Evidence check

20 September 2021

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.

Organisation of emergency departments during COVID-19

Evidence check question

What is the evidence to support surging the capacity of emergency departments (EDs) during the COVID-19 pandemic in terms of:

a. infrastructure, including the use of hot zones, temporary hospitals, and repurposing of existing buildings
b. staffing, including shorter shift patterns, rotations and pandemic rosters, pandemic rosters, using other specialties
c. processes and patient flows, including flows out of ED, consolidating patients to a single hospital, rotating hospital intake, designating COVID-19 hospitals and patients' cohorts, and tipping points for implementation of such changes?

Background

During discussions at the ED Community of Practice meeting on 22 August 2021, three areas outlined in the evidence questions above (infrastructure, staffing and process) were identified as key areas to collate existing evidence. There were also conversations around procurement of medi-hoods, high efficiency particulate air (HEPA) filters and air scrubbers.

The Critical Intelligence Unit in late 2020 undertook a scoping review to identify studies on pre-hospital models of care (including EDiTH and PACER), intra-ED processes, discharge and transfer. The review included triage and virtual models. A summary of the scoping review is provided in tables 1-3.

Methods (Appendix 1)

PubMed and Google searches were undertaken on the 22 and 24 August 2021.

Results

Infrastructure: Hot and cold zones

Peer reviewed literature:

- Core characteristics of designated (hot and cold) zones include designated physical areas, certain personal protective equipment requirements, staffing models and screening areas to separate patients with known or confirmed COVID-19 from those without suspected COVID-19.
- In South Korea, an ED was split into four zones, comprising the isolation care unit as the red and orange zones, emergency fever clinic, acute-care unit, and general zone. A unidirectional air-conditioning system was installed in this space and a dividing wall was installed between all the beds in the ED. People were screened on entry.[1]
- A dedicated are in the ED in the USA trialled two approaches: a dedicated hot area within the ED, and an alternate care site outside the ED, but located in close proximity, to manage low-acuity patients presenting to the ED for concerns of COVID-19. A 52 square metre conference room space was used, and the Centers for Disease Control and Prevention guidance was used to model the floor plan. The mean ED length of stay was shorter for alternate care site patients.[2]
- In the Netherlands, a hospital joined their ED and acute medical unit to allow for designated high and low risk areas. Joining two existing units enabled an instant physical segregation of patients.[3]
- A paediatric hospital in Italy had two designated zones with dedicated healthcare workers. A pre-triage area was created at the entrance of the ED.[4]
- An academic hospital in the USA had a dedicated eight-room pod with a single entry. While staffing assignment remained in designated areas for four how blocks, physicians regularly moved between the hot zone and rest of the ED.[5]
- Other examples of hot and cold zones have also been described in Italy[6] and the USA[7], with the core features as outlined above. In these cases, constructing temporary walls can address some structural limitations. EDs with ample footprints can additionally designate a third 'flex' area that can be flipped between hot and cold, as the situation demands.
- In Philadelphia, existing negative pressure rooms[8] were designated for sicker respiratory patients more likely to require aerosol generating procedures. A tent was placed outside the ambulance and adjacent walk-in entrances of the ED.
- In Canada, classrooms and offices[9] were converted into extra examination rooms exclusively for patients with COVID-19. In New York the hospital converted an ambulance driveway with a high roof into a mini-field hospital with eight beds (including for chest x-rays). In Alberta, the expansion of a call-centre service to coordinate contact between long-term care homes and EDs was critical to keeping vulnerable patients out of the hospital.
- In San Francisco, there was rapid deployment of two military-grade negative-pressure medical tents[10].

Grey literature:

- Australasian College for Emergency Medicine *Clinical guidelines for the management of COVID-19 in Australasian emergency departments* (December 2020).
    - Patients meeting case definition criteria should be streamed into a dedicated high-risk treatment zone within the ED, with immediate isolation from other waiting patients.

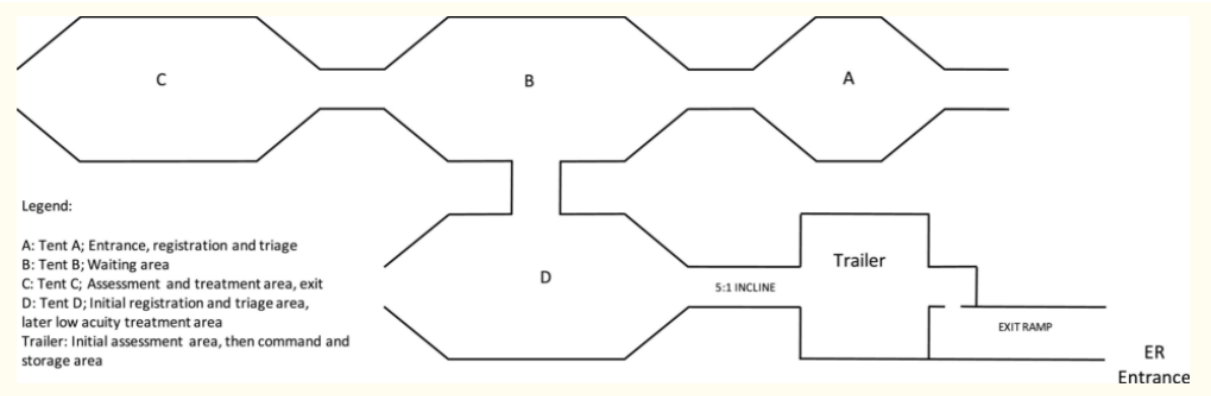
  - In the setting of significant rates of community transmission, it may be necessary to designate the entire ED as a high-risk zone. In effect, this would require staff to use droplet precautions personal protective equipment for every patient interaction. This strategy may decrease the risk that staff inadvertently become close contacts (resulting in furlough), and reduce complexity in the process.

- NSW Health Communities of Practice *Quick Reference Guide to ED assessment and management of COVID-19 in adults* last update 8 Sept 2020[11].
- *6 Approaches to Managing Coronavirus Patient Surges in Emergency Departments* (Aug 2020)[12]: hot and cold zones, rapid testing, personal protective equipment, alternatives to mechanical ventilation, ED space constraints and telemedicine. Has a reference to perspective piece in *Annals of Emergency Medicine* *Surgeproofing the Hot Zone*[13].
- Clinical Excellence Commission. *Emergency Department COVID-19 PPE Quick Reference Guide* (July 2021)[14].
- Design perspective is considered in *The Hot Zone: Designing Hospital Units for Diseases as Infectious as COVID-19*

Infrastructure: Temporary hospitals (e.g. tents and marquees)

Peer reviewed literature:

- In the USA, two military-grade negative-pressure medical tents[10] in the ED parking area were set up as accelerated care units as a model for EDs. The layout of the shelters, while modifiable and adaptable, was initially developed as follows.
  - 1: full triage, patient care occurs in chairs, rapid treat and release without nursing involvement after triage process and/or waiting area for evaluation by a provider; portable x-ray available inside.
  - 2: treatment cots or trolleys where a nurse is assigned to each patient, higher acuity patients, full ED treatments available.
- Also in the USA, tents were used as outdoor treatment centres[15] and these were placed under the control of the ED. The tents were for an arrival and treatment area for stable patients with respiratory symptoms. Image of set up below.



