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Evidence Snapshot

The effectiveness of secondary triage models for residential aged care

An Evidence Snapshot brokered by the Sax Institute for the Ministry of Health.
March 2021

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Disclaimer:

This Evidence Snapshot was produced using the Evidence Snapshot methodology in response to specific questions from the commissioning agency.

It is not necessarily a comprehensive review of all literature relating to the topic area. It was current at the time of production (but not necessarily at the time of publication). It is reproduced for general information and third parties rely upon it at their own risk.

Introduction

This Evidence Snapshot was commissioned by the NSW Ministry of Health and prepared by the Sax Institute. Note that it was completed within two weeks, so while a rigorous process for searching was followed it is possible that some peer reviewed or grey literature may have been missed.

In March 2020, NSW Health, in partnership with NSW Ambulance began implementing the Secondary Triage for Residential Aged Care Facilities (ST-RACF) initiative in NSW. The secondary triage delivered by the My Emergency Doctor (MED) service involves phone consultation with an emergency medicine specialist, an RACF staff member and/or facility resident to determine if the resident requires transport to hospital and to develop an appropriate care plan. This care plan could include referrals to a general practitioner (GP) and/or to community-based services within a Local Health District to support ongoing care.

NSW Health commissioned the Sax Institute to undertake a formative evaluation of the MED Service with consideration given to existing national and international literature on secondary triage models.

Because we found few studies of effectiveness published over the last 12 months, we extended the search to include studies published in the last 5 years.

Review question

What is known about the effectiveness of secondary triage models for residents of aged care facilities?

Methods

We searched Scopus, Medline, BMJ COVID-19 collection and Google Scholar for the peer reviewed literature. We then conducted an extensive grey literature search including relevant government agencies based in Australia (all jurisdictions), US, Canada, UK, and New Zealand. We reviewed the title and abstracts of 592 peer reviewed papers. The grey literature searches were undertaken on 26-30 November and the peer reviewed on 4 December 2020, with all literature sourced 8.00pm on 4 December 2020.

We included models which were evaluated; addressed low-acuity or low-priority cases following primary triage; and which were led by a nurse, paramedic, general physician or emergency specialist clinician. We excluded models that were not evaluated; those addressing children only; focusing on high or moderate acuity or which were implemented in a low- or middle-income country.

The primary outcomes of interest were hospital transfers, ED presentations, ED length of stay (LOS) and hospital admissions and re-admissions. We report our search strategy in Appendix 2 and results in Appendix 4.

Summary of findings

Findings

- We identified 16 papers which met our inclusion criteria, of which there was a systematic review (1); two prospective controlled studies (without randomisation) (2, 3); a prospective cohort study (4); two observational case-control studies (5, 6); five retrospective cohort studies (7-11); a retrospective comparative data analysis (12); a descriptive epidemiological study (13); a stepped wedge evaluation (14); and two modelling studies based on retrospective ambulance data (15, 16).
- **Only three studies were specific to residential aged care facilities (RACFs)** (2, 12, 14); **all three studies were Australian** and reported on two models (VARS, ACE). A fourth study separately reported data from residential care homes and the community (The West Midlands Model (WM), UK)).(4) Of the remaining studies, one examined older adults (VARS, Australia). (8) The remaining studies examined adults of all ages (7) (3) or adults and children (1, 5, 9-11, 13, 17).
- Nine studies were conducted in Australia (2, 7-14), two studies in the US (5, 6), one in the UK (4, 6), one in Sweden (3). The modelling studies used Australian (15) and Korean retrospective data (16). The final study was a systematic review (1).
- **We identified five models of secondary triage** led by a nurse or paramedic with Advanced Life Skills (ALS). They are: the Aged Care Emergency (ACE) service; the Victorian Ambulance Referral Service (VARS); the West Midlands service (WM); the Emergency Telehealth and Navigation (ETHAN) program; and the Early Pre-Hospital Assessment EPHA) model. The models are described in Appendix 5.
- We analysed the effectiveness of the models:
  - with or without medical support
  - with additional intervention in the RACFs
  - with referral to vs collaboration with alternative services.
- The most frequently reported outcome was **ED presentations** (all five models). This was followed by hospital admissions (three models) and ambulance demand (three models). Two models reported 7-day ED re-presentations; one reported response times; one ED LOS and one 30-day ED re-presentation. ETHAN and ACE models reported the greatest number of outcome types.
- **While the strength of the evidence overall is low, the strongest evidence was for interventions in RACFs (**2, 14), and a community based early pre-hospital assessment model.(3)

Effectiveness of secondary triage with or without medical support

- Three of the secondary triage models included access to a medical practitioner by the triage nurse or paramedic as part of the triage process: WM, ETHAN, and EPHA. VARS and ACE in contrast, do not provide access to expert medical advice.
- Of the three models that did access a medical practitioner, two medical practitioners were the individual's own primary care physician (WM, EPHA); the third model (ETHAN) accessed an emergency services physician (who referred the individual to their own primary care physician if appropriate).
- The two models accessing the patient's own primary care physician commented on the value of the physician's knowledge of the patient's medical history and care plan. ETHAN accessed a specialist emergency physician and the decision about disposition was made in consultation with the patient.
- Although the Australian models did not include access to medical support as part of the triage process, VARS demonstrated comparable to or better results than those with access to medical support, in reduced ambulance demand, ED presentations and in hospital admissions. (see Table 2). ACE demonstrated a 20% reduction in the likelihood of ED presentations, which is lower than EPHA (35.7%) and West Midlands (39.7%), but 13% higher than ETHAN. It also reduced hospital admissions by 21%.
- In the nurse-led **ACE** model, like EPHA, goals of care were developed previously with the resident and influenced assessment of the appropriate level of care. A feature of the ACE model was the community of practice collaboration across RACFS, GPs, ambulance, local hospitals and EDs, including quarterly meetings. **VARS** had provider pre-developed care plans for frequent users of ambulance services or patients with known mental health conditions only. Outside of these groups, decisions about triage rely on the nurse or paramedic alone.
- Regarding the **EPHA** model, the authors suggest that the early involvement of the primary care physician and their knowledge of their patients likely account for the significant reduction in ED transfers and increased stay-at-home dispositions. Plus, reduced hospital admissions had additional benefits such as less unnecessary waiting times in EDs, and less frustration and mental strain for patients and carers.
- In the **WM** model, 78% of those who received a GP assessment were not transported to ED; however, those receiving telephone GP support were significantly more likely to be transferred to ED than those receiving face to face assessment.
- In **ETHAN**, the paramedic contacts the emergency physician and the patient receives a referral for follow-up care at a participating clinic. The determination is made with the patient using tele-technology (telehealth and tablet hardware and software).
- This review did not investigate the effectiveness of the alternative services themselves. In terms of effectiveness, two studies assessed 7-day ED re-presentations and one study 30-day re-presentations; but the EPHA model assessed secondary ambulance transport within 24 hours for patients triaged to stay-at-home. There were no significant differences between the intervention and control groups for this indicator.

Effectiveness of secondary triage with additional intervention from alternative services

- Referrals to alternative service providers featured in 3 models, two of which offered 3 referral options (WM and ETHAN) and one offering 12 or more options (VARS).
- In the VARS model (with no GP involvement during triage), alternative service providers (ASPs) are contracted to provide appropriate care to low-acuity patients in their homes. These include nursing and mental health nursing; general practitioner locum services outside normal GP hours, crisis assessment and treatment teams that provide 24h community mental health services and hospital outreach services including nursing and allied health. Other health services include ACAT assessments, out-of-hospital medical care coordination teams, poison information, sexual assault medical teams, dental team, drug and alcohol services, community health, rehabilitation and veterans' affairs services. Costs are shared between VA and the public health system.
- In the WM model, GP advice is provided to ambulance paramedics either over the phone (35.8%) or face to face 'at scene' (64.2). 78% of those receiving GP provided support were not transported to hospital, however of those receiving telephone support, were more likely to be transferred to ED. Alternative services included provision of self-care advice, a prescription or referral to alternative community care pathways (e.g. intermediate care teams, social services, community hospitals) or referral back to the patient's registered GP. The service was highly valued by ambulance crews and participating GPs with no critical incidents or patient complaints received.
- ETHAN was the only model to evaluate a telehealth-enabled community paramedicine program, to identify the most appropriate level of care i.e. hospital ED, local safety-net clinic with pre-paid taxi voucher, self-care at home, or referral to primary care. There was a 56% reduction in ambulance transports to ED with no significant differences in mortality or patient satisfaction.
- This Snapshot Review did not examine the effectiveness of the alternative services provided. Although it seems intuitive that alternative services reduce ED presentations, there is little evidence of this in the included papers. The exception to this is the EPHA model which assessed secondary ambulance transport within 24 hours for patients triaged to stay-at-home. There were no significant differences between the intervention and control groups for this indicator.

Effectiveness of secondary triage using referral or collaboration

- While all models referred low-acuity patients to alternative service providers, few models involve active collaboration among the providers to achieve a holistic program of care. The notable exceptions were the ACE model and EPHA.
- In the ACE model there is no defined referral pathway, as each RACF is linked to a specific ED where the RN provide telephone consultation service to the RACFS. After hours the primary care organisations call centre RN takes over. Care coordination is managed by the ANP. Because the model is intentionally system-wide and includes structured care coordination as well as support of the multi-disciplinary providers (community of practice) which includes the linked ED and RACFs. Thus, a group with shared expertise, collaborating to manage acutely unwell residents of RACFs, integrating and crossing jurisdictional boundaries. As well as a governance committee including the health service, primary care organisation, RACFs and ambulance services.Perhaps because of this integration, the ACE model provided the **largest number of outcome indicators** of any model.

