STUDY PROFILE

MatCH (Mothers and their Children's Health) Profile: Offspring of the 1973–78 Cohort of the Australian Longitudinal Study on Women's Health

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Abstract

MatCH (Mothers and their Children's Health) is a nationwide Australian study to investigate the links between the history of health, wellbeing and living conditions of mothers and the health and development of their children. MatCH builds on the Australian Longitudinal Study on Women's Health (ALSWH), which began in 1996 and has surveyed more than 58,000 women in four nationally representative age cohorts. MatCH focuses on the three youngest offspring of the cohort of ALSWH participants randomly sampled from all women in Australia born in 1973–78 (N=5780 children of N=3039 mothers). These women, who had completed up to seven postal or online surveys since 1996, were invited in 2016–17 to complete surveys about the health and development of their three youngest children aged under 13. The mothers reported on their children's health conditions and symptoms, diet, anthropometric measures, childcare, screen time, physical activity, temperament, behaviour, language development, motor development and health service utilisation, as well as household and environmental factors. These data are being linked with each child's records from official sources including the Australian Early Development Census (collected at age five to six), the National Assessment Program – Literacy and Numeracy (collected at age eight, 10, 12 and 14) and other external datasets. MatCH will combine 20 years of maternal data with all the information on her children, taking into account the family setting. MatCH offers an unprecedented opportunity to advance our understanding of the relationship between maternal health and wellbeing and child health and development.

Keywords

Introduction

Cohort studies are essential to understanding the evolution of health problems across the life course and for health policy planning. However, to fully understand human health and wellbeing, and to plan appropriate prevention policies, we need to understand the intergenerational influences that shape health behaviour and disease onset. The Mothers and their Children's Health study (MatCH; http://www.alswh.org.au/match-about) is designed to investigate the extent to which the history of maternal health and wellbeing, along with characteristics of the family environment, lead to disparities in child health, development and health service use, and how this varies between the three youngest offspring (for example, by sex, birth order, number of siblings).

MatCH builds on the long-running Australian Longitudinal Study on Women's Health (ALSWH) (Dobson et al., 2015; C. Lee et al., 2005; Loxton et al., 2017). Beginning in 1996, ALSWH has surveyed more than 58,000 women in four age cohorts (born in 1921–26, 1946–51, 1973–78 and 1989–95). MatCH combines the rich history of existing maternal data from the 1973–78 cohort (collected seven times between 1996 and 2015) with new data (collected in 2016–17) from the mother about her three youngest children aged under 13. These data are being linked to external data from the Australian Early Development Census (AEDC) (collected during the first year of school when children are aged 5–6), and the National Assessment Program – Literacy and Numeracy (NAPLAN) (collected at ages eight, 10, 12 and 14) and other sources.

The objectives of MatCH are to examine the associations between child health, development and health service use and: 1) maternal sexual and reproductive health; 2) maternal socioeconomic factors and health-related behaviours; 3) history of maternal and family characteristics; 4) family environment; 5) physical home environment (including environmental exposures); and 6) access to health services, including distance from major towns or cities.

Women's sexual health, age at first birth and use of assisted reproductive technology have implications for their own overall health as well as their children's health at birth and beyond (Mishra et al., 2013). Sexually transmitted infections affect almost one in five Australian women (Australia. Department of Health and Ageing, 2010) and can lead to pelvic inflammatory disease, ectopic pregnancy, infertility, pre-term delivery and low birthweight offspring (Aral, 2001). An increasing number of women are having children later in life, increasing the risk of pregnancy complications and poor birth outcomes. Findings from the ALSWH show that by the age of 36, one in five women report infertility (Herbert, Lucke, & Dobson, 2012). Use of assisted reproductive technology by sub-fertile and infertile women has substantial costs, emotionally, physically and financially, and is also associated with an increased risk of pregnancy complications and adverse birth outcomes such as prematurity and low birthweight offspring (Camarano et al., 2012; Filicori et al., 2005; Qin, Liu, Sheng, Wang, & Gao, 2016). MatCH will investigate the extent to which maternal history of poor sexual and reproductive health is associated with poor child outcomes, and whether this effect varies among the three youngest siblings.

Maternal socioeconomic position is a strong determinant of intergenerational effects, from birth outcomes to early child health and development and adult health and wellbeing (Morris et al., 2017). Women in the most disadvantaged areas of Australia have a 50% higher fertility rate, earlier first birth and a higher percentage of low birthweight offspring compared to women in areas with least disadvantage (Australia. Department of Health and Ageing, 2010) (with the continuum of disadvantage–advantage defined by geographical distance to health services provided by large towns or cities). Findings from the ALSWH show that the most disadvantaged young women are twice as likely to smoke, be obese and to have low levels of physical activity compared to the most advantaged women (Lawlor, Tooth, Lee, & Dobson, 2005). Children from families of low socioeconomic