- Internationally, organisations have been converting the outdoor spaces of their urgent care[16] and medical office building to spaces to treat people outdoors. Facilities in the USA have used or have

plans to use their gardens and other outdoor spaces on their property, in tents or in the open air. Mount Sinai Health System in New York City treated patients in a 68-bed tent field hospital in Central Park.

- Recommendations for establishing alternative care sites[17]:
    - preparedness actions need to be continuous and flexible
    - staffing needs must be met
    - health equity must be a focus
    - site should be designed to function without compromising safe and effective care.

Grey Literature:

- The Australian College for Emergency Medicine COVID-19 guidelines[11] outline that it may be necessary for the ED to use temporary spaces for the care of patients. It is recommended that if an expansion of the ED footprint is required, EDs select an area that is in close proximity to the main department and can be rapidly fitted out to meet ED design standards (to the extent that is possible). Outpatient clinics and day treatment areas often represent a good option. In exceptional circumstances, the use of temporary structures (such as tents and marquees) may be required. These areas should be set up using the same design and infection control principles.
- In these news articles, emergency tents were erected in other countries such as Indonesia[18] and in the UK[19], where the tents are used for triaging people who present to the ED.

Infrastructure: Repurposing other buildings and designated COVID-19 hospitals

Note these studies are generally referring to repurposing buildings for hospitals rather than EDs specifically.

Peer reviewed literature:

- In China a community hospital was transformed to improve the emergency capacity of hospitals. Of 198 COVID-19 patients that went to this hospital, only 39 were transferred to the module hospitals, while 131 were discharged and 28 were still in the hospital at the end of the study period.[20]
- Fangcang shelter hospitals[21] and mobile field hospitals[22] were widely used in China and involved the conversion of large-scale public venues[23] into hospitals. They required sites with good ventilation, abundant space, and convenient patient transport. Modelling data[24] found without Fangcang hospitals, cases, deaths and days of the epidemic would have been much greater.
- In Minnesota a long-term acute care hospital was transformed into a COVID-19 hospital, as the usual work at the hospital didn't include emergency, obstetric, or operative services, fewer services had to be suspended. Engineers reconfigured the physical space and infrastructure to create 35 full-range intensive care beds. Additional modifications included wiring rooms for cardiac telemetry capabilities.[25]
- A children's hospital in China implemented transition rooms for children from regions outside of Shanghai to be under medical observation for at least three days.[26]
- In Spain an exhibition centre was transformed[27] into a hospital. It reflected that success depends on delimitation in admission criteria taking into account the proportion of patients who may require, during admission, assistance in the critical care area.
- A concert hall in Italy[28] meant there was a large area, it was covered and heated, the availability of a high-power electricity system, and the availability of parking. The target of the hospital was for

people with mild and moderate COVID-19 and the hospital was split into three zones with differing levels of personal protective equipment.

- A field hospital in Italy[29] had zones partition, dedicated in-hospital pathways for healthcare workers, strict infection prevention and control measures.
- In a military field hospital in France[30], military staff were also used to help manage patients.
- The NHS in the UK[31] developed a framework to support field hospitals including political, environmental, social, technological, legal and economic aspects of development.
- In Bahrain, one floor of an existing car parking structure[32] was converted into a 130-bed field intensive care unit.
- Designated COVID-19 hospitals mainly included services for fever-clinics to screen patients, COVID-19 department for higher-levels of medical care, and makeshift wards for emergencies. One reported having a 'suspected ward' where the key characteristics of this ward were isolate, triage, fast diagnosis and rapid referral.[33, 34]
- Different organisation of care[35] were also described, such as all hospitals manage COVID-19 positive cases, or one hospital is designated to manage, or four hospitals are designated to manage (in Australia, a country experiencing low prevalence of COVID-19).

Grey literature

- In scenarios of community transmission, the World Health Organization[36] recommend new hospitals or temporary structures can serve to augment COVID-19 patient care or essential health services, depending on national strategy.
- Purpose built or designated facilities established in Singapore[37] and Japan[38].
- NSW Health has surge capacity management[39], which includes detail on reinstating clinical spaces that are currently not in use for patient care. Items to consider include selecting a location, bed space, change rooms, utility area, entry to clinical zones, hand hygiene, waste bins, storage, room fabric, medical service, medical equipment, air conditioning, negative pressure environments and other engineering related considerations.

Staffing: Shifts and teams

Peer review literature

- The University Hospital of Brooklyn[40] was designated a COVID-19 hospital in New York and residents were restructured into three teams.
    - Call team – routine floor work, support of medical services including proning patients and emergency resuscitations, covering transplant emergency service.
    - Surgical Emergency Advanced Line Service team – residents and a supervising attendant to assist with procedural solutions for all inpatients.
    - Remaining surgical residents were redeployed to the medical floors, ED and intensive care units.
- The Singapore General Hospital Department of Emergency Medicine Outbreak Response Roster[41] had five fixed teams of doctors working in rotation.
    - Members within teams remained constant and balanced in manpower and seniority.
    - 12 hour shifts with no overlapping or staggering.

  - Handovers kept as brief as possible.
  - Nurses also split into teams that worked same 12 hour shifts.
- The ED of the Royal Victorian Eye and Ear Hospital developed a 12-hour team pandemic roster[42] with six teams of 13-16 members.
  - Staff were required to exclusively work within their team and in no other roles or hospitals.
  - 12 hour 'active' shifts for three days and six days of 'inactive' rest.
  - Equivalent team sizes and expertise.
  - Next active team placed on call.
- The Stanford Hospital[43] in the USA minimised the number of emergency physicians exposed to patients with COVID-19 by reducing resident staff, reassigning emergency medicine residents, increasing backup call capacity, flexing shifts to meet patient volume, using telemedicine and clustering patients to create lower risk areas in ED.
- A modelling study[44] of ED pandemic staffing compared the strengths and limitations of three ED clinician staffing models: two-team and three-team fixed cohort, and three-team unfixed cohort. The study showed time to staffing shortage with and without immunity.
- An academic ED[8] in the US created a respiratory ED team and a non-respiratory ED team to minimise staff exposures.
- An ED in Singapore piloted a military concept, close air support[45], to support ED operations. A senior ED physician and two junior ED physicians on-site were teamed with two junior surgical residents off-site with teleconferencing access.
- In China, an ED was reorganised[46] to respond to a shortage of ED staff.
  - Additional residents were provided to the ED (made possible because elective surgery was curtailed).
  - Staff moved to a 12-hour shift system to maximise the number of staff available per shift.
  - Staff were divided into five teams.

Grey literature:

- The Australian College for Emergency Medicine COVID-19 guidelines[11] outline that evidence has shown the risk of COVID-19 infection is increased with longer shifts. To minimise fatigue and burnout among emergency physicians, it is recommended that 'safe working hours' are used, and that staff are rotated through shifts in areas of high stress (e.g. a high-risk zone) to areas of low stress.
- The Centers for Disease Control and Prevention in the USA advises not scheduling staff for more than 12 hours, if possible, to help avoid workplace fatigue[11].