- The second model which intends collaboration rather than unilateral referrals is the Early pre-assessment model of pre-hospital care for all adult patients with non-urgent medical problems (EPHA). Ambulance nurses collaborate with primary healthcare physicians to assess patients at the scene to choose the appropriate level of care. Patients may remain at home under primary healthcare, or be transported to the primary care unit or to A&E. The study found significantly fewer ambulance transports to A&E and more patients staying at home. The authors posited that the early dialogue between the ambulance nurse and primary care physician about the appropriate level of care, the second assessment by the primary care physician and the physician's knowledge of the individual patient's medical history, account for these differences.

Other outcomes of interest:

Costs and cost savings

- Four studies mentioned costs and found that there were cost savings associated with secondary triage (1, 4, 5) with one modelling study predicting cost-efficiencies. (16)

Staffing, training and qualifications

- Five papers reported on the training or qualifications of either of the triaging nurse (3) or paramedic, or of the advising clinicians.
- In the US model (ETHAN) (6), the on-call emergency medical services physicians are board-certified emergency physicians who practice at local hospital EDs and are contracted for part-time shifts at the Houston Emergency Center specifically for telehealth calls.
- In the UK (WM service) (4), ambulance crews include qualified Health Care Professions Council registered paramedics who are able to conduct advanced life and trauma support procedures in adults and children, and ambulance technicians who have had a lower level of training. GPs are specialty doctors with a minimum of 10 years' medical education, including 3 years' specialist postgraduate training. Participating GPs are given one-day training as triage contacts.
- In Sweden, EPHA provides qualified medical assessment and treatment by ambulance nurses based on patient needs regarding appropriate levels of care.
- In Australia, VARS uses nurses or paramedics trained in telephone triage. In the ACE Service, an ED advanced practice nurse with aged care skills (ACE Clinical Nurse Consultant), leads and coordinates the service, and provides training to RACF staff. An ED advanced practice nurse with skills and experience in aged care nursing provides 24-hour consultation to the RACF staff to assist in decisions and for clinical handover. Their role includes identification of care needs, care planning and advocacy.

Resident and patient participation in decision-making:

- Several studies documented the need for **patient participation** in the decisions about the best level of care at triage. In Champagne et al (ETHAN) for example, the patient decides on the level of care in consultation with the physician.
- Only two papers reported on **patient satisfaction** with care. Eastwood's systematic review noted satisfaction levels in two included studies of 75% and 96% and Larsson (EPHA) noted that there

was no significant difference between intervention and control groups in patient satisfaction with care.

Grey literature

The grey literature search identified four reports that met the inclusion criteria. (18-21)

- The first report by the Emergency Care Institute of NSW (21) described the ACE model, noted that it was evaluated through the John Hunter Hospital and added new information about admissions, with a 35% reduction in occupied bed days.
- The US Department of Veterans Affairs Management e-brief 2019 (20) reported on a systematic review of the effectiveness of remote triage models in the US across a variety of settings. The review had mixed results, with a limited and low to moderate certainty of evidence. The majority of studies did not demonstrate a decrease in primary care or ED use, but the report suggested that locally based triage services had higher case resolution outcomes and referral to EDs compared with regional or national telephone-based remote triage.
- Clinical Excellence Queensland 2018 (19) reported on the Emergency and Community Connect (ECC), an integrated and patient focused project between the Mackay Hospital and Health Service and Queensland, the local Primary Health Network, General Practitioners (GPs), RACFs, Pharmacies and the Queensland Ambulance Service. The Emergencty Senior Early Assessment Team consisted of a Senior Medical, a Junior House Officer, a clinical Nurse Consultant and an Administrative Support Officer. There was a telehealth consultation between the RACF and the Patient's GP (if available), who conducted a preliminary assessment. If required, the consult could be escalated to the Emergency Senior Early Assessment Team SMO, who determined whether an ED transfer was essential. Results from an evaluation of this model showed fewer hospital admissions, with between 60%-90% of telehealth calls treated in place. There was a reduction in the average emergency length of stay of 6.5 hours.
- Under Ambulance Victoria's revised Clinical Response Model, some event types which previously received an automatic emergency response were assessed through a secondary triage process by expert paramedics and registered nurses in the Ambulance Victoria Referral Service. The Referral Service involved a paramedic or registered nurse seeking further information on a patient's condition to determine the most appropriate treatment.

Table 1—Summary overview of model components in the included studies

First Author, year	Model	Country	Study design	Population			Acuity assessed by		Care components									
				Aged care residential	Aged care (other)	General population	Secondary triage algorithm	Guidelilne / reference	Triaged / clinically assessed	Access to specialist advice	Collaboration with partners	Referral to alternative	Transfer to hospital / ED	Rapid medical advice	Information transfer	Patient care plan	Clinical handover	Follow up post triage
NA	ST-RACF	Australia	NA				x	x		x	x			x				
Andrew, 2019	NA	Australia	Modelling based on retrospective ambulance data				x											
Cantwell, 2016	VARS	Australia	Retrospective analysis	x	x		x		x			x	x					
Champagne-Langabeer, 2019	ETHAN	US	Observational			x	x				x	x	x	x				
Eastwood, 2020a	VARS	Australia	Retrospective cohort			x		x	x			x	x	x				
Eastwood K, 2020b	VARS	Australia	Retrospective cohort		x		x	x	x			x	x	x	x			

ST-RACF (NSW): Secondary Triage for Residential Aged Care Facilities (NSW)
VARS: Ambulance Victoria Referral Service
EPHA: Early Pre-Hospital Assessment
ETHAN: Emergency Telehealth and Navigation
ACE: Aged Care Emergency Service
WM: West Midlands

Eastwood K, 2019	VARS	Australia	Retrospective cohort			x			x			x	x	x				
Eastwood K, 2018	VARS	Australia	Retrospective cohort			x			x			x	x	x				
Eastwood K, 2017	VARS	Australia	Retrospective cohort			x			x			x	x	x				
Eastwood K, 2016	VARS	Australia	Descriptive analysis			x			x			x	x	x				
Eastwood, 2015	NA	Australia	SR						x									
Hullick, 2020	ACE	Australia	Step wedged evaluation	x													x	
Hullick, 2016	ACE	Australia	Prospective controlled	x			x	x		x	x		x	x	x	x	x	
Langabeer, 2016	ETHAN	US	Observational			x			x	x		x					x	x
Larsson, 2017	EPHA	Sweden	Prospective controlled			x												
Park, 2019	NA	Korea	Modelling based on retrospective ambulance data															
Villarreal, 2017	West Midlands Ambulance	UK	Prospective cohort			x												

Table 2—Secondary triage significant outcomes from selected papers

Secondary triage model	Source document	Setting	Reduced ambulance demand	Improved response times	ED presentations	ED LOS	Reduced hospital admissions	LOS Hospital	7-day ED representation	30-day ED representation
ETHAN	Langberg, 2016	All	Yes (56%)	Yes (39 min vs 83 min BIS time)	67% vs 74% (IG vs CG)[1]	NA	NA	NA	< 0.2%[2]	NA
VARS	Eastwood, 2016	All	Yes (27.6%)	NA	Yes (31.4% diverted from hospital)[3]	NA	Yes (31.4% diverted from hospital)[3]	NA	NA	NA
ACE	Hullick, 2020	RACF	Yes (not measured)	NA	20% less likely	Yes (384 min vs 410 min)	21% less likely	NA	Reduced 5.7% to 4.9%	Reduced 12% to 10%
EPHA	Larsson, 2017	All	Yes (17.4% vs 53%)	NA	17.4% vs 53.1%	NA	Yes (11.4% vs 25.6%)	NA	No	NA
WM	Villarreal, 2017	All	NA	NA	Yes (21.2% vs 61% for all emergency calls)	NA	NA	NA	NA	NA

1. < 0.2% of patients requested further EMS attendance within two days of initial call.
2. Relatively high rates of presentation to ED by IG likely influenced by US Medicare policies i.e. that reimbursement requires ED presentation.
3. Reduced hospital admissions: 31.4% either diverted to ASPs, given self-care advice or managed by plan for frequent callers.

Abbreviations: ASP: Alternative Service Provider IG: intervention group CG: control group BIS time: back-in-service time

Appendix 1: Included publications

Research reviews and studies

Andrew E, Jones C, Stephenson M, Walker T, Bernard S, Cameron P, et al. Aligning ambulance dispatch priority to patient acuity: A methodology. Emergency Medicine Australasia: EMA. 2019;31(3):405-10.

Cantwell K, Burgess S, Morgans A, Smith K, Livingston M, Dietze P. Temporal trends in falls cases seen by EMS in Melbourne: the effect of residence on time of day and day of week patterns. Injury. 2016;47(1):266-71.

Champagne-Langabeer T, Langabeer JR, Roberts KE, Gross JS, Gleisberg GR, Gonzalez MG, et al. Telehealth impact on primary care related ambulance transports. Prehospital Emergency Care. 2019;23(5):712-7.

Eastwood K, Morgans A, Smith K, Stoelwinder J. Secondary triage in prehospital emergency ambulance services: A systematic review. Emergency Medicine Journal. 2015;32(6):486-92.

Eastwood K, Morgans A, Smith K. Characteristics associated with emergency department suitability in low-acuity ambulance cases. Australasian Journal of Paramedicine. 2020;17.

Eastwood K, Morgans A, Stoelwinder J, Smith K. Patient and case characteristics associated with 'no paramedic treatment' for low-acuity cases referred for emergency ambulance dispatch following a secondary telephone triage: a retrospective cohort study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2018;26(1):8.

