Screening and surveillance in early childhood health:
Rapid review of evidence for effectiveness and efficiency of models.

Karen McLean
Sharon Goldfeld
Carly Molloy
Melissa Wake
Frank Oberklaid

An Evidence Check Review brokered by the Sax Institute for NSW Kids and Families

November 2014

This rapid review was brokered by the Sax Institute.

This report was prepared by Karen McLean, Sharon Goldfeld, Carly Molloy and Melissa Wake

November, 2014

Suggested Citation:
McLean K, Goldfeld S, Molloy C, Wake M. Screening and surveillance in early childhood health: Rapid review of evidence for effectiveness and efficiency of models; 2014

Disclaimer:
This **Rapid Review** was produced using the rapid evidence assessment methodology in response to specific questions from the commissioning agency. It is not necessarily a comprehensive review of all literature relating to the topic area. It was current at the time of production (but not necessarily at the time of publication). It is reproduced for general information and third parties rely upon it at their own risk.

CONTENTS

LIST OF ABBREVIATIONS

ASQ	Ages and Stages Questionnaire
ATSI	Aboriginal and Torres Strait Islander
CALD	Culturally and linguistically diverse
CDC	Centres of Disease Control
DDH	Developmental Dysplasia of the Hip
DEECD	Department of Education and Early Childhood Development (Victoria)
FTE	Full-time equivalent
GP	General Practitioner
HCP	Healthy Child Program
IT	Information Technology
KAS	Key Ages and Stages
LMC	Lead Maternity Carer
MCH	Maternal and Child Health
M-CHAT	Modified Checklist for Autism in Toddlers
NH&MRC	National Health and Medical Research Council
NSW	New South Wales
PEDS	Parent Evaluation of Developmental Status
REA	Rapid Evidence Assessment
RCT	Randomised controlled trial
SDQ	Strengths and Difficulties Questionnaire
SIDS	Sudden Infant Death Syndrome
UK	United Kingdom
USA	United States of America
WCTO	Well Child/Tamariki Ora

MAIN MESSAGES

In this rapid review we appraised universal child and family health services in a number of countries and Australian jurisdictions. This is not a field in which peer-reviewed level one published evidence for overall programs is available. That these programs are so widely available internationally would suggest they are a highly valued and important part of the health system in most western countries. To that end, **the NSW Child and Family Health Service is broadly in line with current worldwide best practice, particularly in similar jurisdictions**.

Key findings:

Universal child health and development programs provide a valued and consistent platform for:

- Early identification of health and developmental problems and connection of children with services for further assessment or intervention
- Health and development promotion and injury prevention.
- Identification of and support for at-risk families

In addition these programs provide a platform for the **delivery of brief evidence-based interventions**. It was beyond the scope of this review to examine the range of such interventions.

Some programs are harnessing **new technologies**, but the evidence for efficacy and effectiveness remains sparse. There is the potential to introduce these technologies for the process of service delivery (e.g. text message reminders regarding appointments or immunisations and hence extending the reach of the program) as well as their content (e.g. health promotion activities such as websites/blogs/apps that enhance parenting strategies, safety or development).

Child and family nurses provide the bulk of the **workforce** for these programs, but more important than their professional background and primary qualification is that practitioners have been adequately trained in the relevant skills. There may be potential for both up-skilling of nurses as well as devolution of aspects of care to those with lower formal qualifications provided they have appropriate training and supervision.

Collection and analysis of routine data can provide valuable information, but is currently under-utilised and not publicly available for many programs.

- Process data are useful indicators for quality control and improvement –
- Specific outcome data (linked to the program areas of focus) are important for determining the effectiveness of what is delivered within the program.
- Investment in longitudinal data collection and linkage with other data sets (e.g. Australian Early Development Census (AEDC) data) could add value by providing highly relevant local area data without the need for primary data collection.

EXECUTIVE SUMMARY

Introduction

The provision of universal well-child health and development programs is well established across Australia and many other developed countries. Such programs aim to promote child health and development, and facilitate early detection and intervention. The importance of this approach is demonstrated by surprisingly consistent national health guidelines across multiple countries, which all aim for universal reach and seek to maximise the outcomes for children. The key components of these programs include monitoring of growth and physical health of children, surveillance of development; and health promotion, including injury prevention and provision of advice to promote child and family wellbeing. This overall approach is supported by research that demonstrates significant short and long term benefit for early detection and intervention programs(1-4).

The aim of this review was to identify programs and service models that deliver population-based screening and surveillance of health, development, and wellbeing for children aged 0-5 years. A secondary aim was to compare and contrast their relative effectiveness and efficiency with a particular focus on sub populations.

Method

To address these questions, a formal rapid review methodology was applied to evidence based peer-reviewed literature. When this failed to yield relevant papers, specific searching of grey literature was conducted to investigate the programs delivered across different jurisdictions in Australia, Canada and the United Kingdom (UK). Programs were restricted to those published since 2009, and where sufficient detail could be found to enable comparison between different models and. A model from the USA was also included.

Results

The NSW model for a universal early childhood health and development program is very much in line with similar jurisdictions across the world. Table 1 outlines the key elements of these programs and compares them to current NSW practice.

Each of the programs is designed to be universal, reaching all newborns through their first years of life. There is a range in the number of visits across these years, with the NSW program offering visits in the middle range. Only Victoria has thus far mandated enrolment into the program through legislation. All programs included a mixture of screening (e.g. vision, hearing), ongoing monitoring or surveillance (e.g. growth, development), and with health promotion activities. Some programs are using this platform to deliver evidence-based interventions. Only the program reviewed in the USA included autism screening.

There was some mention of new technologies for both processes (e.g. reminder messages to improve participation rates) and outcomes (e.g. to aid communication about health or development promotion), however there is little evidence available yet as to the efficacy of these uses.

There was some variability in the workforces used to deliver the programs, although they were generally nurses with specific training in child health.

Only two jurisdictions provided publicly available data regarding the efficiency or process outcomes of their programs.

Discussion and Recommendations

New South Wales is delivering a universal well-child health and development program that is consistent with best and expected practice across the world. This platform harnesses the economically sound and evidence-based practise of primary health care. It incorporates the established principles of early intervention for problems relating to the health and development of the individual child as well as family functioning and wellbeing. It allows for a range of health promotion activities, including proven interventions, to be delivered to all children in the population.

Settings for such programs have traditionally combined clinic visits with home visits by a health care practitioner. The ideal setting will depend upon the local community needs as well as the available resource, but could also include telehealth in regional or remote settings, as well as innovative approaches to take elements of the program to other settings such as child care or playgroups, in order to engage with families that are often hard to reach.

Child health nurses comprise the largest group of clinicians involved in delivering these programs, however a wide variety of other clinicians may also contribute. There is scope to explore literature outside the well-child field for evidence around the workforce requirements, but it seems from the available related evidence that the skill-set and training matters more than particular primary qualifications. There is potential in the future to both up-skill nurses and to devolve some components of program delivery to meet workforce challenges.

At the time of this review, the use of new technologies was emerging in the universal well-child health and development programs, both to improve reach and participation (e.g. through text reminders) and to expand upon health promotion activities (e.g. providing information in the form of blogs or websites). This use was not supported by published evidence, but there are clear research opportunities within this domain.

Finally, the use of data to evaluate processes and outcomes is essential to the quality control and quality improvement of any program. Only two similar programs had publicly available data to contribute to a shared understanding of best practice. There are opportunities for NSW to collect and analyse data to understand the effectiveness of components of their program. Data linkage with other sources of data such as the AEDC can also provide highly valuable information regarding outcomes that can be applied to local areas as well as statewide.

Table 1: Highlights of international universal well-child health and development models –

This table contains the main details of programs; the completed results table can be found on page 25.

	NSW	Australia National VIC Tasmania Western Australia	United Kingdom National Northern Ireland Scotland	Canada Manitoba Northwest Territories	New Zealand National	United States National
Target Population – universal	✓	✓ ✓ ✓ ✓	✓ ✓ ✓	✓ ✓	✓	✓
Ages for contact	Birth to 4 years	Birth to 5 years Birth to 3.5 years Not stated Not stated	Birth to 5 years Birth to 4.5 years Birth to 5.5 years	Not stated Not stated	Birth to 3 years	Birth to adolescence
Number of contact points	8	Not specified 10 Not stated Not stated	Unclear 3-6 13 4	Not stated Not stated	12	15
Monitor physical health	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated ✓	✓	✓
Hearing & vision screening	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated ✓	✓	✓
Growth monitoring	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated ✓	✓	✓
Health promotion	✓	✓ ✓ ✓ ✓	✓ ✓ Not stated	✓ ✓	✓	✓
Developmental assessment	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated ✓	✓	✓
Immunisation	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated Not stated	✓	✓
Anticipatory guidance	✓	✓ ✓ ✓ ✓	✓ ✓ Not stated	✓ ✓	✓	✓

INTRODUCTION

The early childhood years are a time of great change across all domains of development. Research has demonstrated that this period is crucial for brain development, and that both risk and protective factors encountered by the child during this time can have life-long impact. This impact is not merely for the individual's physical or mental health, school performance or employment outcomes, but it flows on to social and economic outcomes within the community(5). It is this understanding that has compelled policymakers to consider how best to intervene early in the life-course, altering the trajectory and long-term outcomes of children.

Fortunately there is mounting evidence that early intervention for a range of risk factors is effective. Short- and long-term benefits to health and functioning have been demonstrated in numerous domains. Examples include screening for developmental dysplasia of the hip - early detection can avoid surgery and have adequate treatment provided through splinting alone. Family-based behavioural intervention has been demonstrated to be an effective treatment for childhood obesity(1, 2). Early identification of permanent childhood hearing impairment leads to beneficial effects on language development(3), and oral health programs help decrease the rate of early childhood caries and improve quality of life(4). Intervention targeting disadvantaged children have demonstrated long-term positive effects, including improved educational achievement(5). Such data has enabled financial modelling that demonstrates that economic benefits of intervention are greatest when problems are addressed as early as possible(6).

Early intervention can, however, only be achieved if problems can be identified early. This is one of the essential criteria for any screening program: being able to identify a condition prior to it causing symptoms. For some conditions, this may be clear-cut, and screening at or near birth may be possible as the condition may be detectable at that time. Detecting developmental problems is more complex, as all children develop along a continuum, at their particular pace within different domains, and there is a wide range of normal.

Why do we need universal well child health and development programs?

Recent models of universal well-child health and development programs have evolved from an emphasis on monitoring growth and screening for physical disorders to including comprehensive surveillance of development and health, together with health promotion activities and targeted interventions(7) in response to the evidence supporting early intervention. Current models now seek to monitor health and development to enable early identification and management of problems, as well as promoting protective factors and identifying and ameliorating risk factors. In countries where public primary health systems are established, these programs are embedded as universal systems, seeking to reach all children and support them in reaching their potential, for the benefit of the individual child, their family and society as a whole. The rationale for these approaches is based on three key areas of research: (a) developmental surveillance for early detection or problems, (b) the benefits of health promotion and (c) the identification of families who may need further support.