Staffing: Using other specialties

Peer review literature

- In the Singapore General Hospital Department of Emergency Medicine[41], manpower was supplemented by junior doctors from other departments.
- At the ED of the Royal Victorian Eye and Ear Hospital[42], additional nurses, clerks and cleaners were deployed from surgical theatres, inpatient wards, and outpatient departments.

- Advanced practice practitioners[42] were trained to work in areas of the hospital impacted by COVID-19 at the Stanford Hospital in the USA.
- The NYU Langone Medical Center[47] in the USA deployed a 'COVID army' of providers from medicine, surgery, and other specialities to work on inpatient wards during the COVID-19 surge.
- At Aarhus University Hospital in Denmark[48], orthopaedic surgeons were redeployed to minor and major injuries and trauma in the ED, while ED physicians were deployed to COVID-19 testing, triaging and clusters.
- Paediatric emergency medicine[49] providers were reallocated to telemedicine and expanded their clinical care to adult patients to meet ED needs at New York-Presbyterian Hospital – Weill Cornell Medical Center in the USA.
- Cancellation of elective procedures[8] and restrictions on ambulatory care visits free up subspecialty, non-ED providers.
- In Switzerland, medical students[50] were enlisted as volunteers to assist with COVID-19 testing.
- Department of urology physicians[51] staffed an ED-intensive care unit in the USA.
- A large tertiary hospital in the UK[52] sourced an additional 205 medical staff from anaesthesia, medical and surgical specialities to work directly in the intensive care unit.
- Specialist surgeons were redeployed[53] to treat COVID-19 patients in the ED of a general hospital in Milan, Italy.

Grey Literature

- The Australian College for Emergency Medicine COVID-19 guidelines recommend that hospitals redeploy non-ED staff (within their scope of practice) to assess acute, low risk COVID-19 patients outside the ED (e.g. in clinics, in the community or on wards) to decrease ED demand.
- The World Health Organization states in settings anticipating numerical shortages, sources of additional health workers should be identified, and existing health workers redeployed. People who may be redeployed include retirees, unemployed but qualified, medical residents, the private sector and national medical reserve corps. Health news articles report on redeploying staff such as in Mount Sinai, where the most obvious recruits for redeployment are those with critical care backgrounds, such as anaesthesiologists and critical care intensivists. Second in line are general surgeons, orthopaedic surgeons, and internal medicine subspecialists like cardiologists and oncologists.

In NSW it was announced dozens of private hospitals will suspend non-urgent elective surgery so staff can help fight COVID-19.

Process and patient flows: Cohorting

Peer reviewed literature

- The University College London Hospital ED, evaluated the cohorting and isolation strategy for suspected COVID-19 cases during the pandemic based on clinical features suggestive of COVID-19, age and comorbidities. Patients were allocated to triage categories defined by likelihood of COVID-19 and risk of a poor outcome: category A (low-likelihood; high-risk), B (high-likelihood; high-risk), C (high-likelihood; low-risk) and D (low-likelihood; low-risk). This determined the order of priority for isolation in single-occupancy rooms with category A the highest. Implementing this

cohorting tool has reduce the risk of hospital-acquired transmission of COVID-19 especially to individuals at the greatest of risk of severe disease.[54]

Grey literature

- The Australasian College of Emergency Medicine recommends patient cohorting in the event of overwhelming patient demand. It may be necessary to cohort patients with suspected and/or confirmed COVID-19 in an open or shared area of the ED (within the 'high risk' zone).[55]
- The American College of Emergency Physicians recommends cohorting patients with signs and symptoms of infection.[56]
    - Waiting rooms and common areas: to establish separate waiting rooms, or separate locations within same waiting area, to screen positive and screen negative patients.
    - Consider outdoor space and tents to screen positive patients.

Treatment resuscitation and trauma: create a separate resuscitation bay for patients with signs and symptoms or diagnosis of high-risk infectious diseases.

Process and patient flows: Directing COVID-19 positive patients to designated COVID-19 centres

Peer reviewed literature

- St Lawrence Health used a hub-and-spoke system to route COVID-19 patients to its flagship hospital. It further assembled a small clinical team to manage admitted COVID-19 patients and to stay abreast of a quickly changing body of literature and standard of care. Twenty COVID-19 patients were identified. Sixteen patients (80%) met National Institutes of Health criteria for severe or critical disease. One patient died. No patients were transferred to other hospitals.[57]
- This paper determines how inter-regional transfers could alleviate bed shortages. For regions with bed shortfalls, transfers to the nearest region with unused beds were simulated using an algorithm that minimized total inter-region transfer distances across the USA. Inter-regional patient transfer has the potential to mitigate regional bed shortages during hospital volume surges.[58]
- *COVID-19 hospital designation: Effect on emergency department patient self-selection and volume*. This study investigated the effect on ED patient self-selection and volume after Glenbrook Hospital was designated as the 'COVID hospital'. Designating a hospital as the pandemic hospital has reduced ED presentations by 30%, whereas the COVID-19 related presentations increased by 20%. Staffing, personal protective equipment distribution, provision of specialised care, and overall resource allocation can be prepped in advance to plan for the shift in ED volumes and pandemic-related visits.[59]

Process and patient flows: Directing COVID-19 positive patients to designated COVID-19 centres

- A case study for Western Australia: *Should Australian states and territories have designated COVID-19 hospitals in low community transmission?* A rapid review of the literature was conducted of the advantages and disadvantages of having designated COVID-19 hospitals. The most practical option chosen was for all hospital facilities to remain prepared to care for COVID-19 patients where they present rather than having specified designated hospitals.[35]

Grey literature

A summary of the lessons learned, and key planning considerations prepared by USA Department of Health and Human Services (TRACIE) relevant to all hospitals designating units for COVID-19 care. There has been an agreement among the facilities interviewed that designating one hospital within the health system or community was ideal for their circumstances and helped focus COVID-19 care and expertise, personal protective equipment, and processes and standardised care in one location.[60]

Limitations

Evidence on some of these topics, particularly around patient flows in the emergency department, is still emerging. International literature is included, and findings should be interpreted in the local context of disease prevalence.

CIU scoping review

The Critical Intelligence Unit in late 2020 undertook a scoping review to identify studies relating to pre-hospital models of care, intra-ED processes, discharge and transfer. This included triage and virtual models. Studies were not limited to COVID-19. Results are in tables 1-3.