position are at increased risk of poor outcomes such as injury, chronic health conditions, psychiatric disturbance, poor cognitive development, poor academic engagement, and maladaptive social functioning (Bradley & Corwyn, 2002; Chen, Matthews, & Boyce, 2002; Propper, Rigg, & Burgess, 2007; Schoon, Sacker, & Bartley, 2003). Compared to children in the least disadvantaged areas, children in the most disadvantaged areas are less likely to be exclusively breastfed to four months of age (Australian Institute of Health and Welfare, 2012). They have more screen time, have a higher intake of energy-dense drinks and snacks, and lower consumption of fruit and vegetables (Cameron et al., 2012), and are almost twice as likely to be overweight or obese (Australian Institute of Health and Welfare, 2012). To identify the potential for early family-specific interventions, MatCH will investigate the extent to which maternal socioeconomic factors (education level, employment status and income) and maternal lifestyle factors (diet, physical activity, body weight, alcohol intake and illicit drug use) are associated with child birth outcomes, health, development and health service use, and whether these effects vary between the three youngest offspring. It will also investigate whether maternal and family characteristics have varying influences on the diet and physical activity of children in the family, and whether this in turn influences child health and development.

The family environment is the most influential social context in early childhood. Family structure, the defining characteristic of the family environment, has become less stable, with family dissolution and divorce increasingly commonplace (Australian Institute of Health and Welfare, 2012). Changes in family structure heighten the risk of poor child mental health and wellbeing (Sawyer et al., 2012; Vimpani, Patton, & Hayes, 2004), and children in one-parent families can be more vulnerable (Pearce, Lewis, & Law, 2013). For example, in 2014, 25% of one-parent families reported ever experiencing homelessness and 56% could not access healthcare due to cost (Australian Bureau of Statistics, 2015). Furthermore, ALSWH data revealed that sole mothers had significant mental health issues, explained in part by financial stress (Loxton, Mooney, & Young, 2006). Parent–child interactions play a key role in determining child health and wellbeing and can have long-term

consequences on child development. Positive and responsive parenting reduces the risk of child behaviour problems and enhances child health and educational outcomes, placing children on a positive developmental trajectory through to adolescence (Maggi, Irwin, Siddiqi, & Hertzman, 2010). While positive and negative parenting practices are largely independent of socioeconomic position (Maggi et al., 2010), family socioeconomic position is closely linked with family stressors (Australian Institute of Health and Welfare, 2012) and also predicts brain development in early childhood (Luby et al., 2013). Positive parenting can build children's coping resources and buffer the impact of family stressors such as financial strain (Maggi et al., 2010). MatCH will investigate the extent to which family environment (household composition, social support, child care, maternal stress, parenting, ability to manage on income, job insecurity, and poor partner relationship including the presence of domestic violence) affect outcomes among children in the family.

Environmental exposures in the home can have long-term influences on health, as infants and young children spend the majority of their time indoors. There is increasing evidence that adverse environmental exposures may play a substantial role in the initiation and/or progression of diseases, including respiratory diseases (e.g. asthma), neuro-behavioural disorders, mild mental disability, obesity, Type 2 diabetes and childhood cancer (Grant, Carpenter, Sly, & Sly, 2013). Exposure to harmful substances in the environment during vulnerable developmental stages can have lifelong consequences. For example, exposure to persistent organic pollutants early in life can influence metabolism in a way that has been hypothesised to promote obesity (D. H. Lee et al., 2010). MatCH will investigate the extent to which the home environment (housing type, over-crowding, tobacco smoke, particulate matter and household chemicals) affects the health and development of children.

In Australia, distance from major towns and cities can affect people's health and their access to health services (Australian Institute of Health and Welfare, 2010; Schofield, Shrestha, & Callander, 2012), with one in three Australians aged over 15 years residing in outer regional and remote areas reporting difficulty accessing health care (Australian Bureau of Statistics, 2015). These issues can be

further compounded by greater socioeconomic disadvantage in rural and remote areas (Australian Bureau of Statistics, 2015). Improving primary health care in these areas is a central tenet of Australian national health policy (Australian Department of Health and Ageing, 2011). Compared to those who live in major cities, children who live in remote areas are 1.4 times more likely to have been born with low birthweight, are twice as likely to be developmentally vulnerable in their first year of school, and have twice the rate of hospital admission due to injury (Australian Institute of Health and Welfare, 2012). MatCH will strengthen the evidence base for family health and health service use needs by investigating the extent to which living in rural and remote areas of Australia is associated with child outcomes, particularly health service use, and whether these effects vary among offspring.

Study design

Selection of mothers

In 1996, three random samples of women born between 1973–78, 1946–51 and 1921–26 were invited to participate in the ALSWH. The women were selected from the database of the Health Insurance Commission (now Medicare Australia). Medicare is Australia's universal health insurance scheme that covers all Australian citizens and permanent residents regardless of age or income. Those living in rural and remote areas were

sampled at twice the rate of women living in urban areas. Details of the ALSWH design, recruitment methods and national representativeness of participants have been described elsewhere (Brown et al., 1998; Dobson et al., 2015; C. Lee et al., 2005). Potential participants in MatCH were all ALSWH participants born in 1973–78 who had not died, withdrawn from the study, asked not to be contacted about sub-studies, or had reported infertility. In 1996, when the women in the 1973–78 cohorts were recruited they were found to be largely representative of Australian women of the same age, with some over-representation of university-educated women (by about 5%) and under representation of immigrants from non-English speaking countries (by about 7%). Over successive surveys, these biases have increased and therefore need to be taken into account when the aim of any analyses are to generalise results to the Australian population (Dobson et al., 2015).

