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Evidence Check

Paediatric services capacity

An **Evidence Check** rapid review brokered by the Sax Institute for the NSW Kids and Families. May 2015.

NSW KIDS + FAMILIES

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This report was prepared by:

Yvonne Zurynski, Amy Phu, Marie Deverell, Elizabeth Elliott

May 2015

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Paediatric services capacity: a rapid review

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1 List of abbreviations

A&E	Accident and Emergency
ABI	Acquired Brain Injury
ACE	Accelerated Care through Emergency
ACEM	The Australasian College for Emergency Medicine
ACI	Agency for Clinical Innovation
ACU	Acute Care Unit
ACS	Acute Care Services
AOT	Assertive Outreach Team
CCNOT	Community Children's Nursing Outreach Team
CCCT	Chronic Cardiac Care Team
CF	Cystic Fibrosis
CICU	Cardiac Intensive Care Unit
COH	Centre for Online Health
CMC	Children with Medical Complexity
CSHCN	Children with Special Health Care Needs
DoH	Department of Health
DSC	Disease-Specific Clinics
DSM	Disease-Specific Model
EBP	Evidence Based Practice
ED	Emergency Department
EMR	Electronic Medical Record
EMSC	Emergency Medical Services for Children
ENP	Emergency Nurse Practitioner
EPC	Embedded Primary Care
ER	Emergency Room
FCS	Family-Centred Service
FTE	Full-Time Equivalent
GP	General Practitioner
ICCM	Integrated Complex Care Model
ICT	Information and Communication Technology
ICU	Intensive Care Unit
JMO	Junior Medical Officer
LHD	Local Health District

LOS	Length of Stay
MA	Medical Assistant
MDC	Multidisciplinary Clinics
MDCM	Multidiscplinary Coordinated Models/Clinics
NMHC	Nurse-Managed Health Centres
NP	Nurse Practitioner
NSW	New South Wales
NR	Not Reported
NT	Northern Territory
NUM	Nursing Unit Manager
OU	Observation Unit
PA	Physicians Assistant
PACU	Paediatric Ambulatory Care Unit
PACCT	Paediatric Advanced Comfort Care Team
PED	Paediatric Emergency Department
PEEC	Paediatric Extended Emergency Care Unit
PICU	Paeditaric Intensive Care Unit
POU	Paediatric Observation Unit
PPC	Paediatric Palliative Care
QOL	Quality of Life
QLD	Queensland
RACP	The Royal Australasian College of Physicians
RAOU	Rapid Access Outpatient Unit
RCPCH	Royal College of Paediatrics and Child Health
RN	Registered Nurse
SA	South Australia
SNP	School Needs Program
SSU	Short-Stay Unit
VIC	Victoria
WA	Western Australia
WTE	Whole Time Equivalent

2 Executive summary

This rapid review aims to identify and describe paediatric models of care. Thirty-seven peer-reviewed papers published in full scientific journals and 18 documents from the grey literature, describing paediatric models of care, were identified. In addition we found nine policy documents recommending key principles and features of ideal paediatric models, although none had been implemented. These policy documents serve as background for this review and will be useful when developing and implementing models of care, but they do not describe specific models.

It is possible that successful models of care might be operating but were not identified in this review because they have not been documented or documents are not publically available. A successful UK model of acute care, mainly paediatric short-stay wards/assessment wards and integration across health sectors (tertiary, secondary, primary/community) was supported by evidence gathered directly through visiting services, in addition to a review of published evidence.

The information contained in the identified documents lacked detail about model attributes such as staffing, resources or funding. Only 10 peer-reviewed publications provided any information on effectiveness, outcomes, barriers, enablers, and sustainability. Thirteen documents from the grey literature provided information on staffing, 14 on enablers and only two on barriers to implementation and only another two documents reported on model sustainability.

Summary of Results

1. Models of care identified by this review include:

1.1. Short-stay units (SSU)/observation units linked with an emergency department (ED). These wards may operate in tertiary children's facilities or in general hospitals which see adults and children. Paediatric short-stay wards support the appropriate flow of patients, preventing needless admissions and speeding up admissions for patients who require admission, thereby reducing waiting times in ED. Such units use specialist paediatric staff and guidelines for scaling-up of care. Some wards or units in adult hospitals have a separate entrance and they provide a family friendly environment.

1.2. Primary health care embedded within the hospital setting. These are clinics within hospitals, staffed by general practitioners (GPs) or nurse practitioners (NPs) providing ambulatory primary care and swift referral to the hospital ED for children who need a higher level of care.

1.3. Paediatric response teams in adult hospitals. These teams of specialist paediatricians respond to paediatric patients in ED and to high risk patients in hospital wards.

1.4. Outreach models including telehealth and outreach clinics. Regular outreach clinics in outer metropolitan, rural and remote regions attended by visiting specialists from metropolitan tertiary paediatric centres, which provide planned care and up-skilling for local health professionals. Several models of paediatric telehealth stood out including Queensland Telepaediatric Health which was evaluated by the

Centre for Online Health, The University of Queensland. This model has been sustained for over 14 years with over 20,000 consultations provided on a wide variety of paediatric clinical problems.

1.5. Multidisciplinary coordinated, integrated and planned complex/chronic care models to prevent acute admissions. State-wide service models included services focused on paediatric palliative care or rehabilitation (e.g. brain injury units). In addition, several models describing individual clinics looking after children with single diseases were found.

1.6. Transition Care. Models supporting young people with chronic conditions as they move to adult healthcare, including joint paediatric/adult clinics, preparation for transition and integrated psychosocial support.

2. Effectiveness of identified models in terms of improved health outcomes or intermediate outcome measures

2.1. Improved health outcomes were reported by only seven peer-reviewed papers and 10 documents from the grey literature. Paediatric short-stay wards, assessment wards and embedded primary care models resulted in:

- Reduced number of admissions to hospital
- Less re-presentations to ED
- Shorter length of stay
- Shorter waiting times
- Less inappropriate investigations and tests
- More appropriate investigations and tests
- Cost savings.

2.2. Increased level of satisfaction among patients/parents and service staff was reported in 10 documents from the peer-reviewed literature and four documents from the grey literature.

2.3. There is scant evidence available about the effectiveness of paediatric response teams.

2.4. Outreach including outreach clinics and telehealth models provided a high level of efficiency, and increased access to specialist paediatric services for patients and for health professionals from rural and remote regions. These models saved costs, waiting times, presentations and admissions to tertiary hospitals in metropolitan areas while providing appropriate and effective health care to patients. Outreach models also supported up-skilling of health professionals practicing outside of tertiary centres in metropolitan cities.

3. Resources, staffing, enablers and barriers for successful implementation

3.1. Only two documents reported on financial viability – in both instances the model was not financially viable due to inadequate funding.

3.2. Only three documents described staffing requirements in detail including the full-time equivalent (FTE) for each staff member. Two models described successful staff sharing arrangements between the adult ED and the paediatric SSU. Outreach models mention the need for efficient video-conferencing facilities to

support the service.

3.3. Successful models included implementation of clear pathways of care, with resources to inform and educate patients and families as well as the medical team.

3.4. Embedding education and improving opportunities and resources for health professionals within all models of care was recommended by most documents.

4. Core elements across different models and systems

4.1. The key principles of successful models should be systematically applied. The principles and frameworks for effective paediatric models of care have been well described in policies and recommendations. The evidence supporting the key principles is weak and largely based in theory rather than empirical evidence gained from actual evaluation of implemented models of care (only five publications from the grey literature and four from the peerreviewed literature reported on the outcome of model evaluation). Key principles and attributes of successful models include:

- Patient and family centred care that meets individual needs and takes the psychosocial context into account
- Connected care across sectors – tertiary, secondary, primary care and community care
- Continuity of care across the lifespan for children with chronic diseases including planned care to avoid unnecessary ED admissions
- Multidisciplinary care for chronic disease – includes general paediatricians, paediatric specialists, paediatric nurses, paediatric allied health professionals including social workers and psychologists
- Coordinated and integrated care with an identified coordinator role
- Implementation of standardised protocols and best practice guidelines to support care while at the same time enabling flexibility and innovation
- Opportunities for up-skilling and continuing education for all personnel
- Equitable access to quality services in rural, remote and disadvantaged areas through outreach (outreach clinics and telehealth)
- Sustainability and cost effectiveness evaluation – models must be appropriately funded, resourced and evaluated for financial viability to ensure sustainability
- Embedded routine data collection to support evaluation and measurement of outcomes
- Evaluation and publication of evaluation results should be an integral and adequately funded requirement when implementing any model of care
- Physical and financial resources
- Appropriately skilled staff
- Well-defined communication strategies within teams and between systems and facilities.

5. Sustainability and maintenance of integrity over time

5.1. Information about model sustainability was reported in only 14 documents. For six models reported, we surmised that the models was sustainable as they had been operating for a number of years, e.g. the Queensland Telepaediatrics model which has been operational for 14 years.

5.2. Where evaluation was undertaken and described, it was often reported within the first 12 months of operation. Longer-term evaluation was seldom reported.

5.3. Funding models were not discussed; only one document in the grey literature discussed financial sustainability through appropriate billing practices.

For detailed results please see summaries on pages: 28, 34, 45, 47, 50, 58, 61-62, 68, 76 and 80.

Recommendations

- Establish paediatric SSUs/observation units in children's hospitals and in adult or general hospitals where children are treated. These units have been shown to be effective in providing appropriate care, including scaling-up of care leading to admission quickly when necessary. At the same time inappropriate admissions are prevented, saving resources while ensuring that quality care is provided
- Ensure an effective and safe paediatric retrieval/transport system to enable appropriate and swift transfer when care needs to be scaled-up
- Outreach clinics including telehealth services prevent acute admissions to large metropolitan hospitals, saving costs for the health system and for the family while providing appropriate care. Outreach also enables up-skilling of healthcare workers who are "close to the patient's home"
- Outreach clinics and telehealth enable paediatric specialists to recommend scaling-up of care when needed and appropriate
- Coordinated multidisciplinary paediatric care models for chronic and complex conditions prevent acute admissions by ensuring medical stability through care planning and responsiveness before there is an acute crisis and need for ED presentation
- Multidisciplinary, integrated paediatric care models hold promise, although few documents were found describing such models and their effectiveness. We recommend a scoping exercise rather than a literature review to identify, describe and evaluate existing models of paediatric care to widen and strengthen the evidence base
- To ensure appropriateness, cost effectiveness and sustainability, new service planning teams must include:
    - Consumers
    - Health professionals who have patient contact and front-line knowledge
    - Policy/decision makers and budget holders
    - Health services evaluators/researchers.

3 Introduction

This review examined models of care and systems of connectedness in paediatric health service delivery in Australia and internationally.

A rapid literature search identified 37 published papers to be included in the review.

Australia – 10 studies
International – 27 studies

Models of care and systems identified, were grouped into five categories:

- Acute Care Services
- Primary Care embedded in Hospital Setting
- Disease Specific Clinics/Multidisciplinary Care Clinics (DSC/MDCC)
- Outreach Services
- Transition Services.

Table 1: Categories of health services and definitions

Models	Definition(s)
Acute Care Services (ACS)	SSUs within a hospital setting. Various terms were used: paediatric emergency assesssment units (PAUs), acute observation units, acute assessment clinics, rapid access outpatient units (RAOUs), ambulatory units
Embedded Primary Care (EPC)	Primary care services embedded within the hospital setting, e.g. GP run clinics, Nurse-led clinics
Multidiscplinary coordinated models/clinics (MDCM)	Models of care aimed at managing chronic and complex problems and requiring specialist care in addition to allied health and psychosocial suport
Outreach Services	Models of care in the community e.g. outreach hospital homes, clinics close to patient's home staffed by specialists from large metropolitan hospitals, or models of care that deliver health related services via telecommunications, e.g. phone triage, hotlines, video-conferencing
Transition Services	Transition from paediatric to adult health services, movement between hospitals, medical homes

4 Methods

Defining the research questions

The research questions were provided by the NSW Kids and Families and are described below.

Question 1: What models of care and systems of connectedness have been implemented in health systems, both in Australia and other developed countries, for the delivery of hospital-based paediatric health services?

Scope of question 1:

Include models developed for any paediatric population: inpatient, outpatient, acute and sub-acute inpatient services, outpatient services in hospital, outreach services, ambulatory care services, including care in the community being delivered by hospital staff (such as hospital in the home) and emergency department presentations.

Describe evidence from Australia and other countries with comparable health systems (excluding developing countries).

The focus for this review was on SSUs/observational units and medical assessment units serving the paediatric population.

The review will include information, where available, about the connectedness between services, not only amongst paediatric services but also the relationships with adult services providing paediatric care.

