been shown to be safe and appropriate in tertiary referral hospitals throughout.							~		/ /			v					V	v	~
O'Brien, 2006, Australia ⁶²	Impact of streaming 'fast track' emergency department patients.	Fast Track	Prospective study over 12 week period of patients identified at triage who were assessed to be likely discharged (ATS category 3,4 5) were treated in a separate FT area by ED medical and nursing staff rostered to work exclusively in the area.	Assessment of the impact on patient flows of a FT system implemented in the ED at hospital which dealt with relatively few low acuity patients.	Streaming FT patients in the emergency department of an Australian tertiary adult teaching hospital can reduce WTs and LOS for discharged patients without increasing WTs for admitted patients, even in an ED with few low acuity patients. The FT area managed 21.6% of all patients presenting during its hours of operation. There was a 20.3% (-18 min; 95%CI -26min to -10 min) relative reduction in the average WT and an 18.0% (-41 min; 95%CI -52min to -30 min) relative education in the average LOS for all discharged patients compared with the 12-week period before the FT trial, there was a 3.4% (-2.1 min; 95%CI -8 min to 4min) relative reduction in the average WT and a 9.7% (-20 min; 95%CI -31 min to -9 min) relative reduction in the average WT and a 9.7% (-20 min; 95%CI -31 min to -9 min) relative reduction in the average WT for admitted patients. This was despite major increases in throughput and access block in the study period.							√ √		✓ ✓									•	
Sanchez, 2006, 1549 ⁸⁵	Effects of a fast-track area on emergency department performance.	Fast Track	Retrospective cohort study over 12 month period before and after FT was implemented: single site.	To determine if a FT area improved ED performance.	The opening of a FTA improved ED effectiveness, measured by decreased WT and LOS, without deterioration in the quality of care provided, measured by rates of mortality and revisits.									√ √		~	√				✓	~	v	~
Sethuraman, 2011, Australia ²⁶	Effect of a rapid assessment program on total length of stay in a pediatric emergency department.	Rapid assessment	Before study to evaluate the impact of the RAP initiative on the overall LOS in the ED. Data acquired (n=2000)	To measure the impact of the RAP initiative in a PED on WTs and ED LOS.	Data from 990 visits (in 2004) and 1010 visits (in 2005) indicated similar age, sex, seasonal distribution, and weekday distribution. The total median LOS decreased by 37 minutes with RAP (103								✓ .	/			•	/	~		V	 ✓ 	✓ ·	~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility ariteria was specified	ouplects randomity anocated to groups Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	ALS Did Not Wait	Disposition	EU Lengtn of Stay Left Without: Being Seen or completing treatment	NEAT Pate Discharme	rado: Francisco Rate: Francisco Rate: Stationalice	Rate: Mortality Ouality: Patients satisfaction	Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics Time to: Decision to admit	Time to: Discharge	Time to: Dr/ Be seen Treatment Time	Triage time	Turn around time	walt little
			through a retrospective review of both medical charts and an electronic database: single site.		[interquartile range [IQR, 57Y187] minutes in 2005 vs 140 [IQR, 78Y234] minutes in 2004, p=0.001) but only among lower triage categories. Median door-to-physician time decreased by 20 minutes with RAP (15 [IQR, 7Y29] minutes in 2005 vs 35 [IQR, 18Y72] minutes in 2004, p=0.001) among lower triage categories. The LOS was reduced both in admitted and discharged patients with no difference in the boarding times or admission frequencies.																		
Shetty, 2011, Australia ⁶⁶	Senior Streaming Assessment Further Evaluation after Triage zone: a novel model of care encompassing various emergency department throughput measures.	Senior-led team triage	BA study evaluating the impact of a new model of care - SAFE-T- some concept on ED performance indicators and statistical outcomes.	Assessment of the implementation of intra-departmental strategies to streamline patient flows and employ innovative strategies to achieve best outcomes. Implementation of evidence-proven ED throughput measures may serve to that end.	In total, 11 408 and 11 845 patients were included in the study periods pre- and post- intervention, respectively. Time to physician KPI improved from 72.5% to 84.1%. Did-not- wait rates dropped from 10.7% to 9.6% (p = 0.02) and off-stretcher times for ambulances KPI improved from 74.5% to 79.5% (p < 0.001). ED LOS dropped most significantly for Australasian Triage Scale categories 3 and 4 (14.3% and 11.8%, p-values <0.001). These results were achieved despite worsened AB and hospital bed-occupancy rates during the intervention period (+3.9% and +6.7%).							× ,	/ √		✓ ,	~	~		~	~ ~	< ✓	✓ ✓	1
Tsai. 2012, Australia ³²	Rapid medical assessment: improving pediatric emergency department time to provider, length of stay, and left without being seen rates.	Rapid assessment	BA study investigating the implementation of a RMA: single site.	Investigation of the impact of a RMA on patient flow and left without being seen rates in a paediatric ED. RMA is designed to evaluate and discharge uncomplicated patients quickly or initiate diagnostic workup and treatment before the patient is placed in an ED bed.	RMA is an effective way to improve patient flow and reduce the LWBS rate. A decrease in the LWBS rate allows the ED to provide healthcare to these potentially high-risk patients.							✓	/							~		v	•
Bouman, 2017, Italy ⁴⁹	Effects of an Integrated 'Fast Track 'Rehabilitation Service for Multi-Trauma Patients: A Non- Randomised Clinical Trial in the Netherlands.	Fast Track	Prospective, multi-centre, non-randomised controlled study over 3 years study period (n=132).	The effects on health related outcomes of a newly-developed rehabilitation program, called 'supported FT multi-trauma rehabilitation service' (FT), were evaluated in comparison with conventional trauma rehabilitation service (Care as Usual).	Both FT and Care as Usual rehabilitation programs were effective in that multi- trauma patients improved their functional status and quality of life. A faster (maximum) recovery in functional status was observed for FT at 6 months compared to 9 months for Care as Usual. At twelve months follow-up no differential effects between treatment conditions were found.							,	/					~		√ √		√ v	*

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified Subiects randomiv allocated to groups	Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups The study provides both point measures and measures of	variabilitý for at least one key outcome ATS	Did Not Wait	Uisposition ED Length of Stay	Left Without: Being Seen or completing treatment NEAT	Rate: Discharge Pete: Peoettandance	Rate: Mortality	Quality: Patients satistaction Quality: Staff Satisfaction	Trme to: analgesia, x-ray, antibiotics Trme to: Decision to admit	Time to: Discharge	Treatment Time	Trage time Turn around time	Wait time
		Mark	Defense after "	Furthers the immedia City of	Distance de vision et tris							1									
Elder, 2016, Australia ⁷⁸	Improving emergency department throughput: An outcomes evaluation of two additional models of care.	Medical Assessment Unit	Retrospective comparative study over 2 seasonally matched 3 week periods over 2 years: single site.	Explore the impact of incorporating a physician at triage (PAT) and the implementation of a medical assessment unit (MAU) on emergency department (ED) patient throughput.	Placing a physician at triage and implementing a medical assessment unit were viable models.						 ✓ 		V							V	~
Vork, 2011, Denmark ³³	A medical admission unit reduces duration of hospital stay and number of readmissions.	Medical Assessment Unit	Before after analysis of hospital data over two year study period comparing impact establishment of MAU: single site.	To determine the impact of MAU.	The establishment of the MAU improved efficacy at the hospital owing to reduction in the length of hospital stay and the number of readmissions. As judged from mortality rates and indicated by readmission rates, neither the quality of treatment nor patient safety was compromised in a setup, where patients with suspected cardiac diseases are admitted along with patients suspected to suffer from other internal medical diseases. The dynamics between multidisciplinary physicians and nurses seems to improve when they are working close to each other in a setting where team spirit evolves.							~		¥							
Wanklyn, 1997, UK ⁷¹	Slowing the rate of acute medical admissions.	Medical Assessment Unit	Prospective cohort (n=1277) 3 study periods over 2 years.	Evaluate the impact of the opening of medical receiving room (5 bed unit for assessment of acute medical referrals). Became operational in 1993. Rearrangement of middle level staffing for each of the study periods.	Direct discharge rates at 24 h increased from 3.6 to 29% in period 2 (p=0.001) and 15% in period 3 (p=0.001). Re-admission rate at 4 weeks decreased from 13.3 to 6.0%. Improved appropriate bed usage. High level of general practitioner satisfaction.							√ √	~	~	· .	~	V			V	✓
Yoon, 2003, Canada ^{s7}	Analysis of factors influencing length of stay in the emergency department.	Medical Assessment Unit	Retrospective cohort study (n=894): single site.	To evaluate ED LOS as a measure of ED throughput and crowding.	The findings from the survey suggested that despite some variation in staffing and procedures, MAU seem to be well established and a promising means of decreasing ED access block. Future comparative study is required to evaluate further the effect of MAL on ED access block and ED LOS. Delay in transfer of patients from the ED to the MAU was common. ED crowding remains an issue CTAS KPI and ED processing times are useful benchmarks to evaluate health service deliverables. The medical service to the majority of MAU was provided by General Medicine physicians and cover was reduced at weekends. In the majority of MAU the emphasis on function was facilitating discharge of patients rather	J					·	 								~	~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified Subierts randomly allocated to crouns	Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups The study provides both point measures and measures of	variability for at least one key outcome ATS Did Not Wait	Disposition	ED Length of Stay Left Without: Being Seen or completing treatment MEAT	Rate: Discharge	kate: Ke-attendance Rate: Mortality	Quality: Patients satisfaction Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics Time to: Decision to admit	Time to: Discharge Time to: Dr/ Be seen	Treatment Time Triage time	Turn around time Mait time
					than managing patients with high acuity of illness.														
Non - Tradit	ional Beds																		
McNaughton, 2012, USA ⁸²	ED crowding and the use of non-traditional beds.	Non- traditional beds	Retrospective cohort study of visits (n=19239) to ED over 1 year study period.	Evaluate the relationship between ED bed assignment (traditional, hallway, or conference room bed) and the duration of ED evaluations.	Use of non-traditional beds is associated with increases in mean ED evaluation time; however, these increases are small and may be further minimized by restricting use of non-traditional beds to patients with specific chief complaints. Non-traditional beds may have a role in improving ED throughput during times of crowding.							~	~				~		V
Nursing Sco	ope of Practice																		
Blank, 2007, USA ⁹⁴	Improving patient safety in the ED waiting room.	Waiting room nurse	Survey (n=110) triage nurses to log only the patients for whom their reassessments resulted in a 'save'(intervening and or changing the acuity rating of the patient/s and impact on left without being seen): single site.	To evaluate the effectiveness and impact of the triage nurse not only undertaking initial triage but with overseeing the waiting area and reassessment of patients.	The waiting room nurse is well positioned to initiate analgesia, order simple x-rays, order and take pathology, reassess patients who have waited for extended periods. The waiting room nurse has been found to report a reduction in patient LOS, the number of adverse incidents in the waiting room, a reduction in the number of patients who have left without treatment as well as higher level patient satisfaction.							✓ ✓							V
Boyd, 2005, Australia⁵	The efficacy of structured assessment and analgesia provision in the paediatric emergency department.	NI analgesia	Prospective intervention study conducted over 3, 2-month periods of all paediatric attendances (n=151), within triage category group 3-5 and peripheral limb injuries within 3 timeframes: single site.	To evaluate if a structured pain assessment tool together with NI analgesia protocols improve uptake and time to analgesia for children presenting to the ED with minor musculoskeletal injuries.	The use of a nurse initiated, oral analgesia protocol for treatment of children with mild to moderate injury can significantly increase analgesia provision rates and decrease time to provision of analgesia. The mean time to analgesia in the initial group was 138 minutes. After initiation of triage pain assessment the mean time to analgesia was 93 minutes, there was no statistical difference between these two groups. After the introduction of nurse initiated analgesia, the time to analgesia fell to a mean of 46 minutes. The rate of analgesia provision was initially 20.5% while after the initiation of triage pain assessment the provision rate was 23%. After the initiation of nurse initiated analgesia the analgesia the analgesia provision rate significantly rose to 34% of attendances.							~							
Byrne, 2000, UK ⁷⁷	An evaluation of the care of patients with minor injuries in emergency settings.	Traditional ED, MATS and Nurse Practitioner MIUs	Prospective study (n=181) measuring LOS, patient satisfaction and WTs, length of time for first consultation, time to consultation, time	To evaluate three models of ED care for patients presenting with minor injuries to traditional ED, MATS and NP MIUs.	NP MIU can be effective in reducing ED congestion and improving patient flow. Significant longer wait (p < 0.001) for patients to see a MO (67 min) compared with a NP (23.1 min). Satisfaction higher for NP with better discharge instructions, written information							√ √			✓				