Data collected on the mothers

Women in this cohort were surveyed by postal questionnaires or online surveys in 1996, 2000, 2003, 2006, 2009, 2012 and 2015. The surveys included items about biological, psychological, social and lifestyle factors as well as physical and mental health and health service use. A summary of the constructs relevant to MatCH is shown in table 1.

Table 1: Sample of constructs and self-reported measures from ALSWH

Construct	Measures
Sexual health	Self-reported doctor diagnosis of sexually transmitted infections, visits to sexual health clinics.
Reproductive characteristics	Age at birth, inter-pregnancy interval, numbers of miscarriages, terminations, stillbirths, ectopic pregnancies and live births.
Fertility history	Diagnosis of endometriosis or polycystic ovary syndrome, use of fertility treatment, use of contraception.
Pregnancy and birth	For each pregnancy: gestational diabetes or hypertension, premature birth, infant birthweight, admission to special care.
Lifestyle factors	Height, weight, cigarette smoking, alcohol intake, use of illicit drugs, level of physical activity, sedentary behaviour.
Health service use	Visits to general practitioners and specialists; hospitalisation.
Childhood	Highest educational qualification and occupation of parents, experiences of abuse and adversity in childhood.
Adult socioeconomic position	Highest educational qualification, employment status, occupation history, income, ability to manage on income.
Family environment	Household composition, relationship with partner, experience of domestic violence, social support, life stressors, work–family conflict, family functioning.
Access to health services	Accessibility of services, remoteness from major cities.
Health related quality of life	Medical Outcomes Study Short Form-36 Health Survey (Version 1)[a].

Notes: [a] (Ware, Snow, Kosinski, Gandek, & Institute, 1993).

MatCH survey development

In 2014, focus groups and telephone interviews were undertaken with mothers of children aged 0–18 years to discuss the survey content, acceptable length and preferred modes of delivery, feelings about record linkage with external education databases and recommendations for encouraging participation by teenagers. For some of the proposed survey constructs, alternative instruments were trialled, with the most suitable chosen. The survey was pilot tested in 2015 with the 1973–78 pilot cohort, who regularly participate in survey development for the ALSWH. Women in this group who had reported at least one live birth were invited to complete surveys, either online or on paper, about their biological children under 13 years. Women were also asked to invite their older biological children (aged 13 to 18 years) to complete an online survey for themselves. There were separate surveys for each child according to age group (0–1 years, 2–4 years, 5–12 and 13–18 years).

As a result of the pilot testing it was decided to exclude teenagers as the recruitment strategy was unsuccessful (yielding a response rate of 8%; for more details see appendix A1). Consequently mothers were only asked to report on their three youngest children (it was estimated that less than 4% had more than three children aged under 13 years). Due to the ages of the children, the mothers completed all questions; that is, there was no child self-report. A tape measure was included in the mailed invitations as this had proved to increase participation and improve completion of the anthropometric measures. Based on maternal feedback about the burden of completing separate surveys for each child, the survey was re-formatted into a single multi-age instrument to make it easier to complete. Mothers who opted out of the survey were given the choice of consenting to data linkage only.

Selection of children

To be eligible for inclusion the children had to have birth mothers in the 1973–78 ALSWH cohort, be aged under 13 years on the date when the mother completed the MatCH survey and be currently living with their birth mother (at least part of the time).

Data collected on the children and families

The MatCH survey ran from August 2016 until May 2017. The measures used in the MatCH survey were designed to give a comprehensive snapshot of child health, development and wellbeing (table 2 and appendix A2). Individual measures were selected based on their scientific rigour, suitability for maternal report and length. Wherever possible, measures from other longitudinal studies were used in order to better enable comparisons.

MatCH is co-located with the ALSWH at the University of Queensland in Brisbane, Australia, with data collection procedures co-located with ALSWH at the University of Newcastle, Australia. Ethics approval was obtained from the University of Newcastle (reference number H-2014-0246) and The University of Queensland (reference number 2014001213) and women gave consent for themselves and their children.