Eastwood K, Morgans A, Stoelwinder J, Smith K. The appropriateness of low-acuity cases referred for emergency ambulance dispatch following ambulance service secondary telephone triage: A retrospective cohort study. PloS One. 2019;14(8):e0221158.

Eastwood K, Morgans A, Smith K, Hodgkinson A, Becker G, Stoelwinder J. A novel approach for managing the growing demand for ambulance services by low-acuity patients. Australian Health Review. 2016;40(4):378-84.

Eastwood K, Nambiar D, Dwyer R, Lowthian JA, Cameron P, Smith K. Ambulance dispatch of older patients following primary and secondary telephone triage in metropolitan Melbourne, Australia: A retrospective cohort study. BMJ Open. 2020;10(11):e042351.

Eastwood K, Smith K, Morgans A, Stoelwinder J. Appropriateness of cases presenting in the emergency department following ambulance service secondary telephone triage: A retrospective cohort study. BMJ Open. 2017;7(10).

Hullick C, Conway J, Higgins I, Hewitt J, Dilworth S, Holliday E, et al. Emergency department transfers and hospital admissions from residential aged care facilities: a controlled pre-post design study. BMC Geriatrics. 2016;16(100968548):102.

Hullick CJ, Hall AE, Conway JF, Hewitt JM, Darcy LF, Barker RT, et al. Reducing Hospital Transfers from Aged Care Facilities: A Large-Scale Stepped Wedge Evaluation. Journal of the American Geriatrics Society. 2020.

Langabeer JR, II, Gonzalez M, Alqusairi D, Champagne-Langabeer T, Jackson A, Mikhail J, et al. Telehealth-enabled emergency medical services program reduces ambulance transport to urban emergency departments. Western Journal of Emergency Medicine. 2016;17(6):713-20.

Larsson G, Holmén A, Ziegert K. Early prehospital assessment of non-urgent patients and outcomes at the appropriate level of care: A prospective exploratory study. International Emergency Nursing. 2017;32:45-9.

Park SH, Lee YH. Two-Tiered Ambulance Dispatch and Redeployment considering Patient Severity Classification Errors. Journal of Healthcare Engineering. 2019;2019.

Villarreal M, Leach J, Ngianga-Bakwin K, Dale J. Can a partnership between general practitioners and ambulance services reduce conveyance to emergency care? Emergency Medicine Journal. 2017;34(7):459-65.

Included peer reviewed commentary

Goldstein J, McVey J, Ackroyd-Stolarz S. The role of emergency medical services in geriatrics: bridging the gap between primary and acute care. Canadian Journal of Emergency Medicine. 2016 Jan;18(1):54-61.

Levine S, Bonner A, Perry A, Melady D, Unroe KT. COVID-19 in older adults: transfers between nursing homes and hospitals.

Jain, Shikha, Peter N. Gonski, Jeannette Jarick, Sandra Frese, and Sheena Gerrard. "Southcare Geriatric Flying Squad: an innovative Australian model providing acute care in residential aged care facilities." Internal Medicine Journal 48, no. 1 (2018): 88-91.

Appendix 2: Search strategy

Key concepts

Concept 1a	Concept 1b	Concept 2	Concept 3
Secondary triage	Low acuity	Residential aged care facility	Aged
Triage	Low priority	Nursing home	Geriatric
Tele*	Non-acute	Aged care	Older

Timeframe

This review includes peer reviewed published in from 1 January 2011 to 4 December 2020 for searches in Scopus and from 1 January 2016 to 4 December 2020 for searches in Medline. The grey literature search covered papers published in the last 10 years.

Inclusion and exclusion criteria

We **included** models which were evaluated; addressed low-acuity or low-priority cases following primary triage; and which were led by a nurse, paramedic, general physician or emergency specialist clinician. We **excluded** models that were not evaluated; those addressing children only; focusing on high or moderate acuity or which were implemented in a low- or middle-income country.

1. Scopus and Medline

   Search terms: (TITLE-ABS-KEY (("aged care" OR geriatric OR retirement OR "nursing home")) AND TITLE-ABS-KEY (((secondary W/3 triage) OR (tele* W/3 triage) OR (emergency W/3 triage) OR (remote W/3 triage) OR (ambulance W/3 dispatch) OR (triage W/3 dispatch) OR (ambulance W/3 triage) OR "low acuity" OR "low priority" OR non-acute)))

   - Scopus limited to articles published from 2011 to 2020
   - Limited to articles published in medicine, nursing, social sciences and health
   - Modifications made for Medline Ovid syntax and limitations from 2016 to 2020.

2. BMJ COVID collection

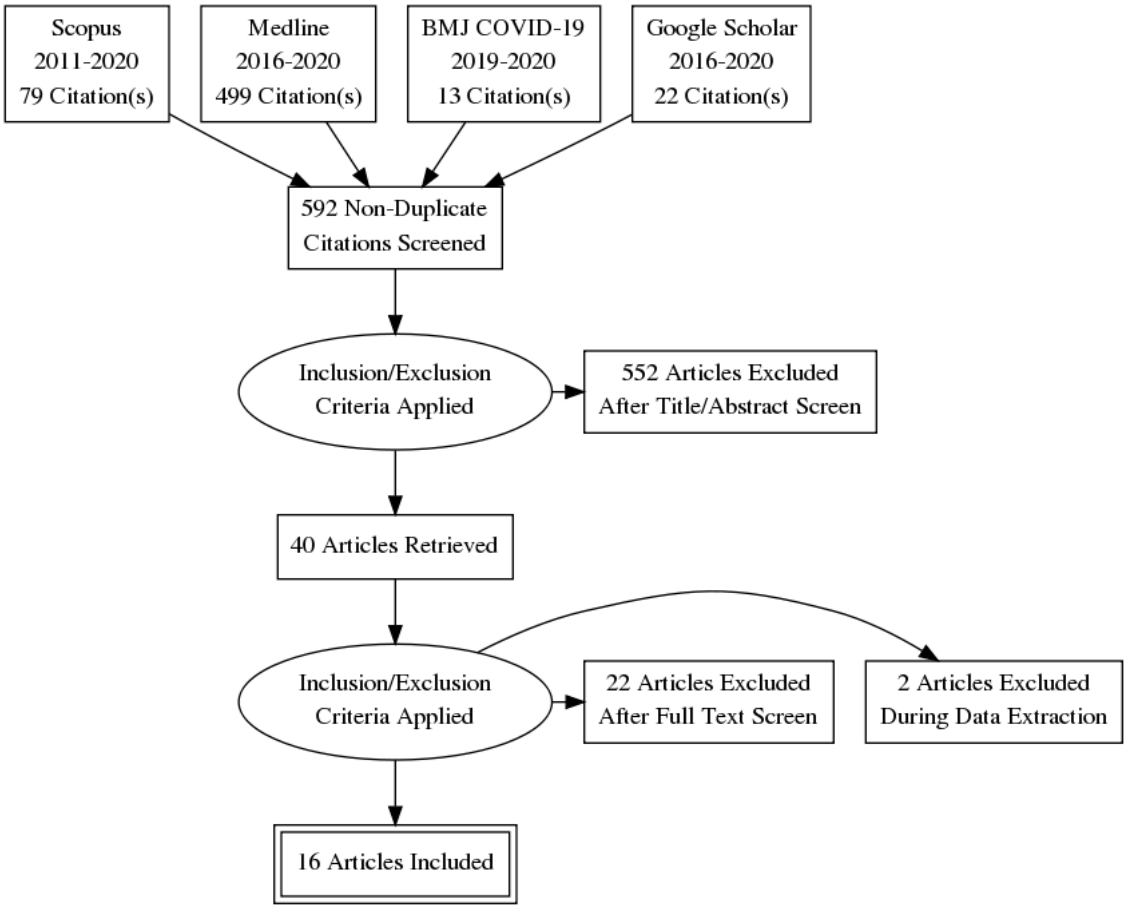
   Keyword search: COVID triage with results filtered as follows:

   Abstract contains ("aged care" OR geriatric OR retirement OR "nursing home") AND Abstract contains (triage OR "low acuity" OR "low priority" OR non-acute)

3. Google Scholar

Appendix 3 Search results

Peer reviewed results



Appendix 4: Data extraction tables

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
Andrew, 2019 Australia	Retrospective analysis of large dataset. Describes a method used to better align responses allocated to MPDS determinant codes with patient acuity. *n*>9,000 records analysed	Medical records from Code 1: allocated determinant codes with <25% high-acuity patients were reviewed for potential change to response allocation. The changed allocations were reviewed then tested by 'mock triage' of a random sample of records drawn from re-allocated determinant codes. Consequent changes to response times were modelled. The changes were then	Response allocation algorithm. The Medical Priority Dispatch System (MPDS) allocates 'determinant codes' to incoming calls, which are then allocated to responses: Code 1: lights and sirens (55%), Code 2: urgent (30%) Secondary triage (>10%). It tends to over-triage patients	NA	NA	Code 1 responses Response time Caseload	The recommended changes to response allocations would result in: - 28% reduction in Code 1 responses - 2.6 percentage point improvement in proportion of Code 1s attended within 15 min. - increase in secondary triage caseload of 120%.	

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
		implemented in stages.	due to its low-to-moderate specificity.					
Cantwell, 2016 Australia	Retrospective analysis of large dataset (4 years' data on ambulance attendances) *n*=77,891 falls cases for people aged 65+ Greater Melbourne; People aged 65+ divided into RACF and community-dwelling (CD)	A study of ambulance demand related to falls cases in people aged 65+.	NA	NA	NA	*System* Accuracy of call taker triage compared to paramedic assessment *Facility* Variation in falls-related ambulance demand over time and by residence type	*System* Call taker triage correctly identified 87% of falls cases, i.e. incidence was underestimated by 13%. *Facility* RACF population was older than the CD population (median 87 vs. 82) and was more likely to be transported to hospital (89.5% vs. 75.8%). Falls peaked for both populations from 6am to noon, but in RACF residents there was another peak from 5pm to 8pm.	For context: "*Falls by older people are the second-biggest contributor to ambulance demand in Melbourne."* (p. 266) Patterns of demand over time and differences in demand across residence types can inform planning, practice and policy.