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Aucuation was conceated The groups were similar at baseline regarding the most important Promostic indirectors	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	AIS Did Not Wait Discontinue	ED Length of Stay Left Without: Being Seen or completing treatment	Rate: Discharge Rate: Re-attendance	Rate: Mortality Quality: Patients satisfaction	Quality: Staff Satisfaction Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit Time to: Discharge	Time to. <i>Dit</i> be seen Treatment Time	Irlage time Turn around time Wait time
			to x-ray. Children <17 were not included: single site.		and health advice; patients willing to see NP again. Average times for length of consultation: MO 6.2 min, MATS units 21.6 min, NP MIU 14.8 min. LOS was significantly longer in the traditional ED ($p < 0.001$): Traditional ED LOS – 101.7 min, MATS 85.6 min, NP MIU 56 min.													
Chang, 1999, Australia ³⁸	An evaluation of the nurse practitioner role in a major rural emergency department.	Nurse Practitioner	RCT (n=169 patients: 4 NPs).	To evaluate quality of care by NP v resident medical officer for wounds and limb injury.	Satisfaction- No difference in satisfaction v resident on 5 point scale willing to see NP again.							~				ì	/	(1
Considine, 2006, Australia ⁸⁸	Defining the scope of practice of the emergency nurse practitioner role in a metropolitan emergency department.	ED nurse practitioner candidate	Case control design study (n=476) measuring ED LOS, time to treatment and WTs for assessment: single site.	To evaluate outcomes of patients under the care of ED-NPC in comparison with patients treated by MO.	ED crowding remains an issue. ENP have the potential to help alleviate ED crowding by facilitating flow when incorporated in an appropriate model of care. There was no significant difference between the control and intervention group for ED LOS, treatment times and WTs ($p = 0.28$, $p = 0.41$ and $p = 0.96$, respectively). No difference in number of x-rays ordered $p = 0.436$ NP sees 1-2 patients hourly. No difference in wat time or LOS for patients in the minor ED whether seen by resident or NP.							 ✓ 	✓ ✓	~				
Considine, 2006, Australia ⁸⁹	Emergency nurse practitioner care and emergency department patient flow: case–control study.	ED Nurse Practitioner care	Case control design study (n=102 NP patients; 623 control) measuring WT for NP patients v traditional ED 102 NP patients.	To compare ED waiting times (for medical assessment and treatment), treatment times and LOS for patients managed by an ED NP candidate with patients managed via traditional ED Care.	WT - same: no difference in WT or LOS for patients in the minor ED whether seen by resident or NP.	I					v	 ✓ 						V
Cooper, 2002, UK ⁷⁶	Evaluating emergency nurse practitioner services: a randomised controlled trial.	Nurse Practitioner- led care or SHO-led care	Retrospective cohort study of patients treated by ENP- led care or SHO-led care (n=199) over 1 month study period: single site.	Aim to develop methods and tools that could be used to measure the quality of ENP-led care. These tools were then tests in a randomised controlled trial.	The study was sufficiently large to demonstrate higher levels of patient satisfaction and clinical documentation quality with ENP-led than SHO-led care. A larger study involving 769 patients in each arm would be required to detect a 2% difference in missed injury rates. The methods and tools used in this trial could be used in Accident and Emergency departments to measure the quality of ENP-led care.							~				✓ < 		
Dewhirst, 2017, Canada ¹⁶	Evaluating a medical directive for nurse-initiated analgesia in the Emergency Department.	NI analgesia	Before-after health record review of patients (n=401) presenting to ED with musculoskeletal back pain in 4 month periods before and after implementation	To assess the effect of a medical directive for nurse-initiated analgesics on time to first dose of analgesics, proportion of patient receiving analgesics in less than 30mins, and total LOS in the ED.	Medical directives for nurse-initiated analgesia effectively improve the timeliness and quality of care for patients with acute pain. A medical directive for nurse-initiated analgesia in the ED was associated with significantly reduced time to the first dose of analgesic, and increased the proportion of							✓	~	~			~	√ √

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified Subiodis randomly allocated to recine	Subjects ranuoring anocated to groups Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	ALS Did Not Wait	usposituur ED Length of Stay Left Without Reinn Seen or commisting treatment	NEAT Rate: Discharge	Rate: Re-attendance Rate: Mortality	Quality: Patients satisfaction Quality: Staff Satisfaction Tono contenents of support	Time to anaryssia, x-ray, anuovoucs Time to: Decision to admit Time tr: Niccharne	Time to: Dr/Be seen	rreament mine Triage time	Turn around time Wait time
			of medical directive: single site.		patients receiving analgesics within 30 min. After implementation there was a shorter time to first dose of analgesic (mean of 118 vs 160 min, $p < 0.001$), and a higher proportion of patients receiving analgesics in the first 30 min (20% vs 4%, $p < 0.001$). However there was no difference in total proportion of patients receiving analgesics (71% vs 67%, $p = 0.46$) or total LOS in the ED (337 vs 323 min, $p = 0.51$).														
Finn, 2012, Australia ¹⁷	Reducing time to analgesia in the emergency department using a nurse-initiated pain protocol: a before-and-after study.	NI analgesia	Before after study with historical control presenting to the ED (n=889) with pain measuring time to first PS recorded and time to first analgesia.	To test the effect of a NIPP of all patients presenting to the ED with pain.	Suboptimal management of pain in emergency departments (EDs) remains a problem. 2/3 Pts had a PS 0–6, 88.8% of cases fell into four ICD10 codes. Time to first PS was reduced from median of 47 (IQR 20–93) minutes in the control group to median of less than 1 min (0–26) in the NIPP intervention group. The time to analgesia in the intervention group was significantly reduced from a median of 98 9IQR 44–137) minutes to 28 (IQR 8–58) minutes (p < 0.001). Pts in the intervention group were more likely to have PS recorded than those in the control group, have reduced median time to first PS, and reduced TTA. Whilst researchers demonstrated the safety and efficacy of a NIPP in ED, an unacceptable proportion of patients continued to have inadequate pain relief.							~							V
Freiji, 1996, UK ⁹⁸	Radiographic interpretation by nurse practitioners in a minor injuries unit.	NI testing: x-ray	CCT (n=300) of x-rays request from both NPs and SHOs over 6 month study period: single site.	To evaluate NP v resident ability to interpret radiographs.	Appropriately trained nurse practitioners are at least as good as SHOs in recognising the need for an x-ray and are as competent in their interpretation.							~	V						~
Fry, 2001, Australia ⁷⁹	Triage nurses order x-rays for patients with isolated distal limb injuries: A 12-month ED study.	NI testing: x-ray	Retrospective before after interventional study of all patients (n=42818) provided option of having an x-ray before seeing a physician over 12 month study period: single site.	Determine impact triage nurses safely accurately and appropriately order x-ray for patients.	Of total 1806 x-rays (NI x-ray: n=876 and PI x-ray: 930) the study concluded that with structured education, triage nurses at one institution safely assessed patients and ordered appropriate distal limb x-rays prior to physician assessment. The outcomes of the study indicated that staff believed that the new triage practice increased patient satisfaction and improved patient flow and WTs.							~			✓	~			✓ ✓
Fry, 2005, Australia ⁸⁰	The clinical initiative nurse: extending the role of the emergency nurse, who benefits?	Clinical Initiatives Nurse	Retrospective exploratory study from questionnaire and hospital database	To evaluate CIN and the understanding of the CIN role.	CIN is a useful role in promoting flow. However, the CIN role requires appropriate education and support as well as a detailed scope of practice. All							~			~	~			✓ ✓