Responses and participant characteristics

A total of 3,039 women responded to the MatCH survey invitation and provided information on 5,780 children (figure 1). The survey was completed online by 79% of respondents and on paper by 21%.
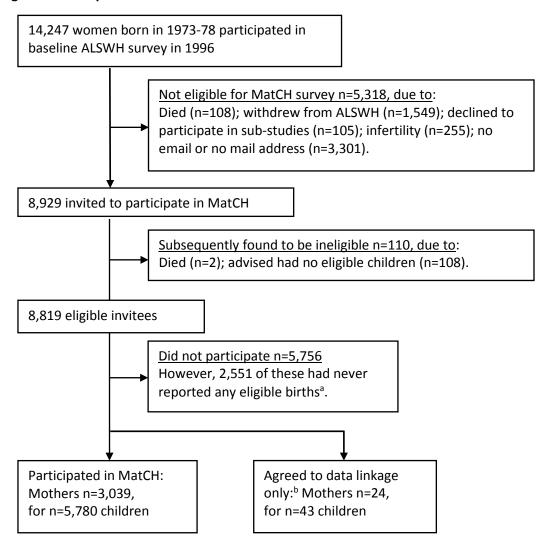
A total of 2,229 mothers (73%) who completed the MatCH surveys consented to external record linkage and provided sufficient personal information to enable data linkage for 4,239 children. A further 24 women who did not complete the MatCH survey about their children did consent to their own survey data (which had details of their children's dates of birth and pregnancy histories) to be linked to external education record linkage about their children. The estimated response rate for the mothers was at least 34% (3,039/8,819) but could be up to 48% (3039/6268; see figure 1). As shown in figure 1, there were 2,551 women who did not respond to the invitation to MatCH for whom we had never ascertained any births. While it is possible that some eligible births had occurred in this group since their last ALSWH survey, many would have been ineligible (70% of the women in this group completed ALSWH survey 7, conducted in 2015–16, and a further 22% had completed at least one ALSWH survey since 2003). For the purposes of comparing MatCH survey participants and non-participants (table 3) we have included only women to have reported a child of eligible age for MatCH (N=6,268).

Table 2: Selection of measures used in MatCH and applicable ages of the children[a]

Construct	Measures	Age range (years)		
		0–1	**2–4**	**5–12**
Child characteristics	Sex, current date, date of birth, multiple/pre-term birth.	✓	✓	✓
	Childcare.	✓	✓	✓
	School grade.	X	X	✓
Quality of life	Pediatric Quality of Life Inventory™	✓	✓	✓
Illness/disability	Longstanding conditions and symptoms, injury, infections, impact of child health on family.	✓	✓	✓
Health care	GP use/ satisfaction, health service use, alternative health practitioner use, immunisation status.	✓	✓	✓
Sleep	Brief Infant Sleep Questionnaire (BISQ).	✓	X	X
	Pediatric Sleep Problems Survey Instrument.	X	✓	✓
Social/emotional development	Short Temperament Scale for Toddlers.	✓	X	X
	Strengths and Difficulties Questionnaire (SDQ)	X	✓	✓
Parenting	Parental warmth and hostility.	✓	✓	X
	Alabama Parenting Scale – Short form.	X	X	✓
Physical activity	Measures against Australian PA guidelines for children.	✓	✓	✓
Home environment	Access to books, reading, play equipment/ facilities.	✓	✓	✓
	Environmental exposures in the child's bedroom (heating/cooling, mould/mildew, dust, floor covering) and in the home generally (renovations, cigarette smoke, pets, pesticides, cleaning practices).	✓	✓	✓
	Age/ number of other children in the household, whether birth father lives with the child	✓	✓	✓
Nutrition	Infant feeding, Children's Dietary Questionnaire (CDQ).	✓	✓	✓
Physical growth/ development	Pubertal Development Scale.	X	X	✓
	Anthropometric measurements.	✓	✓	✓
Language/motor development	Ages and Stages (ASQ 3)™	✓	✓	✓

Notes: [a] see appendix A2 for details of the measures used.

Figure 1: Participation in MatCH.

Notes: [a] Maternal status ascertained at the time of invitation. Women with no known eligible children received a modified invitation protocol, while known mothers received the full protocol.
[b] Mothers did not complete the MatCH survey but agreed to let the study team link information about them and their children (already collected during ALSWH) to external record linkage under MatCH.
(Detailed invitation protocols are provided in appendix A3).

Table 3 shows demographic and other information for mothers who participated in MatCH and known mothers who were invited but did not participate. Descriptively, mothers who participated in MatCH were more likely to have completed the most recent ALSWH survey, to have higher education, to be in full-time work and live in a major city. They were more likely to have never smoked, have healthy weight and report excellent or very good health. Multivariable analysis revealed the factors most predictive of participation (at p<0.001) were a university-level education versus year 12 or equivalent (Odds ratio and 95% confidence interval = 1.79 (1.50, 2.13)), working full time (1.59 (1.37, 1.87)) or part time (1.34 (1.16, 1.55)) versus not being in the labour force, being a current smoker (0.66 (0.54, 0.81)) versus a non-smoker, and being widowed (3.78 (1.18, 12.16)) or separated (0.63 (0.47, 0.84)) versus being married/in a defacto relationship (for details, see appendix table A4a; in addition, appendix table A4b contains a comparison of the differences between the 3,039 known mothers who participated in MatCH and the 2,551 women who had never reported births of children of eligible age for MatCH but who were invited and did not participate).