Table 1: Pre-hospital

Interventions and strategies	Review articles (number of studies in review)	Details of intervention
Pre-hospital triage or assessment	Eastwood et al. 2015 [61] (n=7)	Secondary telephone triage conducted pre-ambulance arrival
Tele-emergency services	Ward et al. 2015 [62] (n=38)	Teleconsultation, telepresence, and tele-specialist services (delivered via methods such as real time audio and/or visual and image transfer)
Strengthening or expanding primary care	• Flores-Mateo et al. 2012 [63] (n=48) • Morley et al. 2018 [64] (n=) • Hong et al. 2020 [65] (n=20)	• Increasing primary care accessibility and emergency department cost-sharing • Extended hours of primary care Improving accessibility to after-hours primary care
Bypassing or delaying ED care	• Kirkland et al. 2019 [66] (n=15) • Li et al. 2019 [67] (n=3)	• Interventions designed to either bypass the ED or direct patients • Offload programs until ED admission
Diversion to other hospitals	• Li et al. 2019 [67] (n=14)	• Ambulance diversion. Patient allocation policy

Interventions and strategies	Review articles (number of studies in review)	Details of intervention
	• Delgado et al. 2013 [68] (n=2)	(coordinated strategy between hospitals)
Modelling or predicting patient flow Understanding patient factors for ED visits	• Dufour et al. 2019 [69] (n=8) • Mohiuddin et al. 2017 [70] (n=21) • Ortíz-Barrios et al. 2020 [71] (n=203) • Kreindler et al. 2016 [72] (n=35) • Liu et al. 2018 [73] (n=45) • Li et al. 2019 (n=18) • Dehghani et al. 2017 [74] (n=11) • Delgado et al. 2013 [68] (n=1)	
Cancellation of elective admissions	Delgado et al. 2013 [68] (n=2)	

Table 2: Intra-ED processes

Interventions and strategies	Review articles (number of studies in review)	Summary of findings
Dedicated zones	• Bullard et al. 2012 [75] (n=4) • Elder et al. 2015 [76] (n=21); • Chan et al. 2015 [77] (n=22); • Galipeau et al. 2015 [78] (n=5) • Delgado et al. 2013 [68] (n=2)	• Rapid assessment zone • Medical assessment units • Holding units • Short-stay units
Increasing beds in ED	Li et al. 2019 [67] (n=2)	Increasing the number of beds
Workforce and staffing in the ED	**Nurse practitioners in ED** • Chan et al. 2015 [77] (n=22); • Elder et al. 2015 [76] (n=21) • Beckerleg et al. 2020 [79] (n=1) **Physiotherapists in ED**	

Interventions and strategies	Review articles (number of studies in review)	Summary of findings
	• Ferreira et al. 2019 [80] (n=27); **Co-location of primary care professionals** • Chan et al. 2015 [77] (n=22); • Gonçalves-Bradley et al. 2018 [81] (n=4) • Khangura et al. 2012 [82] (n=3) **Dedicated day-time surgeon for non-trauma patients in ED** • Beckerleg et al. 2020 [79] (n=1)	
Triage by health care professionals	**Physician triage** • Abdulwahid et al. 2016 [83] (n=25) • Elder et al. 2015 [76] (n=21) • Rowe et al. 2011a [84] (n=28) • Benabbas et al. 2020 [85] (n=12) **Triage team** • Ming et al. 2016 [86] (n=58) • Oredsson et al. 2011 [87] (n=33) • Yarmohammadian et al. 2017 [88] (n=) • Harding et al. 2011 [89] (n=8) **Non-physician provider (e.g. nurse practitioner, physician assistant) triage** • Rowe et al. 2011b [90] (n=14) • Afnan et al. 2020 [91] (n=10) • Benabbas et al. 2020 [85] (n=12) • Harding et al. 2011 [89] (n=4)	

Interventions and strategies	Review articles (number of studies in review)	Summary of findings
	Training personnel in triage processes • Harding et al. 2011 [89] (n=1)	
Triage scales and systems	**Changing triage criteria** • Harding et al. 2011 [89] (n=4) **Various ED scales** • Farrohknia et al. 2011 [92] (n=24) **Manchester Triage System** • Azeredo et al. 2015 [93] (n=22) • Parenti et al. 2014 [94] (n=12)	• Canadian Emergency Department Triage and Acuity Scale (CTAS) • Australian Triage Scale (ATS) • Medical Emergency Triage and Treatment System (METTS) • Emergency Severity Index (ESI) • Soterion Rapid Triage Scale (SRTS)
Re-organisation of the workflows	• Cabilan et al. 2017 [95] (n=5) • Cassarino et al. 2019 [96] (n=6) • Katz et al. 2012 [97] (n=23) • Oredsson et al. 2011 (n=33) • Beckerleg et al. 2020 [79] (n=4)	• Nurse-initiated medications • Early assessment and intervention by health and social care professional teams • ED-based care coordination interventions • Nurse-requested x-ray • Restructuring the consultation process • Education, audit and feedback of ED residents • Implementation of institutional guideline of consultation to decision time • Expansion of ED service coverage and added physician time
Streaming, fast-tracking patients	• Jarvis 2016 [98] (n=) • Oredsson et al. 2011 [87] (n=33) • Yarmohammadian et al. 2017 [88] (n=30)	• Rapid assessment • Streaming • Fast-tracking

Interventions and strategies	Review articles (number of studies in review)	Summary of findings
	• Li et al. 2019 [67] (n=1) • Beckerleg et al. 2020 [79] (n=2)	• Increase ED patient throughput • Standardisation of the admission process
Technologies	• Dobson et al. 2013 [99] (n=22) • Jarvis 2016 [98] (n=) • Oredsson et al. 2011 [87] (n=33) • Yarmohammadian et al. 2017 [88] (n=30) • Beckerleg et al. 2020 [79] (n=2) • Delgado et al. 2013 [68] (n=1)	• Electronic tracking technologies • Point-of-care testing • Text messaging reminder for delays in consultation process

Table 3: Discharge and/or transfer

Interventions and strategies	Review articles (number of studies in review)	Details of intervention
ED to outpatient care transition interventions	• Abraham et al. 2016 [100] (n=16)	ED-based care transition interventions
Discharge strategies interventions	• Chan et al. 2015 [77] (n=22) • Morley et al. 2018 [64] (n=)	• Early discharge • Initiatives to meet timed patient disposition targets
Lean Thinking principle	• Bucci et al. 2016 [101] (n=9) • Ortíz-Barrios et al. 2020 [71] (n=203) • Tlapa et al. 2020 [102] (n=40)	• Computer simulation of patient flow • Lean manufacturing
Other	• Chan et al. 2015 [77] (n=22) • Elder et al. 2015 [76] (n=21) • Morley et al. 2018 [64] (n=102) • Yarmohammadian et al. 2017 [88] (n=30)	• Political action - management and resource priority • Whole-of-system initiatives • Managing supply resources • Strategies toward 'ideal ED patient journey models'

Appendix

Search terms

Hot and cold zones

PubMed and Google searches were conducted on 22 August 2021 using the terms “emergency department” AND “COVID-19” AND (PPE OR triage OR zone OR model OR organis* OR design* OR segreg* OR prepar* OR adapt* OR divid*)

Studies were included from October 2020 to present (22 August 2021). Previous literature is summarised in the CIU evidence check[103] dated 4 November 2020. Insights from some earlier examples from this evidence check have been included in this results table.

Temporary hospitals or repurposing existing buildings

PubMed and google searches were conducted using terms (covid-19) AND ((((“solution*” OR model*) AND "surge capacity") OR ("surge planning" OR "hub and spoke")) OR (hospital[Title] AND (field[Title] OR temporary[Title] OR mobile[Title] OR shelter[Title]))) conducted on 13 August 2021. covid-19 AND tent*[ti] was also searched on 24 August.