Question 2: What is known about the effectiveness of the identified models and systems (as determined by improved health outcomes or intermediate outcome measures)?

Scope of question 2:

Include outcomes of models and systems where available, including patient outcomes of care or intermediate outcome measures (e.g. length of stay (LOS), number of emergency presentations, hospital admissions, and costs).

Question 3: What is known about the resources, staffing and other requirements, enablers and barriers for successful implementation of the identified models and systems?

Scope of question 3:

Include evaluations of the models and systems identified. What resources are required, what are the enablers and barriers for successful implementation of the model?

Examples of enablers: funding, infrastructure, staff availability

Examples of barriers: lack of funds, lack of access to resources such as space, equipment and staff, lack of administration support.

Question 4: What are the core elements of the models and systems identified i.e. what elements are common across different models and systems?

Scope of question 4:

Include information available about the core components of each of the models of care and systems identified. What are the themes that are common across the various models identified?

Question 5: What is known about the sustainability of the models and systems that have been implemented in terms of (i) sustained outcomes (where evaluated), and (ii) maintained integrity over time?

Scope of question 5:

Include outcomes of models and system where available, such as sustained improved patient care, evaluation and sustainability of models and systems of care.

Search Strategy

1. Search for peer-reviewed medical and health services literature

Published literature

Papers were identified via a search of databases including: Ovid Medline, CINAHL (EBSCO), Psycho Info, Cochrone Library, Pubmed and Embase to identify the relevant literature.

Searches were modified in the different databases for differences in syntax and headings. Searches were limited to the inclusion and exlcusion criteria described below.
Searches included MeSH terms and free text. The Ovid Medline search strategies are detailed in Table 9.

Inclusion criteria

- Inpatient, outpatient or emergency department settings
- Age 0-18 years
- Publications from January 2005 to May 2015
- Full text available.

Exclusion criteria

- Non-English language
- Developing countries
- Descriptions of services for rare childhood conditions.

A total of 9424 papers were identified. Qualified reviewers (AP, MD, and YZ) screened the abstracts and made a decision on whether the paper should be included or excluded based on the research questions.

Full-text versions for papers deemed potentially relevant were uploaded to the reference manager library (Endnote X7) (n=235). Where there was uncertainty, the team reviewed the paper and made a decision after discussion. Authors reviewed full-text articles and a total of 37 studies were deemed relevant to the research questions (Figure 1). Papers meeting the inclusion criteria were subject to data abstraction.

2. Search for grey literature including reports, presentations, guidelines, and policies

We searched for grey literature using the following sources (March – April 2015):

- Published reviews
- Google search engines (Including Google scholar)
- Scanning reference list of retrieved relevant articles
- Department of Health websites
- Organisational health websites (Local Health Districts (LHDs))
- Correspondence with experts in the field
- Local and International agency reports
- Association for the wellbeing of children in healthcare (AWCH) website
- Websites of medical colleges e.g. The Royal Australasian College of Physicians (RACP), The Australasian College for Emergency Medicine (ACEM) in Australia, and Royal College of Paediatrics and Child Health (RCPCH) and Paediatric Society of Canada overseas.

Search terms for grey literature

The specific search terms and keywords used to search the grey literature included:

- Models of paediatric health care
- Paediatric health care model
- Service capability framework and guidelines
- Local health district paediatric service plan
- NSW paediatric networks
- Australian paediatric health network
- Delivery of paediatric health care
- Community health planning
- Paediatric health care capabilities
- Paediatric outpatient clinics
- Paediatric ambulatory care
- Paediatric short-stay ward.

5 Results: Peer-reviewed literature

Question 1: What models of care and systems of connectedness have been implemented in health systems, both in Australia and other developed countries, for the delivery of hospital-based paediatric health services?

Table 2: Models of care in Australia and other developed countries

Ref No., Author, Year	Title	Country	Model of care description		
			Model type	Study details	Setting
1. Blair M, et al. (2008)	Multi-method evaluation of a paediatric ambulatory care unit (PACU): impact on families and staff	United Kingdom	***ACS*** PACU	Multi-method evaluation (parent survey, patient journey mapping, staff interviews, referrer survey, and comparison)	Unit established within an adult Accident and Emergency (A&E) department
2. Hopper S, et al. (2010)	Paediatric SSU in a community hospital: effective, efficient and popular	Australia	***ACS*** Paediatric SSU	Single-centre, prosepctive audit (set-up of unit, audit and consumer satisfaction)	Unit established within an adult A&E department
3. Najaf-Zadeh A. et al. (2011)	Effectiveness of multifunction paediatric SSUs: a French multicentre study	France	***ACS*** Paediatric SSU	Multicentre, prospective observational cohort	Nine paediatic SSUs
4. Levett I, Berry K and Wacogne I. (2006)	Review of a paediatric emergency department observation unit	United Kingdom	***ACS*** Paediatric observation unit	Retrospective observational study looking at the activity of a paediatric observation unit in ED	Tertiary paediatric hospital
5. Willis T, Crowley S and Hutton A. (2011)	Paediatric extended emergency care (PEEC): establishing and evaluating a paediatric short-stay ward: a pilot	Australia	***ACS*** Paediatric SSU	Evaluation of a paediatric extended care unit	Paediatric extended emergency care unit (PEEC) located in a general hospital within the paediatric ED

	study				
6. Woolfenden S, Dalkeith T and Anderson T. (2005)	The first eighteen months of a paediatric ambulatory and community service	Australia	***ACS*** Paediatric ambulatory and community service	Establishment of a community-based service model (multidisciplinary team) to provide better outreach services for children with chronic disease. Partnership with acute hospital-based service, primary health care providers and other community-based services (community outreach, community paediatric outpatient clinics)	Western Zone of Sydney South Area Health Service
7. Williams L, et al. (2008)	Setting up a paediatric RAOU: views of general practice teams	United Kingdom (Wales)	***ACS*** Paediatric RAOU	Development of a RAOU at a general district hospital with no paediatric service	General district hospital
8. Towns S, et al. (2007)	Hospital-based care of young people in Australia	Australia	***ACS*** Adolescent inpatient units	Development of hospital-based care for adolescents	Tertiary paediatric hospitals
9. Ajarmeh S, et al. (2012)	The effect of a multidisciplinary care clinic on the outcomes in pediatric chronic kidney disease	Canada	***DSM/MDC*** Disease-specific clinic (DSC)	Single-center, retrospective cross-sectional study examining the effect of MDC on outcomes	Children's Hospital (only paediatric nephrology centre for the province of British Colombia)
10. Chevignard M, et al. (2010)	A comprehensive model of care for rehabilitation of children with Acquired Brain Injuries (ABI)	France	***DSM/MDC*** Disease-specific program	A comprehensive model of care devoted to children with ABI. The ultimate goal of the program is to promote each child's successful reintegration in school and in the community	Rehabiliation department that is part of a network of care (paediatric trauma centre, secondary hospitals and a rehabilitation department)
11. De Blecourt A, et al. (2008)	Preliminary evaluation of a multidisciplinary pain management program for children and adolescents with chronic musculo-skeletal pain	Netherlands	***DSM/MDC*** DSC	Retrospective cohort study examining a three month inpatient multidisciplinary pain management program	Rehabilitation centre
12. Menon S, et al. (2009)	Effectiveness of a multidisciplinary clinic in	United States of America	***DSM/MDC***	Retrospective audit of children presenting to a general nephrology	Paediatric hospital

	managing children with chronic kidney disease		DSC	clinic and after the establishment of a MDC clinic	
13. Garcia X, et al. (2012)	A novel paradigm for providing improved care to chronic patients in cardiac intensive care unit (ICU)	United States of America	***DSM/MDC*** Multidisciplinary care model	Single-centre, retrospective observational study evaluating the impact of a chronic cardiac care team (CCCT) on hospital course of patients, their families and nursing staff	Cardiac ICU at a tertiary paediatric hospital
14. Bird S, et al. (2012)	Integrated care facilitation model reduces use of hospital resources by patients with pediatric asthma	Australia	**DSM/MDC** Integrated care facilitation model	Prospective study enrolling patients with asthma in a model aimed to promote health and reduce/preventable and avoidable use of acute hospital services	Partnership consortium of tertiary, primary and community health: Area health service: acute sector with three hospitals, five primary care (including nursing and partnership), local government, health service, three GP practices, subacute services
15. Oliva J. (2007)	A new model: outpatient pediatric diabetes improves care, profits and protocols for managing other chronic illnesses	United States of America	***DSM/MDC*** DSC	Descripitive study of a multidisciplinary team involved at looking after patients with diabetes	Tertiary paediatric hospital Endocrinology department
16. Dickens K, Matthews L and Thompson J. (2010)	Parent and service provider's perceptions regarding the delivery of family-centred paediatric rehabilitation services in a children's hospital	Australia	***DSM/MDC*** Family-centred care model	Evaluation of family-centred service (FCS) provisions perceptions amongst parents/caregivers	Tertiary paediatric hospital paediatric rehabilitation setting
17. Thomas C, O'Rourke P and Wainwright C. (2008)	Clinical outcomes of Queensland children with Cystic Fibrosis: a comparison between tertiary centre and outreach services	Australia	***DSM/MDC, Outreach*** Comparison between models of care at tertiary centre care and outreach services	Retrospective study comparing children with CF (Cystic Fibrosis) and the treatment received from tertiary care centre MDC with a CF outreach services	Tertiary paediatric hospital and seven outreach sites (remote and rural hospitals)
18. King G., et al. (2006)	Bringing the Life Needs Model to life:	Canada	***DSM/MDC, Outreach***	Description of use and utility of model of care	Regional children's rehabilitation centre (Thames Valley Children's

	implementing a service delivery model for pediatric rehabilitation		Life Needs Model of Paediatric service delivery		Centre, Southwestern Ontario)
19. Cohen E, et al. (2011)	Integrated complex care model: lessons learned from inter-organisational partnership	Canada	***DSM/MDC, Outreach*** Intergrated complex care model	Discussion paper describing a theoretical model of care	The Hospital for Sick Children, Holland Bloorview Kids Rehabilitation Hospital and Toronto Central Community Care Access Centre
20. Boyd J, et al. (2006)	Comparison of outcome measures for a traditional pediatric faculty service and non-faculty hospitalist services in a community teaching hospital	United States of America	**EPC** Practice types (general paediatricians, blend of generalist and subspecialist)	Comparison of cost and length of stay in two hospitalist groups and one traditional faculty group	Community teaching hospital
21. Harden S, Stathis S and Wagner I. (2005)	Redevelopment of a consultation-liaison service at a tertiary paediatric hospital	Australia	**EPC** Redevelopment of pyschiatric service	Single-centre, redevelopment of a consultation-liaison service	Tertiary paediatric hospital
22. Camden C, et al. (2013)	Development, implementation, and evaluation of the Apollo Model of Pediatric Rehabilitation Service Delivery	Canada	***EPC*** Model of dervice delivery – paediatric rehabilitation	Study looking at development, implementation and evaluation of a rehabilitation service delivery model	Program is one of six rehabilitation programs of the Estrie Rehabilitation Centre located in Quebec. Program provides outpatient services to ~ 1000 families (0 -18 yrs). Children with different diagnoses are treated
23. O'Connor M, et al. (2010)	"Dyading" in the pediatric clinic improves access to care	United States of America	***EPC*** "Dyading" on paediatric outpatient care. In dyading medical assistant (MA) works with provider in exam room vs. sequential care patient interacts with MA then team then MA	Evaluation study of intervention (dyading) on clinic time, patient visit time and provider time	Westside Paediatric/Teen Clinic (WPTC), Denver Colorado
24. Ward-Smith	Development of a	United States	***EPC***	Development of a PACCT to meet	270 bed free-standing paediatric