Most of the 5,780 children were aged 5–12 years (table 4). There were slightly more boys than girls, 4% were from multiple births and 6% had been born prematurely. Overall, around 16% of children were overweight or obese. More than 97% had been vaccinated and 44% had been breastfed for 6 months. Older children had fewer sleep problems but more longstanding health problems. Less than 10% had a communication or gross motor development delay. Less than 5% of children overall were reported to have moderate-severe longstanding health conditions: the most prevalent condition was asthma (overall 11%, but with children aged 5-12 years having a prevalence of 12.5%). Overall, 22% of children were reported to have moderate-severe longstanding health symptoms: the most prevalent of these were Eczema, dermatitis, skin allergy (19.2% overall, highest in children aged 2-4 years (22%)), respiratory allergy (15% overall, highest in 5-12 year olds (18%)), and anxiety (11% overall, highest in 5-12 year olds (13%)).

Most mothers reported being satisfied with their general practitioners (89.6%) with 6.8% neither satisfied nor dissatisfied and 3.5% dissatisfied. With regard to characteristics of the home environment, almost all of the households represented in the study had internet access at home, a private yard for children to play in and more than 30 books at home (table 5). Half had a pet dog or cat that lived indoors and less than 1% of households had cigarettes smoked indoors. Almost one in four dwellings had been renovated while the woman was pregnant or in the first 12 months of the child's life and one in three had ever used professional pest treatments.

Table 3. Comparison of MatCH survey participants and women with children of eligible age for MatCH who were invited but did not participate (data are from the most recent ALSWH survey the women completed).

	Participating mothers (48.5%) %	Non-participating mothers[a] (51.5%) %	Difference between groups, *p*
Total number (N)	3,039	3,229	
Age at invitation (mean, SD)	40.8 (1.4)	40.8 (1.4)	0.737
Last ALSWH survey completed:			
Surveys 1–6	5.7	38.6	
Survey 7	94.3	61.4	<0.001
Highest qualification			
Less than year 12 or equivalent	4.0	8.5	
Year 12 or equivalent	9.4	14.3	
Trade/apprenticeship/Cert/Dip	23.5	30.8	
University	63.0	46.4	<0.001
Marital status			
Never married	2.8	2.9	
Married/De facto	90.6	88.9	
Separated	2.8	5.1	
Divorced	3.4	3.0	
Widowed	0.4	0.1	<0.001
Live births reported[b]			
>3	8.3	10.2	
3	23.7	24.5	
2	49.2	46.9	
1	18.9	18.4	0.039
Employment status			
Not in labour force	15.7	23.2	
Employed part time	48.4	47.5	
Employed full time	36.0	29.3	<0.001
Smoking			
Never smoked	54.5	48.9	
Ex-smoker	37.8	38.7	
Current smoker	7.7	12.4	<0.001
Area of residence			
Major city	59.9	54.5	
Inner regional	25.3	28.6	
Outer regional	12.2	13.9	
Remote	2.5	2.9	<0.001
Illicit drug use[c]			
Never used	40.4	42.9	
Ever used	59.6	57.1	0.053
Alcohol use[d]			
Non-drinker	9.8	11.9	
Low risk	84.2	82.4	
High risk	6.0	5.6	0.025

Table 3. Continued.

	Participating mothers (48.5%) %	Non-participating mothers[a] (51.5%) %	Difference between groups, *p*
Body mass index[e]			
Underweight	2.3	1.6	
Healthy	49.1	46.2	
Overweight	27.5	27.7	
Obese	21.1	24.4	0.005
Self-reported health			
Excellent/very good	62.2	55.7	
Good	30.2	34.3	
Fair/poor	7.6	10.0	<0.001

Notes: [a] excludes two women who had died, 108 who advised they had no eligible children, and 2,551 who had never reported any eligible births; [b] This includes all live births regardless of child's age; [c] illicit drugs – amphetamines, LSD, natural hallucinogens, tranquilisers, cocaine, ecstasy, inhalants, heroin or barbiturates; [d] low risk - ≤14 drinks/week, high risk – 15+ drinks/week; [e] World Health Organisation Body mass index (BMI) guidelines – underweight (<18.5 kg/m^2), healthy weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), obese (≥ 30 kg/m^2).

Table 4: Selected characteristics of the children

	Missing	Overall		< 2 years		2–4 years		5–12 years	
	N	N	%	N	%	N	%	N	%
Total number		5,780	100	329	5.7	1,051	18.2	4,400	76.1
Sex	6								
Male		2,990	51.8	173	52.6	571	54.5	2,246	51.1
Female		2,784	48.2	156	47.4	477	45.5	2,151	48.9
Birth									
Twin/triplet	256	218	4.0	13	4.1	38	3.8	167	4.0
Premature	121	349	6.2	15	4.6	74	7.2	260	6.0
Body Mass Index[a]	1220								
Underweight		491	11.6	-	-	92	11.5	399	11.6
Acceptable		3063	72.4	-	-	561	70.2	2503	72.9
Overweight		518	12.2	-	-	112	14.0	406	11.8
Obese		158	3.7	-	-	34	4.3	124	3.6
Current sleep problems	24	969	16.8	101	30.8	245	23.4	623	14.2
Vaccinated[b]	45	5,571	97.2	317	96.4	1,013	97.0	4,242	97.3
Exclusively breastfed to six months of age	125	2,498	44.2	143	44.4	441	42.6	1,914	44.6
Injury in past 12 months	43	982	17.1	23	7.1	163	17.1	797	18.2
Infection in past 12 months	170	2,963	52.8	162	50.0	684	67.4	2,118	49.6
Any moderate–severe longstanding conditions[c]	41	265	4.6	2	0.6	33	3.2	230	5.3
Any moderate–severe longstanding symptoms[c]	47	1,285	22.4	29	8.9	151	14.4	1105	25.4
Communication delay[d]	168	49	5.0	23	9.5	26	3.6	-	-
Gross motor delay[d]	178	86	8.9	33	13.6	53	7.4	-	-