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups The study provides both point measures and measures of variability for at least one key outcome	AIS Did Not Wait Disposition	ED Length of Stay Left Without: Being Seen or completing treatment NE∆T	Rate: Discharge Rate: Re-attendance	Kate: Montality Quality: Patients satisfaction On-thue Order On the Control	uualliy. Stall Sauslacuori Time to: analgesia, x-ray, antibiotics Time to: Devision to admit	Time to: Discharge	Time to: <i>Dit</i> be seen Treatment Time Triane time	megeune Turn around time Wait time
			review (n =55) measuring CIN documentation, patient demographics, triage code, diagnosis, LOS, disposition of DNW patients: single site.		respondents reported there is a need for a dedicated orientation programme to the CIN role; 62% of nurses believed the CIN role provided greater opportunity for clinical and professional advancement; 88% reported the need for additional clinical guidelines to assist in understanding the role function and independence; 42% believed the role of the CIN should be extended.											
Fry, 2002, Australia⁵⁵	Nurse-initiated intravenous morphine in the emergency department: efficacy, rate of adverse events and impact on time to analgesia.	NI analgesia	Observational -prospective convenience sample (n=349) of patients presenting with acute severe pain.	To measure the analgesia efficacy and frequency of adverse events following nurse initiated IV morphine in acute paid.	Experienced emergency nurses can initiate effective intravenous narcotic analgesia for patients in acute pain awaiting medical assessment, with minimal change in physiological parameters. This process can improve the time to analgesia for patients in acute pain. Median TTA of nurse initiated morphine was 18 min. PS initial median was 8.5 cm with a reduction to 4.0 cm at one hour. RR, oxygen saturation, HR and BP all showed small but statistically significant reductions over 60 min. 15 predefined adverse events but no interventions were required.					~		✓	4	/		* *
Fry, 2004, Australia⁵	A prospective study of nurse- initiated Panadine Forte: expanding pain management in the ED.	NI analgesia	Observational-prospective exploratory study (n=202) of patients presenting with mild to moderate pain (hemodynamically stable).	To evaluate the introduction of triage nurse initiated schedule 4 drug.	Improving pain management can have a positive impact on patients in moderate pain who experience extended WTs prior to medical assessment. The average pre PS was 68 mm and the median was 70 mm. The average post PS was 37 mm and the median was 35 mm. The average post PS reduced by 31 mm demonstrating a clinically significant change. Average TTA was 23 min with a median time of 6 min.					✓		~	V	/		 ✓
Kelly. 2005, Australia⁰1	Nurse initiated, titrated intravenous opioid analgesia reduces time to analgesia for selected painful conditions.	NI analgesia	Explicit medical record review of patients (n=167) measuring nurse initiated time to analgesia compared to non-nurse initiated group measuring demographics, condition, ATS, time of arrival, whether analgesia was nurse initiated or not, and TTA.	Audit all adult patients with an ED discharge diagnosis of renal of biliary colic.	A nurse-initiated opioid analgesia protocol reduces delays to opioid analgesia for patients with renal and biliary colic. Groups well matched for gender, age, ATS and time of arrival. Median TTA was 31 min in the nurse initiated group and 57 min in the non-nurse initiated group (95% CI 16–36 min, p < 0.0010).				 ✓ 	 ✓ 	 ✓ 	v	/	`	/ ✓	✓
Kocher, 2011, Australia ⁹²	Interventions to safeguard system effectiveness during periods of emergency department crowding.	NI testing - blood test	Cohort study (n=105473) of ED visits assessing ED Los and frequency of testing (blood testing, urinalysis,	Review of the effects of testing and treatment on ED LOS.	Patients requiring blood tests were found to stay longer (72min) than patients who did not require blood tests. Testing and less substantial treatment were associated with prolonged LOS in the					√	~	~	~	•	/	 ✓ ✓

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most	important Prognostic indicators	measures or at reast one key outcome were obtained iton more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	ATS Did Not Wait	Disposition	ED Length of Stay	Left without: Being Seen of completing treatment NEAT	Rate: Discharge	Rate: Re-attendance Rate: Mortality	Quality: Patients satisfaction	Quality: Starr Satisfaction Time to: analoesia y-ray antihiotics	Time to: Decision to admit	Time to: Discharge Time to: Dr/ Be seen	Treatment Time	Triage time	Turn around time Wait time
			ECG, radiograph, ultrasound, CT or MRI and treatment (providing a medication or performance of a procedure) according to disposition (discharged and/or admitted status) : 364 hospitals.		ED, particularly for blood testing and advanced imaging. This knowledge may better direct efforts at stream- lining delivery of care for the most time- costly diagnostic modalities or suggest areas for future research into improving processes of care. Developing systems to improve efficient utilisation of these services in the ED may improve patient and provider satisfaction. Such practice improvements could then be examined to determine their effects on ED crowding.																			
Lindley-Jones, 2000, UK ⁶⁰	Triage nurse requested x-rays – are they worthwhile?	NI testing: x-ray	Randomised prospective study (n=675) measuring x-rays findings, injured body part, triage category, if an x-ray had been requested, time at every stage during the ED journey (triage, MO/NP consultation, time completed in x-ray department, time Dr/ NP completed patient assessment: single site.	To evaluate the impact of NI x-rays at triage on ED WTs, prospective randomised study.	NI x-ray can reduce ED WTs and improve patient flow. 36% mean time reduction from time of triage to time of disposition (37.2 min) (p < 0.001) in the NI x-ray group. No time difference was noted between groups when comparing time to being seen. Both groups ordered the same amount of x-rays (76%).									~					V	 ✓ 	~		× ·	/
Muntlin, 2011, Sweden ¹⁰⁴	Outcomes of a nurse-initiated intravenous analgesic protocol for abdominal pain in an emergency department: a quasi- experimental study.	NI analgesia	Quasi-experimental design with ABA phases (n=200) measuring pain score, frequency of received analgesic time to analgesic, ED transit time and patients' perception of the quality of care.	To evaluate the outcomes of NI intravenous opioid administration for patients presenting with non- traumatic abdominal pain.	Effective pain management remains an issue in ED impacting on patient ED LOS. Pain score: 52% (n =94) had at least numerical rating scale (NRS) 3 pain rating. Frequency of received analgesic: B: 65% (n =65) compared with A1 and A2: 46% (n =43) (p =0.002). Median time to analgesic: A1: 1.8 h B: 1 h A2: 1.7 h. Transit time in the ED: A1: 1.9 h – 14.3 h (median =5.2 h) B: 2.0 h – 16.4 h (median =5.5 h) A2: 1.4 h – 17 h (median =5.7 h). Patient's perception of pain care: B group reported significantly higher quality of care (4.6) than A1 and A2 (>4.5).	1						~		× •		~		*	~	~			~	/ √
Parris, 1997, Australia ⁶³	Do triage nurse-initiated x-rays for limb injuries reduce patient transit time?	NI testing: x-ray	Randomised prospective study (n=175) measuring transit times of patients who had NI x-rays; Doctor- initiated x-rays; transit times of patients with ankle and wrist injuries; nurse and	Investigate if there are any changes in ED LOS using NI x-rays.	NI x-rays can improve patient satisfaction; however, they have limited impact on ED patient flow. No statistically significant difference noted between cohorts (NI x-ray vs PI x-ray) p=0.37 and p=0.14, respectively. 77% of patients had x-rays taken before seeing the Dr if ordered at triage by the RN.							V	 ✓ 	v v	/				~	/			✓ ·	/ /