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
	populations.							
Champagne-Langabeer, 2019 US	Observational study *n*=15,067	All patients using the programs from 2015 to 2017 were included in the sample. There were 865,000 total EMS incidents in the 3-year period, so ETHAN referrals were 2% of the total. Inclusion criteria: adults and children with non-urgent, primary care related complaints.	Emergency Telehealth and Navigation (ETHAN). See Langabeer, 2016 below for description.	EMS physician	Affiliated clinics	*System* - Ambulance transports to ED.	*System* For patients in the ETHAN program, transport types were: Ambulance 11.2% Taxi 75.6% Self- or no transport 13.2% 5.0% of referrals went to a clinic rather than ED. Patients more likely to travel by ambulance included: older patients and those with low-risk chest pain (Odds ratio 2.544), dizziness (OR 1.658), and shortness of breath (OR 1.567). Those less likely to travel by ambulance included those with: lower extremity pain (OR 0.392) and back pain (OR 0.640).	Note: follow-on study to Langabeer et al. 2016 (see below).

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
Eastwood, 2019 Australia	A retrospective cohort analysis N=23,696 cases were investigated System is provided by Ambulance Victoria		Ambulance-based secondary telephone triage system is a 'Referral Service' operating 24 hours a day, seven days a week, to assess low acuity cases and provide most appropriate disposition.	Qualified and experienced paramedics or nurses.	Referral to an Alternative Service Provider; Self-care advice including home care or to seek further non-urgent medical attention independe ntly. After care services include out-of-hours home-	*System:* referral service *Appropriateness:* the frequency The appropriateness of triaging cases for emergency ambulance dispatch was measured by assessing the frequency of advanced life support (ALS) treatment by paramedic treatment and paramedic transport as surrogate markers. Main aim of the	Rate of paramedic treatment for secondary referral service was 54% for the emergency ambulance followed by referral service and 55.5% for the state-wide emergency services. This shows that paramedic treatment rates were almost similar (OR 0.99 (95% CI 0.97–1.02; p=0.49)). However, secondary telephone triage cases referred for emergency ambulance dispatch showed significantly higher paramedic transportation rates compared to all metropolitan emergency ambulance cases (82.2% vs 71.1%; OR 1.76 (95% CI 1.7–1.8; p<0.001)). Also, cases referred for emergency ambulance dispatch by the referral services were 9.5 times more likely to be transported	

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
					visiting doctor services, and nurses, hospital outreach program (that send allied health staff into the communit y), crisis assessme nt, treatment teams for psychiatric cases, poisons telephone advice	study was to assess whether cases were appropriately referred for emergency ambulance dispatch following secondary telephone triage.	using lights and sirens than low-acuity dispatch pathway. Further, results for transportation rates were also significantly higher showed 82.2 %. Results showed that high-acuity dispatch cases had significantly higher paramedic treatment rates (OR 1.25 (95% CI 1.13–1.38; p<0.001)) and transport rates (OR 1.3 (95% CI 1.13–1.48; p<0.001) compared to cases referred as low-acuity. Similarly, high-acuity dispatch cases also had significantly higher paramedic treatment rates (OR 1.22 (95% CI 1.11–1.34; p<0.001) compared to the state-wide ambulance and transport rates (OR 2.23 (95% CI 1.96–2.5; p<0.001)) when compared to all metropolitan (transport) ambulance cases. Most common therapies reported	

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
					line.		analgesia was the most common paramedic treatment, followed by oxygen therapy. 2.8% (mean age 54.3 years and 56.9% were female) received that paramedic treat among the cases those were not transported by ambulance after ambulance attendance (17.7%). 60.3% of the case that were not transported were dispatched as low-acuity ambulance dispatch, 33.1% were referred as medium-acuity and 6.5% referred as high-acuity ambulance dispatch. abdominal pain, dizziness/vertigo and back pain were common triage guidelines for these sections of cases.	

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
Eastwood 2014	Systematic Review 6 articles and 1 report	Narrative Systematic Review Out of 6 studies 2 studies were of high quality. Setting: various. All studies UK or US.	Secondary telephone triage: (Ambulance-based secondary telephone triage systems for triaging patients to divert ambulance requests from patients categorised as low priority to alternative non-ambulance transport services).	Nurse mostly, in some studies EMT-I (intermediate) and Paramedic were also reported in 2 studies	Self-access further medical advice	Ability and safety of the secondary triage process to identify low-acuity patients. Patient satisfaction.	*Safety:* 5/7 studies reported that the advice given, and disposition assigned was deemed to be safe by nurse or paramedic-led telephone triage and the number of adverse events was small. *Ability:* 5/6 had preformulated questioning algorithms for patients, 3/5 of which were using computer-based algorithm as decision-making support tool. 3 Studies identified self/home care as a final disposition, a maximum of 31% of patients were categorised to this outcome. 3 studies reported that ED and ambulance workload was appropriate healthcare services—bypassing both ambulance attendance and transport to hospital and ED assessment and	The number of adverse events was small, as all cases had already been put through a primary triage process and categorised as low priority. The effectiveness of secondary triage is limited by the range of alternative options available for those conducting the triage.

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
							referral. *Patient satisfaction* 1/2 study reported that patients were satisfied with the outcome (96%) and other study reported 75% of patients were satisfied. 1 study reported that the satisfaction level was lower in the group who underwent secondary triage than in a control group where no secondary telephone triage intervention was used.	
Eastwood, 2017 Australia	A pragmatic retrospective cohort analysis N=44,523 cases were analysed Service is provided by Ambulance	A pragmatic retrospective cohort analysis of all the planned and unplanned ED presentations within 48 hours of a secondary telephone triage.	Victorian Ambulance Referral Service operating 24 hours a day, seven days a week, to identify low acuity cases and to provide most appropriate	Qualified and experienced paramedics or nurses.	Referral to an Alternative Service Provider; Self-care advice including home care or to seek	Appropriateness was measured using an ED suitability definition and hospital admission rates. These were compared with mean population data which	ED suitability: The ED suitability for each of the emergency care pathways was significantly higher for planned ED presentations than unplanned ED presentations following an ambulance-based secondary telephone triage (OR 1.62; 95% CI 1.5–1.7; p<0.001) and rates were also higher when compared to average Victorian ED	

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
	Victoria is a part.		disposition.		further non-urgent medical attention independently. After care services include out-of-hours home-visiting doctor services, and nurses, hospital outreach program (that send allied health staff into the community), crisis	consisted of all of the ED presentations for the state (termed the 'average Victorian ED presentation')	presentations (OR 1.85; 95% CI 1.01–3.4; p=0.046). Under 15% of cases diverted away from the emergency care pathways presented in the ED (unplanned ED attendances). Results for unplanned ED presentations for alternative care pathway cases, showed higher rates for ED suitability than the average Victorian ED presentation (68.8%) while ED suitability rates were similar for the cases originally given self-care advice (60.3%). Only 19.3% of all the cases referred to the alternative service providers and 12.5% of all the cases given self-care advice presented in the ED. 9.5% of all the alternative care pathway cases were classified as ED suitable. Hospital Admission: Statistically significant higher hospital rates	

Table 4.1—Peer reviewed literature

Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
					assessment, treatment teams for psychiatric cases, poisons telephone advice line.		were observed with planned ED presentations than the unplanned ED presentation following an ambulance-based secondary telephone triage (OR 1.5; 95% CI 1.4–1.6; p<0.001). Hospital admission were significantly higher compared to Victorian ED presentation both planned (OR 2.3, 95% CI 2.24–2.33; p<0.001) and unplanned ED presentation showed significantly higher hospital admissions ((OR 1.6, 95%CI 1.5–1.73; p<0.001). 6.5% of all the alternative care pathway cases were admitted to hospital.	
Eastwood et al.*, 2018 Australia	Retrospective cohort analysis. 19,041 patient cases	Descriptive statistical analysis and multivariable binary logistic regression analysis.	Emergency Medical Service-Ambulance Victoria (Referral Services): 'Secondary telephone triage	Nurse or Paramedic	EDs at local hospitals; home visiting doctor.	Association between explanatory variables and the paramedic treatment outcome	Patient age, pain, triage guideline group, time of day and comorbidities were associated with 'no paramedic treatment'(p<0.001). No association between "no paramedic treatment' and call	Barrier-retrospective model with predetermined variables not ideal to evaluate associations.

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
	n= Ambulance Victoria emergency service		to choose appropriate disposition for each patient.'			variable	taker qualification (p=0.816), income status (p=0.544).	Ambulance service operates differently in various regions in Victoria which influences the cases included and limits generalisability of the results.
Eastwood 2016 Australia	Descriptive epidemiology review n=107,148 cases Population wide (all calls to the secondary triage service called RS – Referral	All cases managed by a secondary triage service between September 2009–June 2012. Data included demographic, call duration and date, medical condition, questioning guideline used, final disposition and RS outcome. Victorian admitted episodes	Ambulance-based secondary telephone triage system 'Referral Service' operating 24 hours a day, seven days a week, to assess low acuity cases and to provide most appropriate disposition.	Nurse or paramedic	Alternative service providers are contracted to provide more appropriate care to low-acuity residents or patients in their facility or home.	Case load, frequency of repeat usage, patient profile (age, sex, IRSD category), GP visits, number of GPs per LGA, income, patient condition (reported top 13), final referral service disposition.	Mean time for case to be completely managed was 7.72+-5.00 mins (95CI 7.69–7.75 mins. 9.7% called more than once in the study period. At the time of the study there were 256 active care plans. 6.7% of all cases related to 13 conditions. Geographical sociodemographic status was strongly associated with the rate of calls to the RS (r=0.72; 95%CI, -0.104, -0.049; P<0.001. IRSED accounted for 52.3% of the variability in all call rates.	Authors conclude that the use of secondary triage service providers are an effective strategy for managing emergency demand.