Notes: [a] BMI only valid for children aged two years and over (N=5,451). In some cases BMI could not be calculated due to missing (N=1,184) or biologically implausible values (N=36). [b] Had received all recommended vaccinations for their age to date; [c] 'Longstanding' defined as '…something that has troubled your child over a long period of time, or is likely to affect your child over a long period of time' (e.g. longstanding conditions included asthma, heart problems and epilepsy; longstanding symptoms included dermatitis and food allergies); [d] Communication and Gross motor questions were only presented to online participants, and applicable to the younger age groups (N=1,140).

Table 5: Characteristics of the home environment and environmental exposures

	Missing N	Total N	%
Total number of households		3,039	100.0
Internet access at home	36	2,885	98.8
Private yard for kids to play in	44	2,939	98.1
Number of books at home	42		
None		0	0.0
1–10		34	1.1
11–20		91	3.0
21–30		153	5.1
More than 30		2,719	90.7
Cigarette smoking indoors	59	23	0.8
Pet (dog or cat) indoors	51	1,525	51.0
Use professional pest treatments	68	934	31.4
Mould in bedroom of at least one study child	49	195	6.5
Renovations, during pregnancy/first 12 months of life, of at least one study child	53	1,029	34.5

Conclusions

Multiple aspects of the family environment play a critical role in shaping child health and development and in determining health and social outcomes across the life course. This is reflected in policy and research priorities at the national and international level. The MatCH study has many strengths and can make a unique contribution to advancing this field of knowledge. The study includes the history of maternal and family health and social characteristics and takes a family-centred approach to understanding the varying factors that influence the health, development and health service use of the children within family units. MatCH builds on 20 years of prospectively collected background data on a large and nationally representative cohort of mothers, and includes families living in rural and remote areas. The inclusion of data linkage to national data sets on child development is a major strength and will enable monitoring of child development and health service use well into the future. Limitations to MatCH include the following. The response rate is estimated to be between 34% and 47.5%. Further, as MatCH was limited to women participants in the ALSWH with children aged under 13 years, the cohort of mothers was of restricted age range (25 to 43 years), which may introduce bias as socioeconomic, health and family characteristics of women who give birth at a young age are different from women who give birth at later ages, and the impact on their children's outcomes differ (Fall et al., 2015). The child data have only been collected at a single point in time, however further waves of data collection are planned dependent on funding and the use of data linkage mitigates this limitation to some extent. Only data on the three youngest siblings were examined, although data on birth order and the total number of children in the family are also available. Finally, the majority of data collected in MatCH is by self-report, although in a previous study of the same ALSWH participants agreement between self-reported perinatal outcomes and administrative records was found to be high (<87%) (Gresham et al., 2015). Further, potential biases from self-report may also be mitigated by the use of validated questionnaires and data linkage.

Overall, the MatCH study is uniquely placed to strengthen the evidence base on child health, development and health service use, and to inform policy. Findings from MatCH will support early identification of mothers who are most at risk of having children with poorer health and development outcomes, provide guidance for family-focused health care, and inform preventative and primary health care for Australian families.

Access to MatCH data and data from the ALSWH

The ALSWH data are available free of charge on request to bona fide researchers. The process is documented on the website [http://www.alswh.org.au/], which includes all the survey questionnaires, data books of frequency tables for all surveys, meta-data, conditions of data access and request forms. Restrictions are imposed by some of the human research ethics committees (both national and state-based) and some data custodians on where some of the linked data may be analysed. Currently, MatCH survey data are not available as they are still being cleaned, checked and tested. MatCH data, including weights to enable comparisons with the Australian population, will become available in the future with access through the same process as described above.

Acknowledgements

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Appendix

A1: Overview of attempt to recruit teenage children (13–18 years)

In the MatCH Pilot study, mothers were gatekeepers for access to teens. Survey development and engagement activities that we conducted between 2012 and 2014 (including an online survey of 400 mothers, 80% of whom responded) showed that mothers were highly supportive of the proposed MatCH study. Focus groups with mothers subsequently revealed that incentives would be required for teen recruitment, however, we did not have a specific budget for this. For the Pilot study we offered teen prize draws (200 chances to win a $25 voucher). While similar incentives had recently proved to be highly effective in the online recruitment of a new cohort of 18–23 year old women to the ALSWH study, in that instance participants were drawn from the general public, rather than being already defined by their relationship to members of a previous cohort, as was the case for MatCH.