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most	important Prognosite indicators	measures of at reast one key outcome were obtained in in more than 85% of the subjects initially allocated to groups	I ne study provides both point measures and measures of variability for at least one key outcome	Did Not Wait Disonstition	ED Length of Stay Left Without: Being Seen or completing treatment	NEAT P-t-t	nate: Usularge Rate: Re-attendance Para: Mortality	Nate: Mortainy Quality: Patients satisfaction	Quality: Staff Satisfaction Time to: analgesia, x-ray, antibiotics	Time to: Discharge	Time to: Dr/ Be seen Treatment Time	Triage time	lurn around tme Wait time
			patient satisfaction: single site.																		
Patel, 2012, Australia ⁸³	Effect of nurse initiated x-rays of the lower limb on patient transit time through the emergency department.	NI testing: x-ray	Retrospective study (n=206) measuring no. fractures observed, time to: EP review, time to radiology and ordering time review, patient disposition decision and discharge time and transit times in the ED: single site.	To compare outcomes of NI x-rays with EP initiated x-rays.	Changes to current ED process can assist in reducing access block and improve ED flow. An apparent reduction in the mean transit time (172.9 min for EPIX to 158.6 min for NI x-ray) did not achieve statistical significance (p=0.23); Fractures were reported in 26.7% of EPIX in comparison with 34.7% of NI x-ray (p =0.3); Statistically significant time differences were noted in time to be seen by an EP (p =0.001).	I						v	´ ✓ ✓				V	•	~	✓ 、	(1
Sakr, 2003, UK ⁶⁷	Emergency nurse practitioners: a three part study in clinical and cost effectiveness.	Nurse Practitioner Led Care in MIU	Prospective case control study [NP MIU (n=1313), A&E (n=1447)] comparing cost and clinical effectiveness of NP-led care in MIU in comparison with MO-led care in an A&E: single site.	To evaluate cost, LOS, number of errors in clinical assessment (errors in history taking, clinical examination, follow up and treatment and errors in radiological interpretation), disposal and treatment.	Although slightly more expensive NP MIU can provide safe and effective minor injury treatment and care. Clinical errors: MOs – 191 of 1447 (13.2%); NP – 126 of 1313 (9.6%). Mean WT to be seen: NP MIU – 19 min; A&E – 56 min. Revenue cost of care/ patient: NP MIU – £41.1; A&E – £40.01. Follow-up referrals: NP MIU – £41.1; A&E – 27%.WT reduction from 56.4 mins in traditional ED t 10 min in NP-run MIU p< 0.0001; total LOS down to 51.5 min from 95.4 min p<0.0001.								V						✓ ✓	v v	(1
Physician A	ssistants &/or ED Scribes																				
Ducharme, 2009, Canada ⁷⁷	The impact on patient flow after the integration of nurse practitioners and physician assistants in 6 Ontario emergency departments.	Nurse Practitioner and Physician Assistant	Small retrospective study of health records over 14 day period of patient presenting to ED (n=19592) measuring LOS, LWBS and time to be seen: medium sized hospitals.	To evaluate the impact of NP and PA on patient WTs, ED LOS and number of LWBS.	Changes to front-end services, such as incorporating NPs and PAs in the triage process, can improve patient flow. Patients were 1.6 and 2.1 times more likely to be seen within benchmarked WT timeframes when a PA or NP was involved in care. ED LOS was 30.3% and 48.8% lower when a PA or NP was involved in care. The proportion of DNW patients was higher when a PA or NP was not on shift (44% and 71%, respectively).								~								V
Hendriksen , 2001, UK ⁴²	Occupational therapy in accident and emergency departments: a randomised controlled trial.	OT in the ED	RCT (n=39) patient receiving full OT assessment before discharge at ED with treatment or equipment needs were provided before the patient went home or were arranged as a	Evaluate the potential for an OT in ED to reduce unmet functional needs after releasing patients aged 75 years of more with primary diagnosis of limb, rib or back trauma.	Half of the older patients with lim. Rib or back trauma would have left the ED unable to perform basic ADL. This may be overcome by employing OTs to assess and meet the functional needs of these patents before sending them home.)							✓ √			~	~				~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was conceated The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from	more than 85% of the subjects initially allocated to groups The study provides both point measures and measures of variability for at least one key outcome	ATS Did Not Wait	Disposition	ED Lengtn of Stay Left Without: Being Seen or completing treatment	NEAT Rate: Discharge	Rate: Re-attendance Rate: Mortality	Quality: Patients satisfaction Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics Time to: Decision to actimit	Time to: Discharge	lime to: Dr/ Be seen Treatment Time	Triage time Turn zevuod timo	Nut around mile
			community treatment and appropriate referral made to other agencies: single site																		
Rodi, 2006, USA ¹²⁰	Evaluation of a fast track unit: alignment of resources and demand results in improved satisfaction and decreased length of stay for emergency department patients.	Physician Assistant	Before and after survey (n=146) of implementation of a FT unit staffed by a physician assistant.	Determine if implementation of a separate stream of care focused on low acuity patients in our academic ED.	This study demonstrates that a FT unit staffed by PAs can be successfully initiated in an academic ED with significantly improved patient satisfaction and decreased LOS. This study supports an emphasis on improving turnaround time as a primary driver of satisfaction, and demonstrates that a simple intervention characterized by focusing existing resources on the needs of a specific population can significantly improve healthcare delivery. Thoughtful alignment of resources with the needs of specific patient populations should similarly streamline care in other clinical settings.	1						× 、				✓			~	~	~
Theunissen, 2012, USA ³¹	Fast Track by physician assistants shortens waiting and turnaround times of trauma patients in an emergency department.	Physician Assistants in the ED	BA study (n=1289) of introduction of physician assistant in FT for patients with simple noncomplex health issues in a Dutch ED without the introduction of additional staff over 6 month study period: single site.	Determine whether the introduction of a separate patient flow comprising patients with simple, non-complex health issues [FT (FT)] in a Dutch emergency department setting (ED), without the introduction of additional staff, and treated by a physician assistant, would have favourable effects on waiting and turnaround times without deleterious effects for patients with a higher urgency.	The introduction of FT performed by a physician assistant resulted in a significant drop in WT and LOS in a Dutch ED setting. This reduction was realised without the allocation of additional staff and even reduced waiting and turnaround times for the patient with a high urgency.	5	* *		×	/ √		× 1					✓ ✓	Y		✓ ✓	✓
Point of Ca	re Testing																				
Asha, 2014, Australia ³⁵	Impact from point-of-care devices on emergency department patient processing times compared with central laboratory testing of blood samples: a randomised controlled trial and cost- effectiveness analysis.	Point of Care Testing	RCT of patients presenting with condition considered to only require blood tests available by POC compared to patients treated in usual manner.	To determine if time to disposition decisions for emergency departmeni (ED) patients can be reduced when blood tests are processed using POC devices and to conduct a cost-effectiveness analysis of POC compared with laboratory testing.	Small improvements in disposition decision time were achieved with POC testing for a moderate increase in cost. Greatest benefit may be achieved when POC is targeted to senior medical staff. The mean times to a disposition decision for POC versus controls were 3.24 and 3.50 h respectively, a difference of 7.6% (95% CI 0.4% to 14.3%, p=0.04), and 4.32 and 4.52 h respectively for ED LOS, a difference of 4.4% (95% C 2.7% to 11.0%, p=0.21). Improved processing time was greatest for participants enrolled by senior staff with a reduction in time to disposition decision of 19.1% (95% CI 7.3% to 29.4%, p<0.01) and ED LOS														×	✓ ✓	

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most	important Prognostic indicators	measures of at reast one help outcome were obtained inclu-	The study provides both point measures and measures of variability for at least one key outcome	ATS Did Not Wait	Disposition ED Length of Stay	Left Without: Being Seen or completing treatment NEAT	Rate: Discharge Peter Re-attante	raus, no aucridance Rate: Mortality	Quality: Patients satisfaction Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit	Time to: Dr/ Be seen Treatment Time	Triage time	Turn around time Wait time
					of 15.6% (95% CI 4.9% to 25.2%, p=0.01).																	
Kendall, 1998, USA ⁴³	Point of care testing: randomised controlled trial of clinical outcome.	Point of Care Testing	RCT: blood samples (n=1728) from the ED were randomly allocated to point of care testing or testing by the hospital's central laboratory over 1 year study period: single site.	Determine the proportion of patients for whom point of care testing brought about a change in treatment in which timing was considered to be critical to clinical outcome.	Point of care testing reduced the time taken to make decisions on patient management that were dependent on the results of blood tests. It also brought about faster changes in treatment for which timing was considered to be critical in about 7% of patients. These changes did not affect clinical outcome or the amount of time patients spent in the department.								V					~		✓	•	✓ ✓
Lee- Lewandrowski, 2003, USA ²⁰	Implementation of a point-of- care satellite laboratory in the emergency department of an academic medical centre: impact on test turnaround time and patient emergency department length of stay.	Point of Care Testing	BA study (n=396) comparing implementation of PCT: single site.	Investigate the impact of PCT satellite laboratory in the ED of a hospital.	After initiating a PCT program in the ED, we were able to show a significantly decreased turnaround time for selected tests and an overall decreased ED LOS for the patients who received testing.								~									
Loten, 2010, Australia ⁴⁴	Point of care troponin decreases time in the emergency department for patients with possible acute coronary syndrome: a randomised controlled trial.	Point of Care Testing	RCT over 12 week study period at two EDS presenting with ACS: multi-site.	To determine whether POC troponin testing would decrease patient LOS in the ED for patients arriving with possible ACS.	POC testing for troponin in the ED tended to reduce the LOS for possible ACS patients. The degree of this benefit is likely to be markedly dependent on its acceptance and uptake by attending personnel, and on the ED setting in which it is used.								V					~			1	✓ ✓
Murray, 1999, USA ⁴⁵	Effect of point of care testing on length of stay in an adult emergency department.	Point of Care Testing	RCT compared PCT with central laboratory testing (n=1191) in a hospital ED to assess the difference in patients' LOS: single site.	Evaluation of the effect of PCT on LOS, the median time in ED for PCT patients.	No decrease in LOS was found during the experimental period, leading the investigators to doubt that PCT by itself can be expected to have an impact on LOS in an ED.								√ √									
Rooney, 2014, UK⁵⁴	Point-of-care testing in the overcrowded emergency department-can it make a difference?	Point of Care Testing	Prospective cohort (n=33367) over 4 year study period: single site.	Determine the impact of the reorganisation of medical services to a 59 bed AMU with a dedicated consultant of the day for 24 h take. AMU maximum LOS: 5 days.	Patients did not spend less time in the accident and emergency department even when test results were available more quickly and patient management decisions were made more quickly. This suggests that the availability of test results is not the factor which slows down the arrangement of further care. Improvements in process, such as a reduction in the time doctors wait for test results and the ability to make clinical decisions more quickly, do not seem to improve clinical outcome in this sample of patients .All cause hospital mortality in acute medical patients								V	V		~	✓					✓ ✓