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
	service median age 54 and 55% female	dataset and the Australian Bureau of Statistics data were also used, with the Index of Relative Socio-economic Disadvantage (IRSD).			These include nursing services, mental health nursing services, GP or locum services, community and allied health services, sexual assault services, aged care assessment teams, oral health practitioners, among others.		Abdominal pain and back pain symptoms were the most common patient problems. 68% were referred to the ED. 74% were managed away from emergency ambulance dispatch. Only 27.6% of the total cases were transported by emergency ambulance. The remainder were diverted to non-emergency ambulance or the patient's private transport. 32% of cases were referred to alternative service providers or given home advice. Findings suggest secondary triage addresses important issues for paramedics including fatigue, skills decay, and job dissatisfaction. Additionally, quicker response times because more ambulances available and increased patient safety due to decreased fatigue and higher	

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
							skills.	
Eastwood 2020a Australia	Retrospective cohort study n=90,086 older patients aged 65+ who had an emergency ambulance dispatch vis direct or secondary triage with one of the five most common paramedic diagnoses (to ensure comparability)	A retrospective cohort study of ambulance patient data between September 2009 and June 2012. Multivariable random-effects logistic regression was used to determine the association between secondary ambulance dispatch cases vs direct ambulance dispatch cases. Variables of interest included age, gender, primary diagnosis, LGA, Vital	Ambulance-based secondary telephone triage system 'Referral Service' operating 24 hours a day, seven days a week, to assess low acuity cases and to provide most appropriate disposition. Emergency ambulance dispatch can flow from either direct or secondary triage. Emergency and	Nurse or paramedic, using a condition-specific computer-based questioning algorithm. The other tool is patient care plans are created for patients with chronic psychiatric illness who are frequent user of 000 and the ED. Medical	The Referral Service can refer patients back to emergency dispatch or to alternative providers including GP locums, GP, Nurses, hospital community programs, outreach services, specialists or to home or facility	Descriptive analyses comparing characteristics, treatment and transportation rates between direct and secondary dispatch patients allocated to either emergency ambulance (paramedics with ALS) or to non-emergency ambulance (staff with BLS) Paramedic	The dispatch groups were similar in demographics, vital signs and hospital transportation rates. However, secondary dispatch patients were half as likely to be treated by paramedics (OR 0.51; CI 0.48–0.55; p<0.001). Increasing age was associated with decreasing treatment (p<0.005) and increasing transportation rates (p<0.005). The groups were similar across patient demographics, vital signs and case characteristics. More patients in the secondary dispatch group rated their pain as severe (7 out of 10)	The authors conclude that secondary triage could identify patients who would ultimately be transported to an emergency department. However, the lower paramedic treatment rates suggest many secondary dispatch patients may have been suitable for referral to alternative low-acuity transport or

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
		signs, Time of day, Weighted Charlson Comorbidity Index (WCCI), highest dispatch code, initial pain score.	non-emergency ambulances have staff with Advanced or Basic life skills.	comorbidty, frailty, cognitive impairment or social isolation can heighten the complexity of the assessment and may result in unnecessary referrals to emergency dispatch.	self-care. Patients may be allocated an emergency ambulance, a non-emergency ambulance or self-transport to hospital by private means.	treatment consisted of drug or crystalloid administration, airway management (including airway adjuncts) oxygen therapy and management of behavioural emergencies including chemical or physical restraint.		referral options. Need for training in chronic pain and for alternative pathways to for non-emergency patients.
Eastwood, 2020b Australia	Retrospective cohort analysis was conducted of n=2,694 secondary telephone triage cases transported to	Patients were considered ED suitable if they were triaged as a category 1, 2 or 3 according to the Australian Triage Scale, were admitted to hospital	'Referral Service' 24 hours a day, 7 days a week. Secondary telephone triage by clinicians using a computer-based	Nurse or paramedics. With ALS	The final dispositions include self-care advice, a recommend ation to present at a	Explanatory variables included gender, age, time of day, income status, pain level, triage guideline groups. Other explanatory	There were 2,694 (21.2%) cases classified as 'not ED suitable'. The mean age of this group was 51.7 years (SD 23.7 years) and 56.5% were female. Those that were ED suitable were older, with a mean age of 59.1 years (SD 22.6 years) and 53.6% were female. After	The authors conclude that there are patient and case characteristics associated with ED suitability that could be used to

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
	an ED by emergency ambulance between September 2009 and June 2012 in Melbourne, Australia.	or referred to another hospital for admission, or died in the ED. Descriptive statistics and multivariable binary logistic regression analysis were used to identify the variables associated with ED suitability.	triage algorithm to determine a disposition.		community-based health service or hospital, dispatch of alternative service providers such as home-visiting doctors, nurses or hospital outreach programs, or dispatch of a non-emergency or emergency ambulance.	variables included referral service call-taker qualification, patient comorbidities, and three pain categories (mild, moderate or severe pain).	adjusting for confounders, the age ($p<0.001$), pain ($p<0.001$) and triage guideline groups ($p<0.001$) variables had statistically significant relationships with ED suitability. Gender ($p=0.108$), time of day ($p=0.118$), secondary triage call-taker qualification ($p=0.237$) and comorbidities ($p=0.182$) showed no association with ED suitability, and income status was approaching significance (95% CI 0.85–1.02, $p=0.055$).	improve patient triage to better match patients with care pathways appropriate to their needs.
Hullick, 2020	Stepped-wedge cluster	Nine EDs and 81 RACFs participated.	ACE program—	Nurse	• Aged Care Emergency	Hospital	Residents were 20% less likely to be transferred to ED and 21% less	

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	trial RACF	18,837 ED visits were analysed. The first 3 months' data from the intervention period were excluded from analysis due to the substantial changes required by the ACE program.	as above.		Service (ACE) • ED at a local hospital	admissions ED visits 7-day ED re-presentation 30-day hospital readmission Australasian Triage Scale (ATS) Admission to critical care Rates of death.	likely to be admitted to hospital 7-day ED re-presentation fell from 5.7% to 4.9% and 30-day hospital readmission from 12% to 10% In the control period 6.6% of residents admitted to ED died in hospital; in the intervention period it was 7.0%, reflecting selection bias (i.e. in the intervention period the people admitted to ED were more unwell overall).	
Hullick*, 2016 Australia	Pre-post with controls 1,289 beds RACF	4 intervention RACFs matched with 8 controls on total beds, dementia & high care beds. RACFs reviewed over same months to eliminate seasonal	Aged Care Emergency Service (ACE): *"allow[s] residents to be managed in place and avoid transfer to the ED."*	Nurse	• Aged Care Emergency Service (ACE) • EDs at local hospitals	1. ED presentations per bed 2. LOS in ED 3. Hospital admission following ED presentation, 4. LOS in hospital,	IG 40 % less likely to be admitted (p=0.0012) and reduced ED stay 45 min (p=0.06). Hospital LOS decreased 1.36 days in IG but this was n.s. No reduction in ED presentations.	Intervention RACFs selected for high no. of ED presentations (most to gain from intervention).

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
		variation.	• Intervention was nurse-led telephone triage supported by a care manual (detailing over 20 evidence-based care algorithms) and education. Care goals established prior to ED transfer • Case management performed in ED • Stakeholder collaboration developed, implementation and change management co-ordinated by CNC in partnership with an emergency			and 5. 28-day readmission pre- and post-intervention		Mean age at RACFs 86 years. J Conway 2nd author; Uni Newcastle / J Hunter / UNE group

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
			physician.					
Langabeer, 2016 US	Case-control study *n*=11,140 (5,570 each in IG and CG) General population: age >3 months	Controls matched on multiple criteria incl. similar main complaints, age, and sex. Inclusion criteria: full mental capacity; chief complaints primary-care related. Patients with serious symptoms (e.g. chest pain) excluded.	Emergency Telehealth and Navigation (ETHAN). Features: 1. Telehealth connecting paramedic, patient, and EMS physician (video via tablet; EMR from paramedic accessible to physician). 2. Patient navigation and scheduling to contracted safety net clinics (as an	EMS physician	Contracted clinics	Ambulance transports to ED "Back in service time": from EMS notification to renewed availability Mortality Experience Patient satisfaction	Ambulance transports to ED were 18% for IG vs. 74% for CG (p<0.001). NB patients could be offered a prepaid taxi voucher to attend ED (59% of IG) of which about 5 in 6 actually attended ED (59%). So, 67% of IG attended ED. 8% of IG were given a clinic referral with a taxi voucher; 55% of this group attended the clinic. Follow-up revealed most no-shows were because symptoms subsided. Median time from EMS notification to unit back in service 39 min. for IG compared to 83 min. for CG. Mortality – no difference (zero for both IG and CG) *Experience*	Note that *"Medicare currently does not provide reimbursement unless the patient is transported to the ED"* (p. 719), which may have limited the number of patients willing to be diverted to a clinic. Conclusion: *"A telehealth-enabled*