Developmental surveillance

Developmental surveillance is a flexible, longitudinal, continuous and cumulative process whereby knowledgeable healthcare professionals identify children who may have developmental problems(7, 8). The key components of developmental surveillance include

eliciting and attending to parents' concerns about their child's development; documenting and maintaining a developmental history; making accurate observations of the child; identifying risk and protective factors; and maintaining an accurate record of findings(8). Once a risk or problem has been identified systems need to be in place to provide appropriate referral, support and intervention(8). Evidence from Australia (7) and major American and British organisations do not recommend the routine administration of stand alone developmental screening tests due to the lack of evidence base to justify routine screening for all children for developmental problems. However state and national policies do recommend models of universal developmental surveillance aimed at improving child health care. Similar policy documents also exist internationally.

Health and development promotion

Alongside research concerning early intervention, evidence has also developed regarding the positive impact of health and development promotion activities. Educational opportunities abound to inform parents about behaviours that can help prevent disease or injury, promote development, and develop parenting skills. Campaigns that have encouraged parents to use safe sleep practices for their babies have been associated with a vast reduction in Sudden Infant Death Syndrome (SIDS) deaths(9), and interventions to improve infant's sleep have been successfully delivered within the context of well-child visits(10). Such activities can be both anticipatory as well as responsive to the issues being discussed within the visit, and are intended to maximise the protective factors for children.

Identification and supports for at risk families

The immediate environment for children in these early years is predominantly that of their home and family. Many risk factors to health and development can be present within the family domain e.g. poverty, parental mental health issues or substance use, family violence – and equally, many protective factors can be present within the family(5). Optimising outcomes for children cannot be done in isolation from identifying family factors that may impact upon development, and providing support for at risk families.

What is the aim of this review?

NSW Kids and Families is responsible for strategic, long-term planning for the health services for children and young people across NSW. The delivery of a universal well-child health and development program - including screening and surveillance - is the core approach to maximising health outcomes for this population. Whilst a previous National Health and Medical Research Council (NH&MRC) review was comprehensive in its detail about individual components of early childhood health and developmental screening, this review aimed to focus on the overall models in relation to broad outcomes of health and wellbeing. The main areas of interest were mechanisms of delivery of models and workforce requirements.

Ultimately, this rapid review aimed to provide the key considerations deserving attention in the design and evaluation of a universal program for screening and surveillance in childhood health, based on evidence where available.

To address these areas, a formal rapid review methodology was applied to evidence based peer-reviewed literature. When this failed to yield relevant papers, specific searching of grey

literature was conducted to find the programs delivered across different jurisdictions across Australia and in countries with similar health services. These models are described and compared in their content, providing the springboard for the discussion of relevant considerations for NSW in the context of their own planning processes.

METHOD

The literature review utilised a rapid evidence assessment (REA) methodology. The REA is a research methodology that uses similar methods and principles to a systematic review but makes concessions to the breadth and depth of the process, in order to be completed within a short timeframe. Rigorous methods for locating, appraising and synthesising the evidence related to a specific topic are utilised by the REA, however, the methodology places a number of limitations in the search criteria and in how the evidence is assessed. For example, REAs often limit the selection of studies to a specific time frame (e.g., last 10 years), and limit selection of studies to published peer-reviewed, English studies (therefore excluding unpublished pilot studies, difficult-to-obtain material and/or non-English language studies). The REA can help inform policy and decision makers more efficiently by synthesising and ranking the evidence in a relatively short space of time, although it is not necessarily as exhaustive as a well-constructed systematic review or meta-analysis.

Defining the Research Question

The components of the question for this review were defined in terms of the population, the screening and surveillance models, and the outcomes. Operational definitions were established for key concepts, and specific inclusion and exclusion criteria were defined for screening studies for this review.

The population was defined as infants and children between the age of 0 and 5 years, screening and surveillance were defined in line with the definition specified in the NH&MRC review 2002 as follows:

Screening test

"Any measurement aimed at identifying individuals who could potentially benefit from intervention. This includes symptoms, signs, lab tests, or risk scores for the detection of existing or future disease'(11).

Screening program

"In a screening program, a test, or a series of tests, is performed on a population that has neither the signs nor symptoms of the disease being sought but whose members have some characteristic that identifies them as being at risk from that disease, the outcome of which can be improved by early detection and treatment. Screening actually consists of all the steps in a program from the identification of the population at risk to the diagnosis of the disease or its precursor in certain individuals to the treatment of those individuals' (12).

Population surveillance

Population surveillance focuses on groups or entire populations, and enables observation of changes and trends at a public health level. This is sometimes referred to as monitoring(11).

The outcome was defined as the fundamental components of the developmental models of interest and the workforce competency requirements.

Search Strategy

As a first step we searched for high levels of evidence in the form of meta-analyses, systematic reviews and/or randomised controlled trials (RCTs). We were unable to find any relevant publications that were appropriate for answering the research question and thus broadened the scope and aimed to identify any relevant peer-reviewed literature. Initial searches were conducted using the following databases: Ovid MEDLINE and CINAHL (EBSCO). We used broad search criteria however it did not yield any relevant papers within the specified exclusion-inclusion criteria. Refer to Appendix 1 for an example of the search strategy used in Medline.

Search Terms

The search terms specific to this question that were included in searching the Title/s, Abstract/s, MeSH terms, and Keywords lists were: *Mass screening, population surveillance, public health surveillance, well child care, evaluation studies (topic), program evaluation, child development, language development, child welfare, child health services, early intervention child behaviour disorders, developmental disabilities, language development disorders, speech disorders, diagnosis, differential.*

Grey Literature

Having sought out expert opinion in relation to the lack of evidence-base in this area we were directed to the grey literature, specifically searching for guidelines and guidance documents produced by states and specific jurisdictions within Australia, United Kingdom, Canada, and New Zealand. These documents were sought through targeted governmental website searches in specific regions, determined by the brief as relevant due to reasonably similar health systems.

The search of the relevant grey literature did not involve a systematic search using specific search terms but rather a directed and targeted approach on the websites of states and jurisdictions of interest.

Paper Selection

After conducting searches, guidelines and guidance documents were evaluated according to the following inclusion and exclusion criteria:

Included:
1. Human infants and children between 0-5 years 2. English language 3. Selective inclusion of US documents - Bright Futures developmental checklist & CDC Legacy for Children intervention program
Excluded:
1. Non-English 2. Published prior to 2009 3. Exclude if age of participants >5

4. Exclude if program has no documented process
5. Insufficient information on the model/program to evaluate or extract required information
6. Exclude if NOT Australia, UK, Canada, NZ
7. Exclude if documentation lacks comprehensiveness
8. Screening test for specific disease or disorder

Information Management

Guidelines and guidance documents identified via our targeted searches were imported into EPPI-Reviewer 4 software.

The following information (where possible) was extracted from studies that met the inclusion criteria:

How participants are linked into the program
Description of targeted sample
Description of Screening & Surveillance Model

- Model topics
- Year commenced
- Target time points
- Assessment methods & tools
- Setting
- Workforce & capacity
- What factors are utilised to increase program participation?

Full details about the included studies are supplied in Appendix 5.

Additional Targeted Searches

Information Technology

As a separate search we endeavoured to determine the degree to which technology is being utilised to extend reach and provide relevant and targeted information to families about health care in early development. We searched for high levels of evidence in the form of systematic reviews and/or randomised controlled trials (RCTs). We were unable to find any relevant publications and thus broadened the scope and aimed to identify any relevant peer-reviewed literature. Initial searches were conducted using the following databases: Ovid MEDLINE and CINAHL (EBSCO). We used broad search criteria however it did not yield any relevant papers. Refer to Appendix 2 for an example of the search strategy used in Medline.

In an attempt to identify emerging uses of technology in the primary care setting a search involving the grey literature was undertaken. Given the potential breadth of materials and avenues to acquire this knowledge we were in the first instance directed from experts in the field and a secondary search was undertaken in Android and Apple ‘app’ Stores.

Autism Screening

In response to a specific request from NSW Kids and Families we specifically sought to determine if there is relevant peer-reviewed literature evidence to include autism screening as part of a developmental surveillance program. Initial searches were conducted using the following databases: Ovid MEDLINE and CINAHL (EBSCO). We aimed to identify at least one good quality review paper in order to provide a summary of the current thinking in this area. Refer to Appendix 3 for an example of the search strategy used in Medline.

Evaluation of the Evidence

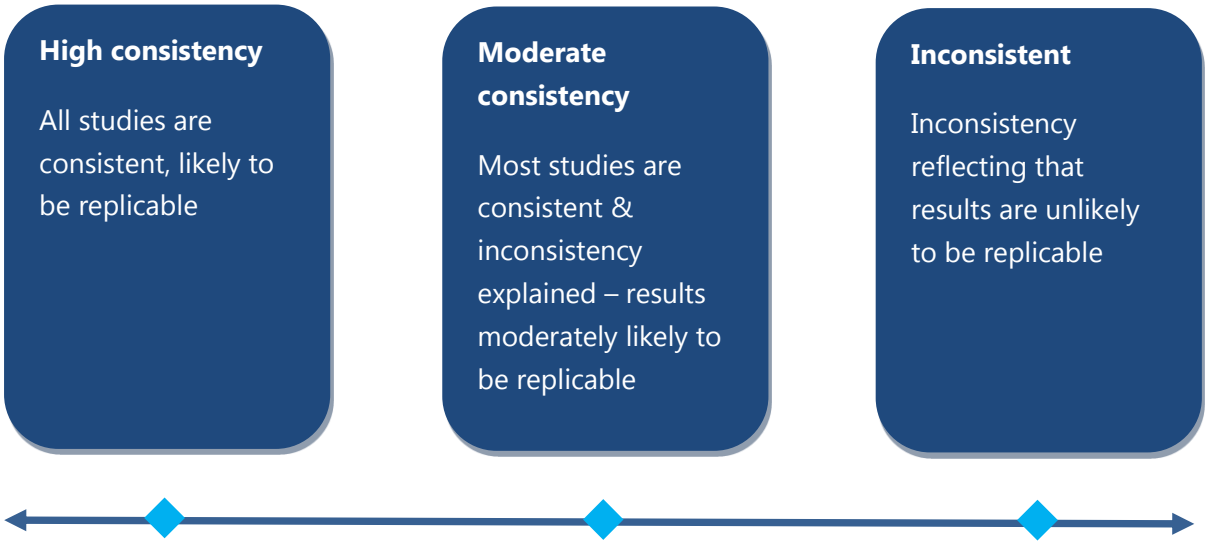
There were 4 key components that contributed to the overall evaluation of the evidence.

- Consistency
- Cost effectiveness (Efficiency)
- Generalisability
- Applicability.

An evaluation of the evidence would usually include an assessment of the strength of the evidence, which includes quality & risk of bias, quantity of evidence, and level of evidence, however this approach was inappropriate to apply to governmental based guidelines.

Consistency

A judgement was made as to whether the findings were consistent across the included studies (including across a range of study populations and study designs).