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	subjects randomly allocated to groups Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from the set of the set one key outcome were obtained from	The study provides both point measures and measures of	variability for at least one key outcome ATS	Did Not Wait Disposition	ED Length of Stay	Left Without: Being Seen or completing treatment NFAT	Rate: Discharge	Rate: Re-attendance Rate: Mortality	Quality: Patients satisfaction	Quality: Staff Satisfaction Time to: analoesia x-ray antihiotics	Time to: Decision to admit	Time to: Discharge Trime to: Dr/ Ra seen	Treatment Time	Triage time Trino annind time	Wait time
					reduced from 12.6 to 7.0% (p< 0.0001). Median LOS reduced from 7 to 5 days (p<0.0001). Median number of patients in ED awaiting beds at 7am reduced from 14 to 2 (p<0.001).																		
Singer, 2008, USA ²⁷	Introduction of a stat laboratory reduces emergency department length of stay.	Point of Care Testing	Before-and-after study design was used to compare ED LOS before and after introducing a Stat lab within the central laboratory over 2 month period: single site.	Determine whether introduction of a stat lad dedicated to the ED within a central laboratory was associated with shorter turnaround time and shorter ED LOS for admitted patients.	The introduction of a stat lab within the central laboratory that is dedicated to the ED is associated with the significant improvement in laboratory turnaround time, especially for admitted patients, in whom ED LOS was reduced by more than 1 hour.								~										~
Short Stay &	Cobservation Units																						
Farkouh, 1998, USA⁴	A clinical trial of a chest-pain observation unit for patients with unstable angina.	Short stay/ observation wards	RCT (n=424) patients with unstable angina over 2 year study period: single site.	To evaluate the impact of the safety, efficacy and use of resources of chest pain unit with those of routine hospital admissions for patients with unstable angina who were at intermediate risk for cardiovascular events in the short term.	An ED chest pain OU can be safe, effective, and cost saving alternative for patients at intermediate risk of cardiovascular events.							~	∕ ✓	V					✓	V	✓	V	
Rydman, 1998, USA ⁶⁶	Emergency department observation unit versus hospital inpatient care for a chronic asthmatic population: a randomised trial of health status outcome and cost.	Short stay/ observation wards	Prospective RCT (n=113) patients who acute asthma exacerbation had not resolved after 3 hours of presentation to the ED.	Examination of the progress of 113 patients whose acute asthma exacerbation had not resolved after 3 hours of ED therapy who were randomly allocated to receive treatment in an observation unit or inpatient care.	The ED OU was a lower cost and equally effective treatment alternative for refractory asthma. Patients showed a pattern of improved quality of life associated with the observation unit. Patients randomly allocated to the asthma observation unit located in the ED. patients reported fewer problems with overall care and fewer problems with communication, emotional support, physical comfort and special needs that patients receiving routine hospital care.							V	✓ ✓					V	✓ ✓		v ,	/ /	· V
Streaming																							
Aranosky, 2008, USA ⁹³	Supporting patient care in the emergency department with a computerized whiteboard system.	Tracking systems and white boards	Case report	To describe the design, functionality, and experiences with a computerized ED whiteboard, which has the ability to display relevant operational and patient-related information in real time.	The computerized whiteboard has become an essential instrument for communication and coordination of care in our ED. The real-time availability of cross-sectional and patient-centric data helps to improve the efficiency of patient flow, create transparency and accountability, optimise information management, and maximize effective communication within and outside of the ED. Increased communication inter-provider; improved ED								~	V				~		 ✓ 	✓ ,		

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The mouns were similar at baseline renarring the most	important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	ATS Did Not Wait	Disposition ED 1 month of Start	Let Without: Being Seen or completing treatment	NEAT	kate: Uischarge Rate: Re-attendance	Rate: Mortality	Quality: Partents satisfaction Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit. Time to: Discharge	Time to: Dr/ Be seen	Triage time	Turn around time Wait time
					workflow, research study recruitment and available administrative data.																		
Boger, 2003, USA ⁹⁵	Electronic tracking board reduces ED patient length of stay at Indiana Hospital.	Tracking systems and white boards	Case report	Describe the implementation of an electronic patient tracking system would support more efficient care of patients.	The study found the new tracking board helped the ED staff better manage the flow of patients. The system has transformed numerous manual processes into a seamless function by giving all clinicians access to vital information from triage, emergency, urgent care, and ancillary areas. A glance at the tracking board shows which staff are caring for particular patients or if the patient is out of the department for testing. Hospital admission and/or bed assignment information is also available for relay to families. Decreased WT 0.62%; decreased LWBS 3.7%; improved patient satisfaction.								•	 ✓ 			·					~	✓
Burke, 2017, Australia ¹⁰	Two Hour Evaluation and Referral Model for Shorter Turnaround Times in the emergency department.	Streaming	BA study 2- seasonally matched 26 week intervals compared: single site.	To assess the implementation of a novel ED model of care, which combines clinical streaming, team-based assessment and early senior consultation to reduce length of stay?	A facilitated team leader role for senior doctors can help to reduce length of stay by via early disposition, without significant risks to the patient.								v	/	× •	/ √	~			~	√ v	 ✓ 	√ √
Gordon, 2008, Australia ⁵⁷	Accuracy of staff-initiated emergency department tracking system timestamps in identifying actual event times.	Tracking systems and white boards	Prospective observational study.	This study was designed to determine how accurately these timestamps reflect the actual ED events they purport to represent.	The timestamps recorded by both active and passive tracking systems contain systematic errors and no normal distributions. The active system had much lower precision than the passive system but similar accuracy when large numbers of active system observations were used. Medians should be used to represent timestamp and interval data for reporting purposes. Site-specific data validation should be performed before use of data in high-profile situations. The study noted a total of 901 events; 686 (76%) of these were successfully matched to active system timestamps and 60 (6.7%) were matched to passive system timestamps. For the active system, the median event was recorded 1.8 minutes before it was observed interquartile range 30.7 minutes before to 2.9 minutes after). Protocol execution difficulties limited the study of the passive system (low number of successfully matched events). The median event was recorded by the passive system 1.1 minutes before it was observed (interquartile range 1.3 minutes before to 0.9 minutes before) (n=60).								v										×

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eliqibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from	more than 85% of the subjects initially allocated to groups The stuck provides both point measures and measures of	variability for at least one key outcome	AIS Did Not Wait	ED Length of Stay	Left Without: Being Seen or completing treatment NEAT	Rate: Discharge	kate: Re-auenoance Rate: Mortality	Quality: Patients satisfaction Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics Time to: Decision to admit	Time to: Discharge	Time to: Ur/ Be seen Treatment Time	Triage time	uurir around unie Wait time
Triage																						
Asha, 2013, Australia⁴7	Improvement in emergency department length of stay using an early senior medical assessment and streaming model of care: a cohort study.	Senior led- team triage	Prospective cohort study (n=18962) measuring the processing efficiency of patients streamed through a clinical area staffed by an ED physician, intern and nurse for a 3-month study period.	To determine if a model of care called Senior Assessment and Streaming (SAS) would increase the proportion of patients achieving NEAT.	Through the introduction of SAS, the present study has demonstrated that providing early senior medical assessment can improve an ED's ability to meet NEAT. After controlling for confounding, the odds of meeting NEAT on days with SAS was 15% higher compared with days without (odds ratio, 1.15; 95% confidence interval [CI], 1.07–1.24; p < 0.001). For the subgroups of patients admitted, discharged, triage category 3, 4, 5, or presentation 12.00–18.00 the odds of meeting NEAT on days with SAS was, respectively, 1.10 (95% CI 0.98–1.23; p =0.10), 1.17 (95% CI 1.07–1.28; p < 0.001), 1.17 (95% CI 1.08–1.27; p < 0.001) and 1.19 (95% CI 1.06–1.35; p =0.003). The odds of a patient not waiting to be seen on days with SAS was 28% lower compared with days without (odds ratio, 0.72; 95% CI 0.58–0.90; p =0.003).								~	*								~
Bruijns, 2008, South Africa⁵¹	Effect of introduction of nurse triage on waiting times in a South African emergency department.	Nurse triage operating for 3 month period in ED	e Cross-sectional cohort study (retrospective n=323), prospective n=823) to evaluate the introduction of nurse triage on patient WTs	To evaluate the impact of ; introducing nurse triage on WTs for patients presenting to a South African public hospital ED.	The results demonstrate that use of the CTS, as implemented by trained nurses, dramatically reduced the WT of patients attending a busy public hospital ED in South Africa. WTs were significantly reduced in all but the lowest priority category. The introduction of nurse triage, using the CTS, resulted in an overall reduction in WT from 237 min to 146 min (p>0.001). Patients triaged "red" (highest priority) demonstrated a mean reduction in WT from 216 min to 38 min (p>0.001).	~	* •	د /	د ،	c	✓		~		√ ∨	^		√ √	-	×	~	~
Burstrom, 2012, Australia ⁷²	Physician-led team triage based on lean principles may be superior for efficiency and quality? A comparison of three emergency departments with different triage models.	Senior doctor & nurse triage	Retrospective cohort study (n=147579) period 1 year: multi-site.	Compare the performance of different triage models used in three Swedish Eds. Using efficiency and quality indicators, we compared the following triage models: physician -led team triage, nurse first/ emergency physician second, and nurse first/ junior physician second.	Physician- led team triage seemed advantageous, both expressed as efficiency and quality indicators compared with the two other models.								~									
Chan, 2005, USA ¹¹	Impact of rapid entry and accelerated care at triage on reducing emergency department patient wait times, lengths of	Streaming	BA study (n=1429) to assess the impact of new ED REACT process in an ED: single site.	Determine the effect of a new ED REACT process on the frequency of patients who leave before being seen.	The initiation of a rapid entry and accelerated care process significantly decreased patient leave before being seen rates, average WTs and LOS, despite an overall increase in patient census.							v v	< ✓	√					~		v	r 🗸