Due to the CIU evidence check[104] published in April 2020, only studies in the peer reviewed literature from May 2020 onwards were included. This brief focused on the establishment or new facilities or repurposing existing facilities for the care of COVID-19 patients. Studies on surge capacity within a hospital (e.g. increasing intensive care unit beds by using corridor space) were not included.

Staffing

PubMed and Google searches were conducted on 23 August using the terms (workforce[Title/Abstract] OR roster*[Title/Abstract] OR sprint*[Title/Abstract] OR restructur*[Title/Abstract] OR "staffing models" OR redeploy*[Title/Abstract]) AND ("emergency medical services"[MeSH Terms] OR "emergency medical services"[All Fields] OR "emergency service"[Title/Abstract] OR "emergency medical services"[Title/Abstract] OR "emergency medicine"[Title/Abstract] OR "emergency department*"[Title/Abstract] OR "emergency hospital"[Title/Abstract] OR "emergency hospitals"[Title/Abstract] OR "emergency medical service"[Title/Abstract] OR "emergency medicine"[Title/Abstract] OR "emergency service, hospital"[MeSH Terms] OR ED[Title/Abstract]) AND ("COVID-19"[Title/Abstract] OR "COVID-19"[MeSH Terms])

Process and patient flows

PubMed searches were conducted on 24 August 2021 using the terms “emergency department” AND “COVID-19” AND (patient flow OR cohort* OR model OR designat* OR trasfer*). Google searches included: emergency department, flow out of ED, SPRINT, consolidating COVID-19 patients, cohorting, designating hospitals.

References

1. Choi A, Kim HY, Cho A, et al. Efficacy of a four-tier infection response system in the emergency department during the coronavirus disease-2019 outbreak. PLoS One. 2021;16(8):e0256116. DOI: 10.1371/journal.pone.0256116
2. Garra G, Gupta S, Ferrante S, et al. Dedicated area within the emergency department versus an outside dedicated area for evaluation and management of suspected coronavirus disease 2019. J Am Coll Emerg Physicians Open. 2020 Dec;1(6):1349-53. DOI: 10.1002/emp2.12288
3. Barten DG, Kusters RWJ, Peters N. A Swift and Dynamic Strategy to Expand Emergency Department Capacity for COVID-19. Disaster Med Public Health Prep. 2020 Nov 4:1-4. DOI: 10.1017/dmp.2020.430
4. Donà D, Masiero S, Costenaro P, et al. Children's Hospital Management in the COVID-19 Era: The Reorganization of a Tertiary Care Pediatric Emergency Department in Northern Italy. Front Pediatr. 2020;8:594831. DOI: 10.3389/fped.2020.594831
5. Barksdale AN, Zeger WG, Santarpia JL, et al. Implementation of a COVID-19 cohort area resulted in no surface or air contamination in surrounding areas in one academic emergency department. Am J Emerg Med. 2021 Sep;47:253-7. DOI: 10.1016/j.ajem.2021.04.082
6. Nazerian P, Lumini E, Prota A, et al. Acquired COVID-19 infection in the Emergency Department after its reorganization during the pandemic: single center prospective study. Internal and Emergency Medicine. 2021 2021/08/01;16(5):1401-3. DOI: 10.1007/s11739-020-02549-z
7. Natsui S, Silvestri DM, Salway RJ, et al. Envisioning the Post-COVID-19, Pre-Vaccine Emergency Department. Health Secur. 2020 Jul 8. DOI: 10.1089/hs.2020.0090
8. Schreyer KE, Del Portal DA, King LJL, et al. Emergency Department Management of the Covid-19 Pandemic. The Journal of Emergency Medicine. 2020;59(6):946-51. DOI: 10.1016/j.jemermed.2020.07.022
9. Varner C. Pandemic advances alternatives to hallway medicine. Canadian Medical Association Journal. 2020;192(27):E789-E90. DOI: 10.1503/cmaj.1095880
10. Noble J, Degesys NF, Kwan E, et al. Emergency department preparation for COVID-19: accelerated care units. Emergency Medicine Journal. 2020;37(7):402-6. DOI: 10.1136/emermed-2020-209788
11. Australasian College of Emergency Medicine. Clinical guidelines for the management of COVID-19 in Australasian Emergency Departments [Internet] ACEM [cited 7 September 2021]. Available from: file:///C:/Users/60026403/Downloads/Clinical-Guidelines-v5-0.pdf.
12. Health Leaders. 6 approaches to managing coronavirus patient surges in Emergency Departments [Internet]. August 2021. [cited 7 September 2021]. Available from: https://www.healthleadersmedia.com/clinical-care/6-approaches-managing-coronavirus-patient-surges-emergency-departments.
13. Millard WB. Surgeproofing the Hot Zone: Preparing for a Second Wave of COVID-19. Annals of Emergency Medicine. 2020;76(4):A19-A22. DOI: 10.1016/j.annemergmed.2020.07.034
14. Clinical Excellence Commission. Emergency Department – COVID-19 PPE Quick Reference Guide [Internet]. NSW Health. [cited 7 September 2021]. Available from: https://www.cec.health.nsw.gov.au/__data/assets/pdf_file/0007/579760/PPE-Quick-Reference-Guide.pdf
15. Peterson KHJ, Muckey EJC. Deployment and Operation of Outdoor Treatment Tents During the COVID-19 Pandemic. Disaster Medicine and Public Health Preparedness. 2020:1-4. DOI: 10.1017/dmp.2020.355
16. Naomi AS. Access to Nature Has Always Been Important; With COVID-19, It Is Essential. HERD: Health Environments Research & Design Journal. 2020 2020/10/01;13(4):242-4. DOI: 10.1177/1937586720949792
17. Bell SA, Krienke L, Quanstrom K. Alternate care sites during the COVID-19 pandemic: Policy Implications for pandemic surge planning. Disaster Med Public Health Prep. 2021 Jul 23:1-8. DOI: 10.1017/dmp.2021.241