Cost Effectiveness (Efficiency)

Efficiency is a measure of the economy with which an intervention of known efficacy and effectiveness is carried out. This is frequently used synonymously with cost-effectiveness,

which in most cases is appropriate. As well as the actual costs of a screening program, a measure of efficiency or cost-effectiveness must consider the costs of any potential harms of the intervention versus the benefits, and the opportunity costs of other interventions that are foregone in favour of the program in question.

High efficiency

Several level I or II studies which show high cost effectiveness

Moderate efficiency

1+ Level II studies or 2+ level III- IV studies which show moderate to high cost-effectiveness

Low efficiency

1+ Level II studies or 2+ level III- IV studies which show low cost-effectiveness

Generalisability

Generalisability refers to how well participants and settings can be generalised to the NSW population. Population issues that might influence the relative importance of recommendations include gender, age or ethnicity, baseline risk, or the level of care (eg community or hospital). This is particularly important for evidence from RCTs, as the setting and entry requirements for such trials are generally narrowly based and therefore may not be representative of all the patients to whom the recommendation may be applied in practice.

High

The populations investigated in the evidence base are the same as the target population

Moderate

The population/s examined are similar to the target population or is clinically sensible to apply this evidence to the target population

Low

The population/s examined are different to the target population

Applicability

A judgement on the applicability is determined by whether the evidence base is relevant to the NSW context, or to specific local settings (rural, cities). Factors that may reduce the

direct application of study findings to the Australian or more local settings include organisational factors (e.g. availability of trained staff, clinic time, specialised equipment, tests or other resources) and cultural factors (e.g. attitudes to health issues, including those that may affect compliance with the recommendation).

RESULTS

The initial search of peer-reviewed literature did not yield any papers that met the inclusion criteria.

Table 2 outlines the models that were found across the jurisdictions of interest following our search of the grey literature, including the New South Wales model as outlined in the *NSW Maternal and Child Health, Primary Health Care Policy*(13). New Zealand has a clear national approach, with a recently published national schedule for their Well Child/Tamariki Ora (WCTO) program(14). Australia and the United Kingdom have high-level frameworks or guidelines at a national level(15, 16), but each has devolved responsibility for the delivery of programs to a more local level of government. As such, details of these programs were sought on Australian state/territory government websites, as well as for each province and territory within Canada, and separately for England, Scotland, Northern Ireland and Wales. Programs were only included in this review if sufficiently detailed documents were found through this searching of the grey literature.

"Who": Description of target population

Each of the comprehensive models sought to include all children (universal reach) and most noted a need to increase focus and intensify resources for under-privileged/at risk children, a principle variously described as progressive or proportionate universalism. Documents varied with respect to the amount of detail regarding the identification, engagement and management of such at-risk children, although sub-populations of indigenous/aboriginal families, teenage mothers and children in poverty were frequently mentioned.

New Zealand's general guidance document for supporting vulnerable families(17) stood out as providing comprehensive details and advice for practitioners on a range of key domains, specific to a wide range of sub-populations. It includes avenues for referral to support services, and provides a list of resource documents and additional reading.

The *Healthy Child Healthy Future* program in Northern Ireland(18) had clear categories to assist in determining the amount of support needed by families using a "Thresholds of Need" approach:

- Level 1 base population
- Level 2 children with additional need
- Level 3 children in need
- Level 4 children with complex and/or acute needs

"How": Enrolment into program and factors aiming to increase participation

Unfortunately, despite all frameworks stating intent to reach all children and their families, only some of the documents outlined how children were connected into the program. It was not clear in the guideline documents what the exact processes were. Mention was frequently made of hospital-based enrolment around the time of birth, but some components were described as being offered to parents (e.g. in Scotland: a health check at age 2 years(19)). The UK is moving towards mandating several components of their Healthy Child Program (HCP) through legislation(20), and Victoria has legislated the notification of births to the local councils who deliver the Maternal & Child Health program. In New Zealand, there is an expectation of triple enrolment of newborns, firstly a linked National Immunisation Registrar/General Practice enrolment, enrolment with a WCTO provider and enrolment with a Community Oral Health Service(14). Parents are responsible for the first of these, but the Lead Maternity Carer (LMC) is responsible for referring an infant to the WCTO by 4 weeks of age, using a standard referral form. Where a baby has particularly high needs, the LMC may involve the WCTO by two weeks of age.

It is well recognised in many of the different frameworks that often the most vulnerable sub-populations have the lowest usage rates. Although all models aim for universal reach, and most outlined the need to target at-risk populations, guidelines and specifications as to how to reach those at greatest risk (e.g. Culturally & Linguistically Diverse populations, those with special needs, indigenous populations etc.) were hard to find. This has been addressed within Western Australia by the Aboriginal Health Council of WA, which established a maternal and child health (MCH) program for Aboriginal Community Controlled Health Services aiming to close the gap in indigenous life outcomes in early childhood(21).

The guidelines from the Northwest Territories in Canada were the only ones to make specific mention of using technology to assist with both engaging parents online as well as providing electronic resources to increase access to information via modern streams. This region has a small and high-risk population, and their current action plan includes developing resources for electronic tablets that will help mothers track developmental milestones, provide immunization information and highlight the importance of early childhood development, developing website content, and using social media based support networks, with the aim of distributing electronic tablets to new parents in 2015/2016(22).

"When": Recommended ages for visits/contact

There was some variability as to the specific ages that children and families were targeted for follow-up and monitoring (see Appendix 5). However there was global acceptance that "around birth" is a critical time point to access families and perform a number of health checks and anticipatory guidance. Most regions have at least a couple of scheduled time points before 6 months and there is some variability in the frequency and specific time points targeted beyond 6 months, and up to what age, ranging from approximately 2 years to up to 5 years and beyond.

The NSW model has 8 specified time points (1-4 weeks, 6-8 weeks, 6 months, 12 months, 18 months, 2 years, 3 years, and 4 years). New Zealand, Victoria, USA, and Northern Ireland are particularly comprehensive with most variation explained by several additional key target ages before 6 months.

"What": Description of program

The themes and topics identified across the states/provinces were fairly consistent. The major areas acknowledged as important for inclusion in a universal program included:

- Developmental surveillance and health monitoring – including physical health, vision and hearing, oral health, and growth monitoring. This enables early identification of health and developmental problems as well as connection of children with services for further assessment or intervention.
- Early identification and management of family needs – including parenting skills, family functioning, family violence, and parental mental health. Fathers were frequently specifically mentioned as a subgroup with their own needs to be addressed.
- Health and developmental promotion – e.g. providing information on and encouraging safe sleeping, injury and illness prevention, breastfeeding, and nutrition.

A significant point of difference was the terminology emphasis of the USA model, Bright Futures: themes were focused on promotion rather than monitoring and identifying need (e.g. promoting child development, promoting safety and injury prevention)(23).

The United States (USA) have a health education campaign called "Learn the Signs. Act Early" which aims to highlight the importance of identifying developmental concerns early and provides parents and professionals with a range of tools to assist(24). The program has 3 main components, which promotes awareness of 1) healthy developmental milestones during early childhood, 2) the importance of tracking each child's development, 3) the importance of acting early if there are concerns. The program has a strong focus on early identification of children with autism.

The following information is provided for parents and health professionals on the Centres for Disease Control (CDC) website:

i) Detailed checklists about developmental milestones from 2 months to 5 years of age in English and Spanish

ii) Free materials that can be translated or customised to put an organisations contact information

iii) Advice on what to do if you're concerned – how to help your child and how to talk with the doctor

iv) Autism case training – A developmental-behavioural paediatrics curriculum

v) A free online training course, "Watch Me! Celebrating Milestones and Sharing Concerns"

vi) Multimedia and tools – videos, public service announcements

Interventions

An emerging area of inclusion is that of evidence-based interventions. The Victorian MCH program includes the delivery of a program to improve the sleep of young children, which was piloted and then tested in a randomised controlled trial(10, 25). While it could be argued that some health promotion is intervention (for example, there is clear evidence that SIDS rates have fallen dramatically since there has been an awareness and implementation of safe sleep practices for infants), this emerging area includes more complex interventions than information transfer, such as participation in a weekly parent program (e.g. Legacy(26)).

See Appendix 5 for a summary of the main topics identified in each state/province.

Assessment methods & tools

Within the broad domains of screening/surveillance, health promotion and family functioning, various measures and tools were specified in the different models. These included:

- physical examination for growth and physical abnormalities (e.g. undescended testes, Developmental Dysplasia of the Hip (DDH), dental health)
- specific developmental assessment tools, administered either as a one-off or repeatedly over time (e.g. PEDS, Ages & Stages Questionnaire, M-CHAT) – administered directly by the clinician to the child or by questioning of the parent, depending on the tool
- parent questionnaires to elicit family functioning concerns (e.g. the Edinburgh Postnatal Depression Scale)

However, most guidelines also included lists of areas to be addressed that did not necessarily have a prescribed or evidence-based tool, such as safe sleeping checklists, topics that might be addressed in specific age visits etc. Prioritising these lists is one of the significant challenges for practitioners and policy makers alike. In one model, up to 80-100 topics for behavioural counselling were listed per visit (Bright Futures(27)).
See Appendix 5 for details of specific guidelines).

"Where": Setting

The NSW *Supporting Families Early Maternal and Child Health Primary Care Policy* outlines a model for the provision of population-based screening and surveillance, which includes guidelines related to the assessment, coordinated care, and home visiting(13). The provision of a home visit to families with a new baby is offered within two weeks of the birth, in addition there is some isolated targeted home visiting, and for families that require additional support there is an option for Sustained Health Home Visiting. Centre based activities and programs are conducted for a range of issues captured by the model.

Not all models provided detail as to the setting/s in which their screening and surveillance models were adopted, however those that did invariably provided these activities within a mixed-setting framework, very similar to New South Wales. Home visits were specifically part of the models described in the following regions: New Zealand(14), Northern Ireland(18), Scotland(19), Tasmania(28), and Victoria(29).

Autism screening

The Bright Futures Guidelines for health supervision of infants, children, and adolescents in the USA is the only national document included in this review that recommends specific screening for autism (27). In view of this fact we sought to determine the evidence base to justify its inclusion. The most recent high quality review examining this question was conducted in 2011 and published in Pediatrics (30). According to these findings there have been no autism screening programs that have been studied in randomised controlled trials challenging the recommendations of the American Academy of Pediatrics who suggest screening for autism be incorporated into routine practice (31). We can confirm that the evidence base is still sparse and there have been no RCTs since 2011 thus providing no additional evidence on the effectiveness of autism screening programs.

Although there are many available therapeutic approaches to childhood autism, including educational interventions, applied behavioural analysis, structured teaching, parent-mediated intervention, speech and language therapy, social skills therapy, and pharmacologic therapy, most of the studies evaluating their efficaciousness have significant methodological limitations thus resulting in a lack of evidence base to make clinical recommendations (32, 33). In addition to being able to clearly define and accurately test a condition, the effectiveness, acceptability, and affordability of management would need to be considered before recommending screening for autism. While there are some screening tools with sufficient sensitivity and specificity that they are used in the USA (e.g. M-CHAT), there are issues across many components necessary for screening for autism, including defining, diagnosis, measurement, and management (30).