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	AIS Did Not Wait	Uisposition ED Length of Stay	Left Without: Being Seen or completing treatment NEAT	Rate: Discharge Rate: Re-attendance	Rate: Mortality Quality: Patients satisfaction	Quality: Staff Satisfaction Time to: analgesia, X-ray, antiblotics	Time to: Decision to admit Time to: Discharge	Time to: Dr/ Be seen Treatment Time	Triage time	Turn around time Vait time
	stay, and rate of left without being seen.																			
Cheng, 2013, Australia ³⁹	Implementing wait-time reductions under Ontario government benchmarks (Pay-for-Results): a Cluster Randomised Trial of the Effect of a Physician-Nurse Supplementary Triage Assistance team (MDRNSTAT) on emergency department patient wait times.	Senior doctor & nurse triage	RCT (n=17034) over 4 month study period: single-site.	Investigating the impact of a physician nurse supplementary triage assessment team: measuring physician-led triage impact on ED LOS, time to consultation, time to diagnostic imaging and pathology, LWBS rates and measurement of harm.	The intervention reduced delays and LWBS rate without increased return visits or jeopardizing urgent care of severely ill patients. Physician-led triage has the potential to improve ED WTs and subsequently improve ED flow. Physician-led triage decreased LWBS rates (1.5% compared with 2.2% in the control group) ($p = 0.06$); significant reduction in ED LOS for discharged patients (95% CI: 1: 45 to 2: 08): as well as for the time-to-initial physician assessment (26 min reduction).	✓ 1	× v	× ×	~	×	~	~	✓				✓	V	•	(1
Choi, 2006, USA ¹²	Triage rapid initial assessment by doctor (TRIAD) improves waiting time and processing time of the emergency department.	Senior led- team triage	Before after study over 2 week study period (n=2665) of senior EP at triage compared to compared to nurse led triage.	Evaluate the effect of TRIAD on waiting time and processing tome of an ED without extra staff. The study found an 18min (38% p < 0.001) decrease WT; 21-min (23%) decrease LOS; 18 min (50%) decrease radiograph ET; 18% decrease LOS for patients with radiograph.	The WT and processing time of the ED were greatly reduced by TRIAD without extra manpower.							V		V			~	~	√ ,	(
Davis, 2014, Australia ⁴⁰	Senior work-up assessment and treatment team in an emergency department: a randomised control trial.	Single SDT	RCT (n=1737) measuring the proportion of patients meeting NEAT criteria (ED LOS less than 4 h) and ED LOS and the time to decision to admit over a 36 day study period: single site.	To evaluate the impact of senior early assessment model (senior workup assessment and treatment team (SWAT) on performance measures in a single ED. Team comprising of emergency medicine consultant, a junior medical officer and an ED nurse.	A senior early assessment model of care was not associated with improved overall NEAT performance and ED LOS. However, there is evidence that improvements were made in the subgroup of discharged patients. There was no difference in overall NEAT performance among the three study groups. There was no overall difference in NEAT performance (48% [95% CI 44, 51] vs 41% ([95% CI 37, 45] vs 46% [95% CI 41, 50], p=0.09) or ED LOS (p=0.65) between SWAT, non-SWAT and standard of care control groups, respectively. In the subgroup of patients discharged from ED (non- admitted), the SWAT intervention group was associated with higher NEAT performance (p=0.004) compared with non-SWAT and control.						~	~								•
George, 1998, UK ⁹⁹	Evaluation of nurse triage in a British accident and emergency department.	Formal Nurse triage (pre- reception)	Non RCT study with equal number control (n=2522) and intervention (n=2515) shifts over 6 weeks week	Comparison of formal nurse triage with an informal prioritisation process for WTs and patient satisfaction.	This study does not confirm the benefits claimed for formal nurse tirage. Nurse tirage may impose additional delay for patient treatment particularly among patients needing the most urgent attention.							~			~					~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed	The groups were similar at paseline regarding the most important Prognostic indicators	measures or at reast one wey outcome were obtained notin more than 85% of the subjects initially allocated to groups The study provides both point measures of	variability for at least one key outcome	Did Not Wait	Disposition FD I enoth of Stav	Left Without: Being Seen or completing treatment	NEAI Rate: Discharge	Kate: Ke-attendance Rate: Mortality	Quality: Patients satisfaction	Quality: Staff Satistaction Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit	lime to: Discharge Time to: Dr/ Be seen	Treatment Time	Triage time	ruiri alound ume Wait time
			study period.		WT increased with nurse triage in all four triage categories. Successful in identifying urgent cases and reducing WTs and reducing DNA rate.																		
Goodacre, 2004, UK ¹⁰⁰	Can additional experienced staff reduce emergency medical admissions?	Physician assisted triage	Audit of cases referred to A and E physician and cluster randomised comparison of service delivery with and without the A & E physician over 6 month study period: single site.	Determination of the workload of the A & E physician and the number of potential admissions diverted to discharge home and/ or to outpatient follow up.	Despite receiving many referrals and discharging a substantial proportion of patients home, the physician did not significantly change emergency medical admissions and may have increased admission to other specialities.								V										
Han, 2010, USA ⁵⁸	The effect of physician triage on emergency department length of stay.	Single SDT	Prospective interventional study (n=17265) measuring ED LOS, daily ED occupancy levels, WR LOS, boarding time, admitted and not admitted patients, number of patient in the WR per hour, number of LWBS patients of ~ 5 month study period: single site.	To evaluate the impact of a PIT SINGLE SDT - board certified emergency physician.	A PIT can help improve patient flow. PIT reduced the overall ED LOS in discharged patients (from 246 min to 232 min, p < 0.001) with no effect on LOS of admitted patients. PIT also decreased ambulance diversion (from median diversion episode 431 min to 256 min, P =0.025), and the number of LWBS patients (from 4.5% to 2.5%, p < 0.001).	~	*	~	×	×	×	~	~	×					~				*
Holroyd, 2007, Canada ^{s9}	Impact of a triage liaison physician on emergency department overcrowding and throughput: a randomised controlled trial.	Senior doctor & nurse triage	Prospective RCT study (n=5718) measuring patient LOS, proportion of patients LWCA, staff satisfaction and episodes of ambulance diversion over 6 week study period.	To evaluate the implementation of TLP shots at an academic tertiary care adult ED using comprehensive outcome reporting.	A TLP improved important outcomes in an overcrowded ED and could improve delivery of emergency medical care in tertiary EDs that are similar. The study found significant reduction in LOS with combined senior doctor and nurse triage. The study found LOS decrease 36 min (p=0.001); LWBS decrease 20% (6.6 to 5.4%); 90% nurses and physicians report improved patient care; 80% nurses and >70% physicians satisfied with process improvement.								~	×			✓ 、						~
Imperato, 2012, USA ¹⁸	Physician in triage improves emergency department patient throughput.	Senior led- team triage	BA study (n=18109) measuring patient registration times, mode of arrival, time seen by physician, disposition category and disposition time, total time on ambulance diversion 6 month study period; single site.	To evaluate the impact of a PIT on ED flow.	Study found a significant reduction in LOS with combined senior doctor and nurse triage. PIT can help improve flow, but ED crowding remains a problem. PIT decreased ED LOS (median LOS for admitted patients was reduced by 24 min, $p = 0.005$) as well as a decrease in ambulance diversions (number of days from 24 days to 9 days). Patient satisfaction, impact on radiology or pathology studies was not evaluated.								√ √	×					¥ ·	~			~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Elicibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	ATS Did Not Wait	Disposition	ED Length of Stay Left Without-Being Seen or completing treatment		Rate: Discharge Rate: Re-attendance	Rate: Mortality Ouality: Deficients setisfaction	oudiny. Fauerics satisfaction Quality. Staff Satisfaction	Time to: analgesia, x-ray, antibiotics Time to: Decision to admit	Time to: Discharge Time to: Discharge	Treatment Time	Triage time Turn around time	Wait time
Mallett , 1990, UK ¹⁰¹	Triage in accident and emergency departments.	Formal nurse triage system	Observational study (n=822 [pre] & n=692 [post] intervention. Study period covered two 7- day periods pre-and post-introduction of triage system.	To compare formal nurse tirage with informal prioritisation process.	Triage delayed time to see doctor but reduced time to first appraised by health professional (nurse). The study found significantly longer WTs to see a doctor post-triage.	~	× `	~	×	✓	×			√ √									~
Nestler, 2012, USA ⁹⁶	Effect of a physician assistant as triage liaison provider on patient throughput in an academic emergency department.	Physician at triage	Observational cohort controlled BA study ([intervention] n=353 [control] n=371) over 16 day study period (8- control days; 8-pilot days).	Determine whether TLP may shorten patient LOS and reduce the proportion of patients who LWBS.	The addition of a PA as a TLP was associated with decreased LOS and lower proportion of LWBS.	V	×	~	×	~	×			√ √	/						v	^	~
Partovi, 2001, USA ⁹⁷	Faculty triage shortens emergency department length of stay.	Comparison study measuring impact of triage on ED LOS	Comparative study measuring the impact of triage v no triage on LOS: single site- only 1 weekday (Mon) and 8-day intervention.	To determine whether triage activities can shorten ED LOS.	The study found that triage by faculty doctor offered a moderate increase in efficiency at the ED, but with a higher financial cost. The study found that mean LOS decreased 82 min (18%); LWBS decreased 46%.	√	✓	~	×	×	×			~					~	~ ~			~
Patel, 2005, Australia ²¹	Team assignment system: expediting emergency department care.	Rapid Assessment	Before after comparative study of the effects of team assignment system on predefined outcome measures spaning 1 year on either side of the date of implementation.	Assessment of the impact on patient flow of a team assignment system, each team consisting on 1 ED physician, 2 nurses and 1 technician. Patients were assigned in rotation upon arrival to a specific team that was responsible for their care.	The implementation of a team assignment system in our ED was associated with reduced time to physiciar assessment, a reduced percentage of patients who left without being seen and improved patient satisfaction. The 12-month ED census was 38716 before team assignment system implementation and 39,301 afterwards. Complete time data were recorded for 34,152 (88.2%) and 32,537 (82.8%) of the patients, respectively. The mean time to physician assessment was 71.3G7.0 minutes before and 61.8G6.4 minutes after team assignment system implementation (absolute difference 9.5 minutes). The percentage of patients seen by a physician within 1 hour was 56.3% before and 64.0% after team assignment system implementation (absolute difference 7.7%; 95% CI 5.1% to 10.3%). The percentage of patients who waited more than 3 hours for physician assessment was 17.8% before and 11.8% after team assignment system implementation (absolute difference 6.0%, 95% CI 4.0% to 8.1%). Before team assignment system, the left without	√ 1	× ×	✓	×	V	✓			✓			Ŷ						~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The monins were similar at hasaline renarding the most	important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome.	ATS	Did Not Wart Disposition	ED Length of Stay Left Without: Being Seen or completing treatment	NEAT Rate: Discharge	Rate: Re-attendance Pata: Mortality	Nate: wortany Quality: Patients satisfaction	Quality: Start Satisfaction Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit Time try Discharge	Time to: Dr/ Be seen	Ireatment lime Triage time	Turn around time	Wait time
					being seen rate was 2.3% compared to 1.6% after team assignment system (absolute difference 0.8%; 95% CI 0.4% to 1.1%). Patient satisfaction reported as very good or excellent showed improvement in satisfaction with the physician (absolute increase 3.1%; 95% CI 1.0% to 5.3%), staff courtesy (absolute increase 4.5%; 95% CI 2.3% to 6.7%), and coordination of care (absolute increase 3.6%; 95% CI 0.8% to 6.4%).																		
Paulson, 2004, USA ⁸⁴	A comparison of wait times and patients leaving without being seen when licensed nurses versus unlicensed assistive personnel perform triage.	Nurse performing triage	Comparative retrospective cohort study over 6 month study period covering pre- and post-intervention.	To compare WTs when nurses perform triage compared with unlicensed personnel.	No difference in triage time. WT reduced by 73 min (127 v. 54 in) when nurse performed triage LWBS rate fell 85%. Results of this study show a triage system using nurses provided more services during triage and were associated with less WT after triage and a decreased likelihood of patients LWBS compared with the triage system using UAP.									 ✓ 									~
Richardson, 2004, Australia ²²	Multidisciplinary assessment at triage: a new way forward.	Senior doctor & nurse triage	BA study of senior EP (multidisciplinary team MDT comprising of a senior registrar /consultant and triage nurse) at triage (n=4148) over 6 month study period.	To evaluate a dual doctor and nurse triage system at a tertiary referral hospital.	Study found that multidisciplinary triage performs a useful function in our department enabling us to reduce WTs. The process is widely accepted amongst the staff and it ensures a senior doctor assesses most patients. It reduces the number of patients leaving prior to being seen by a doctor and it provides one way of getting around access block and physically small department.								V	~					✓				~
Rogers, 2004, UK ²⁴	Evaluation of a 'see and treat' pilot study introduced to an emergency department.	See and Treat	BA study from questionnaire and hospital database review measuring time to be seen, time to be discharged ED LOS: single site. No record of sample size for 6 week study period.	To evaluate the effectiveness of a See and Treat model of care on WTs for minor injury and illness presentations to the ED.	'See and treat' models of care have the potential to improve patient flow and decrease WTs if staffed appropriately. A reduction in overall ED LOS of 22 min (1 h 39 min compared with 1 h 17 min), average WT to see a Dr or NP reduced by 26 min. The percentage of patients assessed within 15 min of presenting increased from 82% to 98%. Average WT to see practitioner decreased from 56-30 mins; average LOS decreased from 99min to 77 min, WT for all patients in the department decreased.								~	 ✓ 			~		•	~		~	
Rogg, 2013, USA ²⁵	A long-term analysis of physician triage screening in the emergency department.	Senior led- team triage	BA study (n=180870) measuring LOS for ED patients, percentage of patients who LWCA, proportion of patients treated and dispositioned	Evaluate the impact of the Supplemented Triage and Rapid Treatment of senior physicians and nurses (START).	Significant reduction in LOS with combined senior doctor and nurse triage. Physician led triage appears to provide sustainable improvements in ED performance metrics including ED percentage of patients who LWCA, door-to-room time, and percentage of patients treated without using a									√ √			~				~ ~		~