P, et al. (2007)	pediatric palliative care team	of America	Paediatric Advanced Comfort Care Team (PACCT)	the needs of children with life-limiting illness with the focus on direct patient contact, education and research	hospital, Missouri
25. Cichon M, Fuchs S, Lyons E and Leonard D. (2009)	A state-wide model program to improve emergency department readiness for pediatric care	United States of America	***EPC*** Emergency Medical Services fo Children (EMSC) program	Descriptive paper of steps involved in implementing model	Illinois (population 12.7 million people, 30% of the population aged < 20yrs)
26. Glegg S. (2010)	Knowledge brokering as an intervention in paediatric rehabilitation practice	Canada	***EPC*** Intervention to promote research use in clinical practice	Theoretical basis for knowledge brokering and describe model used by brain injury team	Paediatric Health Care Centre (patient ABI rehabilitation team)
27. Organ K, et al. (2005)	Evaluating the introduction of a paediatric emergency nurse practitioner service	England	***EPC*** Nurse practitioner services	Evaluation of the effectivness of a paediatic emergency nurse practitioner (ENP) service	Single site, audit of a multidisciplinary department of a city hospital that provides emergency care
28. Frizzola M and Miller E. (2014)	Referrals to a new pediatric palliative care team: details of the first 12 months of operation	United States of America	***EPC*** Paediatric palliative care team	Descriptive comparison of patient population in new program	Free-standing children's hospital
29. Sutton D, Stanley P, Babl F and Phillips F. (2008)	Preventing or accelerating emergency care for children with complex health care needs	Australia	**Outreach** ED nurse telephone triage/advice service	Single-centre, prospective study looking at the 24-hour on-call mobile phone service for patients with chronic disease (ACE – Accelerated Care through Emergency)	Teritary paediatric hospital
30. Ng S, Mariguddi S, Coward S and Middleton H. (2014)	Paediatric community home nursing: a model of acute care	United Kingdom	***Outreach*** Community children's nursing outreach team (CCNOT)	Pilot prospective study of a CCNOT service as a model of care	Within a dual-site intergrated care organisation in England
31. Kirsch S, et al. (2014)	Feasibility of using a pediatric call center as	United States of America	***Outreach***	Intervention study assessing the feasibility of a telephone nurse	Free-standing children's hospital affiliated with major universities with

	part of a quality improvement effort to prevent hospital readmission		Paediatric call centre	triage model	both medical and nursing colleges. Tertiary referral centre for paediatric care (0 – 21yrs) for area including Washington, Alaska, Montana, Idaho and Wyoming
32. Beaulieu R and Humphreys J. (2008)	Evaluation of a telephone advice nurse in a nursing faculty managed pediatric community clinic	United States of America	***Outreach*** Telephone advice nurse service	Evaluation of service by parents/caregivers. Quasi experimental separate pre-post sample design study	Paediatric community-based clinic, major west coast urban centre. Administered and managed by university-based school of nursing
33. Martin A, et al. (2007)	Medical homes for children with special health care needs	United States of America	***Outreach*** Medical Home for children with special health care needs	Evaluation of pilot project. Untreated comparison group design	Home base – family practice located in rural county of southeastern state (~ 66,000 residents)
34. Wane J, et al. (2007)	The effectiveness of rural assertive outreach: a prospective cohort study in an English region	United Kingdom	***Outreach*** Assertive Outreach Team (AOT) model	Prospective, cohort study examining a multidisciplinary team which aims to support patients using intensive case management	South Warwickshire (substantial rural and semi-rural areas in a number of small towns and three large settlements)
35. Smith A, et al. (2010)	Clinical services and professional support: a review of mobile telepaediatric services in Queensland	Australia	***Outreach*** Mobile telepaediatric services	Review paper of clinical services and professional support for local health professionals	Queensland, Centre for Online Health (COH) at the Royal Children's Hospital Brisbane
36. Gordon J, et al. (2007)	A tertiary care-primary care partnership model for medically complex and fragile children and youth with special health care needs	United States of America	**Transition** Transition of care (inpatient, outpatient and medical homes)	Evaluation of a special needs program that partners families and primare care physicians to ensure seamless transition from inpatient and outpatient care and assists in providing medical homes	Tertiary care centre paediatric hospital and medical school serving urban and rural patients
37. Lewis S, and Noyes J. (2013)	Effective process or dangerous precipice: qualitative comparative embedded case study with young people with epilepsy and their	United Kingdom	***Transition*** Transition model	Qualitative comparative embedded case study looking at children transitioning to adult epilepsy services	Epilepsy services as two general district hospitals

	parents during transition from children's to adult services				

Table 3a: Summary of key findings for each of the ACS models of care

Ref No.	Effectiveness/ outcomes	Staffing	Enablers	Barriers	Sustainability/ Evaluation
1	✔	✔	✔	✔	✔
2	✔	✔	✔	✖	✖
3	✔	✖	✔	✖	✖
4	✔	✔	✔	✖	✖
5	✔	✔	✖	✔	✖
6	✔	✔	✖	✔	✖
7	✔	✔	✖	✔	✔
8	✔	✔	✔	✖	✖

Table 3b: Summary of key findings for each of the DSM/MDC models of care

Ref No.	Effectiveness/ outcomes	Staffing	Enablers	Barriers	Sustainability/ Evaluation
9	✔	✔	✔	✖	✖
10	✔	✔	✔	✔	✔
11	✔	✔	✖	✖	✖
12	✔	✔	✖	✖	✖
13	✔	✔	✖	✔	✔
14	✔	✔	✔	✖	✖
15	✔	✖	✔	✖	✔
16	✔	✖	✖	✖	✖
17	✔	✔	✔	✖	✖
18	✔	✔	✔	✔	✖
19	✔	✔	✖	✔	✔

Table 3c: Summary of key findings for each of the EPC models of care

Ref No.	Effectiveness/ outcomes	Staffing	Enablers	Barriers	Sustainability/ Evaluation
20	✔	✔	✖	✖	✖
21	✔	✔	✔	✖	✖
22	✔	✔	✔	✔	✔
23	✔	✔	✖	✔	✖
24	✔	✔	✔	✔	✖
25	✔	✔	✔	✔	✔
26	✔	✔	✔	✔	✖
27	✔	✔	✖	✔	✔
28	✔	✔	✖	✖	✖

Table 3d: Summary of key findings for each of the Outreach models of care

Ref No.	Effectiveness/ outcomes	Staffing	Enablers	Barriers	Sustainability/ Evaluation
29	✔	✔	✔	✖	✖
30	✔	✔	✔	✖	✖
31	✔	✔	✔	✔	✖
32	✔	✔	✖	✔	✖
33	✔	✔	✖	✖	✖
34	✔	✔	✖	✖	✖
35	✔	✖	✔	✔	✖

Table 3e: Summary of key findings for each of the Transition models of care

Ref No.	Effectiveness/ outcomes	Staffing	Enablers	Barriers	Sustainability/ Evaluation
36	✔	✔	✔	✔	✖
37	✔	✔	✔	✔	✖

Summary of peer-reviewed literature – Question 1

- A total of 37 papers were identified. This consisted of 10 papers from Australia and 27 from overseas (United Kingdom, United States of America, Canada, France and Netherlands)
- Nine papers were on embedded primary care models, eight acute care services, eight disease specific models/multidisciplinary care models, seven on outreach services, two on transition models of care and three were classified as combined outreach and disease specific models of care
- Papers reviewed mainly discussed the effectiveness and outcomes of the model of care, most mentioned staffing requirements but with minimal detail
- Only 10 documents reported outcome of evaluation and nine discussed long term sustainability of the model of care
- Tables 3a–3e describe whether or not the papers reviewed provided information relevant to the five questions in this rapid review.

Question 2: What is known about the effectiveness of the identified models and systems (as determined by improved health outcomes or intermediate outcome measures)?

Table 4: Effectiveness of models of care

Ref No.	Paper	Effectiveness of identified ACS models
1	Blair M, et al. (2008)	Provided a user-centred service which demonstrated enhanced satisfaction for both patients and families. This model of care was preferred by both staff and parents over the traditional A&E services, however this was limited to English-speaking patients only
2	Hopper S, et al. (2010)	SSU is an efficient, popular and viable alternative for paediatrics services in an adult service that has no specialist paediatric units
3	Najaf-Zadeh A, et al. (2011)	SSU provides easily accessible facilities for diagnostic and early treatment for a wide-range of sick children. It also provides rapid access to relevant investigations. This model of care could be beneficial to children with complex and undifferentiated medical conditions
4	Levett I, Berry K and Wacogne I. (2006)	Observational units enabled children with a variety of conditions to be managed in ED rather than admitted to paediatric wards (decreasing the number of ward admissions)
5	Willis R, Crowley S and Hutton A. (2011)	PEEC allowed patients to have more focused therapy after presenting to the Paediatric Emergency Department (PED). However it was not financially viable and was an inefficient use of human resources
6	Woolfenden S, Dalkeith T and Anderson T. (2005)	Paediatric ambulatory and community service model has decreased the overall length of stay for patients. However, it has not changed the admission or readmission rates for children with asthma. The model overall provided greater access for families to community health services through outreach and increased referrals and parental satisfaction
7	Williams L, et al. (2008)	RAOU was a useful additional service for GPs which provided specialist opinion locally with facilities to observe children and access to rapid diagnostic testing
8	Towns S, et al. (2007)	Adolescent inpatient units provide developmentally appropriate health care with routine psychosocial screening and support for young people. When they are linked to broader adolescent medicine programs they help drive education, training and research into adolescent health. It also facilitated links to peer support groups or disease specific programs for young people

Ref No.	Paper	Effectiveness of identified DSM/MDC models
9	Ajarmeh S, et al. (2012)	MDC is required to optimise chronic kidney disease management. Improved health outcomes for patients included a reduced LOS and reduced rate of disease progression
10	Chevignard M, et al. (2010)	The program provides adequate personalised plans for ongoing rehabilitation and school adaptations for the children with ABI discharged from the hospital
11	De Blecourt A, et al. (2008)	MDC pain management program for children and adolescents with chronic musculoskeletal pain was shown to be effective e.g. improved levels of motor function, activities of daily living, significant decrease in pain scores and improved understanding of the chronic pain process
12	Menon S, et al. (2009)	MDC for chronic disease provides better outcomes for patients than a general nephrology clinic. Children had fewer unplanned hospitalisations and spent fewer days in hospital compared with those seen in the general nephrology clinic
13	Garcia X, et al. (2012)	CCCT program improves the care provided to patients of the cardiac intensive care unit. It bridges the communication gap betweeen CICU staff and families. The CCCT enhances care related to non-cardiac issues and end-of-life decisions
14	Bird S, et al. (2012)	The reduction in the use of hospital services was attributed to the model that enhanced carer/self management and access to community health service. Model demonstrated improved patient health outcomes and quality of life. Repeat visits with a care facilitator optimised quality of health care and ensured appropriate referral to community health services
15	Oliva J. (2007)	This was an efficient patient-focused service model, providing clinical, educational and support services necessary to teach and empower patients and families to be more involved in, and responsible for, their health
16	Dickens K, Matthews L and Thompson J. (2010)	Parents and caregivers of children who accessed therapies and services from the rehabilitation department reported positive perceptions of the FCS provided. Families were seen as equal partners in the rehabilitation process
17	Thomas C, O'Rourke P and Wainwright C. (2008)	Outreach services for CF were effective in the delivery of specialised multidisciplinary care for children and adolescents in rural and regional areas
18	King G, et al. (2006)	The model redefined core services for rehabilitation, and now encompasses more than just occupational, speech and physical therapy. Broadened to include recreation therapy, psychosocial services (psychology and social work) and service coordination. The model has been useful in raising community awareness about needs and services for children, supports a research agenda and assists in community relation activities (e.g. fundraising)
19	Cohen E, et al. (2011)	This is a promising model to effectively intergrate complex care delivery across organisational structures, service sectors and regional boundaries. This model has the potential for further development and replication to facilitate delivery of care as close to home as possible

Ref No.	Paper	Effectiveness of identified EPC models
20	Boyd J, et al. (2006)	Traditional faculty model (i.e. general paediatrician run service) is more efficient in terms of total direct cost and length of stay in comparison to the two hospitalists groups
21	Harden S, Stathis S and Wagner I. (2005)	Restructuring of mental health service allowed for more focused and coordinated team, with clear case management procedures (e.g. referral procedures and intake structures)
22	Camden C, et al. (2013)	This model provided the structure for organising rehabilitation programs, but its service delivery components need to be constantly updated to stay in-line with the evidence
23	O'Connor M, et al. (2010)	Study showed a significant decrease in patient visit times, which allowed the clinic to increase the number of patients seen
24	Ward-Smith P, et al. (2007)	Children using the PACCT services had better pain control, better coordinated outpatient visits, and spent fewer days in the hospital
25	Cichon M, Fuchs S, Lyons E and Leonard D. (2009)	Key inititative has been the development of three-tiered paediatric ED facility recognition process for general hospitals. Needs assessment outlined the status of paediatric emergency care within Illinois. At the time of publication 110/197 hospitals with EDs in Illinois participated in the paediatric facility recognition system
26	Glegg S, et al. (2010)	Initiative demonstrated a role for clinicians as knowledge brokers, with opportunities to take on leadership roles, to develop facilitation skills and to access and use evidence with their team
27	Organ K. et al. (2005)	ENPs care of patients with minor injuries and illnesses was shown to be clinically safe, effective and of a high standard
28	Frizzola M and Miller E. (2014)	The Paediatric Palliative Care (PPC) model was accepted by health care professionals. Health care professionals were ready, willing and eager to be involved in palliative care for their patients. The service experienced a higher number of referrals in the first year of operation
Ref No.	**Paper**	**Effectiveness of identified outreach models**
29	Sutton D, Stanley P, Babl F and Phillips F. (2008)	The Accelerated Care through Emergency (ACE) program enhances the capacity of families to manage their children's health condition in the community (virtual medical home). The program had a moderate effect on the intervention (improvement of quality of care rather than a quantitative change in ED attendances)
30	Ng S, Mariguddi S, Coward S and Middleton H. (2014)	CCNOT model of care reduced admissions to A&E, non-elective admissions, readmissions and improved patient and carer satisfaction