That said, there is enough agreement within the field that early intervention is warranted where a diagnosis is suspected or made, along with sufficient public concern about the rising prevalence of autism that the Australian federal government has a funded ‘Helping Children with Autism’ package, which is age capped (diagnosis must be made by six years of age, and the available money for therapy must be used by seven years of age). Without population screening specifically for autism, current identification relies upon sufficient contact with health practitioners or early childhood educators that can either respond to parental concerns and point parents in the right direction or inform parents of their own professional concerns and encourage full assessment.

Information technology

There were no peer-reviewed publications utilising IT-based services to improve reach or demonstrate emerging ways to promote health in the primary care setting. We did however identify numerous “apps” available for tracking infant and early childhood milestones, from a wide variety of companies (see Table 3 for examples of “apps” relating to domains covered by child health/developmental programs). The time constraints for this review prevented us from exploring these “apps” in detail, however it is clear from a brief search that the sheer volume available could be potentially overwhelming or confusing to parents.

"Who": Workforce

There were numerous health professionals identified across the countries and regions of interest. Specifics regarding training requirements and workforce qualifications were infrequently documented.

The most comprehensive reference to workforce requirements was the NSW *Supporting Families Early Maternal and Child Health Primary Care Policy*(13) who stipulate that the minimum qualifications for universal health home visiting staff employed in the early childhood health service are registered nurse or midwife with qualifications in child and family health. Desirable qualifications include Graduate Certificate in Lactation/International Board Certified Lactation Consultant, Graduate Diploma of Midwifery/Midwifery Certificate, Graduate Diploma in Infant Mental Health, or advanced counselling skills. Other training specifications within this model include Clinical supervision, The Family Partnership Training, and SAFE START psychosocial assessment and depression screening training.

Recommendations are also provided in regards to the ratio of nurse to family, which is stipulated as one nurse full time equivalent (FTE) position to every 25 families for sustained health home visiting, where it is specifically funded and delivered as a distinct and separate service by child and family health nurses. The ratio for rural areas is less and recommended at one nurse FTE to every 20 families.

Other professionals employed within the various frameworks include: General Practitioners (GPs), Aboriginal health workers, Aboriginal Health Education Officers, Indigenous Health Workers, Strong Women Workers, Community-based workers, Aboriginal Maternal and Infant Care practitioners, Midwife, Obstetricians, Nurse Practitioners, Paediatricians, Vision & Hearing Technicians, Newborn Hearing Screeners, Authorised Vaccinators, Enrolled Nurses, Administration & clerical officers, Social workers, Psychologists, and speech pathologists.

Other training requirements include:

- Cultural competence training
- Informed consent
- Effective communication
- Privacy obligations & Well Child/Tamariki Ora services
- National Occupational Standards for Work with Parents
- Knowledge of relevant local services and guidelines.

Table 2: NSW Child Health Primary Health Care Policy compared with other Australian and International Models

	NSW	Australia National VIC Tasmania Western Australia	United Kingdom National Northern Ireland Scotland	Canada Manitoba Northwest Territories	New Zealand National	United States National
Target Population – universal	✓	✓ ✓ ✓ ✓	✓ ✓ ✓	✓ ✓	✓	✓
Progressive or proportionate universalism	✓	✓ ✓ ✗ ✓	✓ ✓	✓ ✓	✓	✓
Legislates an element of program	✗	✗ ✓ ✗ ✗	✓ ✗ ✗	✗ ✗	✗	✗
Ages for contact	Birth to 4 years	Birth to 5 years Birth to 3.5 years Not stated Not stated	Birth to 5 years Birth to 4.5 years Birth to 5.5 years	Not stated Not stated	Birth to 3 years	Birth to adolescence
Number of contact points	8	Not specified 10 Not stated Not stated	Unclear 3-6 13 4	Not stated Not stated	12	15
Monitor physical health	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated ✓	✓	✓
Hearing & vision screening	✓	✓ ✓	✓ ✓ ✓	Not stated ✓	✓	✓

	NSW	Australia National VIC Tasmania Western Australia	United Kingdom National Northern Ireland Scotland	Canada Manitoba Northwest Territories	New Zealand National	United States National
		Not stated ✓				
Growth monitoring	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated ✓	✓	✓
Health promotion	✓	✓ ✓ ✓ ✓	✓ ✓ Not stated	✓ ✓	✓	✓
Developmental assessment	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated ✓	✓	✓
Immunisation	✓	✓ ✓ Not stated ✓	✓ ✓ ✓	Not stated Not stated	✓	✓
Anticipatory guidance	✓	✓ ✓ ✓ ✓	✓ ✓ Not stated	✓ ✓	✓	✓
Autism Screening	×	× × × ×	× × ×	× ×	×	✓
IT utilised in program	×	× Related website × ×	× × ×	× ✓ - specific future plan	×	×

Table 3: "Apps" Related to Components of Developmental Surveillance Models

Developmental milestones	**Child Development Milestones** *Academy for Professional Excellence* List of child development Activities to promote healthy growth Developmental concerns	**Baby Wonder Weeks Milestones** *Domus Technica* Developmental changes Mental development Journal logger Tracker or diary	**Baby Milestones Checklist** *Digital Applications* Developmental milestones	**Baby Milestones** *Solpari* Tracks baby's achievements over the first year Associate a date & photo with each milestone	**Budding Baby: Milestones** *Sivart Technology LLC* Helps you keep up-to-date with baby's developmental milestones Play time ideas for babies & toddlers YouTube videos that demonstrate several aspects of parenting
Immunisations	**CDC Vaccine Schedule** *Centers for Disease Control and Prevention* For Clinicians recommending or administering vaccines Child & adolescent schedule Contraindications & precautions table Colour coding coordinates Vaccine name & dose specifics Catch-up schedule for children 4 months	**Save the Date** *NSW Ministry of Health* Parents can enter their child's name, DOB, & GP contact details – APP will calculate the next immunisation due date and send reminders	**Vaximate** *Pfizer Inc* Immunisation management and reminder app for parents (Australia). Create profile, customize Australian immunization schedule by location, tracks immunization progress from birth to 4 years, prompts appointment bookings & sets reminders. Plus disease info, child length/height/weight, game	**Vaccination Record** *SmartWave Inc* Apps comes bundled with recommended vaccination schedule for US, UK, Canada, and Australia. Can create custom schedule	**Vaccines on the Go** *CHOP Applications* Vaccines & the diseases they prevent, vaccine safety topics, including autism, thimerosal & too many vaccines, types of vaccines and how they are made, links to videos, vaccine-related games

	through 18 years min dosing interval				
Parenting	**Best of Parenting** *Best of Parenting* Helpful daily tips & inspiring quotes, solutions to over 100 common parenting challenges, insights into why challenges occur and how to deal with them, step-by-step tools, how-to-guide for developing parenting strengths & child's strength, links to tools	**Proactive Parenting** Appsuneed Training, tips, tricks, games, and fundamentals for mobile parents. Parenting forms, organisational spreadsheets, how to guides from newborn through to school	**All About Parenting** *Dind Apps* Parenting ideas, positive parenting tips on child development, practical solutions, tips for improving communication, building positive relationships and other useful parenting skills	**Parenting Guide** *Five Step Apps* Pregnancy guide week by week, toddler milestones & behaviour tips, child behaviour & health tips, teen tips, time out timer, fertility calculator, activities for kids, note pad, fertility questions & tips, single parenting tips, relationship tips	**Conscious Parenting 101 Lite** *SWB International* Provides videos on conscious parenting 101, motivational video, bedtime affirmations, interactive parent forum.
Growth	**Baby Growth Charts** *Meluna* Track child's growth with the help of somatometrics curves (weight, height, and head circumference)	**Baby Growth Apps** *Small Fish* Development Useful contact information, baby growth measurement, teeth chart, firsts/diary, and vaccine tracker.	**Baby Growth Spurt** *ConceptBase* Uses WHO data to show infant and baby growth charts for height, weight, head circumference, and BMI	**Baby Care** *Breet.Jia* Track baby growth – percentile charts height, weight, head circumference. Chart by DOB/Due date, compare baby's growth with CDC/WHO guidelines.	**Growth Chart Lite** *Cooloy.com* Helps keep track of child's growth from birth to 20 years. Calculates the growth percentile of the weight, height, and head circumference based on age and gender using data from CDC and WHO.
Breastfeeding	**Feed Baby** *Penguin Apps* Track & monitor baby's breastfeeding, diapers, sleep, pumpings, baths,	**Breastfeeding** *Whisper Arts* Remember what time breast-fed baby last time, record the time & duration of feedings,	**Breastfeeding** *Matthias Droste* Record & analyse nursing times, complementary	**Breast Feeding** *Tabulator CCW* Keep track of baby's breast/bottle feeding times with notes,	**Breastfeeding Log** *Erik Westlund* Display last feeding session, start & stop time, time since lsat feed, history of all

	growth & development. Record bottle feeds & breastfeeding, baby sleep pattern, journals & diary	keep a record of supplementary feeding, view summary reports	feedings, sleeps and crying Support for multiples	volume of milk, check when last fed, useful stats, set reminders	feeding sessions (possible to export via email), track vitamin D supplementation, reminder to stop feed, export history via mail

Efficacy and efficiency of programs

Information evaluating the overall programs/models identified was difficult to access. The peer-reviewed literature search did not yield any evaluations performed that included outcome measures for children and their families.

Victoria and New Zealand are two jurisdictions that have enabled evaluations of their early child health programs to be readily available. Victoria introduced a revised Key Ages and Stages (KAS) Framework in 2009, and following this commissioned an evaluation of its implementation (34). The first stage of evaluation 12 months following implementation focussed on the degree to which the framework was implemented, the impact on outcomes for families and children and the impact on the MCH workforce. Nurses and families were surveyed, along with MCH senior management staff and local service providers. Victorian usage data was also included, outlining participation rates for KAS visits in 3 time periods between 2000 and 2010.

More recent evaluation reports were not found, however, annual data reports are available on the DEECD website(35). These are broken down by region and by ATSI status, and include:

- enrolment figures,
- Key Ages and Stages Consultation figures and participation rates,
- MCH flexible capacity activities (e.g. numbers of telephone consultations or community strengthening activities)
- counts of reasons for counselling for child health and well-being(e.g. development, DDH, illness, dental health etc) as well as maternal/family wellbeing
- counts of reasons for referral for both children and mother/family
- breastfeeding counts and rates

The New Zealand Well Child/Tamariki Ora health service had quality reviews performed in 2007/08 and 2012 that informed the development of the WCTO Quality Improvement Framework. The second report using this framework was published in March 2014(36). The quality indicators are drawn from existing collection and reporting mechanisms to monitor and promote quality improvement without adding to the workload for practitioners or services. They are all reported on by region, deprivation and ethnicity. The indicators are grouped into three main categories:

- universal access (10 indicators, e.g. proportion of newborns enrolled with a general practice by 3 months, infants receiving all WCTO core contacts within their first year)
- equitable outcomes (e.g. breastfeeding, weight, dental health) and
- continuous quality improvement (e.g. children with abnormal scores on the Strengths and Difficulties Questionnaire (SDQ) and PEDS are referred)

The “Learn the Signs. Act Early” campaign was evaluated in regards to the use of a social marketing approach to increase the early identification and treatment of autism and other developmental disorders. The survey results indicated that three years after the program

launch more parents strongly agreed they look for the developmental milestones (66% in 2007 vs. 51% in 2004) (24). Daniel et al. also noted that pediatricians aware of the campaign were significantly more confident discussing cognitive development with parents (84% vs 74%), were more likely to be aware of resources available for referral and treatment (87% vs 70%), and to have resources to educate parents than paediatricians who had not heard of the campaign (59% vs 44%). Of note, the Centers for Disease Control and Prevention (CDC) support a number of research and evaluation projects to increase understanding of how to improve early identification of children with autism and other developmental disabilities, especially among population groups with health disparities.