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed	The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subiests initially allocated to rirouns	The study provides both point measures and measures of	variability for at least one key outcome ATS	Did Not Wait	Lesposition ED Length of Stay 16: Without: Drive Sono or completing frontmost	Letr without: Being Seen of completing reatment NEAT	Rate: Discharge Rate: Re-attendance	Rate: Mortality	Quality: Patients satisfaction Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics	Lime to: Decision to admit Time to: Discharge	Time to: Dr/ Be seen	Triage time	Turn around time	Wait time
			by START without using monitored beds and door-to room time over a 4 year study period: single site.		monitored bed, despite increasing ED volume. Physician screening delivers additional incremental benefits for several years after implementation and can effectively increase ED capacity by allowing emergency physicians to more efficiently use monitored beds.																			
Russ, 2010, USA ⁶⁵	Placing physician orders at triage: the effect on length of stay.	Physician assisted triage	Prospective cohort study (n=66909) over 23 month period: single site.	Assess the effect of order placement by a triage physician on LOS for patients ultimately treated in a bed within the ED.	Study suggests that early orders placed by a triage physician can significantly influence ED bed utilization. Utilization of physician orders at triage allows for more patients to be treated in conditions with large numbers of boarded patients by limiting the amount of time patients spend occupying an ED bed. During times of increased boarding of admitted patients, available beds become a valuable resource that must be used more efficiently to maintain throughput. Further efforts are needed to identify which patients and ED conditions are affected the most from this type of process change to optimize its benefit, given ever-present limitations in resources.									✓										-
Soremekun, 2012 USA ²⁸	Operational and financial impact of physician screening in the emergency department.	Senior led- team triage	BA study (n=20 318). 2 year study period.	To START Team of senior physicians and nurses.	Significant reduction in LOS with combined senior doctor and nurse triage.									v v	1									1
Soremekun, 2012 USA ²⁹	Impact of physician screening in the emergency department on patient flow.	Senior led- team triage	BA study (n=76 858) of physician- led triage measuring time to physician evaluation, treatment order entry, diagnostic order enters and disposition time for admitted patients over 2 year study period: single site.	To evaluate the impact of the START Team of senior physicians and nurses on key components of ED patient flow.	Physician triage that focuses on both the disposition of straightforward patients and initiating work-ups, leads to a modest improvement in the time to disposition decision for admitted patients and more marked improvements in the times to evaluation, diagnostic testing, and initiation of critical treatments. The median time to disposition decision decreased by 6 min, and the time to physician evaluation, analgesia, antiemetic, antibiotic, and radiology order decreased by 16, 70, 66, 36, and 16 min, respectively. These findings were all statistically significant. Similar results were observed from the multivariable regression models after controlling for potential confounding factors. Conclusions: Physician triage led to earlier evaluation, physician orders, and a decrease in the time to disposition decision.							V	*	V v						√ √	*	V	v	
Soremekun, 2014 USA ³⁰	The effect of an emergency department dedicated 'mid-track'	Senior doctor &	BA Study (n=91903) of the effect of a dedicated mid	Attending physician and 2 RNs.	Significant reduction in LOS with combined senior doctor and nurse triage. Implementation							~	~	√ v	1									1

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most	important Prognostic indicators Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	The study provides both point measures and measures of variability for at least one key outcome	AIS Did Not Wait Disposition	ED Length of Stay Left Without: Being Seen or completing treatment	NEAT	kate: Uisonarge Rate: Re-attendance Doto: Mortolity	Nate: Moltainy Quality: Patients satisfaction	uuallity. Stati Satustaction Time to: analgesia, x-ray, antibiotics	Time to: Decision to admit Time to: Discharge	Time to. <i>Dir</i> be seen Treatment Time	niege tine Turn around tine Wait time
	area on patient flow.	nurse triage	track area in the ED on patient flow metrics (ED LOS, LWBS) and the effect on higher and lower acuity patients over 2 month study period: single site.		of a 'mid-track' area dedicated to the evaluation of uncomplicated medium-acuity patients was associated with reduction in overall left without being seen rates and ED LOS for medium-acuity patients. There was no significant change in percentage of patients with high triage acuity levels. Despite this increase in volume and crowding, the unadjusted and adjusted LWBS rates decreased from 6.85% to 4.46% (p < 0.0001) and from 7.33% to 3.97% (p < 0.0001), respectively. The mean LOS for medium- acuity patients also decreased by 39.2 minutes (p < 0.0001). For high-acuity patients, there was no significant change in the meantime to room (14.69 minutes vs. 15.21 minutes, p =0.07); however, their mean LOS increased by 24 minutes (331 minutes vs. 355 minutes, p < 0.0001).													
Subash, 2004, UK ⁴⁶	Team triage improves emergency department efficiency.	Senior led- team triage	RCT (n=1028) study period over 8 days of a team of designated consultant, a middle grad, two senior house officers and triage nurse: single site.	To see whether three hours of combined doctor and nurse triage would lead to earlier medical assessment and treatment and whether this benefit would carry on for the rest of the day when normal triage had resumed.	Three hours of combined doctor and nurse triage significantly reduces the time to medical assessment, radiology and to discharge during the intervention period. WTs at midday where shorter in the triage group. There was not significant knock on effect the rest of the day.						•			~		 ✓ 	< ✓	~
Tachakra & Deboo, 2001, UK ¹⁰²	Comparing performance of ENPs and SHOs: SAPAL TACHAKRA and PROCHI DEBOO describe the results of a comparative study of ENPs and senior house officers.	Senior doctor & nurse triage	Case control (n=400).	To examine productivity, quality of history, exam radiology, interpretation and treatment of NP v SHO.	Ordering of radiology equal in numbers. NP equivalent to resident for history taking, exam, diagnosis and investigations; significantly better documentation (p<0.001). COST- same or higher than NP; QUALITY - same; WT- 17.75% of major side patients could theoretically have been seen by NP while minor areas was slow.						~	~		× 1	(~	 ✓
Terris, 2004, UK ⁶⁹	Making an IMPACT on emergency department flow: improving patient processing assisted by consultant at triage.	Senior doctor & nurse triage	Prospective observational study (CCT)(n=378) to measure patients waiting to be seen in the ED, time to be seen by the 'IMPACT team' (ED consultant and senior registered nurse), disposition, duration of presenting condition for 3 month study period: single study.	To evaluate the PAT on patient WTs and ED congestion.	Senior doctor and nurse triage. PAT is one solution addressing ED throughput issues. The number of patients waiting in ED to be seen in a 2 h period was reduced from 18.3 to 5.5 (p=0.001). Mean WT from registration to IMPACT assessment ranged from 16 to 20 min. Median WT 13 min. 48.9% of patients were seen and discharged home from triage by the IMPACT team. 26.5% were further assessed and treated in the ED. 6.9% were referred to a primary healthcare provider. 17.7% had an unknown disposition.						~			✓ 、	1			V