31	Kirsch S, et al. (2014)	Prevented readmission of patients, anecdotal evidence of family satisfaction (grateful for opportunity to ask questions not covered in discharge of patient). Telephone hotline was used by community paediatricians as well as the public
32	Beaulieu R and Humphreys J. (2008)	40% of parents/caregivers reported that they would have sought emergency care if they had not been able to speak with the advice nurse. Participants reported a higher degree of satisfaction with the NMHC and with the advice nurse. The model provided continuity of care with and a more balanced clinic flow as the advice nurse was able to triage patients appropriately
33	Martin A, et al. (2007)	Care coordination team meetings assisted with developing a comprehensive care plan for each child Developed relationships with school districts, providing continuing education programs for teachers, school nurses and principals, enhancing independence of children, and improving care coordination and quality of care Developed emergency management plans/care plan cards containing important health information on the child, thereby supporting expedited care during unanticipated emergency presentation Decreaseed emergency room presentations. The Quality of Life (QOL) indicators demonstrated reduced family stress, reduced work or school absences, and improved self-perceived health
34	Wane J, et al. (2007)	Significant reduction in admission and occupied bed days between pre- and post-implementation of the AOT program
35	Smith A, et al. (2010)	Model provided a streamlined method of delivering specialist health services to children and families living in rural and remote areas. Seven mobile services have been established and education sessions have been delivered to staff
Ref No.	**Paper**	**Effectiveness of identified transition models**
36	Gordon J, et al. (2007)	The partnership model improved health care and demonstrated reduced cost, with modest institutional support. The four key interventions were: (1) partnering with families and primary care physician, (2) developing familiarity with the child's condition, (3) close involvement during hospitalisation, (4) proactive outpatient care
37	Lewis S and Noyes J (2013)	A joint epilepsy clinic model was more likely to facilitate positive engagement with adult healthcare professionals and retention of self-care information by patients

Summary of peer-reviewed literature – Question 2

- Seven studies reported improved health outcomes for patients. There were four studies that demonstrated a decrease in LOS. In a paediatric ambulatory care unit evaluation study[6] there was a decrease in LOS from 2.19 to 1.72 days. A MDC clinic for chronic kidney disease[9] showed a reduced LOS from 3.00 to 0.2 days. In a traditional faculty model compared with a hospitalist group model[20] there was a reduction in LOS from 3.1 to 2.6 days, and for a rural outreach service[34] there was a decrease of LOS from 88.4 days to 44.5 days
- Acute care services[1,2,4,5] demonstrated that children could be managed in ED rather than being admitted. These acute services were becoming an acceptable alternative to inpatient admission[1]
- Eight studies showed a decrease usage of healthcare resources and services. Studies showed a decrease in hospital admissions,[4,14,30,34] fewer days spent in hospital,[12,24] reduced readmission,[31] decrease in emergency room presentations[33]
- Models of care showed increased satisfaction with services. Seven papers demonstrated increased satisfaction with services among patients and their families,[1,6,16,30,31,32,33] while one paper reported increased satisfaction with service delivery among staff members[1]
- Most papers (n=15) discussed the efficiency of the model/service. Examples of efficiency include earlier diagnosis and treatment,[3,7,8] decreased time of patient visits,[23] and refinement of service pathways.[17,18] Only three studies discussed cost,[20,36] with one showing that the model evaluated was not financially viable.[5]

Question 3: What is known about the resources, staffing and other requirements, enablers and barriers for successful implementation of the identified models and systems?

Table 5: Resources needs, enablers and barriers for implementation of identified models of care

Ref No.	Paper	Findings of identified ACS models
1	Blair M, et al. (2008)	Staffing: Administrator, full-time consultant, middle-grade doctor, two specialist paediatric nurses (per shift). Unit hours were 9am–10pm, seven days a week. Unit located close to inpatient wards and outpatients department Enablers: Family-friendly environment (nursery area at reception, brightly decorated corridor, dedicated assessment and treatment rooms (four beds and cots) nurse station directly facing rooms. Major treatment room and observation area for ongoing assessment Barriers: PACU can be overused, some patients could be seen in outpatient setting
2	Hopper S, et al. (2010)	Staffing: Three paediatricians (a total of 1.0 FTE) with an interest/subspeciality in emergency medicine, complemented by existing 9.0 FTE emergency physicians and paediatric nurse educator Enablers: Paediatric section was designed to cater for needs of children, physical layout was quarantined from adult section. Eight beds were assigned for paediatric patients, with the ability to expand to accommodate up to 12 patients. Formal linksto two other paediatric units which had full paediatric services if transfer was required
3	Najaf-Zadeh A, et al. (2011)	Enablers: Unit in a designated area, adjacent/within ED but functions as a separate unit. Provides intensive assessment, observation or therapy. Unit is open 24-hours, Seven days a week Able to assess and manage different groups of paediatric patients with a variety of conditions

4	Levett I, Berry K and Wacogne I. (2006)	Staffing: One nurse, one senior house officer, one consultant or one middle grade officer Enablers: Incorporated into the ED open 24-hours, seven days a week. Six beds/cots, requires cooperation with a general paediatric department
5	Willis T, Crowley S and Hutton A. (2011)	Staffing: Two nurses allocated to the PECC unit each day, average of 1.92 children per day admitted to PECC Barriers: Not financially viable and did not reduce waiting time in the PED Lack of communication and handover to PED staff
6	Woolfenden S, Dalkeith T and Anderson T. (2005)	Staffing: MD team is made up of a paediatrician, registrar, community paediatric clinical nurse consultant, community paediatric registered nurses, speech pathologist, occupational therapist, social worker and adminstrative staff Barriers: Time consuming consultation amongst stakeholders, lack of after-hours service, lack of short-stay facility in this model. A 3-4 month waiting time to access the service, which is not ideal
7	Williams L, et al. (2008)	Staffing: Two experienced paediatric nurses, one paediatric registrar and a paediatrician Barriers: Limited hours of operation of the service (9am-5pm), Monday to Friday (except Bank Holidays). Last referral to service is at 4pm No access to emergency department within hospital and no paediatric intensive care unit. There is an anaesthetic team to assist if required (e.g. airway stabilisation) Anyone was able to refer, however, there was lack of information about the unit and criteria for admission to unit Some GPs had concerns regarding patient safety as unit didn't have all the facilities required

8	Towns S, et al. (2007)	Staffing: Allied health team members including teachers, mental health workers, occupational therapist, social workers, art and music therapist Enablers: Supportive ward environment offers privacy, respects confidentiality and fosters development of young peoples skill to self-manage their health care
Ref No.	**Paper**	**Findings of identified DSM/MDC models**
9	Ajarmeh S, et al. (2012)	Staffing: Two paediatric nephrologists, specialised renal nurse, dietician, pharmacist, social worker, clinic data manager Enablers: Prior to clinic, patient care was provided in separate general nephrology clinics by individual nephrologists Dedicated additional funding was key to establishing clinic which allowed for new allied health positions. Province provided infrastructure with centralised disease registry
10	Chevignard M, et al. (2010)	Staffing: 4.0 FTE physical medicine and rehabilitation doctor, 0.5 FTE paediatrician, 0.5 FTE child psychiatrist, 5.6 FTE psychologist, 3.0 FTE team coordinator, 4.6 FTE physical therapist, 4.6 FTE occupational therapist, 3.55 FTE speech and language therapist, 1.5 FTE psychomotrician, 3.0 FTE social workers, 5.1 FTE secretaries, 6.6 FTE specialist educators, 7.0 FTE nurses, 19.2 FTE nurses aid, 5.0 FTE domestic staff Enablers: All children with ABI are eligible to benefit and the whole system is publicly funded Barriers: The system relies on referrals from acute care hospitals.The referral process is only systematic for severe head injuries; children with moderate injuries would be lost to follow up as they are discharged directly to home
11	De Blecourt A, et al (2008)	Staffing: One physiatrist, one physiotherapist, one occupational therapist, one psychologist and one social worker

12	Menon S, et al. (2009)	Staffing: MDC: paediatric nephrologist, nurse clinician, dietician, social work and psychologist
13	Garcia X, et al. (2012)	Staffing: One physician, one clinical nurse specialist, one registered nurse facilitator, one social worker, one nutritionist, one physical therapist and one occupational therapist Barriers: Requires collaboration between the ICU team and the CCCT as care often overlaps. Lack of knowledge about the CCCT role
14	Bird S, et al. (2012)	Staffing: Specialist practitioners, nurses and care facilitator Enablers: Victorian State Government invested $150m for projects aimed at reducing demand on hospital services and improving patient health through new approaches to patient management. Further funding ($53m) was provided to enable successful implementation of the models of care
15	Oliva J. (2007)	Staffing: Team of specialists included: endocrinologist, advanced practice registered nurses, registered nurses, nurse/nutrition educators, registered dietiticians, psychological suppport specialist, medical assistants Enablers: A clinical database was developed to provide staff with immediate access to a variety of patient outcomes. Ability to analyse trends in outcomes and service utility by using collected data
17	Thomas C, O'Rourke P and Wainwright C. (2008)	Staffing: Outreach clinics occur twice a year except at one site which has one clinic. Two telehealth clinics per year Outreach model: one respiratory physician, one physiotherapist, one dietician, one nurse and also managed by their local paediatrician or GP Telehealth model: specialist staff available in tertiary metropolitan hospital Enablers: Active education program for healthcare professionals by the outreach service

18	King G, et al. (2006)	Staffing: Approximately 170 service providers and 70 support staff members Enablers: Useful organisational tool for refining services, developing new clinical services and programs, model helps staff see opportunites in expanding services Barriers: People's readiness to adopt the model, ownership and understanding of the model. Clinicians to champion the model Stretching limited resources to meet multiple needs. Financial and human resourcing restraints
19	Cohen E, et al. (2011)	Staffing: Clinical key worker (paediatric nurse) – prominent focus on clinical needs. System key worker – concentrates primarily on system needs e.g. community resources, responsible for meeting the childs' health needs and working together with family member Barriers: Lack of information management for the key worker team. Shortage of paediatric home care providers and outdated coverage by insurance cariers. Requirement of more creative strategies to engage with patients and their families
Ref No.	**Paper**	**Findings of identified EPC models**
20	Boyd J, et al. (2006)	Staffing: Hospitalist model: two paeditricians on at any one time (pool of four paediatricians and five paediatricians) Traditional facility model: eight paediatricians – one half-day continuity clinic per week Each model also had one or more attending physicians, residents, interns
21	Harden S, Stathis S and Wagner I. (2005)	Staffing: 0.2 FTE project officer for six months, 0.5 FTE psychiatrist Enablers: Staff were re-allocated to better meet case load demands Clearer defintions regarding mental health problems were identified (e.g. those with severe or life-threatening illness)

22	Camden C, et al. (2013)	Staffing: Working committee – head of the program, three clinical coordinators, one research coordinator, one organisational development counselor, five clinician representatives (physiotherapist, occupational therapist, speech and language therapist, special educator and social worker) Enablers: Involving stakeholders (patient, family and community partners) is useful to facilitate success of project Barriers: High turnover of project leaders and need to standardised practices across professionals within the same discipline. Challenges to implementation were related mainly to integration within the overall model Difficulties with coordination among clinicians. Lack of proper database system to plan services for a particular child. Difficulties with time needed to develop agreement with community partners
23	O'Connor M, et al. (2010)	Staffing: 14 providers who worked a total of 4.9 FTE MDs, and 3.4 FTE PAs/NPs Barriers: Model requires same number of MAs as providers (one-to-one model), as unable to share MAs (unable to "dyad") Providers and MAs uncomfortable being in the same room during the visit, some providers felt that MA's presence may influence patients when discussing sensitive topics
24	Ward-Smith P, et al. (2007)	Staffing: Physicians, nurses, social workers, chaplain, child-life specialist, child psychologist, intergrative medicine, pain management support, education coordinators and researchers Enablers: PACCT service was supported by the hospital administration Barriers: Success of model was dependent on physician referral to the PACCT