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
			alternative to ED) 3. Taxi transportation (either to ED or clinic) and social service follow-up post incident. EMS physicians received 4 hr training for telehealth and navigation components.				Patient satisfaction – no difference	*emergency medical services program reduced unnecessary ambulance transports by 56% to urban emergency departments, and put paramedic units back in service an average of 44 minutes faster."*
Larsson 2017 Sweden	A 1-year prospective controlled exploratory	Patients were 18 years or more, assessed as low priority.	Early pre-hospital assessment of non-urgent patients using a triage and priority model by	The assessment is made by ambulance nurses who contact a	Partners	Data included: time, date, gender, age, place, reason for calling an ambulance, and	No significant differences based on age, gender and reason for calling an ambulance and no significant differences for transport to primary care and secondary	The authors conclude that collaboration between ambulance

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
	study (not randomised) n=394 with 184 in the intervention group and 210 in the control group	Data was collected from electronic health records from April 2014 to July 2015. A comparison was made with a retrospective control group without prehospital triage or treatment i.e. without consulting a physician concerning the appropriate level of care.	the Rapid Emergency Triage and Treatment System (RHETTS) resulting in a priority assessment of patients. Ambulance nurses contact primary care physicians on decisions on whether a patient should be transported to a primary healthcare unit or an A&E. Levels of care are: (1) patient is well enough to stay at home under supervision of the primary health provider (2) Patient is transported to	primary care physician.		the decision on level of care. Secondary transports within 24 hrs were registered to assess whether a patient's condition deteriorated, with further need of ambulance care. Data for admission to a hospital ward and mortality were also collected.	transfer within 24 hrs. There were statistically significant differences in favour of the study group ($p<0.001$) regarding no transport, or transport and admission to an A&E i.e. the prehospital assessment led to a decrease in ambulance transports to an A&E and admissions to a hospital ward.	nurses and primary physicians affects the decision for the appropriate level of care for patients with a non-urgent condition.

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
			the primary healthcare unit for assessment and (3) Patient is transported by ambulance to emergency ward.					
Eastwood, 2015	Systematic review *K*=7. Setting: Various. All studies UK or US.	Systematic review.	Various.	Nurses in 5 studies; paramedics or EMTs in the other two.	Only one study had an alternative service, which was a private conveyance provider.	System: Ability and safety of the secondary triage process to identify low-acuity patients	Secondary triage found to be safe (5/6 studies where it was addressed) and accurate in identifying low-acuity patients. Few adverse events reported. Also, secondary triage found cases with potential indicators of high priority which were missed in primary triage—a larger number than possible adverse outcomes resulting from secondary triage. Reduced demand on ambulance services and EDs Cost savings	A larger range of alternatives than those available in the reviewed studies might improve outcomes still further e.g. home visits from nurses or GPs, transfer to other specialised health

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
							Two studies measured patient satisfaction: 75% and 96% were satisfied.	management services.
Park, 2019 Korea	System dynamic modelling	Uses a semi-Markov decision process and a minibatch monotone-approximate dynamic programming (ADP) algorithm using realistic system dynamics based on historical data taking into account patient severity classification errors that occur during the emergency call.	The model assumes a two-tiered ambulance system of dispatch and redeployment based on urgency. Ambulances are classified into ALS with paramedics and BLS with emergency medical technicians.	Decision maker (not further specified)	Not stated	The study identified the influence of system parameters such as the percentage of advanced-life support units among all ambulances and patient classification errors.	The proposed approach and algorithm reduced the risk level index (RLI) for all patients by an average of 11.2% compared to the alternative. A key finding is that an increase in under-triage rates (of actual high-risk patients) has a greater negative effect on patient RLI than an increase in over-triage rates (actual low-risk patients). The proposed algorithm delivers an efficient two-tiered ambulance management strategy. A limitation of the mixed ALS/BLS system is the high risk of errors when classifying the severity of the patient's condition.	The authors conclude that the findings could provide useful guidelines for practitioners, enabling them to classify patient severity in order to minimise under-triage rates.

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
Villarreal, 2017 UK	Patients of any age calling 999 emergency ambulance service between 5 October 2012 and 6 November 2013 at the times the GP services were available and which the ambulance crews assessed as having a problem that was appropriate for GP telephone	Routine data were collected from October 2012 to November 2013, from the ambulance service computer-aided dispatch system. Logistic regression models were used to determine the likelihood for patients being transported to ED.	West Midlands Ambulance Service Call handlers identified patients with needs that could be addressed by a GP using locally agreed criteria. GPs supported either at scene or by telephone. The service operates Mon–Friday 12–8pm with 1 GP. Sat, Sunday 8am–8pm with two GPs available	GP face-to-face and telephone support to ambulance crews. Ambulance crews include qualified registered paramedics with advance life and trauma support skills in adults and children and ambulance technicians with less training GPs have at least 10 years' medical education. Plus 1-day induction course.	Partners include alternative community care services (e.g. intermediate care teams, social services, community hospitals or referral back to the patient's own registered GP for follow-up and treatment). the provision of self-care	Source of call, time of contact, demographics, location, chief complaint and patient's conveyance were retrieved from the ambulance service computer-aided dispatch system.	Calls originated from the general public or community-based services such as care homes, community nursing and other GP services. Of 23,395 emergency contacts during the evaluation period, 1,903 (8.1%) patients were triaged to GP supported assessment. Mean age (SD) was 61.8 (27.9) years; 42.9% were aged 75 years and over. 1,221 (64.2%) had face-to-face GP assessment and 682 (35.8%) via telephone. 1500 (78%) of those who received GP support were not transported to hospital. After controlling for confounders, those aged greater than 75 years (OR 0.67; 95% CI 0.52–0.86), and females (OR 0.64; 95% CI 0.51–0.82) were less likely to be transported, while those who	Support of the paramedic service by GPs enabled a substantial proportion of patients to avoid transfer to an ED, potentially avoiding subsequent hospital admission, reducing costs and improving quality of care for patients that are not in need of hospital services. However, use of services in the days following the call was not assessed, and hence the overall

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Author, year Country	Study design *n*=Setting	Methods	Model of care name and key features	Secondary triage personnel	Service partners / linked or alternative services*	What was measured? System, facility, experience*	Outcomes: System, facility, experience	Comments (barriers and facilitators?)
	or face to face attendance.				advice, a prescription		received GP telephone input rather than face-to-face assessment were more likely to be transferred to an ED (OR 2.14; 95% CI 1.69–2.72). 9.4% of patients had been referred from care homes, community nursing and GP services and they were substantially less likely to be conveyed to an ED. However, calls from care homes occurred mainly during the weekend at time when a GP may not have been available, and it appears that an alternative might have been more appropriate. Informal feedback suggests that the service is highly valued by ambulance crews and GPs, there were no critical incidents, and no patient complaints were received.	impact and safety requires further evaluation.

Note: the above table includes both direct quotations (in quotes) and re-wordings (in italics) from the primary sources. University of Newcastle / John Hunter Hospital / MMRI / UNE group

Abbreviations:

ALS	Advanced Life Skills
BLS	Basic Life Skills
CG	control group
CNC	clinical nurse consultant
ED	emergency department
FACEM	Fellow of the Australian College of Emergency Physicians (i.e. an emergency physician)
IG	intervention group
INTERACT	Interventions to Reduce Acute Care Transfers - a decision support tool originating in the US
LHD	Local Health District
LOS	length of stay
ML	Medicare Local
n.s.	not (statistically) significant
PAH	potentially avoidable hospitalisation
PPH	potentially preventable hospitalisation
RACF	residential aged care facility
n.s.	not (statistically) significant
ML	Medicare Local

Table 4.2 Peer reviewed commentary

Author, Year, Title	Summary	Are secondary triage models effective?
Levine et al., 2020 *COVID-19 in Older Adults: Transfers Between Nursing Homes and Hospitals*	Article describing the challenges of COVID-19 in older adults transferring between residential aged care facilities (RACFs) and hospitals. Communication between emergency services and aged care facilities is critical. The authors recommend direct communication lines between emergency department providers and aged care facilities.	"Forward triage" should be considered. This process involves emergency physicians assessing the resident's level of acuity whilst in the aged care facility and determining where their care needs can most appropriately be met.
Shikha et al., 2018	Describes the Geriatric Flying Squad (GFS) model of care, a rapid response outreach service to RACFs in the Sutherland Shire, NSW. The team consists of a specialist Geriatrician, Nurse Practitioner and a Clinical Nurse Consultant. Referred patients are assessed in aged care facilities within two to four hours of referral during hours of service. GFS saw a total of 640 acutely unwell residents over an 18-month period.	Yes, GFS may have diverted emergency presentations for 90,3% of referred acutely unwell patients by offering rapid assessment and management, choice in place of treatment and level of interventions.
Goldstein et al., 2015 *The Role of Emergency Medical Services in Geriatrics:* *Bridging the Gap between Primary and Acute Care*	Commentary on expanding the scope and role of paramedics in geriatric care. The authors describe a Canadian-based program whereby expanded scope paramedics responded to select 911 calls at long-term care facilities. The paramedic conducts a detailed assessment and consults over the phone with a geriatric care family physician and an emergency medicine physician. When implemented, 70% of patients were able to remain at the facility for further care/testing/follow-up, 24% of patients had their transport to the emergency department delayed in order to avoid peak times and off-load delays, and 6% were transferred to the emergency department immediately.	Expanded-scope emergency medical systems could lead to more efficient, timely and efficacious care for older patients.