Author	Title of Paper	Model of Care	Study Design	Purpose	Findings	Eligibility criteria was specified	Subjects randomly allocated to groups	Allocation was concealed The groups were similar at baseline regarding the most important Prognostic indicators	Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups The study provides both point measures and measures of variability for at least one key on troome	ATS	ud Not Wait Disposition	ED Length of Stay	Lett Without: Being Seen or completing treatment NEAT	Rate: Discharge Rate: Re-attendance	Rate: Mortality Outality: Perivants senisfaction	Quality: Staff Satisfaction	Time to: analgesia, x-ray, antibiotics Time to: Decision to admit	Time to: Discharge Time to: Discharge	Trine to by be seen Treatment Time	Triage time Turn around time	Wait time
Travers, 2006, Singapore ⁷⁰	Avoiding prolonged waiting time during busy periods in the emergency department: is there a role for the senior emergency physician in triage?	Senior doctor & nurse triage	Prospective interventional study (CCT) (n=792) measuring WT of PASC presentations over 10 day period v normal traditional workflow practice for a 6 month study period: single site.	To evaluate the impact of senior PIT on ED process.	Senior emergency physicians working at triage can reduce ED congestion and improve patient flow (for walk in cases). 78% of PACS 3 patients seen within 30 min compared with 48% on control days, average WT decreased from 36 min to 19 min; the WT for PACS 2 category patients also significantly decreased in the experimental group (p < 0.05).					``	-	✓ 、						v			~
White, 2012, USA ³⁴	Supplemented Triage And Rapid Treatment (START) improves performance measures in the emergency department.	Senior led- team triage	BA Study (n=27156) measuring supplemented triage and rapid over 3 months period on overall LOS, LOS for discharged and admitted patients and % of patient LWCA.	To evaluate the impact of a tea, of clinicians (START team of senior physicians and nurses) on who initiated the diagnostic work-up and selectively accelerated disposition in a subset of patients against the standard ED performance measures.	Comprehensive screening and clinical care program was associated with significant decreasing overall ED LOS, LOS for discharged and admitted patients and rate of LWCA despite increase in ED patient volume. Patient volume increased 9% and boarder hours decreased by 1.3%. Median overall ED LOS decreased by 29 min (8%, 361 min pre-intervention, 332 min post-intervention, $q < 0.001$). Median LOS for discharged patients decreased by 23 min (7%, 318 min pre-intervention, 295 min post-intervention; $p < 0.001$), and by 31 min (7%, 431 min pre-intervention, 400 min post-intervention) for admitted patients. LWCA was decreased by 1.7% (4.1% pre-intervention, 2.4% post intervention; $p < 0.001$).							√ v	×			*	 ✓ 				✓

Model of Care Author Title of Paper Objective Outcome Abdulwah, The impact of senior Team Triage Review of the literature to Of 4506 articles identified, 25 relevant studies were retrieved; 12 were of the weak pre-post study 2014, UK¹⁰⁷ design, 9 were of moderate quality and 4 were of strong quality. The majority of the studies revealed doctor assessment at determine if placing a senior doctor at triage versus standard single improvements in ED performance measures favouring SDT. Pooled results from two Canadian RCTs triage on emergency nurse in a hospital emergency showed a significant reduction in LOS of medium acuity patients (weighted means difference (WMD) department performance measures: systematic department (ED) improves ED -26.26 min, 95% CI -38.50 to -14.01). Another two RCTs revealed a significant reduction in WT (WMD review and meta-analysis performance by reviewing evidence -26.17 min, 95% CI -31.68 to -20.65). LWBS was reduced in two Canadian RCTs (risk ratio (RR)=0.79, of comparative studies. from comparative design studies 95% CI 0.66 to 0.94). This was echoed by the majority of pre-post study designs. SDT did not change using several quality indicators. the occurrence of adverse events. No clear benefit of SDT in terms of patient satisfaction or cost effectiveness could be identified. The medical community should further explore the use of NPs, particularly in fast track areas for high Carter, 2007, A systematic review **Nursing Scope** Review of literature that discussed **USA**¹²³ of the impact of nurse of Practice & NPs in the ED setting, looking volume departments. In rural areas, NPs could supplement overextended physicians and allow health centres to remain open when they might otherwise have to close. These strategies could improve access practitioners on cost, Fast Track specifically at 4 key outcome to care and patient satisfaction for selected urban and rural populations as well as make the best use of quality of care, satisfaction measures; wait times, patient and wait times in the satisfaction, guality of care and limited medical resources. emergency department. cost effectiveness. Streaming Crawford, 2014, Initiatives to reduce Review of the current literature Many of the initiatives analysed have proven successful at reducing the number of people re-presenting Australia¹⁰⁹ to the ED, addressing time delays and improving the management of existing resources and patient overcrowding and access highlighting strategies adopted by block in Australian different EDs to reduce delays and flow. More recent changes include increasing the scope of practice and workload for triage nurses. With streamline patient flow, including: NEAT (which requires that most patients presenting to the ED within 4 h) the traditional roles of nurses emergency departments: a literature review. Collegian. waiting room nurses; streaming; in the ED are changing and expanding to meet the needs of modern healthcare systems. rapid assessment teams: short stay units and care coordination programs. Daly, 2003, Short-stay units and Short Stay/ Review of the literate of how short Short Stay Observation Units have the potential to increase patient satisfaction, reduce length of stay, Australia¹¹⁰ observation medicine: a Observation stay observation units affect the improve the efficiency of emergency departments and improve cost effectiveness. However, SOUs have systematic review. Wards efficiency of healthcare delivery and commonly been implemented alongside new clinical protocols, and it is not possible to distinguish the

relative benefits of each. As demand increases, providing effective and cost-efficient care will become increasingly important. SOUs may help organisations that are attempting to streamline patient care

Advanced practice nursing roles, physician assisted triage and medical assessment units are models

of care that can positively impact ED throughput. They have been shown to decrease ED LOS and DNW

rates. Confounding factors such as site specific staffing requirements, patient acuity and rest-of-hospital

Triage systems an improve patient flow, and providing some options for management of simple cases at

the point of triage is likely to be of benefit in achieving this outcome across a broad spectrum of health

is conflicting evidence that triage systems that only prioritise patients, without providing any treatment

improve overall patient flow, although tailoring triage criteria more specifically to the patient population

services. Moderate evidence exists from a range of health services that the ability to combine triage and initial treatment in less resource intensive cases can have a positive effect on patient flow. There

while maintaining their quality of service delivery.

processes can also impact on patient throughout through the ED.

or using triage to prioritise treatable cases may be of benefit.

Appendix 5: Data extraction of studies reporting on a models of care to address ED congestion and manage patient flow.

the quality of services provided.

Exploration of the literature

regarding 3 key strategies (PAT,

MAU, NPs) designed to promote

patient throughput in the ED.

Exploration of the literature to

not effect patient flow.

understand how triage systems may

be used to ensure the most urgent

patients get timely service, but do

Elder, 2015,

Australia¹¹¹

Harding, 2011,

Australia¹¹⁷

Systematic review of three

healthcare improve patient

flow? A systematic review

key strategies designed

to improve patient flow

through the emergency

Do triage systems in

of the literature.

department.

Nursing Scope

Triage systems

of Practice

Author	Title of Paper	Model of Care	Objective	Outcome
Oredsson, 2011, Sweden ¹¹²	A systematic review of triage-related interventions to improve patient flow in emergency departments.	Triage related interventions (Fast track/ point of care testing)	Literature search to scientifically explore which interventions improve patient flow in ED.	Introducing fast track for patients with less severe symptoms result in shorter waiting time, shorter LOS and fewer patients leaving without being seen. Team triage, with a doctor in the team, will probably result in shorter waiting time and shorter LOS and most likely in fewer patients leaving without being seen. There is only limited evidence that streaming of patients into different tracks, performing laboratory analysis in the ED or having nurses to request certain x rays result in shorter waiting time and LOS.
Scott, 2011, UK	Effectiveness of acute medical units in hospitals: A systematic review.	Medical Assessment Units	Review of articles reporting effect of the introduction of a acute medical unit on mortality, length of stay, discharge disposition, readmissions, resource use and patient and/ or staff satisfaction.	Limited observational data suggest acute medical units reduce in - patient mortality, LOS and ED access block without increasing readmission rates, and improve patient and staff satisfaction.
Wiler, 2010, USA ²³	Optimizing emergency department front-end operations.	Streaming	Critical review of academic literature to identify ways to improve operations and promote patient throughput.	This critical review of the academic medical literature reveals that few and often methodologically limited studies have been published concerning front-end operational improvement strategies. Currently, there exists a knowledge gap about what the optimal ED front-end strategy is, with the need for more well-designed trials identified. Although an optimal approach to streamline front-end operations for all EDs has not yet been identified, the strategies presented here may be important components of change management initiatives for individualised EDs to improve front-end operations and throughput.

For more information contact:

Dr Chris May Healthcare Improvement Unit Clinical Excellence Division Queensland Health Level 2, 15 Butterfield St, Herston, QLD 4006 Email: chris.may@health.qld.gov.au

© State of Queensland (Queensland Health) 2018