18. Widianto, S. and Nangoy, F. Emergency tents erected outside Jakarta hospitals as virus cases surge [Internet}. Reuters. [cited 7 September 2021]. Available from: https://www.reuters.com/world/asia-pacific/indonesia-has-enough-oxygen-covid-19-patients-health-minister-2021-06-25/
19. NHS, Hospital trust transforms emergency department as part of COVID-19 response. [Internet]. NHS Trust April 2021. [cited 7 September 2021]. Available from: https://www.uhs.nhs.uk/AboutTheTrust/Newsandpublications/Latestnews/2020/April/Hospital-trust-transforms-emergency-department-as-part-of-COVID-19-response.aspx
20. Zhang Q, Cheng S, Cheng Q. Experience summary of a COVID-19 designated community hospital and its operation model. Panminerva Med. 2020 Apr 14. DOI: 10.23736/s0031-0808.20.03908-7
21. Fang D, Pan S, Li Z, et al. Large-scale public venues as medical emergency sites in disasters: lessons from COVID-19 and the use of Fangcang shelter hospitals in Wuhan, China. BMJ Glob Health. 2020 Jun;5(6). DOI: 10.1136/bmjgh-2020-002815
22. Chen Z, He S, Li F, et al. Mobile field hospitals, an effective way of dealing with COVID-19 in China: sharing our experience. Biosci Trends. 2020 Jul 17;14(3):212-4. DOI: 10.5582/bst.2020.01110
23. Shen B, Chen L, Zhang L, et al. Wuchang Fangcang Shelter Hospital: Practices, Experiences, and Lessons Learned in Controlling COVID-19. SN Compr Clin Med. 2020 Jul 4:1-6. DOI: 10.1007/s42399-020-00382-1
24. Li J, Yuan P, Heffernan J, et al. Fangcang shelter hospitals during the COVID-19 epidemic, Wuhan, China. Bull World Health Organ. 2020 Dec 1;98(12):830-41d. DOI: 10.2471/blt.20.258152
25. Robbins A, Beilman GJ, Amdahl B, et al. Transforming a Long-Term Acute Care Hospital into a COVID-19-Designated Hospital. Surg Infect (Larchmt). 2020 Nov;21(9):729-31. DOI: 10.1089/sur.2020.155
26. Zhang XB, Hu XJ, Zhai XW, et al. Strategies for children's hospital in response to COVID-19 pandemic: perspective and practice at a designated pediatric hospital in Shanghai, China. World J Pediatr. 2020 Dec;16(6):556-9. DOI: 10.1007/s12519-020-00394-w
27. Candel FJ, Canora J, Zapatero A, et al. Temporary hospitals in times of the COVID pandemic. An example and a practical view. Rev Esp Quimioter. 2021 Aug;34(4):280-8. DOI: 10.37201/req/041.2021
28. Sacchetto D, Raviolo M, Beltrando C, et al. COVID-19 Surge Capacity Solutions: Our Experience of Converting a Concert Hall into a Temporary Hospital for Mild and Moderate COVID-19 Patients. Disaster Medicine and Public Health Preparedness. 2020:1-4. DOI: 10.1017/dmp.2020.412
29. Spagnolello O, Rota S, Francesco Valoti O, et al. Bergamo Field Hospital Confronting COVID-19: Operating Instructions. Disaster Med Public Health Prep. 2020 Nov 19:1-3. DOI: 10.1017/dmp.2020.447
30. Danguy des Déserts M, Mathais Q, Morvan JB, et al. Outcomes of COVID-19-Related ARDS Patients Hospitalized in a Military Field Intensive Care Unit. Mil Med. 2021 Jul 1. DOI: 10.1093/milmed/usab268
31. de Val J, Sohal G, Sarwar A, et al. Investigating the challenges and opportunities for medicines management in an NHS field hospital during the COVID-19 pandemic. Eur J Hosp Pharm. 2021 Jan;28(1):10-5. DOI: 10.1136/ejhpharm-2020-002364
32. Louri NA, Alkhan JA, Isa HH, et al. Establishing a 130-Bed Field Intensive Care Unit to Prepare for COVID-19 in 7 Days in Bahrain Military Hospital. Disaster Med Public Health Prep. 2021 Feb;15(1):e34-e43. DOI: 10.1017/dmp.2020.297
33. Li Q, Wang L, Wang B, et al. The COVID-19-designated hospitals in China: preparing for public health emergencies. Emerg Microbes Infect. 2021 Dec;10(1):998-1001. DOI: 10.1080/22221751.2021.1931467
34. Hui J, Li H, Gao F, et al. Combating COVID-19 as a designated hospital: Experience from Shanghai, China. Glob Health Med. 2021 Apr 30;3(2):112-4. DOI: 10.35772/ghm.2020.01079
35. Ferguson C, Fletcher R, Ho P, et al. Should Australian states and territories have designated COVID hospitals in low community transmission? Case study for Western Australia. Aust Health Rev. 2020 Sep;44(5):728-32. DOI: 10.1071/ah20199

36. World Health Organisation. Operational considerations for case management of COVID-19 in health facility and community, Interim Guide [Internet]. WHO, March 2020. [cited 7 September 2021]. Available from: https://apps.who.int/iris/bitstream/handle/10665/331492/WHO-2019-nCoV-HCF_operations-2020.1-eng.pdf.
37. Jacinta I-Pei Chen, Khin Chaw Ko, Amelia Yamato Leow Mei-li, Jason CH Yap & Jeremy Lim. (2021). COVID-19 health system response monitor: Singapore. World Health Organization. Regional Office for South-East Asia. https://apps.who.int/iris/handle/10665/341403. License: CC BY-NC-SA 3.0 IGO.
38. Tokumoto A, Akaba H, Oshitani H, Jindai K, Wada K. et al. (2020). COVID-19 Health system response monitor: Japan. World Health Organization. Regional Office for South-East Asia. https://apps.who.int/iris/handle/10665/338399. License: CC BY-NC-SA 3.0 IGO.
39. NSW Health, COVID-19 surge capacity management: Adapting and commissioning clinical spaces [Internet]. NSW Government, April 2020. [cited 7 September 2021]. Available from: https://www.health.nsw.gov.au/Infectious/covid-19/communities-of-practice/Pages/surge-management.aspx
40. Edwards JA, Breitman I, Kovatch I, et al. Lessons Learned at a COVID-19 designated hospital. Am J Surg. 2021 Jan;221(1):62-4. DOI: 10.1016/j.amjsurg.2020.07.029
41. Chua WLT, Quah LJJ, Shen Y, et al. Emergency department 'outbreak rostering' to meet challenges of COVID-19. Emerg Med J. 2020 Jul;37(7):407-10. DOI: 10.1136/emermed-2020-209614
42. Au BW, Tranquilino R, Apswoude G, et al. Implementing a pandemic roster in a specialty emergency department: Challenges and benefits. Emerg Med Australas. 2021 Jan 18. DOI: 10.1111/1742-6723.13732
43. Lee MO, Ribeira R, Fang A, et al. Protecting the emergency physician workforce during the coronavirus disease 2019 pandemic through precision scheduling at an academic tertiary care trauma center. J Am Coll Emerg Physicians Open. 2021 Feb;2(1):e12221. DOI: 10.1002/emp2.12221
44. Sangal RB, Venkatesh AK, Kinsman J, et al. Simulating approaches to emergency department pandemic physician staffing during COVID-19. Am J Disaster Med. 2021 Spring;16(2):85-93. DOI: 10.5055/ajdm.2021.0391
45. Low TY, Mathews I, Lau JW-L, et al. Close air support: enhancing emergency care in the COVID-19 pandemic. Emergency Medicine Journal. 2020;37(10):642-3. DOI: 10.1136/emermed-2020-210148
46. Quah LJJ, Tan BKK, Fua T-P, et al. Reorganising the emergency department to manage the COVID-19 outbreak. International Journal of Emergency Medicine. 2020 2020/06/17;13(1):32. DOI: 10.1186/s12245-020-00294-w
47. Hauck KD, Hochman KA, Pochapin MB, et al. The COVID-19 Army: Experiences From the Deployment of Non-Hospitalist Physician Volunteers During the COVID-19 Pandemic. Disaster Med Public Health Prep. 2021 Apr 6:1-5. DOI: 10.1017/dmp.2021.109
48. Jensen RD, Bie M, Gundsø AP, et al. Preparing an orthopedic department for COVID-19. Acta orthopaedica. 2020;91(6):644-9. DOI: 10.1080/17453674.2020.1817305
49. Fraymovich S, Levine DA, Platt SL. A Blueprint for Pediatric Emergency Resource Reallocation During the COVID-19 Pandemic: An NYC Hospital Experience. Pediatr Emerg Care. 2020 Sep;36(9):452-4. DOI: 10.1097/pec.0000000000002203
50. Klasen JM, Meienberg A, Nickel C, et al. SWAB team instead of SWAT team: Medical students as a frontline force during the COVID-19 pandemic. Med Educ. 2020 Sep;54(9):860. DOI: 10.1111/medu.14224
51. Kurtzman JT, Moran GW, Anderson CB, et al. A Novel and Successful Model for Redeploying Urologists to Establish a Closed Intensive Care Unit within the Emergency Department during the COVID-19 Crisis. Journal of Urology. 2020;204(5):901-2. DOI: doi:10.1097/JU.0000000000001188
52. Oakley C, Pascoe C, Balthazor D, et al. Assembly Line ICU: what the Long Shops taught us about managing surge capacity for COVID-19. BMJ Open Quality. 2020;9(4):e001117. DOI: 10.1136/bmjoq-2020-001117