Table 4.3 Grey literature data extraction

Author, Year	Summary	Are secondary triage models effective?
Emergency Care Institute New South Wales, Agency for Clinical Innovation (ACI) 2020	The Aged Care Emergency (ACE) model of care is nurse-led and is aimed at reducing the need for residents of Residential Aged Care Facilities (RACFs) to present to an Emergency Department (ED) for acute care, with their healthcare needs being met within the facility. The model has seven key elements: 1. The use of evidence-based algorithms to manage common health problems within the RACF 2. A telephone consultation service for RACF staff to access clinical guidance 3. Development of clear goals of care prior to transferring to an ED 4. Proactive case management within the ED 5. Education and empowerment of RACF staff 6. Collaborative relationships with RACFs, GPs, Primary Health Networks, NSW Ambulance and EDs 7. A management team to implement and support the key elements.	Yes. Evaluation of the model at John Hunter Hospital demonstrated transfers and subsequent admissions for people living in the RACFs was reduced, including a 35% reduction in occupied bed days and 16% reduction in ED presentations.
US Department of Veterans Affairs, 2019	This Management eBrief is part of the Veteran's Affairs Evidence Synthesis Program and reports on a systematic review of the effectiveness of remote triage, defined as making clinical decisions in the absence of a face-to-face encounter. The systematic review reports on remote triage models across a variety of health settings.	Mixed results, with a limited and low to moderate certainty of evidence. The majority of studies did not demonstrate a decrease in primary care or ED use but the evidence suggests that locally based triage services have higher case resolution outcomes and referral to EDs compared with regional or national telephone-based remote triage.
Clinical Excellence Queensland, 2018	The Emergency and Community Connect (ECC) is an integrative and patient focused project between the Mackay Hospital and Health Service in Queensland, the local Primary Health Network, General Practitioners (GPs), RACFs, Pharmacies and the Queensland Ambulance Service. The Emergency Senior Early Assessment Team consists of a Senior Medical Officer, a Junior House Officer, a Clinical Nurse	Yes. Results from an evaluation of this model show a reduced need for hospital admissions, with between 60-90 per cent of telehealth calls being able to be treated in place. There was a reduction in the average

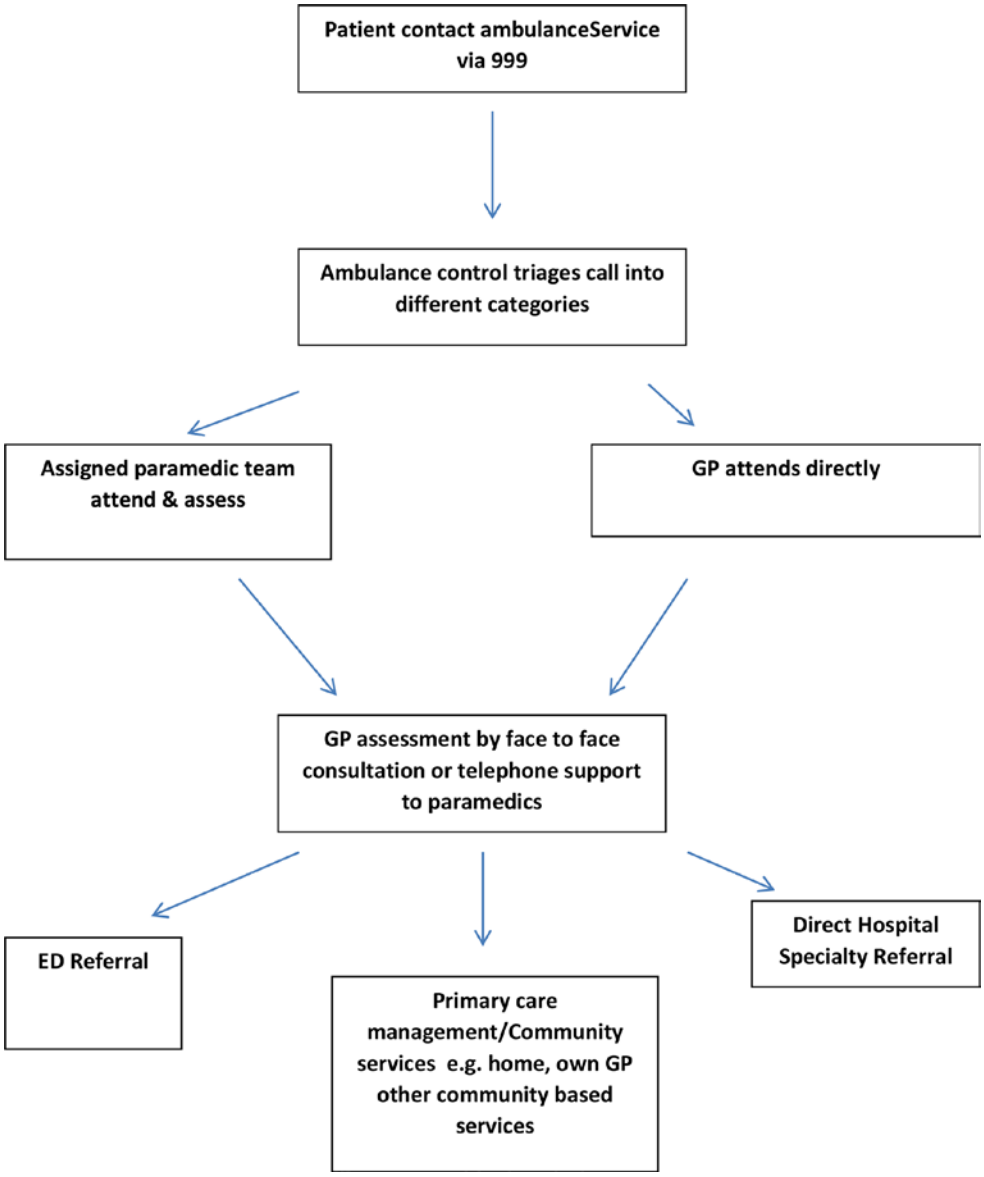
Table 4.3 Grey literature data extraction

Author, Year	Summary	Are secondary triage models effective?
	and an Administrative Support Officer. In the first instance there is a telehealth consultation between the RACF and the patient's GP (if available), who conducts a preliminary assessment. If required, the consult can be escalated to the Emergency Senior Early Assessment Team SMO, who determine whether an ED transfer is essential.	emergency length of stay by 6.5hrs.
Ambulance Victoria, 2017.	Under Ambulance Victoria's revised Clinical Response Model, some event types which previously received an automatic emergency response are now being assessed more thoroughly through a secondary triage process by expert paramedics and registered nurses in the Ambulance Victoria Referral Service. The Referral Service involves a paramedic or registered nurse seeking further information on a patient's condition to determine the most appropriate treatment.	Yes. The revised Clinical Response Model increased the availability of Mobile Intensive Care Ambulances (MICA), allowing them to attend to patients most in need of urgent care. For example: 92.1% of patients in cardiac arrest were attended to after implementation of the model, compared with 87.7% prior to implementation. Clinical outcomes improved for patients with cardiac arrest, with the highest quarterly survival rate recorded during the 12-month implementation. Stroke patients transported to a stroke unit within 60 minutes improved from 87.6% to 92.1%.

Appendix 5: Secondary triage models from the included studies

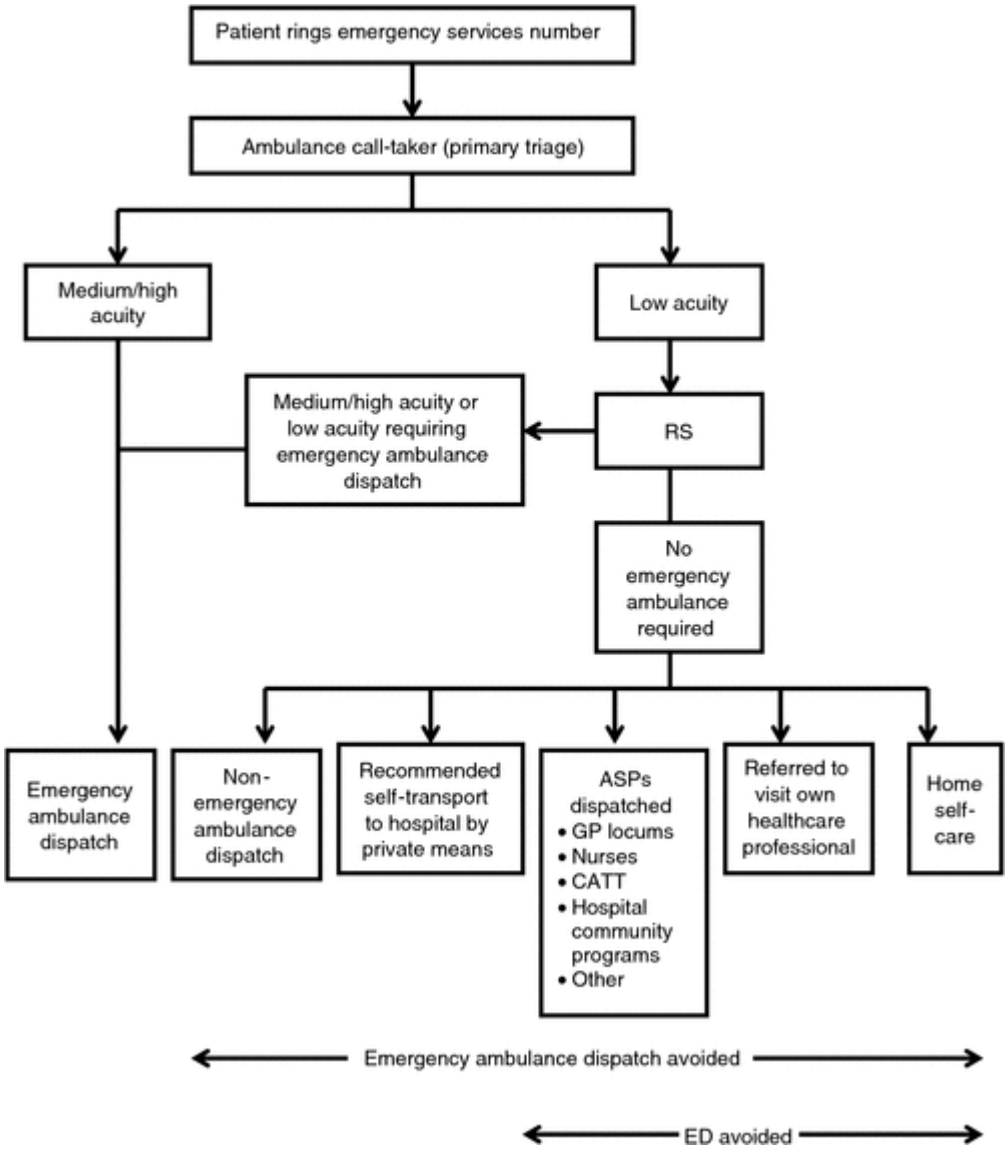
Model 1: West Midlands Ambulance service, UK (4)