25	Cichon M, Fuchs S, Lyons E and Leonard D. (2009)	Staffing: EMSC manager, quality improvement project coordinator and data administrator Enablers: Program is supported by grant funding from the Health Resources and Services Administration and the Assistant Secretary for Prepardness and Response. Emergency medical services for children (EMSC) manager is funded by Illinois Department of Public Health. Quality Improvement project coordinator and data administrator position is funded through a three year grant. Task force members attend meetings voluntarily Illinois Department of Public Health in colloboration with Loyola University Medical Centre and with Federal EMSC funding established the program Barriers: Not all hospitals participated in the program, reasons for not participating included lack of emergency physician support, lack of hospital administration support, lack of perceived need, lack of availabilty of paediatric continuing medical education units, difficulties tracking paediatrician education hours, lack of paediatric focus in the quality improvement processes
26	Glegg S. (2010)	Staffing: Evidence centre coordinator, clinical librarian and clinical technologist Enablers: Physical space – meeting area, resource area and professional library Sunny Hill Foundation for Children – prepartion and implementation of the knowledge brokering sessions Barriers: Lack of knowledge broker community, lack of mentoring and support. Lack of online training/learning module. Need for additional funding for dedicated time to perform this role. Turnover of team members and team leader. Difficulties in retaining motivation of colleagues
27	Organ K, et al. (2005)	Staffing: 3.0 ENP staff, services operated between 11am and 9pm. One of the ENP nurses would be on duty at these times seven days a week Barriers: ENPS were also required to work as flexible members of the ED nursing establishment, provide additional support to junior staff in the resuscitation room

28	Frizzola M and Miller E. (2014)	Staffing: Full-time medical director, nurse practittioner, social worker, additonal part-time physician staffing. Team provides coverage during weekdays and phone coverage after hours (nights and weekends). Team also conducts home visits for home hospice patients Enablers: Preparation and education training began prior to program launch. Well-designed program by senior hospital leadership. Clinical, administrative and financial support from the organisation
Ref No.	**Paper**	**Findings of identified Outreach models**
29	Sutton D, Stanley P, Babl F and Phillips F. (2008)	Staffing: Paedatric ED nurses with extensive experience in triage and resuscitation – room experience and be Paediatric Life Support Certified Enablers: Funded by the Victorian Health Government pilot grant, ongoing funding through the Victorian Government and internal hospital funding Multiple methods to access database through computers and PDA 24-hour phone access, development of electronic portable patient care plans, care coordination with complex care teams and a small group of experienced nurses Program is highly regarded by subspecialty medical teams and embraced by ED medical staff
30	Ng S, Mariguddi S, Coward S and Middleton H. (2014)	Staffing: 7.2 WTE paediatric trained nurses, 0.5 WTE administration and clerical support staff. Regular supervision and mentorship from consultant paediatrician. Collaborations with pharmacy, IT and specialist services Enablers: Service ran from 7am–10pm, seven days a week. Service led by paediatric matron with regular supervision and mentorship of a lead CCNOT consultant paediatrician. Referrals taken from A&E, short-stay paediatric admission unit, inpatient ward, tertiary hospital (covers population ~ 300,000)

31	Kirsch S, et al. (2014)	Staffing: Discharge follow-up calls were made by the children's consulting nurse team – group of nurses trained in telenursing who staff a 24-hour nurse advice line – service used by community paediatricans and public Enablers: Time commitment involved was minimal, potentially cost-effective Barriers: Many readmissions took place before the 24–48-hour time frame for follow-up phone call. Intervention aimed at preventing early readmissions may be more effective but logistically more difficult
32	Beaulieu R and Humphreys J. (2008)	Staffing: Several nurse practitioners and a part-time paediatrician Barriers: Limitation with regards to non-english speaking families
33	Martin A, et al. (2007)	Staffing: Care coordinator (licensed social worker), two physicians, mother of child with special health care needs
34	Wane J, et al. (2007)	Staffing: Staff from several disciplines including nursing, psychology, occupational therapy, social work and psychiatry, operates with the abiliy to provide 24-hour care on a planned basis when needed
35	Smith A, et al. (2010)	Enablers: Single point of contact with COH for coordination of service, all support provided immediately from time of referral to actual response by specialist. All systems were managed remotely by coordinators at COH. Child friendly design of the equipment Barriers: Acceptance and utilisation of service, sites that didn't have a pre-defined clinical need had very limited uptake of service

Ref No.	Paper	Findings of identified Transition models
36	Gordon J, et al. (2007)	Staffing: One Special needs program (SNP) paediatric nurse, SNP physician and primary care physician and other specialist Enablers: Good communication amongst the partners, detailed clinical summaries of patient care and history which reduced time spent coordinating care of these medically complex patients Barriers: Lack of formal criteria for enrolment in SNP program
37	Lewis S and Noyes J (2013)	Staffing: Paediatricians, neurologist and epilepsy nurse Enablers: Young people were more actively involved in discussions with healthcare professionals. Continuity of care, psychological health care needs provided, support and advice for parents, providing accurate advice in lay language Barriers: Parents found it difficult to ask questions, frequently unable to seek information while child present Parent felt that health care professionals in handover clinic lacked facilitative skills when communicating with their children

Summary of peer-reviewed literature – Question 3

- A total of 33 papers described staffing requirements for the model of care, however staffing levels were not always specified (e.g. full-time equivalent (FTE), part-time equivalent, specific number of staff). Only eight papers specified FTE[1,2,10,21,23,28,30,32]
- United States of America was noted that the models of care/services were limited to patients who were English speakers only[1, 32]
- Of the studies reviewed, 22 discussed enablers, including having designated paediatric areas in an ED setting[2,3], family friendly environments[1,8], establishment of paediatric specific services[9,18,30,35], funding[10,14,25,29] and administrative/hospital support.[24,25]

A total of 19 studies discussed barriers to model implementation. The main barriers identified were: lack of communication[5, 13,19,32,37] (e.g. patients found it difficult to ask questions during transition, lack of staff who spoke a language other than English, lack of collaboration between teams and between staff), lack of staffing[22,23,25,27], inadequate after-hours coverage [6,7], lack of funding for services[5,18] and issues with unclear referral pathways.[10,24]

Question 4: What are the core elements of the models and systems identified i.e. what elements are common across different models and systems?

Table 6: Core element of models and systems

Models	Core element(s)	Relevant papers
Acute Care Services (ACS)	• Quarantined space for paediatric patients, an area separate from adult patients • Designated beds for paediatric patients, some units had the option to expand if necessary (i.e. have more beds) • Family friendly environment/waiting room • Increased satisfaction among patients and families with the service • Early treatment and diagnostic services.	1, 2, 3,4, 5, 6, 7, 8
Disease Specific Model/ Multidisciplinary Clinics (DSM/MDC)	• Integration of specialists with other health professionals, such as allied health (social workers, physiotherapy, occupational therapy, case coordinators, and psychologist) and researchers • Using organisational tools for defining and refining services • Flexibility to develop new clinical services and programs • Working for improved health outcomes for patients.	9, 10, 11, 12, 13, 14,15, 16, 17,18, 19
Embedded Primary Care (EPC)	• These models were designed to be more efficient e.g. improved coordination of patient visits, more appropriate use of resources, provide a higher standard of care through the redesign of the service.	20,21,22, 23, 24,25, 26, 27, 28
Outreach	• Improved family satisfaction with service • Connectedness of service (organisational, primary services providers) • Telehealth designed to improve the efficiencies of healthcare delivery, assist families in remote/rural locations by providing healthcare close to home.	29, 30, 31, 32, 33,34,35
Transition	• Guided process, facilitated transition to adult health services through use of a coordinator.	36, 37

Summary of peer-reviewed literature – Question 4

- Eight papers examined acute care services. These models were patient and family-centred, taking into account the psychosocial context and providing designated spaces for the assessment and treatment of paediatric patients
- Eleven papers described disease specific models, including multidisciplinary clinics, and the use of care coordinators. Multidisciplinary care teams included: general paediatricians, paediatric specialists, paediatric nurses, paediatric allied health professionals such as social workers and psychologists
- Nine papers described primary care models. These models aimed to implement standardised protocols and best practice guidelines to support care, while at the same time enabling flexibility and innovation. Three of the papers embedded routine data collection to support evaluation and measurement of outcomes [22,25,27]
- Seven papers described outreach models. The models provided access to quality services in rural, remote and disadvantaged areas through the use of outreach clinics and telehealth. These models relied on connectedness amongst tertiary, secondary, primary care and community care sectors
- Two papers described models of transition from paediatrics to adult care. These models examined the continuity of care across the lifespan for children living with chronic diseases and moving into adulthood. The Service models provided regular planned care to support medical stability, thereby avoiding unnecessary ED admissions for unexpected acute problems. None of these models had been evaluated.

Question 5: What is known about the sustainability of the models and systems that have been implemented in terms of (i) sustained outcomes (where evaluated), and (ii) maintained integrity over time?

Table 7: Sustainability and evaluation of models and systems

Ref No.	Paper	Findings
1	Blair M, et al. (2008)	Evaluation: PACU has been running for four years, evaluation was on staff and family satisfaction of the unit compared to standard A&E services
5	Willis T, Crowley S and Hutton A. (2011)	Evaluation: This model of care was not sustainable, the service was not financially viable
7	Williams L, et al. (2008)	Sustainability: Risk of closure of the unit due to other acute services being moved to other teaching hospitals
10	Chevignard M, et al. (2010)	Sustainabilty Program has been running for 22 years (established in 1986). The department has been able to deal with new admissions and follow-up, no restrictions on intake of patients with more severe ABI, criteria for patients has not changed during the time. Teams have been reinforced as needed e.g. assessment, academic and vocational guidance unit established when new needs were identified. However, the unit would not be able to deal with referrals from emergency rooms of all children with moderate/mild ABI
13	Garcia X, et al. (2012)	Evaluation: One year after implentation of the model 85% of nurse indicated improved understanding of patient problems, 57% reported improved working relationship with families, and 87% reported improved team communication
15	Oliva J. (2007)	Sustainability: Over a five-year period there was an increase in patient volume and improved health outcomes for patients
19	Cohen E, et al. (2011)	Sustainability: Facilitated by aligning with policy priorties and integration at the point of care
22	Camden C, et al. (2013)	Evaluation: Clincians felt there was improved service accessibility but worried about the possibility of not being able to tailor services according to childrens needs

25	Cichon M, Fuchs S, Lyons E and Leonard D. (2009)	Sustainability: Since implementation of the program, national objectives have been developed including US Department of Health and Human services Healthy People 2010 objectives 1-14b. Every three years hospitals undergo renewal of their status to be astand by ED for paediatric. Sixty-two Emergency Medical Service hospitals are now part of the statewide disaster prepardness effort also covering paediatric emergencies
27	Organ K, et al. (2005)	Sustainability: Formal funding provided, five ENPs employed (part-time or full-time basis), service now provided seven days a week between 11am and 11pm. Clincial audit and education are undertaken on a continual cycle so that the service continues to improve

Summary of peer-reviewed literature – Question 5

- Ten out of 33 studies described evaluation or sustainability. Only four studies provided information on evaluation of the model of care. Two of the studies did not mention the follow-up period,[5,22] while one study was evaluated after a year of the model being implemented and reported improvement in the continuity of care within the service,[13] the other study was evaluated after four years and reported staff and family satisfaction[1]
- Seven studies discussed sustainability of the model or service. Studies mentioned that they were still running[1,10,15,25,27] but none of the studies discussed having been evaluated or how they were sustainable. Study by Organ et al.[27] reported that formal funding within existing nursing budget, although they didn't not include the amount of funding or period covered by the funding
- We noted that if evaluations were conducted it was mainly for patient/family satisfaction and short-term health outcomes, long-term outcomes were not routinely evaluated
- Many studies reported planning to conduct an evaluation based on preliminary study findings but none had published their evaluation results.

6 Results: Grey literature

Question 1: What models of care and systems of connectedness have been implemented in health systems, both in Australia and other developed countries, for the delivery of hospital-based paediatric health services?