The MatCH recruitment strategy was designed with due regard to teen privacy: we had no means of directly contacting and following up potential teen participants. Rather, we asked the mother to pass on the online survey link. There were also ethical constraints about using unequal power relationships (in this case, parent–child) to induce participation. Therefore, we could not disclose to the mothers that their teen's survey was still not completed (however, in cases where we followed up the mother about her own survey, we added a general reminder about passing the invitation on to any teenaged children). Feedback from the telephone follow up of mothers revealed that they were frequently reluctant to pass the invitation on to their teens, or, if they did pass it on, to remind them about it.

The poor results to the Teen Pilot meant that we would have had to develop a completely new recruitment strategy for this group. However, there was a high risk that this would exhaust the remaining budget and timelines, so we decided to focus only on the younger children for the current survey wave. Teen participation may be re-visited in future waves, depending on available funding, the length of follow up, and the interests and capacity of the researchers.

A2: Details of the measurements and assessment scales used in the MatCH survey

Measurements and assessment scales	Details	Applicable ages
Ages and Stages Questionnaires Third Edition (ASQ-3)® Communication and Gross Motor subscales only	Squires, J., Bricker, D., & Potter, L. (1997). Revision of a parent-completed developmental screening tool: Ages and Stages Questionnaires. *Journal of Pediatric Psychology*, *22*(3), 313–328. http://www.brookespublishing.com/resource-center/screening-and-assessment/asq/asq-3/	1–66 months
Alabama Parenting Scale – Short form	Elgar, F. J., Waschbusch, D. A., Dadds, M. R., & Sigvaldason, N. (2007). Development and Validation of a Short Form of the Alabama Parenting Questionnaire. *Journal of Child and Family Studies*, *16*(2), 243–259. doi: 10.1007/s10826-006-9082-5	5–12 years
Body Mass Index in children	Cole, T. J., Flegal, K. M., Nicholls, D., & Jackson, A. A. (2007). Body mass index cut offs to define thinness in children and adolescents: international survey. *British Medical Journal*, *335*(7612), 194. doi: 10.1136/bmj.39238.399444.55	2–12 years
Brief Infant Sleep Questionnaire	Sadeh, A. (2004). A brief screening questionnaire for infant sleep problems: validation and findings for an Internet sample. *Pediatrics*, *113*(6), e570–e577.	0–1 years
Checklist of longstanding conditions and symptoms	Adapted from question used in the 2013 Primary Caregiver 3-Year Questionnaire, Growing up in Ireland Study[a]	0–12 years
Childcare	Adapted from unpublished question used in Deakin University 'HAPPY/INFANT' Studies[b]	0–12 years
Children's Dietary Questionnaire, Section B and C only	Adapted from: Magarey, A., Golley, R., Spurrier, N., Goodwin, E., & Ong, F. (2009). Reliability and validity of the Children's Dietary Questionnaire; a new tool to measure children's dietary patterns. *International Journal of Pediatric Obesity*, *4*(4), 257–265. doi: 10.3109/17477160902846161	0–12 years (individual items were asked for all children old enough to consume solid foods, but scores were only computed for children aged 2 years and over)
Health service utilisation:	Based on questions used in Longitudinal Study of Australian Children (LSAC)[c] and Growing up in New Zealand[d] studies.	0–12 years
Home environment:		0–12 years
- Availability/use of play equipment / facilities, including screen-based equipment	Based on questions used by Deakin University HAPPY and INFANT Studies[b]	

Measurements and assessment scales	Details	Applicable ages
- Books and reading	Questions used in the Longitudinal Study of Australian Children (LSAC)[c] and Growing up in New Zealand[d] Studies	
- Bedroom heating/cooling, ventilation	Questions used in Growing up in New Zealand Study[d] adapted for Australian environment.	
- Bedroom floor covering - Home renovations during gestation/ early life - Passive cigarette smoke - Pets in the home - Home pesticide use - Home cleaning practices	Selected items from a questionnaire under development by Queensland Children's Medical Research Institute (The questions are new, but are based on associations described in English, K., Healy, B., Jagals, P., & Sly, P. D. (2015). Assessing exposure of young children to common endocrine-disrupting chemicals in the home environment: a review and commentary of the questionnaire-based approach. *Reviews of Environmental Health*, *30*(1), 25-49. doi: 10.1515/reveh-2014-0069).	
- Other resident family members	New question	
Immunisation status	New question	0–12 years
Impact of child's health on child and family	New question	0–12 years

Infant feeding	Adapted from questions used in:
	• Feeding Queensland Babies.
	  Newby, R., Brodribb, W., Ware, R. S., & Davies, P. S. (2014). Infant feeding knowledge, attitudes, and beliefs predict antenatal intention among first-time mothers in Queensland. *Breastfeeding Medicine*, *9*, 266–272. doi: 10.1089/bfm.2014.0012
	• Australian National Infant Feeding Survey.
	  Fein, S. B., Labiner-Wolfe, J., Shealy, K. R., Li, R., Chen, J., & Grummer-Strawn, L. M. (2008). Infant Feeding Practices Study II: study methods. *Pediatrics*, *122 Suppl 2*, S28–35. doi: 10.1542/peds.2008-1315c
		0–12 years