53. Ferrara F, Galmarini V, Tosco P, et al. Redeployment of specialist surgeons in the COVID-19 pandemic in a general hospital: critical issues and suggestions. Acta bio-medica : Atenei Parmensis. 2021;92(2):e2021172-e. DOI: 10.23750/abm.v92i2.10921
54. Patterson B, Marks M, Martinez-Garcia G, et al. A novel cohorting and isolation strategy for suspected COVID-19 cases during a pandemic. J Hosp Infect. 2020 Aug;105(4):632-7. DOI: 10.1016/j.jhin.2020.05.035
55. Australasian College of Emergency Medicine. Department Design Layout [Internet] ACEM [cited 24 August 2021]. Available from: https://acem.org.au/Content-Sources/Advancing-Emergency-Medicine/COVID-19/Resources/Clinical-Guidelines/Emergency-Department-Design-LayoutEmergency.
56. American College of Emergency Physicians. Infection Prevention and Control Recommendations for Patient Arrival and Triage [Internet]. ACEP. [cited 24 August 2021]. Available from: https://www.acep.org/corona/covid-19-field-guide/triage/infection-prevention-and-control-recommendations-for-patient-arrival-and-triage/
57. Kedar E, Scott R, Soule DM, et al. COVID-19 in a rural health system in New York - case series and an approach to management. Rural Remote Health. 2021 Jul;21(3):6464. DOI: 10.22605/RRH6464
58. Michelson KA, Rees CA, Sarathy J, et al. Inter-Region Transfers for Pandemic Surges. Clin Infect Dis. 2020 Oct 10. DOI: 10.1093/cid/ciaa1549
59. Dhake SS, Folk J, Haag A, et al. COVID-19 hospital designation: Effect on emergency department patient self-selection and volume. Journal of Hospital Administration. 2020;9:14.
60. Assistant Secretary for Preparedness and Response. Designated COVID-19 Hospitals: Case Studies and Lessons Learned [Internet]. ASPR. [cited 24 August 2021]. Available from: https://files.asprtracie.hhs.gov/documents/designated-covid-19-hospitals-lessons-learned.pdf
61. Eastwood K, Morgans A, Smith K, et al. Secondary triage in prehospital emergency ambulance services: a systematic review. Emergency Medicine Journal. 2015;32(6):486. DOI: 10.1136/emermed-2013-203120
62. Ward MM, Jaana M, Natafgi N. Systematic review of telemedicine applications in emergency rooms. Int J Med Inform. 2015 Sep;84(9):601-16. DOI: 10.1016/j.ijmedinf.2015.05.009
63. Flores-Mateo G, Violan-Fors C, Carrillo-Santisteve P, et al. Effectiveness of organizational interventions to reduce emergency department utilization: a systematic review. PLoS One. 2012;7(5):e35903. DOI: 10.1371/journal.pone.0035903
64. Morley C, Unwin M, Peterson GM, et al. Emergency department crowding: A systematic review of causes, consequences and solutions. PLoS One. 2018;13(8):e0203316. DOI: 10.1371/journal.pone.0203316
65. Hong M, Thind A, Zaric GS, et al. The impact of improved access to after-hours primary care on emergency department and primary care utilization: A systematic review. Health Policy. 2020 May 27. DOI: 10.1016/j.healthpol.2020.05.015
66. Kirkland SW, Soleimani A, Rowe BH, et al. A systematic review examining the impact of redirecting low-acuity patients seeking emergency department care: is the juice worth the squeeze? Emerg Med J. 2019 Feb;36(2):97-106. DOI: 10.1136/emermed-2017-207045
67. Li M, Vanberkel P, Carter AJE. A review on ambulance offload delay literature. Health Care Management Science. 2019 2019/12/01;22(4):658-75. DOI: 10.1007/s10729-018-9450-x
68. Delgado MK, Meng LJ, Mercer MP, et al. Reducing ambulance diversion at hospital and regional levels: systemic review of insights from simulation models. West J Emerg Med. 2013 Sep;14(5):489-98. DOI: 10.5811/westjem.2013.3.12788
69. Dufour I, Chouinard MC, Dubuc N, et al. Factors associated with frequent use of emergency-department services in a geriatric population: a systematic review. BMC Geriatr. 2019 Jul 5;19(1):185. DOI: 10.1186/s12877-019-1197-9
70. Mohiuddin S, Busby J, Savović J, et al. Patient flow within UK emergency departments: a systematic review of the use of computer simulation modelling methods. BMJ Open. 2017 May 9;7(5):e015007. DOI: 10.1136/bmjopen-2016-015007