Evaluation of the evidence

Whilst it was inappropriate to complete a comprehensive scientific evaluation of the evidence, including expert judgment of the strength of the evidence (quality and risk of bias, quantity of evidence, and level of evidence), it was possible to apply other scientific and useful criteria to the evidence base. Specifically, it was clear from the review that the key components that constitute a population-based screening and surveillance health care model across various countries and jurisdictions were consistently applied. The significant resource devoted to implementing such programs internationally highlight the investment and cultural value of such services/programs albeit that data on cost-effectiveness was difficult to ascertain. Given the population similarities between the reviewed regions and the contextual similarity to NSW, the generalisability and applicability were judged to be high. Thus overall there appears to be little evidence to suggest discontinuing such a program.

DISCUSSION

This rapid review of evidence in universal well child health programs has demonstrated that while there are some differences in their delivery, these are relatively minor. New South Wales is delivering a program that is highly consistent with those in jurisdictions with comparable models of health care delivery across the world. These models all aim to reach the entire population of newborns through their first five years of life, monitor children's growth, physical health and development, identify problems early, and promote optimal development, safety and wellbeing.

In the age of 'evidence-based medicine', there can be a temptation to demand high level, peer-reviewed evidence to support every decision made within health care. However, it is increasingly apparent that evidence satisfying that definition is often not available nor appropriate, particularly in the domain of population level programs. It would not be achievable (or arguably ethical) to design a trial of an overall universal well-child health and development program that would translate across different countries with different models of health care, but neither is it necessary. For example, the benefits of primary health care, under which fall the type of child health/development models considered in this review, have been well established: primary care helps prevent illness and death and is associated with a more equitable distribution of health (37).

Similarly, early intervention (therefore requiring early identification) for a variety of health and developmental problems is widely accepted to be a cost-effective strategy that optimises outcomes, due to evidence across a variety of conditions(5, 6). Universal surveillance of children's health and development engages parents and children in a regular and timely manner with experts who can evaluate parental concerns, assess children and make clinical judgements about those who may need further assessment.

There are a number of components to universal well child health programs that emerged from the review and are worth discussing further. For most there are no definitive answers but the review provides some direction for the NSW government. These are outlined below.

Population reach

The sparsely available data regarding efficiency and reach of these programs also makes it difficult to assess which components might be more effective. All programs have the intention of reaching all children. Many programs have adopted the approach of proportionate universalism, that is, acting with a scale and intensity proportionate to the level and scale of disadvantage, with the aim of reducing the steepness of the social gradient in health(38). While this principle is accepted, the detail regarding which disadvantaged populations to target and which interventions to use appear to be locally developed, as demonstrated in the Western Australia model that produced specific guidelines for their Aboriginal population (21).

Despite the aim of universal reach, all jurisdictions have a rate of 'drop-out' across the program that is difficult to conquer. The highest participation rates appear to be those in Victoria (35), where legislation mandates notification of births to the local council. The United Kingdom is moving towards mandation through legislation, due to commence in 2015. Most programs did not make clear their specific strategies to increase participation, although two referred to the

current or intended use of modern technology such as using text message reminders or engaging with families through websites, blogs or apps (22, 29)The effectiveness of the use of such technology within universal well-child health and development programs has not yet made an appearance in peer-reviewed literature, but such interventions and strategies to improve participation could be a future area of research.

Number of visits

There is a wide range in the number of visits recommended between jurisdictions (4 -15), with New South Wales recommending eight visits (mid-range). The optimal number of visits is not known, and resource limitations would encourage jurisdictions to keep visits to a minimum number that can still provide good outcomes for children. An interesting lesson emerges from the UK where a decade ago they changed their guidelines for child health surveillance, suggesting targeted checks of only some children instead of the previously conducted routine or universal screening at 2 years and 3.5 years. This was in response to the lack of evidence regarding the number of visits necessary and the concurrent need to rationalise. Subsequently, there were concerns that these changes could lead to a delay in the detection of children with autism and other pervasive developmental disorders) (39). Most recently, the UK has decided to reverse this decision and mandate a number of universal reviews, including a visit at 2-21/2 years.(20)

Setting

The setting for delivery of child health/development programs is varied – many programs have a combination of home visiting and clinic visits. Several systematic reviews have concluded that home visiting has strong evidence of effectiveness - a recent meta-analysis found mean effect sizes were significant and positive for three of the six outcome domains (maternal life course outcomes, child cognitive outcomes, and parent behaviours and skills) (40). The most appropriate setting in a particular jurisdiction will be in part related to the available workforce. Some research has shown that parents prefer using videoconferencing at a health care clinic to access a second professional assessment rather than having a second appointment at a different site(41). The rise of telehealth will provide increased opportunities to use the available workforce in more flexible ways to meet the needs of communities, particularly where distance is an issue.

It is also important to consider vulnerable populations and the best way to engage those who are often least likely to attend – it may be that neither clinic visits nor home visiting is appropriate for some sub-groups. For example a current research project in Southwest Sydney is about to examine whether developmental surveillance could be achieved in a CALD community by training playgroup facilitators in the use of a developmental screening tool (PEDS) – using the innovative approach of bringing developmental surveillance to the child but not in the home setting (42).

Health and development content

The content of the child health/development programs had significant overlap between the models. Physical health (including growth, vision and hearing) and development were monitored in all programs. However, it is important to note that these programs are not simply

about traditionally defined screening and/or surveillance. All include health promotion and education across a wide range of topics (e.g. safe sleeping, tobacco use in the home, providing developmentally appropriate activities). Some include evidence-based interventions as a routine part of their model, for example for promoting quality sleep in children (25) or using parent groups to improve child outcomes(23). A number of inclusions would fall into both categories of health promotion/education and intervention.

Technology

When considering specific screening tools, an area of future importance will be the use of technology in administering such tools. This is commonplace in the USA, where the PEDS, ASQ, Child Behaviour Checklist, and M-CHAT (to name a few) are all readily available, for a price, to be completed online by parents prior to well child health visits. Cost-effectiveness analyses have suggested that the completion of these tools in advance has been cost-saving, with reduced time required for visits, and an ability to focus on areas of need identified prior to the visit. None of the other jurisdictions seem to be routinely employing this technology at this time. The role of technology in face-to-face clinical practice as an adjunct to treatment and interventions employed to promote the uptake of technology by professionals in practice was recently reviewed, and consistent with our own peer-reviewed search concluded that there is a need to evaluate the feasibility, acceptability, safety, and efficacy of technologies(43).

Workforce

All of the models included in this review are delivered within established health care systems. The health care practitioners involved are predominantly from a child health nursing workforce, but a wide range of other clinicians are involved, including Aboriginal/indigenous health workers, GPs, paediatricians, and allied health practitioners. Within the nursing workforce, a wide range of skills can be required as minimum qualifications, depending on the expectations of the program, along with availability of the necessary training. When considering who should best deliver a child health and development program, it is not practical to separate out skill sets usually associated with a particular discipline from health care system constraints. For example, within Australia, GPs in ordinary practice are not as well set up to perform child health checks as their MCH nursing counterparts – many are not specifically trained in child development, appointments within clinics are often restricted to ten minute slots, and families may find themselves seeing different doctors within a particular practice, reducing continuity of care. Even in the US, where provision of well child checks is part of core business for primary care paediatricians, systems barriers contribute to difficulties in delivering developmental monitoring: time constraints, inadequate reimbursement, lack of non-physician support staff, lack of further diagnostic and treatment services, insufficient training and lack of familiarity with assessment tools. (44).

This theme of training was further explored in a study of NSW primary health-care practitioners investigating the knowledge, training and practice of identification and management of communication impairments in pre-school-aged children. (45). In this study, just 8% of practitioners correctly identified all of the ‘red flags’ for verbal and non-verbal communication. The majority (80%) correctly described the management of a typical case presentation. One-third felt their training in this area was poor and 90% indicated they would like further training. Interestingly, less than half of GPs used the NSW Blue Book in their regular practice. Despite

the barriers, a recent study looking at the implementation of the Australian 4 year old (GP delivered) “Healthy Kids Check” suggests that when reimbursed appropriately, GPs can do well child health checks successfully. (46)

There are some exceptions to the level of skill required. Home Visiting programs to specific subpopulations seem to require highly skilled professionals (47), when compared to volunteer staff. However, there is also evidence for interventions within early child health being successfully delivered by a workforce only trained for that specific intervention (i.e. not health care providers) (48) as well as trials that have successfully devolved interventions that would be usually delivered by tertiary practitioners to primary care (10, 49).

It is worth noting that regardless of the particular practitioner delivering the program, there are inherent difficulties associated with current approaches time constraints, access to quality and affordable care, access to needs specific care, and various obstacles to needs based intervention such as long waiting lists for assessment and intervention (50-53). Common to all of the different but successful models is tapping into the available and most appropriate workforce within the setting, and ensuring access to the appropriate training and tools.

Data

The scarcity of available data suggests several missed opportunities. The use of data is essential for quality control and quality improvement internally. Making these data publicly available enables different jurisdictions to compare and understand possible best practice. Ideally data should be collected from databases and records already in use, minimising any burden on the clinicians delivering the service. Specific outcome data linked to areas of focus are important to determine the effectiveness of what is delivered within the program. Electronic records can also enable data linkage to other data sets (e.g. AEDC data) which can add value by providing highly relevant local data without the need for primary data collection.

The value and significant appeal of programs that deliver population-based screening and surveillance also stem from how information can be used at national, state, and local levels to help monitor the effectiveness of public health services or interventions that are specifically designed to promote health and wellbeing. The Australian Childhood Immunisation Register is a good example of the use of data to both inform and monitor the effectiveness of a universal program. The data has been utilised to both “find” children who are not immunised as well as reporting immunisation rates at the local, state and national level.

RECOMMENDATIONS

In this rapid review we appraised universal child and family health services in a number of countries and Australian jurisdictions. This is not a field in which peer-reviewed level one published evidence for overall programs can or is likely to be available, much like similar universal platforms (e.g. schools). The prevalence of these programs would suggest they are a highly valued and critical part of the health system in most western countries; delivered with remarkable and surprising consistency. To that end, NSW is broadly in line with current worldwide best practice in child health/development models, particularly in similar jurisdictions.