Table 8: Models of care identified in the grey literature

Ref No., author, link, access date	Title	Country	Model of care description		
			Model type	Model details	Model setting
38. www.wch.sa.gov.au/services/az/divisions/paedm/shortstay/index.html [cited: April 2015]	Short-stay ward Women and Children's Health Network, Division of Paediatric Medicine	Australia	***ACS*** Short-stay ward	Ward is attached to and run by a paediatric ED (16 bed unit) Admissions for observation before admission to a ward Accessible separately to ED	One public hospital in SA
39. http://humanservicesdirectory.vic.gov.au/SiteServiceDetails.aspx?SiteID=27932#Service161195 [cited: April 2015]	Sandringham Hospital Alfred Health	Australia	***ACS*** SSU	A community hospital, there is no dedicated paediatric ward – paediatric patients are admitted to the SSU in the ED	One public hospital in VIC

40. Lennon R. www.ecinsw.com.au/sites/default/files/field/file/RNSH%20Paeds%20SSUPER%20REPORT%20%20FINAL.pdf [cited: April 2015]	Report on the SSU paediatric emergency room project at the Royal North Shore Hospital Emergency Department (RNSH) October 2011-November 2012	Australia	***ACS*** SSU	SSU in a paediatric Emergency Room (SSUPER) in a general tertiary hospital	Single adult hospital in NSW
41. Bhatti T, Sibley H, Dowie JA. http://asph.mobi/Guidelines_Paediatrics/PAU.pdf [cited: April 2015]	PAU Ashford and St Peter's Hospitals NHF Foundation Trust	United Kingdom	***ACS*** PAU	The PAUis situated in the "Ash Ward". The ward has 23 in-patient beds, including two close observation beds, admitting children from 0-17 years old with a wide-range of medical, surgical and psychological conditions	Hospital based – Ashford and St Peter's Hospital

42. www.rcpch.ac.uk/improving-child-health/better-nhs-children/service-standards-and-planning/general-paediatrics/faci-4 www.ldh.nhs.uk/our-services/emergency-department/ www.ldh.nhs.uk/our-services/paediatrics-childrens-services/ [cited April: 2015	Facing the future together for child health: whole systems	United Kingdom	***ACS*** PAU	Full range of acute paediatric services with dedicated facilities in a child and parent-friendly environment	Hospital-based – Lutton and Dunstable Hospital
43. www.bhs.org.au/node/158 [cited April: 2015]	Ballarat Hospital Services, Paediatric and Adolescent Unit	Australia	***ACS, MDC*** PAU in a general hospital	Unit which offers specialist care for children and adolescents up to 18 years of age	Single hospital, Ballarat Base Hospital, VIC (rural centre)
44. www.fsh.health.wa.gov.au/Our-services/Service-Directory/Paediatrics [cited May: 2015]	Fiona Stanley Hospital Paediatric Ward	Australia	***ACS, MDC*** Paediatric unit	Medium high-risk (level four) service providing care for planned and unplanned presentations of children and adolescents up to 16 years of age	Single public Hospital in WA

45. Piper S. www.tourhosts.com.au/archive/physiciansweek/pdf/Presentations/PIPER.pdf [cited: April 2015]	Paediatric ambulatory care: the way of the future. Wyong Paediatric Ambulatory Care. Northern Sydney Central Coast NSW Health. 2009	Australia	***ACS, Outreach*** PACU	General hospital with no paediatric ward (high paediatric presentations ~ 12,000 per year)	Single public hospital in NSW
46. www.health.vic.gov.au/subacute/vic_paed_rehab_service_model.pdf Supplement: www.health.vic.gov.au/vprs/ [cited: April 2015]	Victorian Paediatric Rehabilitation Service model of care Victorian Government (Year of publication not provided)	Australia	***MDC***	Combined and coordinated care that includes social and medical aspects, this is based on the child's function rather than disease specific. Links with primary care, community health, school sector	State-wide model of care for paediatric rehabilitation in VIC
47. www.kidsfamilies.health.nsw.gov.au/current-work/paediatric-healthcare/childrens-healthcare-network-%28chn%29/ [cited: June 2015]	NSW Kids and Families Children's Healthcare Network (CHN)	Australia	***MDC, Outreach***	Integration of three children's health networks	State-wide children's health network in NSW

48. www.caresearch.com.au/caresearch/tabid/3339/Default.aspx [cited: June 2015]	NSW Paediatric Palliative Care Programme	Australia	***MDC, Outreach*** NSW Paediatric Palliative Care Programme	Networks the three Children's Hospitals across the state	State-wide palliative care service in NSW
49. Goss P, Paterson M and Renalson J. http://ruralhealth.org.au/10thNRHC/10thnrhc.ruralhealth.org.au/general/index51c3.html [cited: May 2015]	Holistic paediatric diabetes care – evaluation of a new rural model. 10th National Rural Health Conference, Cairns, 2009	Australia	***MDC, Outreach***	Multidisciplinary clinic for children (<20yo) with diabetes Multidisciplinary case meetings Paediatric endocrinologist or Tertiary Diabetes team consulted by phone or email	Single rural public hospital in VIC
50. http://health.nt.gov.au/Specialist_Outreach_NT/index.aspx [cited: April 2015]	Specialist outreach NT. Department of Health, Northern Territory Government	Australia	***Outreach***	Coordinated specialist outreach provided from a small number of program areas and private providers	State-wide coordination of specialist outreach services in NT
51. www.kaleidoscope.org.au/site/belmont) [cited: April 2015]	Belmont Hospital Paediatric Clinics	Australia	***Outreach***	A regional hospital where there is no specific paediatric services. Staff from a tertiary children's hospital holds general paediatric clinic and a child and familty health nursing clinic, five days per week onsite	Single public hospital in NSW

52. www.nswrdn.com.au/site/outreach-programs) [cited: April 2015]	NSW Rural Doctors Network Outreach Program	Australia	***Outreach***	Supports regional, remote and Aboriginal communities to access a wide-range of health services (medical, allied health and nurse)	State-wide outreach service in NSW and ACT
53. www.uq.edu.au/coh/telepaediatrics [cited: April 2015]	Queensland Telepaediatric Service, The University of Queensland	Australia	***Outreach***	Telepaediatric service run from a tertiary paediatric hospital through communication by email, telephone, teleconferencing, videoconferencing	State-wide telehealth service in QLD
54. Ho J, Bridgett M. www.ausimplementationconference.net.au/presentations/2014/81.pdf [conference presentation, cited: April 2015] Policy: www.schn.health.nsw.gov.au/_policies/pdf/2014-9015.pdf	Trapeze: making the leap with ease. Australian Implementation Conference, September 2014	Australia	***Transition***	Team of health care specialists to assist in the coordination of services in preparation for transition from paediatric to adult healthcare for children aged 14-25 years with chronic conditions from two tertiary paediatric hospitals	Transition service in NSW for patients in the Sydney Children's Hospital's network.

Summary of grey literature – Question 1

In addition to the peer-reviewed papers detailed above, 27 relevant documents describing health service models including nine policy documents (mainly strategic plans or documents describing potential service models) were found. In addition to the 27 documents mentioned above, we reviewed at least 15 service plans/agreements – all of these provided broad principles but none provided specific information about paediatric models of care and were therefore excluded.

There were eight examples of **ACS** models, mainly short-stay wards, assessment wards or similar which provided triage for ambulatory patients and channelled these patients appropriately to ED/hospital admission or to discharge home thereby preventing admissions. Two ACS models included a multidisciplinary approach and one also provided outreach clinics to outlaying hospitals.

Four **multidisciplinary-coordinated care models** or networked models were identified; one for palliative care, one for rehabilitation, and two were general models which were not disease based. There was a plan for a well-defined model of care for paediatric rheumatology but we found no documentation on whether this proposed model had been implemented.
Seven documents described models of **outreach**, two involving telehealth and outreach clinics[50,52], one providing telehealth[53], and 4 provided outreach clinics with paediatricians running clinic in a general hospital in a rural centre setting.[45,47-49]

Three documents[54,62,63] described services supporting **transition** from paediatric to adult care, one of these was a conference abstract describing a service[54], one was a policy document describing the need for a transition service in WA[62] but there was no information about the implementation of the proposed service, and the other was a policy document describing key principles for smooth transition.[63]
One model of care from the UK stood out as it included well-defined specific clinical care pathways in addition to multidisciplinary care and outreach.[42]

Question 2: What is known about the effectiveness of the identified models and systems (as determined by improved health outcomes or intermediate outcome measures)?

Table 9: Effectiveness of models of care identified in the grey literature

Ref No.	Reference	Effectivensess of identified ACS models
40.	Report on the SSU at RNSH	Model was a success with patients, carers and staff. Improved patient care and comfort for those admitted to the SSU unit. There was increased spaced and improved flow of patients
45.	Paediatric ambulatory care: the way of the future	Model demonstrated a 20% reduction in paediatric admissions from Wyong ED to Gosford. Paediatric admission to Gosford decreased despite an increase in paediatric ED presentations. Model demonstrated a high-level of patient/parent satisfaction
Ref No.	**Reference**	**Effectivensess of identified MDC/Outreach models**
46.	Victorian Paediatric Rehabilitation Service model of care	Model sets out clearly defined pathways for referral, able to respond according to patient complexity. Plans for long-term care including transition into adult health care
47.	Children's Healthcare Network (CHN)	The model allows children to be treated as close to home as possible. Model provides access to high quality care healthcare, including shared treatment protocols and guidelines
48.	NSW Paediatric Palliative Care Programme	Model provides multidisciplinary care for a range of diseases for children and their families living in NSW including rural and remote areas
49.	Holistic paediatric diabetes care – evaluation of a new rural model	Model enhances primary care plans
Ref No.	**Reference**	**Effectivensess of identified Outreach models**
50.	Specialist Outreach NT Northern Territory Government	Model has facilitated the delivery of efficient and needs-based service delivery. There has been enhancements made to the delivery of eye health services through stronger integration and coordination of all ophthalmology providers (government, private, not-for-profit and the non-government sector)
52.	NSW Rural Doctors Network	Model provides provision of services in regional and remote locations and via telehealth, support for services that are bulk-

		billed or free of charge, culturally fitting services and clinical up-skilling sessions for staff
53.	Queensland Telepaediatric Service	Rapid medical response to referring clinician within 24-hours. 90% of referrals result in a video-conference consultation
Ref No.	**Reference**	**Effectivensess of identified Transition models**
54.	Trapeze: making the leap with ease	Model facilitates, monitor and coordinate patient care during transition

Summary of grey literature – Question 2

Few models had been formally evaluated. Nevertheless 10 documents reported measured or perceived benefits:

Four documents[40-42,45] describing ACS models reported the following benefits:

- Less bed block [40]
- Less waiting time [40]
- Better patient flow [40]
- Less hospital admissions [41,42,45]
- Increase in necessary tests [42]
- Decrease in unnecessary tests [42]
- Shorted LOS [42]
- Decreased costs [41]
- Patient/parent satisfaction.[40,41,42,45]

Outreach models using telehealth, outreach clinics or both[46-53]:

- Convenience and efficiency for patients/families, saving time and costs that would have been spent on reaching a paediatric centre in the metropolitan area [46,47,50,52,53]
- Rapid medical response to referring clinician (telehealth)[53]
- Improved accessibility of healthcare for patients/families[46,47,48,50,52,53]
- Efficient in terms of resource use in the tertiary hospital providing outreach by telemedicine (saving time and costs)[53]
- Improved capacity in the tertiary metropolitan centres as not all patients need to attend in person[53]
- Up-skilling and building confidence among local staff in regional, remote or disadvantaged areas[52,53]
- Care provision close to home and within cultural context [46-49,50,52,53]
- Enhanced coordination and linking-up of local services with tertiary sector.

Multidisciplinary models:

- Better outcomes for patients including less complications
- Efficient provision of needs-based care[46,47,50]
- Health planning and shared care including shared protocols and guidelines[46,47,48]
- Integration of tertiary services with primary care and community health[49]
- Prevention of unplanned ED presentations efficient and appropriate care pathways.[46,47,49,50]

The proposed ACI multidisciplinary model for paediatric rheumatology[61] suggested that if implemented, it would result in more equitable access, reduced inappropraite treatments and investigations, improved medical stability and less complications, and less duplication on services. We found no information to suggest that this model has been implemented or evaluated.

Transition care models:

There is a general lack of documentation describing evaluation of the existing models. The Trapeze model, has been functional for only two years and evaluation has not been published. We found no published documents reporting on any formal evaluation of the ACI transition care program.

Question 3: What is known about the resources, staffing and other requirements, enablers and barriers for successful implementation of the identified models and systems?