71. Ortíz-Barrios MA, Alfaro-Saíz JJ. Methodological Approaches to Support Process Improvement in Emergency Departments: A Systematic Review. Int J Environ Res Public Health. 2020 Apr 13;17(8). DOI: 10.3390/ijerph17082664
72. Kreindler SA, Cui Y, Metge CJ, et al. Patient characteristics associated with longer emergency department stay: a rapid review. Emerg Med J. 2016 Mar;33(3):194-9. DOI: 10.1136/emermed-2015-204913
73. Liu Y, Kong Q, Yuan S, et al. Factors influencing choice of health system access level in China: A systematic review. PLoS One. 2018;13(8):e0201887. DOI: 10.1371/journal.pone.0201887
74. Dehghani M, Moftian N, Rezaei-Hachesu P, et al. A Step-by-Step Framework on Discrete Events Simulation in Emergency Department; A Systematic Review. Bull Emerg Trauma. 2017 Apr;5(2):79-89.
75. Bullard MJ, Villa-Roel C, Guo X, et al. The role of a rapid assessment zone/pod on reducing overcrowding in emergency departments: a systematic review. Emerg Med J. 2012 May;29(5):372-8. DOI: 10.1136/emj.2010.103598
76. Elder E, Johnston AN, Crilly J. Review article: systematic review of three key strategies designed to improve patient flow through the emergency department. Emerg Med Australas. 2015 Oct;27(5):394-404. DOI: 10.1111/1742-6723.12446
77. Chan SS, Cheung NK, Graham CA, et al. Strategies and solutions to alleviate access block and overcrowding in emergency departments. Hong Kong Med J. 2015 Aug;21(4):345-52. DOI: 10.12809/hkmj144399
78. Galipeau J, Pussegoda K, Stevens A, et al. Effectiveness and safety of short-stay units in the emergency department: a systematic review. Acad Emerg Med. 2015 Aug;22(8):893-907. DOI: 10.1111/acem.12730
79. Beckerleg W, Wooller K, Hasimjia D. Interventions to reduce emergency department consultation time: A systematic review of the literature. Cjem. 2020 Jan;22(1):56-64. DOI: 10.1017/cem.2019.435
80. Ferreira GE, Traeger AC, Maher CG. Review article: A scoping review of physiotherapists in the adult emergency department. Emerg Med Australas. 2019 Feb;31(1):43-57. DOI: 10.1111/1742-6723.12987
81. Gonçalves-Bradley D, Khangura JK, Flodgren G, et al. Primary care professionals providing non-urgent care in hospital emergency departments. Cochrane Database Syst Rev. 2018 Feb 13;2(2):Cd002097. DOI: 10.1002/14651858.CD002097.pub4
82. Khangura JK, Flodgren G, Perera R, et al. Primary care professionals providing non-urgent care in hospital emergency departments. Cochrane Database of Systematic Reviews. 2012 (11). DOI: 10.1002/14651858.CD002097.pub3
83. Abdulwahid MA, Booth A, Kuczawski M, et al. 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 Jul;33(7):504-13. DOI: 10.1136/emermed-2014-204388
84. Rowe BH, Guo X, Villa-Roel C, et al. The role of triage liaison physicians on mitigating overcrowding in emergency departments: a systematic review. Acad Emerg Med. 2011 Feb;18(2):111-20. DOI: 10.1111/j.1553-2712.2010.00984.x
85. Benabbas R, Shah R, Zonnoor B, et al. Impact of triage liaison provider on emergency department throughput: A systematic review and meta-analysis. Am J Emerg Med. 2020 May 3. DOI: 10.1016/j.ajem.2020.04.068
86. Ming T, Lai A, Lau PM. Can Team Triage Improve Patient Flow in the Emergency Department? A Systematic Review and Meta-Analysis. Adv Emerg Nurs J. 2016 Jul-Sep;38(3):233-50. DOI: 10.1097/tme.0000000000000113
87. Oredsson S, Jonsson H, Rognes J, et al. A systematic review of triage-related interventions to improve patient flow in emergency departments. Scand J Trauma Resusc Emerg Med. 2011 Jul 19;19:43. DOI: 10.1186/1757-7241-19-43
88. Yarmohammadian MH, Rezaei F, Haghshenas A, et al. Overcrowding in emergency departments: A review of strategies to decrease future challenges. J Res Med Sci. 2017;22:23. DOI: 10.4103/1735-1995.200277

89. Harding KE, Taylor NF, Leggat SG. Do triage systems in healthcare improve patient flow? A systematic review of the literature. Aust Health Rev. 2011 Aug;35(3):371-83. DOI: 10.1071/ah10927
90. Rowe BH, Villa-Roel C, Guo X, et al. The role of triage nurse ordering on mitigating overcrowding in emergency departments: a systematic review. Acad Emerg Med. 2011 Dec;18(12):1349-57. DOI: 10.1111/j.1553-2712.2011.01081.x
91. Afnan MAM, Netke T, Singh P, et al. Ability of triage nurses to predict, at the time of triage, the eventual disposition of patients attending the emergency department (ED): a systematic literature review and meta-analysis. Emerg Med J. 2020 Jun 19. DOI: 10.1136/emermed-2019-208910
92. Farrohknia N, Castrén M, Ehrenberg A, et al. Emergency department triage scales and their components: a systematic review of the scientific evidence. Scand J Trauma Resusc Emerg Med. 2011 Jun 30;19:42. DOI: 10.1186/1757-7241-19-42
93. Azeredo TR, Guedes HM, Rebelo de Almeida RA, et al. Efficacy of the Manchester Triage System: a systematic review. Int Emerg Nurs. 2015 Apr;23(2):47-52. DOI: 10.1016/j.ienj.2014.06.001
94. Parenti N, Reggiani ML, Iannone P, et al. A systematic review on the validity and reliability of an emergency department triage scale, the Manchester Triage System. Int J Nurs Stud. 2014 Jul;51(7):1062-9. DOI: 10.1016/j.ijnurstu.2014.01.013
95. Cabilan CJ, Boyde M. A systematic review of the impact of nurse-initiated medications in the emergency department. Australas Emerg Nurs J. 2017 May;20(2):53-62. DOI: 10.1016/j.aenj.2017.04.001
96. Cassarino M, Robinson K, Quinn R, et al. Impact of early assessment and intervention by teams involving health and social care professionals in the emergency department: A systematic review. PLoS One. 2019;14(7):e0220709. DOI: 10.1371/journal.pone.0220709
97. Katz EB, Carrier ER, Umscheid CA, et al. Comparative effectiveness of care coordination interventions in the emergency department: a systematic review. Ann Emerg Med. 2012 Jul;60(1):12-23.e1. DOI: 10.1016/j.annemergmed.2012.02.025
98. Jarvis PR. Improving emergency department patient flow. Clin Exp Emerg Med. 2016 Jun;3(2):63-8. DOI: 10.15441/ceem.16.127
99. Dobson I, Doan Q, Hung G. A systematic review of patient tracking systems for use in the pediatric emergency department. J Emerg Med. 2013 Jan;44(1):242-8. DOI: 10.1016/j.jemermed.2012.02.017
100. Abraham J, Kannampallil T, Caskey RN, et al. Emergency Department-Based Care Transitions for Pediatric Patients: A Systematic Review. Pediatrics. 2016 Aug;138(2). DOI: 10.1542/peds.2016-0969
101. Bucci S, de Belvis AG, Marventano S, et al. Emergency Department crowding and hospital bed shortage: is Lean a smart answer? A systematic review. Eur Rev Med Pharmacol Sci. 2016 Oct;20(20):4209-19.
102. Tlapa D, Zepeda-Lugo CA, Tortorella GL, et al. Effects of Lean Healthcare on Patient Flow: A Systematic Review. Value Health. 2020 Feb;23(2):260-73. DOI: 10.1016/j.jval.2019.11.002
103. COVID-19 Critical Intelligence Unit. Infection control recommendations in the emergency department according to local transmission risk [Internet]. NSW Government, November 2020. [cited 7 September 2021]. Available from: https://aci.health.nsw.gov.au/__data/assets/pdf_file/0018/616041/Evidence-Check-Infection-control-recommendations-in-the-emergency-department-according-to-local-transmission-risk.pdf.
104. COVID-19 Critical Intelligence Unit. Dedicated or temporary COVID-19 healthcare facilities [Internet]. NSW Government, April 2020. [cited 7 September 2021]. Available from: https://aci.health.nsw.gov.au/__data/assets/pdf_file/0004/577723/Evidence-Check-Dedicated-or-temporary-COVID-19-healthcare-facilities.pdf

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