Secondary triage system: e.g. nurse-led



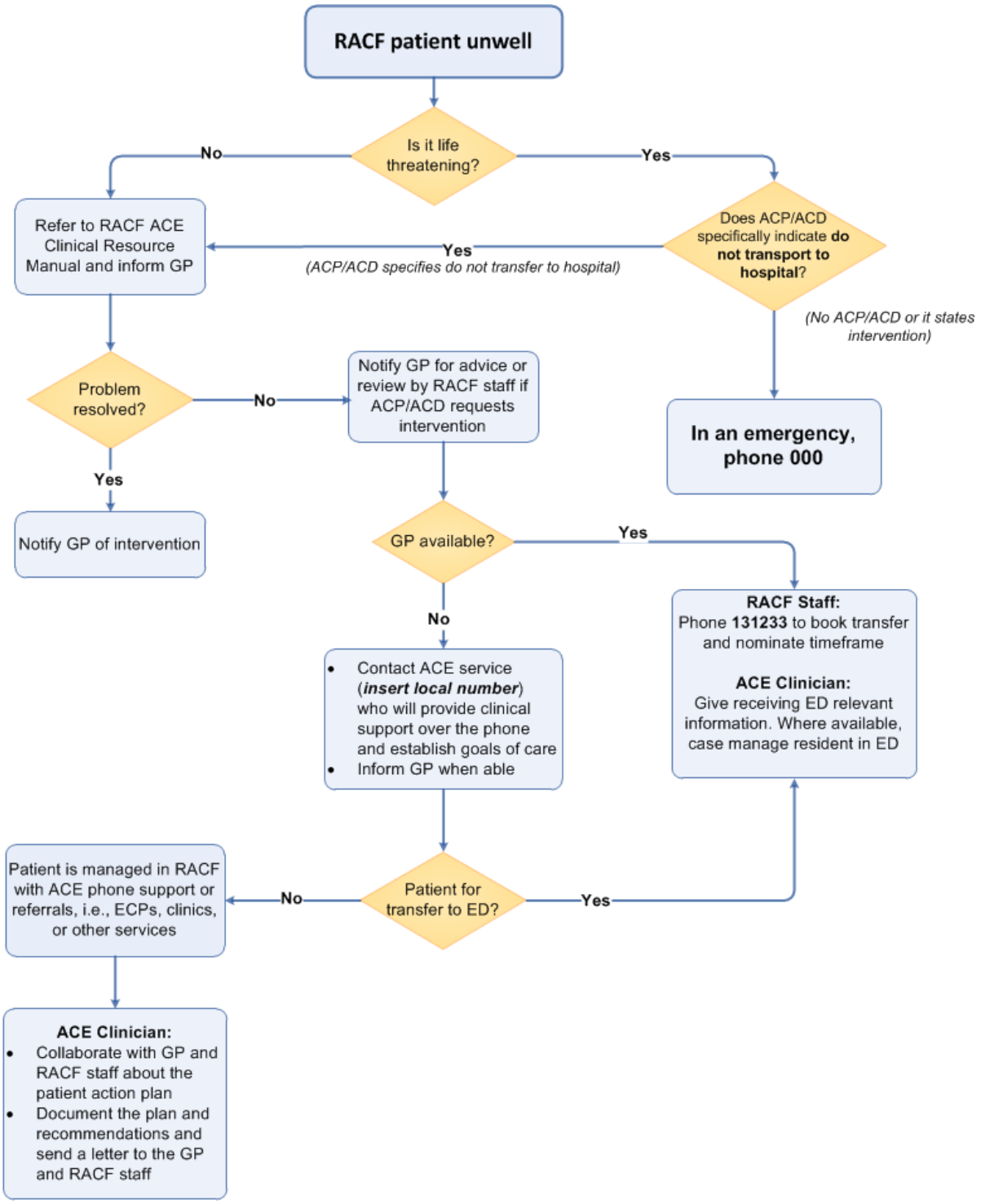
Model 2 Victoria Ambulance Referral Service (VARS), Australia (13)

Secondary triage system: Medical Priority Dispatch System (MPDS) with a Nurse and ALS paramedic call-taker trained in telephone triage who assess cases with condition specific computer based questioning algorithms contained within the Care Enhanced Call Centre (CECC). Decisions made without further consultation.



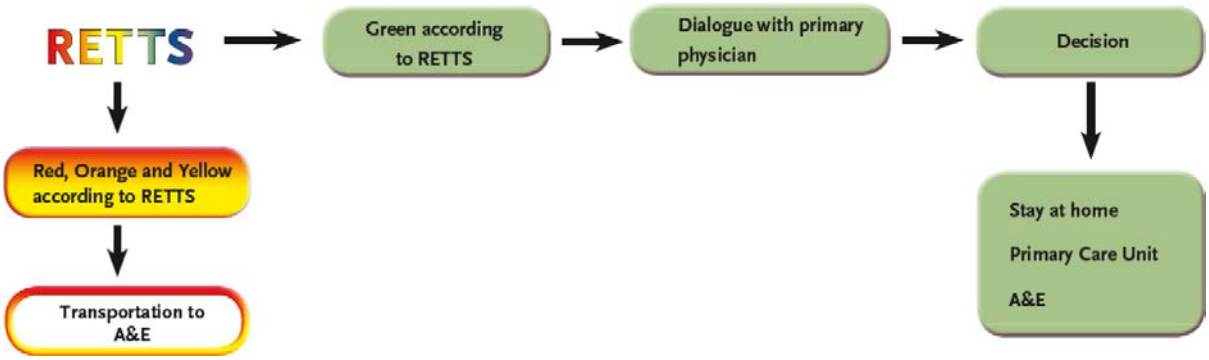
Model 3: Aged Care Emergency (ACE) Service, NSW Australia (2, 14)

Secondary triage system: e.g. nurse-led



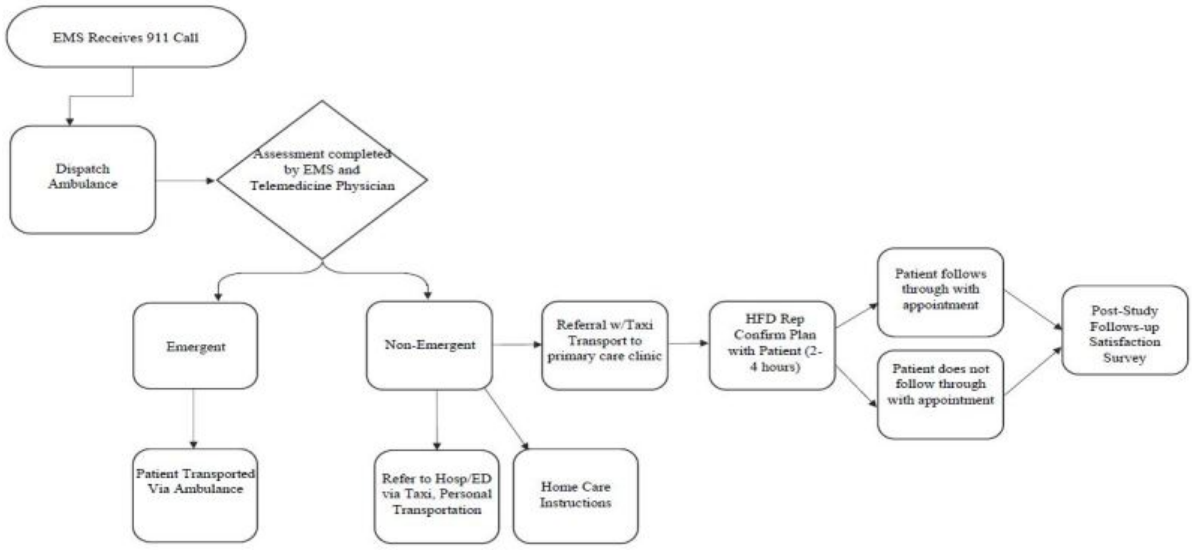
Model 4: Early Pre-hospital assessment (EPHA) (3)

Secondary triage system: Patients assessed as low-acuity (Green) by Rapid Emergency Triage and Treatment System (RETTS). Ambulance nurse contacts primary care physician on whether a patient should be transported to a primary healthcare unit or an A&E.



Model 5: United States: Emergency Telehealth and Navigation (ETHAN) program (6)

Secondary triage system: Primary triage by on-site paramedic or medical technician. Low-acuity response activated by paramedic with immediate connection to emergency physician using ETHAN technology.



Intervention protocol acronyms: EMS, emergency medical services; *ED,* emergency department; *HFD,* Houston Fire Department

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