Although beyond the scope of this review, expert advice would suggest there are a number of existing evidence-based interventions that could maximise the potential of having a universal platform that extends to families of children in this young age group. These could be beneficial to both the child and the parent. Therefore, while the evidence to support the universal infrastructure per se is likely to remain elusive, the ability of the workforce to respond to problems (elicited through the existing surveillance and screening tools) is highlighted as a potential opportunity to leverage the investment already made by government. We would recommend further rapid reviews be undertaken to ascertain the availability of robust evidence supporting brief interventions delivered through well-child care. These could capitalise on the longitudinal nature of follow up and be embedded into nurse practice. This could include interventions related to breastfeeding, infant sleep, smoking, language, obesity, nutrition, parenting, postnatal depression.

In addition, there are literatures beyond well child care per se that could be sourced in order to investigate the capability and capacity of a range of professionals in undertaking the type of work delivered through well-child health/development models. For example there are a number of language studies that have demonstrated the ability of non- specialist workforces to deliver language interventions. This review would not be limited to effectiveness trials but would rather scope how non-traditional workforces have been shown to effectively deliver, under supervision, elements of specialist based interventions and programs. This suggests that it is possible for nurses, for example, to either be skilled to undertake more specialist work (e.g. in interventions) and/or devolve responsibility to lesser skilled professionals who could be trained to deliver the program under supervision.

It is clear, even from this rapid review that evidence is not keeping pace with technological developments. Various jurisdictions are already engaging with IT and communication technologies for a wide variety of purposes: to increase attendance (through text reminders or apps that remind about visits or immunisation schedules), to provide health promotion materials (websites, blogs, tablets, apps) and (mostly in the USA) to improve the efficiency of administration of screening tools. Few of these opportunities have been robustly tested to determine their effectiveness or even their quality. Just as there is potential for brief interventions to be delivered through traditional models of well-child care (e.g. at visits with the health care worker), there is much potential for technology to be harnessed for interventions, and analysed to provide evidence for effectiveness and efficiency.

Finally, only a few jurisdictions made data about their programs readily available. This may not reflect a lack of data, but perhaps an underutilisation of the data that already exist. Finding both process and outcome measures that are not overly onerous on those providing

the care (ideally those that can be collected automatically from existing databases including the use of data linkage) makes it possible to perform quality improvement internally (providing data back to providers), to determine the impact of the program against key outcome indictors, and to contribute to the understanding of best practice in this domain.

REFERENCES

1. Coppock JH, Ridolfi DR, Hayes JF, St Paul M, Wilfley DE. Current approaches to the management of pediatric overweight and obesity. *Current Treatment Options In Cardiovascular Medicine*. 2014;16(11):343.
2. Fagg J, Chadwick P, Cole TJ, Cummins S, Goldstein H, Lewis H, et al. From trial to population: a study of a family-based community intervention for childhood overweight implemented at scale. *International Journal of Obesity* (2005). 2014;38(10):1343-9.
3. Pimperton H, Kennedy CR. The impact of early identification of permanent childhood hearing impairment on speech and language outcomes. *Archives of Disease in Childhood.* 2012;97(7):648-53.
4. Mattheus DJ. Efficacy of oral health promotion in primary care practice during early childhood: creating positive changes in parent's oral health beliefs and behaviors. *Oral Health and Dental Management.* 2014;13(2):316-9.
5. Moore TGaM, M. Acting Early, Changing Lives: How prevention and early action saves money and improves wellbeing. Paddington, NSW: The Benevolent Society, 2013.
6. Heckman JJ. Giving Kids a Fair Chance: A Strategy That Works: MIT Press; 2013.
7. NHMRC. Child Health Screening and Surveillance: A Critical Review of the Evidence. Report prepared by Centre for Community Child Health, Royal Children's Hospital Melbourne for the National Health and Medical Research Council: 2002.
8. Council on Children With Disabilities. Identifying infants and young children with developmental disorders in the medical home: an algorithm for developmental surveillance and screening. *Pediatrics.* 2006;118(1):405-20.
9. NICS. Evidence-Practice Gaps Report. National Institute of Clinical Studies, 2005.
10. Hiscock H, Bayer J, Gold L, Hampton A, Ukoumunne OC, Wake M. Improving infant sleep and maternal mental health: a cluster randomised trial. *Archives of Disease in Childhood*. 2007;92(11):952-8.
11. Health CfCC. Child Health Screening and Surveillance: A Critical Review of the Evidence. Royal Children’s Hospital Melbourne for the National Health and Medical Research Council: 2002.
12. Muir Gray JA. Evidence-based healthcare: How to make health policy and management decisions. New York: Churchill Livingstone; 1997.
13. New South Wales Department of H. NSW Health/Families NSW Supporting Families Early Package – maternal and child health primary health care policy. Australia: 2009.
14. Ministry of Health New Z. Well Child/Tamariki Ora National Schedule. New Zealand: 2013

15. Australian Health Ministers' Advisory C. National Framework for Universal Child and Family Health Services. 2011

16. Department of Health. Healthy Child Programme: Pregnancy and the first five years of life. United Kingdom: 2009

17. Ministry of Health NZ. Well Child / Tamariki Ora Programme Practitioner Handbook: Supporting families and whānau to promote their child's health and development. New Zealand. Wellington2013.

18. Department of Health Social Sciences and Public Safety. Healthy Child, Healthy Future: A framework for the universal child health promotion programme in Northern Ireland. Northern Ireland: 2010

19. Scotland NHS. Child Health Surveillance Programme Pre-School - Clinical Guidelines. Scotland: 2010.

20. Department of Health UK. Factsheet: Commissioning the national Healthy Child Pogramme - mandation to ensure universal prevention, protection and health promotion services. United Kingdom: 2014

21. McHugh AM, Hornbuckle J. Maternal and Child Health Model of Care in the Aboriginal Community Controlled Health Sector. 2011.

22. Departments of Education C, Employment, Health, So. A Framework for Early Childhood Development in the Northwest Territories: Action Plan. 2013.

23. Hagan JF, Shaw JS, Duncan PM. Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents - Third Edition. United States of America: American Academy of Pediatrics, 2008

24. Daniel KL, Prue C, Taylor MK, Thomas J, Scales M. 'Learn the signs. Act early': A campaign to help every child reach his or her full potential. *Public Health*. 2009;123, Supplement 1(0):e11-e6.

25. DEECD. Maternal and Child Health Service: Practice Guidelines. Victoria Australia: 2009 2009. Report No.

26. National Center on Birth Defects and Developmental Disabilities. Legagcy For Children: Prevention Program. United States of America: Division of Human Development and Disability, 2011.

27. Hagan JF, Shaw JS, Duncan PM. Bright Futures Guidelines for Health Supervision of Infants, Children, and Adolescents. Edition T, editor. Elk Grove Village: American Academy of Pediatrics; 2008.

28. Department of Health and Human Services. Child Health and Parenting Service - Strategic Plan. Tasmania: 2009 2009. Report No.

29. DEECD. Maternal and Child Health Service Guidelines. Victoria, Australia: 2011 2011.

30. Al-Qabandi M, Gorter JW, Rosenbaum P. Early autism detection: are we ready for routine screening? *Pediatrics*. 2011;128(1):e211-7.

31. Johnson CP. American Academy of Pediatrics, Council on Children With Disabilities. Identification and evaluation of children with autism spectrum disorders. *Pediatrics.*;120:1183-215.

32. Rogers SJ, Vismara LA. Evidence-based comprehensive treatments for early autism. *Journal of Clinical Child and Adolescent Psychology,* 2008;37(1):8-38.

33. Granpeesheh D, Tarbox J, Dixon DR. Applied behavior analytic interventions for children with autism: a description and review of treatment research. A*nnals of Clinical Psychiatry*. 2009;21(3):162-73.

34. Centre for Community Child Health M, RCH. Evaluation of the Implementation of the MCH Key Ages and Stages Service Activity Framework Year 1 (2010) Report.

35. Maternal & Child Health Services, Victoia. Maternal & Child Health Services Annual Report 2012-2013. DEECD. 2014

36. Ministry of Health NZ. Indicators for the Well Child / Tamariki Ora Quality Improvement Framework March 2014. Wellington, New Zealand.

37. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *The Milbank Quarterly.* 2005;83(3):457-502.

38. Marmot. Fair Society, Healthy Lives. London, UK: 2010.

39. Tebruegge M, Nandini V, Ritchie J. Does routine child health surveillance contribute to the early detection of children with pervasive developmental disorders? An epidemiological study in Kent, U.K. *BMC Pediatrics*. 2004;4:4.

40. Filene JH, Kaminski JW, Valle LA, Cachat P. Components associated with home visiting program outcomes: a meta-analysis. *Pediatrics*. 2013;132 Suppl 2:S100-9.

41. Ciccia AH, Whitford B, Krumm M, McNeal K. Improving the access of young urban children to speech, language and hearing screening via telehealth. *Journal of Telemedicine and Telecare*. 2011;17(5):240-4.

42. Woolfenden S. CALD Playgroup PEDS project in South East Sydney.(personal communication) 2014.

43. Montague AE, Varcin KJ, Parker AG. Putting Technology into Practice: Evidence and opinions on integrating technology with youth health services. Young and Well Cooperative Research Centre: Orygen, 2014.

44. Pediatrics Periodic Survey No. 53. Identification of children <36 months at risk for developmental problems and referral to identification programs. Elk Grove Village, IL: American Academy of Pediatrics, 2003.

45. Woolfenden S, Short K, Blackmore R, Pennock R, Moore M. How do primary health-care practitioners identify and manage communication impairments in preschool children? *Australian Journal of Primary Health*. 2013.

46. Thomas R, Doust JA, Vasan K, Rajapakse B, McGregor L, Ackermann E, et al. Identified health concerns and changes in management resulting from the Healthy Kids Check in two Queensland practices. *The Medical Journal of Australia.* 2014;201(7):404-8.

47. Olds DL, Robinson J, O'Brien R, Luckey DW, Pettitt LM, Henderson CR, Jr., et al. Home visiting by paraprofessionals and by nurses: a randomized, controlled trial. Pediatrics.110(3):486-96.

48. Boyle JM, McCartney E, O'Hare A, Forbes J. Direct versus indirect and individual versus group modes of language therapy for children with primary language impairment: principal outcomes from a randomized controlled trial and economic evaluation. *International Journal of Language & Communication Disorders.* 2009;44(6):826-46.

49. Wake M, Lycett K, Clifford SA, Sabin MA, Gunn J, Gibbons K, et al. Shared care obesity management in 3-10 year old children: 12 month outcomes of HopSCOTCH randomised trial. *BMJ*.346:f3092.

50. Child and family health nurses working with families of preschool-aged children. *Contemporary Nurse* 2014;23(1).

51. Jeyendra A, Rajadurai J, Chanmugam J, Trieu A, Nair S, Baskaran R, et al. Australian general practitioners' perspectives on their role in well-child health care. *BMC Family Practice*. 2013;14:2.

52. Schmied V, Donovan J, Kruske S, Kemp L, Homer C, Fowler C. Commonalities and challenges: a review of Australian state and territory maternity and child health policies. *Contemporary Nurse*. 2011;40(1):106-17.