Table 10: Resources of models of care identified in the grey literature

Ref No.	Reference	Findings of identified ACS models
38.	Women and Children's Health Network, Division of Paediatric Medicine	Staffing: Nurses, doctors, allied health staff, patient service attendants and clerical staff Enablers: Accessible seperately to ED. Attached to and run by paediatric ED. Admissions for observation before admission to ward. Four, two and one bed areas – enables isolation e.g for infectious diseases
39.	Sandrigham Hospital Alfred Health	Staffing: Six paediatricans listed, no information provided about other health professionals Enablers: Supports Women's Sandringham Maternity, special care nursery, ED and surgery for <16 years old. Four bed SSU in ED, unclear if this is shared with adults or paediatric specific Barriers: No dedicated paediatric ward – paediatric patients are admitted to the SSU, no information about referrals out of the SSU
40.	Report on the SSU at RNSH	Staffing: Junior medical officer (JMO) from ED continued care in SSU (may be paedatric trainees or phsyician trainees), 1-2 nursing staff Enablers: The SSU is a separate area within the paediatric ED. Two beds allocated within the paediatric ED. The availability of funding through the Ministerial Taskforce on Emergency Care process Barriers: NR
41.	PAU	Staffing: Experienced paediatric nurse, senior paediatric doctor, A&E registrar (to cover both A&E and PAU four bed bay; two bed cubicle) Enablers: Enables short-stay for patients (up to eight hour) for assessment and observation. Unit operates 24-hours seven days a week. Admission via A&E, rapid access clinic and outpatients. Developed an assesment tool (specific admission and exlcusion criteria). Patient seen by nurse within 10 minutes and doctor within the hour. Developed guidelines on admission and discharge procedures and standard parent information sheet Barriers: NR

42.	Facing the future together for child health: whole systems	Staffing: Seven general paediatric consultants(each of whom have special areas of interest), complemented by five locum consultants, Enablers: Dedicated facilities in a child and parent-friendly environment, hands-on consultant cover 24-hours a day. Supporting service by the physiotherapy team Barriers: NR
43.	Ballarat Hospital Services	Staffing: Paediatric nurses, consultant paediatricians, paediatric allied health staff Enablers: Unit is open 24-hours (~ 200 admissions per months) 20 cot and bed unit, four, three and single bed rooms, recliners and trolleys. Family-friendly environment (parent overnight stay with child, family-centred room can accommodate the whole family), playroom and lounge area. Links with community services. MDC paediatric skilled team Barriers: NR
44.	Fiona Stanley Hospital Paediatric Ward www.fsh.health.wa.gov.au/Our-services/Service-Directory/Paediatrics [cited: May 2015]	Staffing: NR Enablers: Family-friendly environment: a parent lounge, facilities for parents to stay overnight with their children, indoor and outdoor play area Barriers: NR
45.	Paediatric ambulatory care: the way of the future	Staffing: 2.0FTE paediatricians, 2.0 FTE registrars, 1.0 FTE NUM, 6.6 FTE RNs, 2.0 FTE clerical, 0.8 FTE cleaner Enablers: Operates during the day only 8am to 6pm, Monday to Friday and 8am to 3pm Saturday and Sunday. Daily acute review clinics, designated SSU, telephone follow-up provided, shared care with tertiary hospitals, routine ouptaient clinics Barriers: Limited operating hours, plans to cover 8am to 10pm in the future (operating hours didn't coincide with peak ED paedaitric presentation times). Requires linked data system to accurately document patient journey and activity, lack of GP awareness/communication/liaison. Staff attitudes with change from traditional nursing model of care.

Ref No.	Reference	Findings of identified MDC models
46.	Victorian Paediatric Rehabilitation Service model of care	Staffing: 24-hour medically available paediatrician, beside nursing, access to rehabilitation consultant, physiotherapist, occuaptional therapist, speech pathologist, social worker, neuropsychologist, educational advisors, regional care coordinators, GPs Enablers: Family-centred, sharing of resources (links with primary care, community health, school sector), outreach clinic Barriers: NR
47.	Children's Healthcare Network (CHN)	Staffing: Each region has a convenor and a coordinator. Regions are supported by a team of paediatric clinical nurse consultants. They also have an allied health educator who provides support for allied health professionals Enablers: Staff rotation between services (sharing of knowledge and skills) Barriers: NR
48.	NSW Paediatric Palliative Care Programme	Staffing: On-call clinical fellow and staff specialist run the after-hours service. No further information on staffing provided Enablers: Each site has a MDC services which includes rural outreach services, these inlcude: assessment and symptom management, coordination and communication, respite options, end-of-life planning, psyhcosocial suppport for families and siblings, advice on bereavement care, advice to health professionals caring for the child Barriers: NR
Ref No.	**Reference**	**Findings of identified MDC/Outreach models**
49.	Holistic paediatric diabetes care – evaluation of a new rural model	Staffing: General paediatrician, credentialed diabetes educator, counsellor and GP Enablers: NR Barriers: NR

Ref No.	Reference	Findings of identified Outreach models
50.	Specialist Outreach NT Northern Territory Government	Staffing: NR Enablers: Secured funding from the Northern Territory Government and the Australian Government – Rural Health Outreach Fund. Assessment and planning tools developed facilitate the delivery of efficient and needs-based service delivery Barriers: NR
52.	NSW Rural Doctors Network	Staffing: NR Enablers: Funded by the Australian Government Department of Health. Telehealth facilities across sites. Up-skiling for health professionals Barriers: NR
53.	Queensland Telepaediatric Service	Staffing: Specialists at Lady Cilento Children's Hospital: specialist from diabetes, endocrinology, burns' cardiology, dermatology, oncology, orthopaedics, gastroenterology, neurology, psychiatry and paediatric surgery Enablers: NR Barriers: NR
Ref No.	**Reference**	**Findings of identified Transition models**
54.	Trapeze: making the leap with ease	Staffing: Team of health care specialists. No further information avaliable Enablers: Links with the ACI Transition Care Service Barriers: NR

NR = NOT Reported

Summary of grey literature – Question 3

Only 13 of the 27 documents identified described staffing with many listing multidiscipinary teams including paediatricians, nurses, paediatric allied health staff, psychologists, and social workers.[43, 44, 46-49] Large teams were supported by clerical or management staff. [46-47] Some models linked in with community health care services and general practitioners.[46] The ACS models generally needed their own dedicated space which was child- and family-friendly.

No document described the funding model used to support the service. One document described short-term grant funding used to establish a paediatric assessment unit within an adult hospital ED. The PAU was not sustained due to short-term grant funding and lack of planning during a major move of the adult ED facilities.

Enablers included:

- Clearly defined processes, care guidelines, and standardised documentation
- Clearly defined pathways of care with clear entry and exit points according to patient acuity and complexity
- Defined coordination roles for team members e.g. care coordinators
- Excellent and open communication via teleconferencing and other means, multidisciplinary team meetings, joint clinics.

Barriers included:

- Lack of appropriate data collection systems to capture activity and to support evaluation
- Lack of funding or lack of support to cover the service out of hours
- GPs/community health professionals may not be aware of relevant models where they can refer their patients
- Models are reliant on community health or GPs but there is no opportunity to up-skill GPs.

Question 4: What are the core elements of the models and systems identified i.e. what elements are common across different models and systems?

Table 11 provides information from policy and position statement documents describing principles of paediatric care models based on theory and literature rather than models that have been implemented. Question 4 requires a synthesis of data from tables 9, 10 and 11.

Table 11: Policy/position statements and recommendations where principles for models of care are described

Ref No.	Reference and document type	Country / scope	Principles/recommendations
55.	Gauthier M, Issenman RM, Wilson I. A model of paediatrics: rethinking health care for children and youth. Paediatric Human Resource Planning Committee, Canadian Paediatric Society, Position Statement, 2009 Position Statement/ Recommendations	Canada Nation-wide	Key principles: • Children and youth should have timely access to appropriate care no matter where they live • Continuity of care is essential – general paediatrician has an important coordination role • Family-centred care which involves the family in decisions • Provide paediatric specific acute care in general hospitals • Multidisciplinary team care that involves a paediatrician • Develop outreach or telemedicine programs for rural and remote regions • Children with serious chronic or acute illness should have a paediatrician involved in their care • Meet the needs of diverse communities • Newborn care – neonates with serious illness should have access to specialised care and paediatric ICU and appropriate specialised medical transportation. How? • Wider geographic distribution of paediatricians – increased workforce • Appropriate resourcing and training of paediatricians including access to evidence based guidelines of care • All paediatricians should be trained in recognition of child maltreatment, • Paediatricians should participate in transportation/retrieval teams • All paediatricians should receive training in palliative care and pain control • Establish appropriate on-call services in which paediatricians participate

			• Facilitate health care teams which include paediatricians • Create child and youth specific electronic medical records. Re-Examine remuneration models for paediatricians – models should encourage paediatricians to work with other health professionals and recognise the time required to provide optimal care

56.	National Model of Care for Paediatric Healthcare in Ireland
	
	National Paediatric Hospital development Board, 2010
	
	www.newchildrenshospital.ie/index.cfm/.../researchandpublications
	[cited: April 2015]
		Ireland
		
		Nation-wide
			Key components:
			• Clinical networks incorporating regional and local services, community and home-based services with tertiary hospitals
			• Integration of network through:
			  ◦ Programmatic management of health care services
			  ◦ Standardisation of care processes
			  ◦ Outreach services from tertiary hospital to regional and local hospitals
			  ◦ Coordination of community and home-based services by the tertiary paediatric hospital
			  ◦ Agreed referral and communication protocols
			  ◦ Integrated Information and Communication Technology (ICT) across the paediatric healthcare system
			• Integrated approach to workforce planning:
			  ◦ Development of new roles to implement new methods of health care delivery
			  ◦ Shift from inpatient to short-stay and ambulatory care models
			  ◦ Agreed framework for the structured transition of young people to adult services
			  ◦ Coordinated retrieval and transport system
			  ◦ Embedding education and research.

57.	Children's Health Queensland Strategic Plan 2013-2017 (2014 update) Children's Health Queensland Hospital and Health Service 2014 www.health.qld.gov.au/childrenshealth/docs/strat-plan-13-17.pdf [cited: April 2015]	QLD Australia State-wide	Provides a strategic plan which lists key actions. There is no information about implementation strategies nor what has been implemented so far; specific models of care not described; no mention of sustainability Key actions relevant to this review: • Roll-out the Children's Early Warning Tool and Ryan's Rule • Develop a "hospital at night" strategy • Develop a "special patient on the ward" to identify patients with high-needs or at high-risk • Implement integrated state-wide care for mental health disorders • Engage with primary health care, consumers and community • Map and evaluate outreach services and improve use of telehealth to provide specialist paediatric support to outlying hospitals and services • Establish a network of paediatric complex care coordinators, reserve clinic time for children with complex care needs and involve families in care process. Enhance research and learning – develop knowledge management processes to enable regular appraisal and review

58.	Strategic framework for paediatric health services in Victoria Clinical Networks and Service Development, program branch, Metropolitan Health and Aged Care Services Division, Victorian Government Department of Human Services, 2009 www.health.vic.gov.au/childrenatrisk/documents/paediatric_framework.pdf [cited: April 2015]	VIC Australia State-wide	Strategic plan. No information on what has been implemented Key points relevant to this review: • Establish the Paediatric Clinical Network and a Paediatric Leadership Group • Define the responsibilities at the two paediatric centres (RCH and Murdoch) • Link-up primary, secondary and tertiary paediatric health services • Review funding models – ensure recognition of complex care/chronic care • Support outreach models including telehealth, hospital in the home • Identify enablers and barriers to reform • Need for measurement and evaluation. 10 Principles to support service development: • Safe, high quality services • Child and family centred • Built on evidence, research and knowledge • Partnerships and integrated care • Innovation and flexibility • Provision in the community and close to home • Cost effective and sustainable • Skilled, innovative, flexible workforce • Planning of complex activity to optimise outcomes • Networking and evaluation frameworks.

59.	The adolescent model of care, The Royal Children's Hospital (RCH), Melbourne, 2009 www.rch.org.au/uploadedFiles/Main/Content/cah/RCH_ModelofCare_November2009_Final.pdf [cited: April 2015]	VIC Australia RCH	Key messages: • Identify vulnerable young people through consistent psychosocial screening • Develop clear pathways to specialist care • Retain an adolescent ward and build a critical mass of expertise in adolescent health • Create a holistic model of care which addresses medical, psychological and social issues, taking into account developmental stages and based in youth-friendly spaces • Develop coordinated approaches to promoting greater self-care where possible • Establish a Youth Advisory Council to enable inclusion of the youth voice in any service development initiatives in the hospital • Improve integration between hospital- and community-based youth health services • Provide education services to support learning between schools, home and hospital. Develop cooperative partnerships to address youth health needs
60.	Paediatric and adolescent palliative care model of care WA Cancer and Palliative Care Network Government of Western Australia, Department of Health 2009 Government Recommendations	WA Australia State-wide	Proposed palliative care model – no information about implementation Key components: • Model proposes all children and adolescents with a life-limiting illness, and their families, will have timely access to specialist palliative care services and expertise • Model acknowledges that no single organisation or service can provide the level of care required to meet the complex needs • Specialist paediatric and adolescent palliative care services must work in partnership with primary, secondary and tertiary health care services and supportive care organisations to meet these needs

61.	Model of care for the NSW Paediatric Rheumatology Network NSW Agency for Clinical Innovation, 2013 ISBN: 9781741879087	NSW Australia State-wide	Framework describes the optimal model of care for the provision of service delivery to support the management of children and young people with rheumatic diseases in NSW. Key components: • Multidisciplinary team involved in patient care and in service improvement. Staff includes: rheumatologist 2.5 FTE, clinical nurse consultant – care coordinator, 2.5 FTE, physiotherapist 2.5 FTE, occupational therapist 1.0 FTE, dietician 0.3 FTE, social worker 0.3 FTE, clinical psychologist 0.5 FTE, clinical support officer 1.5 FTE, program development officer 1.0 FTE • Specialist palliative care services will provide care in the location preferred by the child/adolescent and family • Planned post-implementation evaluation.
62.	WA Child and Youth Health Network. Paediatric Chronic Disease Transition Framework, Government of WA, Department of Health www.healthnetworks.health.wa.gov.au/modelsofcare/docs/Paediatric_Chronic_Diseases_Transition_Framework.pdf [cited: April 2015]	WA Australia State-wide	Proposed transition framework – no information about implementation Key points relevant to this review: • Ensure that the care in transition from paediatric to adult health services is planned, accessible, coordinated and continuous • Developmentally and psychologically appropriate • Meets expectations of the young person, their family and the transition team.
63.	Key principles for transition of young people from paediatric to adult health care Agency for Clinical Innovation and Trapeze, The Sydney Children's Hospitals Network, 2014 www.aci.health.nsw.gov.au/__data/assets/pdf_file/0011/251696/Key_Principles_for_Transition.pdf [cited: April 2015]	NSW Australia State-wide	Transition policy Key principles: • A systematic and formal transition process • Early preparation • Identification of a transition coordinator/facilitator • Good communication • Individual transition plan • Empower, encourage and enable young people to self-manage • Follow-up and evaluation

Summary of grey literature – Question 4

This summary is based on information in tables 9, 10, 11 and 12.

Common elements of succesful models:

- Coordination of care
- Multidisciplinary approach with effective planning of chronic care to reduce the need for urgent care
- Appropriately skilled staff; need for regular up-skilling of staff
- Patient/family-centred care
- Well-defined care pathways
- Standardised guidelines and protocols
- Accessibility for patients/families
- Linkage and connectedness with other specialists, GPs, community health
- Provision of care close to home
- Physical and financial resources
- Well-defined communication strategies within teams and between systems and facilities.

The need for service activity data collection systems to support ongoing evaluation including linkage with electronic medical records, and the need for routine collection of data on educational needs of staff, level of satisfaction among staff and parents was raised by four documents.[40,45,49,53] No document reported that data collection facilities and Electronic Medical Records (EMR) were adequate. Two documents[39,45] reported that data collection and linkage with EMR were needed.

Question 5: What is known about the sustainability of the models and systems that have been implemented in terms of (i) sustained outcomes (where evaluated), and (ii) maintained integrity over time?

Table 12: Sustainability and evaluation of models and systems

Ref No.	Reference	Findings
40.	Report on the SSU at RNSH	Sustainability: • Model implemented using a small grant for 12 months • RNSH ED plans to continue this model in the new Acute Services Building (ASB) renaming it The Paediatric Emergency Medical Unit when appropriate adjustments can be made to the clinical space in the new ED • No documents were found to confirm that the model has continued. Evaluation: • Shorter waiting times to see a doctor after presentation • National Emergency Access Target reached more often 72.6% compared with prior to the SSU – 67% • Admission rates rose during the SSU period compared with the pre SSU period (19.8% vs. 16.4%) – in the pre-SSU period patients would have languished unadmitted in the department • High levels of satisfaction among patients/families • High levels of satisfaction among staff.
49.	Holistic paediatric diabetes care – evaluation of a new rural model	Sustainability: • The model was supported by a sponsored grant. To make the model cost effective in its own right, the • Commonwealth Medical benefits Schedule (CMBS) including Enhanced Primary Care rebates should mirror the NHMRC Clinical practice guidelines for paediatric diabetes care • Multidisciplinary visits should be expanded to 16 rebatable visits and, rural credentialed mental health nurses should be eligible for focused psychological strategies rebates for the many rural diabetic children requiring ongoing psychological assistance. Evaluation: • After 18 months of clinic operation, metabolic control had improved significantly compared with the previous

		two years and was comparable to that of major paediatric metropolitan units • There was overwhelming acceptance of the model by patients and parents • QOL measures for children improved • Team members indicated greater professional satisfaction with the team approach.
45.	Paediatric ambulatory care the way of the future	Sustainability: Operating since 2007; no other information on sustainability found Evaluation: • ~20% reduction in paediatric admissions from Wyong ED to Gosford • Paediatric admissions to Gosford have decreased despite an increase in paediatric ED presentations • High levels of patient/parent satisfaction on survey March 2008.
46.	Victorian paediatric rehabilitation service model of care	Sustainability: Program has been sustained for 22 years Evaluation: Please see Table 7. ref no. 10
53.	Queensland Telepaediatric Service	Sustainability: Operational for over 14 years therefore deemed sustainable; no other published information about sustainability Evaluation: • Fewer costs for families • Better accessibility for rural and remote health professionals who need advice – response within 24-hours • Pre/post comparisons of consultations and admissions to the tertiary hospital in Brisbane showed marked reduction in the number of children travelling to Brisbane for consultations which are now done remotely • Increased number of children from rural and remote regions accessing specialist paediatric services • Satisfaction among patients/parents and health professionals.

Summary of grey literature – Question 5

Information about model sustainability was rarely reported in the grey literature.

One document reported that the model was not sustainable and was disbanded when the short-term funding ran out.[40] This document specifically discussed sustainability into the future and described plans to implement the ACS model in a new adult facility.[40] No further documents were found describing whether this actually occurred.

For many models the only information available was that the model had been operational for several years and was therefore sustainable.[45,46,53]

One model of holistic paediatric diabetes care[49] provided strategies for ongoing financial sustainability through appropraite billing practices.

Sustained outcomes:

Five documents [40,49,45,46,53] reported information about outcomes attributed to the model of care:

- Better medical control of the patient's condition [49,53]
- Improved access to specialist paediatric services for patients/families [40,49,45,53]
- Improved access to specialist paediatric services for health professionals working in regional and remote areas [49,53]
- Reduced waiting times in ED[40,45]
- Reduced number of admissions [45,53]
- Improved quality of life for patients [49]
- Satisfaction among parents/carers [40,49,53]
- Satisfaction among staff members [40,49,53]

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8 Appendices

Figure 1: PRISMA flow chart

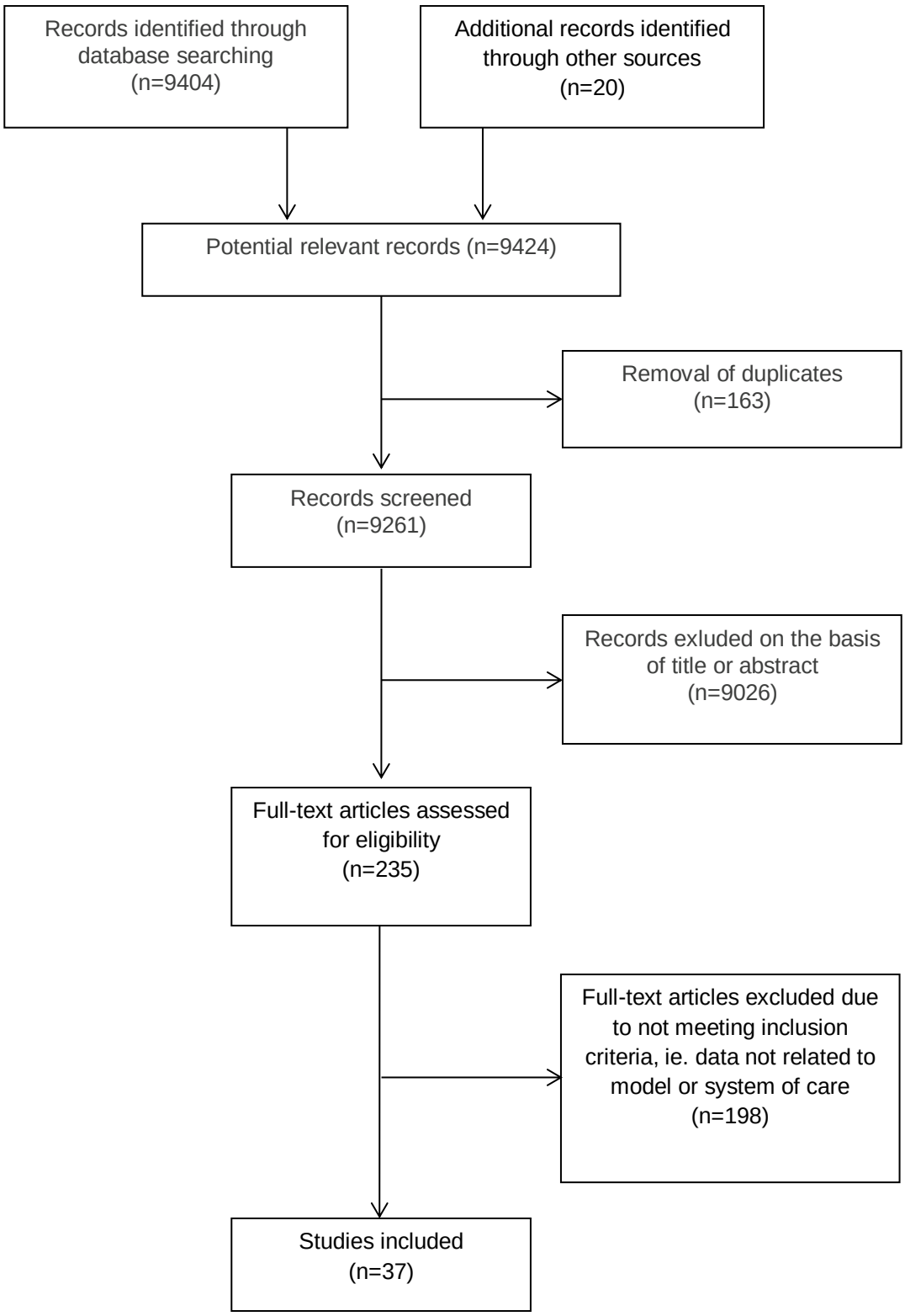

Table 13: Search strategy for Medline - Ovid (1996 to present): accessed on 08/04/15

Step	Search terms	No. of records
1	medical assessment unit*.tw.	64
2	Ambulatory Care/	36712
3	acute care.tw.	13119
4	observational unit*.tw.	45
5	Emergency Service, Hospital/	45995
6	Ambulatory Care Facilities/	12417
7	Outpatient Clinics, Hospital/	14537
8	short stay unit*.tw.	144
9	Hospitals, Pediatric/	9480
10	Secondary Care Centers/	41
11	Tertiary Care Centers/	2972
12	((inpatient or outpatient) adj (care or unit or clinic or clinics)).tw.	24563
13	Child Health Services/	17749
14	((secondary or tertiary) adj hospital*).tw.	4456
15	Community Health Services/	27350
16	outreach service*.tw.	469
17	Subacute Care/	755
18	((acute or subacute) adj care).tw.	13384
19	Inpatients/	13985
20	inpatient service*.tw.	1421
21	((P?ediatric or child) adj health service*).tw.	1045
22	((p?ediatric or children*) adj hospital*).tw.	21038
23	or/1-22	224336
24	model* of care.tw.	3494
25	system* of care.tw.	2881
26	(system* adj care).tw.	190
27	(system* adj2 care).tw.	35864
28	((multidisciplinary or multi disciplinary) adj2 (care or team*)).tw.	12238
29	or/24-28	50882
30	Pediatrics/	42005
31	(pediatric* or paediatric*).tw.	213324
32	child/	1395583
33	child, preschool/	770108
34	infant/	652393

35	infant, newborn/	504053
36	adolescent/	1659409
37	(child* or infant* or newborn or teen* or youth* or adolescent*).tw.	1353445
38	or/30-37	3209278
39	and/23,29,38	1872
40	exp delivery of health care/ and (exp models, theoretical/ or exp models, economics/)	52360
41	"quality of health care"/ or "health care quality, access, and evaluation"/ or "delivery of health care"/	121632
42	Program Evaluation/	48168
43	Practice Guidelines as Topic/	85083
44	40 or 41 or 42 or 43	292536
45	39 and 44	490
46	limit 45 to (English language and humans and yr="2005 -Current")	246