53. Homer CSE, Henry K, Schmied V, Kemp L, Leap N, Briggs C. 'It looks good on paper': transitions of care between midwives and child and family health nurses in New South Wales. Women and Birth : *Journal of the Australian College of Midwives*. 2009;22(2):64-72.

APPENDICES

Appendix 1: Information Retrieval

The following is an example of the search strategy conducted in Medline

Step	Search Terms	No. of Records
S1	Exp Mass Screening/	74918
S2	population surveillance/ or public health surveillance/	40018
S3	evaluation studies as topic/ or program evaluation/	69635
S4	child development/ or language development/	23900
S5	Child Welfare/	13265
S6	child health services/ or "early intervention (education)"/	10568
S7	child behavior disorders/ or developmental disabilities/	19774
S8	language development disorders/ or speech disorders/	6716
S9	Diagnosis, Differential/	20500
S10	Well Child care/	972
S11	developing countries/	36034
S12	(developing countr$ or third world or underdeveloped countr$ or under developed countr$).mp.	57178
S13	exp africa/	129298
S14	europe/ or exp europe, eastern/ or exp transcaucasia/	135754
S15	americas/ or exp caribbean region/ or exp central america/ or latin america/ or mexico/ or exp south america/	117388
S16	antarctic regions/ or exp atlantic islands/ or exp indian ocean islands/ or exp pacific islands/	37615
S17	New Guinea/	290
S18	asia/ or exp asia, central/ or asia, southeastern/ or borneo/ or cambodia/ or east timor/ or indonesia/ or laos/ or malaysia/ or mekong valley/ or myanmar/ or philippines/ or thailand/ or vietnam/ or asia, western/ or bangladesh/ or bhutan/ or india/ or middle east/ or afghanistan/ or iran/ or iraq/ or jordan/ or lebanon/ or oman/ or saudi arabia/ or syria/ or turkey/ or yemen/ or nepal/ or pakistan/ or sri lanka/ or far east/ or china/ or tibet/ or exp korea/ or mongolia/	264407

Step	Search Terms	No. of Records
S19	(Afghanistan or Albania or Algeria or Angola or Antigua or Argentina or Armenia or Azerbaijan or Bangladesh or Barbados or Barbuda or Belarus or Belize or Bhutan or Bolivia or Bosnia or Botswana or Brazil or Bulgaria or Burkina Faso or Burundi or Cambodia or Cameroon or Central African Republic or Chad or Chile or Colombia or Comoros or Congo or Costa Rica or Croatia or Cuba or Czech* or Congo or Djibouti or Dominica or Dominican or East Timor or Ecuador or Egypt or El Salvador or Equatorial Guinea or Eritrea or Estonia or Ethiopia or Fiji or Gabon or Gambia or Ghana or Grenada or Guatemala or Guinea-Bissau or Guyana or Haiti or Honduras or Hungary or India or Indonesia or Iran or Iraq or Ivory Coast or Jamaica or Jordan or Kazakhstan or Kenya or Kiribati or Kyrgyzstan or Laos or Latvia or Lebanon or Lesotho or Liberia or Libya or Lithuania or Madagascar or Malawi or Malaysia or Maldives or Mali or Marshall Islands or Mauritania or Mauritius or Mexico or Micronesia or Moldova or Mongolia or Montenegro or Morocco or Mozambique or Myanmar or Namibia or Nepal or New Guinea or Nicaragua or Niger or Nigeria or Korea or Oman or Pakistan or Palau or Panama or Papua New Guinea or Paraguay or Benin or China or Peru or Philippines or Poland or Cape Verde or Georgia or Kosovo or Macedonia or Yemen or Romania or Russia or Rwanda or Saint Kitts or Saint Vincent or Saint Lucia or Sao Tome Principe or Saudi Arabia or Senegal or Serbia or Seychelles or Sierra Leone or Slovak* or South Africa or Solomon Islands or Somalia or Sri Lanka or Sri-Lanka or Sudan or Suriname or Swaziland or Syria or Tajikistan or Tanzania or Thailand or Togo or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Uganda or Ukraine or Uruguay or Uzbekistan or Vanuatu or Venezuela or Vietnam or Samoa or Zambia or Zimbabwe).af.	2364822
S20	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19	2364822
S21	(*Mass Screening/ or (*population surveillance/ or *public health surveillance/) or (*evaluation studies as topic/ or *program	1624

Step	Search Terms	No. of Records
	evaluation/)) and (4 or 5 or 6 or 7 or 8 or 9 or 10)	
S22	21 not 20	1332
S23	Child, Preschool/	400399
S24	22 and 23	471
S25	limit 22 to ("newborn infant (birth to 1 month)" or "infant (1 to 23 months)" or "preschool child (2 to 5 years)")	558
S26	24 or 25	558
S27	limit 25 to (english language and yr="2004 - Current")	347

Appendix 2: Information Retrieval – Information Technology

The following is an example of the search strategy conducted in Medline

Step	Search Terms	No. of Records
S1	well child visit.mp.	136
S2	app*.mp.	2986028
S3	1 and 2	43
S4	exp Technology/	224177
S5	1 and 4	3
S6	exp Child Health Services/	10568
S7	4 and 6	72
S8	exp Program Evaluation/	51764
S9	6 and 8	799
S10	4 and 6 and 8	11
S11	exp Mass Screening/	74918
S12	child/ or child, preschool/	813639
S13	Mass Screening/	60026
S14	12 and 13 and 4	29
S15	Technology/	3263
S16	12 and 13 and 15	1
S17	6 and 15	0

Appendix 3: Information Retrieval – Screening for Autism

The following is an example of the search strategy conducted in Medline

Step	Search Terms	No. of Records
S1	*Autistic Disorder/	11245
S2	exp Mass Screening/	74918
S3	population surveillance/ or public health surveillance/	40018
S4	evaluation studies as topic/ or program evaluation/	69635
S5	exp Child Health Services/	10568
S6	2 or 3 or 4 or 5	189191
S7	Child, Preschool/	400399
S8	1 and 6	525
S9	7 and 8	343
S10	limit 9 to ("newborn infant (birth to 1 month)" or "infant (1 to 23 months)" or "preschool child (2 to 5 years)")	343
S11	limit 10 to (english language and yr="2009 - Current")	107
S12	(developing countr$ or third world or underdeveloped countr$ or under developed countr$).mp.	57178
S13	exp africa/	129298
S14	europe/ or exp europe, eastern/ or exp transcaucasia/	135754
S15	americas/ or exp caribbean region/ or exp central america/ or latin america/ or mexico/ or exp south america/	117388
S16	antarctic regions/ or exp atlantic islands/ or exp indian ocean islands/ or exp pacific islands/	37615
S17	New Guinea/	290
S18	asia/ or exp asia, central/ or asia, southeastern/ or borneo/ or cambodia/ or east timor/ or indonesia/ or laos/ or malaysia/ or mekong valley/ or myanmar/ or philippines/ or thailand/ or vietnam/ or asia, western/ or bangladesh/ or bhutan/ or india/ or middle east/ or afghanistan/ or iran/ or iraq/ or jordan/ or lebanon/ or oman/ or saudi arabia/ or syria/ or turkey/ or yemen/ or nepal/ or pakistan/ or sri lanka/ or far east/ or china/ or tibet/ or exp korea/ or mongolia/	264407
S19	(Afghanistan or Albania or Algeria or Angola or Antigua or Argentina or Armenia or Azerbaijan or Bangladesh or Barbados or Barbuda or Belarus or Belize or Bhutan or Bolivia or Bosnia or Botswana or Brazil or Bulgaria or Burkina Faso or Burundi or	2364822

Step	Search Terms	No. of Records
	Cambodia or Cameroon or Central African Republic or Chad or Chile or Colombia or Comoros or Congo or Costa Rica or Croatia or Cuba or Czech* or Congo or Djibouti or Dominica or Dominican or East Timor or Ecuador or Egypt or El Salvador or Equatorial Guinea or Eritrea or Estonia or Ethiopia or Fiji or Gabon or Gambia or Ghana or Grenada or Guatemala or Guinea-Bissau or Guyana or Haiti or Honduras or Hungary or India or Indonesia or Iran or Iraq or Ivory Coast or Jamaica or Jordan or Kazakhstan or Kenya or Kiribati or Kyrgyzstan or Laos or Latvia or Lebanon or Lesotho or Liberia or Libya or Lithuania or Madagascar or Malawi or Malaysia or Maldives or Mali or Marshall Islands or Mauritania or Mauritius or Mexico or Micronesia or Moldova or Mongolia or Montenegro or Morocco or Mozambique or Myanmar or Namibia or Nepal or New Guinea or Nicaragua or Niger or Nigeria or Korea or Oman or Pakistan or Palau or Panama or Papua New Guinea or Paraguay or Benin or China or Peru or Philippines or Poland or Cape Verde or Georgia or Kosovo or Macedonia or Yemen or Romania or Russia or Rwanda or Saint Kitts or Saint Vincent or Saint Lucia or Sao Tome Principe or Saudi Arabia or Senegal or Serbia or Seychelles or Sierra Leone or Slovak* or South Africa or Solomon Islands or Somalia or Sri Lanka or Sri-Lanka or Sudan or Suriname or Swaziland or Syria or Tajikistan or Tanzania or Thailand or Togo or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Uganda or Ukraine or Uruguay or Uzbekistan or Vanuatu or Venezuela or Vietnam or Samoa or Zambia or Zimbabwe).af.	
S20	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19	2364822
S22	11 not 20	1332

Appendix 4: Screening Form

Used to code the eligibility of references acquired through search paradigms.

Screen on Title & Abstract

1. EXCLUDE Language: *Exclude if non-English*
2. EXCLUDE Date: *Exclude if published prior to 2004*
3. EXCLUDE Age: *Exclude if age of participants >5*
4. EXCLUDE Study Type: *Exclude if validation study, animal study, review paper, technical report, stand-alone methods paper*
5. EXCLUDE Demographic location: *Exclude if developing country*
6. EXCLUDE Study Group: *Exclude if specific disease/disorder*
7. EXCLUDE Outcome: *Exclude if outcome data does not report on the screening model or is inappropriate*
8. EXCLUDE Unavailable: *Exclude if full-text version is not readily available*
9. INCLUDE based on title & abstract: *Cannot be excluded so is marked as INCLUDE. Will require retrieval of full paper*

Appendix 5: Evidence Summary

Childhood Screening & Surveillance: Thematic Analysis

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
12507504	Australia: National Framework (2011)	**Origin of study/report** • Australia	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development • Support for mothers, fathers & carers • Community capacity building Responding to identified need • Child protection &	**Target time points** • Antenatal • General reference to time points birth - 6 months • General reference to time points 0-18 months • General reference to time points 2-5 years	**Assessment methods & tools** • Family & Pregnancy history • Observation for hygiene • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment • Maternal health & wellbeing check • Immunisation • Infant sleeping • Oral health check • vision screening • hearing screening

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			mandatory reporting		
12626714	Bright Futures (2008)	**Origin of study/report** • USA	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development • Support for mothers, fathers & carers • Community capacity building **Early identification of family needs** • Identifying high risk families	**Target time points** • newborn • Up to 1 week • 4 weeks • 8 weeks • 4 months • 6 months • 9 months • 12 months • 15 months • 18 months • 2 years • 2.5 years • 3 years • 4 years • Program f/u extends beyond 5 years	**Assessment methods & tools** • Family & Pregnancy history • Safe sleeping checklist • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment • Maternal health & wellbeing check • Immunisation • Infant sleeping • Oral health check • vision screening • hearing screening • Risk identification (e.g. smoking, alcohol) • Behavioural assessment • Physical activity • Autism-specific screening tool • Anemia

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			• Involvement of fathers		• Lead screening
12533494	Manitoba Early Childhood Developmental Framework (2013)	**Origin of study/report** • Canada	**Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development • Support for mothers, fathers & carers • Community capacity building **Early identification of family needs** • Identifying high risk families Responding to identified need • Child protection & mandatory reporting		
12630476	National ()	**Origin of study/report** • USA		**Target time points** • Miami curriculum • Los Angeles curriculum	

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
				[Info] Starts prenatal sessions to age 3. Five weekly group sessions (prenatally). At approx 2 months of age, intervention sessions resume - conducted in blocks of 10 meetings, followed by a break of 4 to 6 weeks to allow for home visits. The weekly meetings are 2 hours long.	
12533539	New Zealand National Schedule (2013)	**Origin of study/report** • NZ	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development	**Target time points** • newborn • within 48 hours • Up to 1 week • 2-6 weeks • 4-6 weeks • 6 weeks • 8-10 weeks • 3-4 months • 5-7 months • 9-12 months • 15-18 months • 2-3 years	**Assessment methods & tools** • Family & Pregnancy history • Observation for hygiene • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			• Support for mothers, fathers & carers • Community capacity building **Early identification of family needs** • Identifying high risk families Responding to identified need • Child protection & mandatory reporting		• Maternal health & wellbeing check • Immunisation • Infant sleeping • Oral health check • vision screening • hearing screening • Risk identification (e.g. smoking, alcohol) • Behavioural assessment
12533495	Northern Ireland A Framework for the Universal Child Health Programme	**Origin of study/report** • UK	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness	**Target time points** • Antenatal • newborn • 5 to 8 days • 10-14 days • 6-8 weeks • 8 weeks • 14-16 weeks • 3-4 months • 6-9 months • 12 months • 15 months	**Assessment methods & tools** • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			• Health education, anticipatory guidance & parenting skill development • Support for mothers, fathers & carers • Community capacity building **Early identification of family needs** • Identifying high risk families • Involvement of fathers	• 2 years • 3 or more years • 4-4.5 years	• Physical assessment • Maternal health & wellbeing check • Immunisation • Oral health check • vision screening • hearing screening
12533709	Northwest Territories Framework for Early Childhood Development (2013)	**Origin of study/report** • Canada	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education,		

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			anticipatory guidance & parenting skill development • Support for mothers, fathers & carers • Community capacity building **Early identification of family needs** • Identifying high risk families		
12507500	NSW Maternal and child health primary health care policy (2009)	**Origin of study/report** • Australia	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill	**Target time points** • Antenatal • newborn • 6-8 weeks • 6-9 months • 12 months • 18 months • 2 years • 3 or more years • 4 years	**Assessment methods & tools** • Family & Pregnancy history • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			development • Support for mothers, fathers & carers • Community capacity building **Early identification of family needs** • Identifying high risk families **Responding to identified need** • Child protection & mandatory reporting		• Maternal health & wellbeing check • Immunisation • Infant sleeping • Oral health check • vision screening • hearing screening • Risk identification (e.g. smoking, alcohol)
12533492	Scotland Child Health Surveillance Programme (2010)	**Origin of study/report** • UK	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Growth monitoring	**Target time points** • max. 28 days • 6-8 weeks • 2 years • Program f/u extends beyond 5 years	**Assessment methods & tools** • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment • Maternal health &

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
					wellbeing check • Immunisation • vision screening • hearing screening • Risk identification (e.g. smoking, alcohol) • Behavioural assessment
12507503	Tasmania Child Health & Parenting (2009)	**Origin of study/report** • Australia	**Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development • Support for mothers, fathers & carers • Community capacity building **Responding to identified need** • Child protection & mandatory reporting		
12533714	UK Factsheet Healthy Child	**Origin of study/report** • UK		**Target time points** • Antenatal • newborn	

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
	Programme (2014)			• 8 weeks • 12 months • General reference to time points 2-5 years	
12533712	UK Healthy Child Programme (2009)	**Origin of study/report** • UK	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development • Support for mothers, fathers & carers • Community capacity building **Early identification of family needs** • Identifying high risk	**Target time points** • Antenatal • newborn • 5 to 8 days • 8 weeks • General reference to time points birth - 6 months • General reference to time points 0-18 months • General reference to time points 2-5 years	**Assessment methods & tools** • Family & Pregnancy history • Observation for hygiene • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment • Maternal health & wellbeing check • Immunisation • Infant sleeping • Oral health check • vision screening • hearing screening • Antenatal promotional

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			families • Involvement of fathers • Signposting to information & services **Responding to identified need** • Child protection & mandatory reporting		interview • Postnatal promotional interviews
12507506	Victoria Department of Education (2011)	**Origin of study/report** • Australia	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development • Support for mothers, fathers & carers	**Target time points** • newborn • 2 weeks • 4 weeks • 8 weeks • 4 months • 8 months • 12 months • 18 months • 2 years • 3.5 years	**Assessment methods & tools** • Family & Pregnancy history • Observation for hygiene • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment • Maternal health & wellbeing check

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			• Community capacity building **Early identification of family needs** • Identifying high risk families **Responding to identified need** • Child protection & mandatory reporting		• Immunisation • Brigance • Infant sleeping • Oral health check • vision screening • hearing screening
12507505	Victoria Maternal & Child Health Services: Guidelines (2009)	**Origin of study/report** • Australia	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance &	**Target time points** • newborn • 2 weeks • 4 weeks • 8 weeks • 4 months • 8 months • 12 months • 18 months • 2 years • 3.5 years	**Assessment methods & tools** • Family & Pregnancy history • Observation for hygiene • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			parenting skill development • Support for mothers, fathers & carers • Community capacity building **Responding to identified need** • Child protection & mandatory reporting		feedings • Physical assessment • Maternal health & wellbeing check • Immunisation • Brigance • Infant sleeping • Oral health check • vision screening • hearing screening
12507508	Western Australia Maternal and Child Health Model in the Aboriginal Co	**Origin of study/report** • Australia	**Developmental surveillance & health monitoring** • Physical health • Vision & hearing • Oral health • Growth monitoring **Health promotion** • Prevention of disease, injury & illness • Health education, anticipatory guidance & parenting skill development		**Assessment methods & tools** • Family & Pregnancy history • Safe sleeping checklist • Observation for family violence • Developmental assessment • Growth (weight, height, & head circumference) • Nutrition – feeding type, frequency, response to feedings • Physical assessment • Maternal health &

Item ID	Short Title	Country	Major Themes	Key Ages	Major Areas of Interest
			• Support for mothers, fathers & carers • Community capacity building		wellbeing check • Immunisation • Infant sleeping • Oral health check • hearing screening • STI screening [Info] Antenatal - includes testing for Gonorrhea with Chlamydia specimens. • Between 28 and 36 weeks gestation –repeat HIV and syphilis serology. • At 36 weeks gestation – Chlamydia and Gonorrhea. • Risk identification (e.g. smoking, alcohol)

Appendix 6: Quality & Bias Checklist for RCTs

Checklist for appraising the quality of RCTs

Completed		
Yes	No	
		Method of treatment assignment
		Correct, blinded randomisation method described OR randomised, double-blind method stated AND group similarity documented
		Blinding and randomisation stated but method not described OR suspect technique (eg allocation by drawing from an envelope)
		Randomisation claimed but not described and investigator not blinded
		Randomisation not mentioned
		Control of selection bias after treatment assignment
		Intention to treat analysis AND full follow-up
		Intention to treat analysis AND <25% loss to follow-up
		Analysis by treatment received only OR no mention of withdrawals
		Analysis by treatment received AND no mention of withdrawals OR more than 25% withdrawals/loss-to-follow-up/post-randomisation exclusions
		Blinding
		Blinding of outcome assessor AND patient and care giver (where relevant)
		Blinding of outcome assessor OR patient and care giver (where relevant)
		Blinding not done
		Blinding not applicable
		Outcome assessment (if blinding was not possible)
		All patients had standardised assessment
		No standardised assessment OR not mentioned
		Additional Notes
		Any factors that may impact upon study quality or generalisability

Appendix 7: Quality & Bias Checklist for Observational Studies

Checklist for Appraising the Quality of Observational Studies

Completed		
Yes	No	
		1. Study Question
		Clearly focused and appropriate question
		2. Study Population
		Description of study population
		Sample size justification
		3. Comparability of Subjects
		Specific inclusion/exclusion criteria for all groups
		Criteria applied equally to all groups
		Comparability of groups at baseline with regard to disease status and prognostic factors
		Study groups comparable to non-participants with regard to confounding factors
		Use of concurrent controls
		Comparability of follow-up among groups at each assessment
		4. Exposure or Intervention
		Clear definition of exposure
		Measurement method standard, valid and reliable
		Exposure measured equally in all study groups
		5. Outcome measures
		Primary/secondary outcomes clearly defined
		Outcomes assessed blind to exposure or intervention
		Method of outcome assessment standard, valid and reliable
		Length of follow-up adequate for question
		6. **Statistical Analysis**
		Statistical tests appropriate
		Multiple comparisons taken into consideration
		Modelling and multivariate techniques appropriate
		Power calculation provided
		Assessment of confounding
		Dose-response assessment if appropriate
		7. **Results**
		Measure of effect for outcomes and appropriate measure of precision
		Adequacy of follow-up for each study group
		8. **Discussion**
		Conclusions supported by results with possible biases and limitations taken into consideration

Appendix 8: Criteria for the appraisal of screening tests and screening programs

Criteria for a Screening Test

	Yes/No/Unknown
Simple, quick & easy to interpret	
Acceptable to public	
Accurate	
Repeatable	
Sensitive	
Specific	

Criteria for a Screening Program

	Yes/No/Unknown
Important health problem	
Accepted treatment	
Facilities for diagnosis and treatment	
Latent or early symptomatic stage	
Suitable test or examination	
Test acceptable to the population	
Natural history adequately understood	
Agreed policy on whom to treat	
The cost of case-finding balanced with expenditure on medical care as a whole	

Appendix 9: Levels of Evidence Hierarchy

NHMRC Evidence Hierarchy: Designations of 'Levels of Evidence' for Screening Intervention

Level	Screening Intervention
Level I	A systematic review of level II studies
Level II	RCT
Level III-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternative allocation or some other method)
Level III-2	A comparative study with concurrent controls: • Non-randomised, experimental trial • Cohort study • Case-control study
Level III-3	A comparative study without concurrent controls: • Historical control study • Two or more single arm study
Level IV	Evidence obtained from case studies
Level V	*The current tables exclude expert opinion and consensus from an expert committee as they do not arise from scientific investigation*