Infections	Growing up in New Zealand Study[d]	0–12 years
Injury question	From question in WHO Health Behaviour in School Children Study. Scheidt, P. C., Harel, Y., Trumble, A. C., Jones, D. H., Overpeck, M. D., & Bijur, P. E. (1995). The epidemiology of nonfatal injuries among US children and youth. *American Journal of Public Health*, *85*(7), 932–938.	0–12 years
PACE+: adherence to Physical Activity guidelines	Question adapted for Australian Guidelines. Prochaska, J. J., Sallis, J. F., & Long, B. (2001). A physical activity screening measure for use with adolescents in primary care. *Archives of Pediatric and Adolescent Medicine*, *155*(5), 554–559.	1–12 years

Measurements and assessment scales	Details	Applicable ages
Parental warmth	Paterson, G., & Sanson, A. (1999). The Association of Behavioural Adjustment to Temperament, Parenting and Family Characteristics among 5-Year-Old Children. *Social Development*, *8*(3), 293–309. doi: 10.1111/1467-9507.00097	0–4 years
Parental hostility	Early Childhood Longitudinal Program[e] (as used in LSAC[c])	
Pediatric Sleep Problems Survey Instrument	Biggs, S. N., Kennedy, J. D., Martin, A. J., van den Heuvel, C. J., & Lushington, K. (2012). Psychometric properties of an omnibus sleep problems questionnaire for school-aged children. *Sleep Medicine*, *13*(4), 390-395. doi: 10.1016/j.sleep.2011.12.005	2–12 years
PedsQL[TM]: Infant/ Toddler/ Young child/ Child (Australian) versions	Varni, J. W., Seid, M., & Rode, C. A. (1999). The PedsQL (TM): Measurement model for the pediatric quality of life inventory. *Medical Care*, *37*(2), 126–139. http://pedsql.org/	0–12 years
Pubertal Development Scale	Carskadon, M. A., & Acebo, C. (1993). A self-administered rating scale for pubertal development. *Journal of Adolescent Health*, *14*(3), 190–195.	5–12 years
School grade	New question	4–12 years
Short Temperament Scale for Toddlers	Short version as used by the Longitudinal Study on Australian Children (LSAC) Fullard, W., McDevitt, S. C., & Carey, W. B. (1984). Assessing Temperament in One-to Three-Year-Old Children. *Journal of Pediatric Psychology*, *9*(2), 205–217. doi: 10.1093/jpepsy/9.2.205	0–1 years
Strengths and Difficulties Questionnaire (SDQ), 2–4, 4–10 years (Australian) versions	Goodman, R. (1994). A Modified Version of the Rutter Parent Questionnaire Including Extra Items on Children's Strengths: A Research Note. *Journal of Child Psychology and Psychiatry*, *35*(8), 1483–1494. doi: 10.1111/j.1469-7610.1994.tb01289.x http://www.sdqinfo.com/	2–12 years

[a] http://growingup.ie/index.php?id=83
[b] http://www.deakin.edu.au/ipan/our-research/other-projects
[c] http://www.growingupinaustralia.gov.au/
[d] http://www.growingup.co.nz/en.html
[e] https://nces.ed.gov/ecls/

A3: Details of the MatCH study invitation protocol and response rates

Table A3a: MatCH study invitation protocol

MatCH Study: Recruitment protocols	When sent[c]
A	**Full invitation protocol: Women with children of eligible age for MatCH[a] (N=6245)**	
A1	Mailed invitation	Batch 1: 23/8/2016
		Batch 2: 28/10/2016
A2	Email invitation	8 days after A1
A3	Email reminder with survey link	8 days after A2
A4	SMS reminder	8-10 days A3
A5	Mailed letter and paper survey	4-7 weeks A4
A6	Telephone follow up[d]	4 weeks after A5
A7	Email Invitation or paper survey re-sent (if requested	As soon as possible after A6
A8	Final SMS notification	3/05/2017
A9	Final email re data linkage-only option[d]	10/05/2017
B	**Modified invitation protocol: Women who had never reported births of children of eligible age for MatCH[b] (N=2684)**	
B1	Email invitation	Batch 1: 1/09/2016
		Batch 2: 2/11/2016
B2	Email reminder with survey link	8 days after B1
C	**Follow up of incomplete online surveys (N=1,499)**	
C1	First email reminder	2 hours after last survey login
C2	Second email reminder	8 days after C2
C3	SMS reminder	8 days after C3
C4	Telephone follow up	14 days after C4
C5	Email reminder or paper survey re-sent (if requested)	As soon as possible after C4
C6	Final SMS notification	3/05/2017

Notes: [a] Women in the ALSWH 1973–78 cohort who had reported at least one birth in the eligible age range in ALSWH surveys since 2003. [b] Women in the ALSWH 1973–78 cohort who had never reported any births in the eligible age range in ALSWH surveys since 2003. The protocol was modified to be sensitive to personal reproductive circumstances. [c] Invitations were initially issued to women who had completed follow up for ALSWH Survey 7. Batch 2 was issued to remaining potentially eligible women after the close of data collection for ALSWH Survey 7. [d] The 'data linkage only' option was offered on declining the survey online; on telephone follow up (where women indicated they did not have time to do the survey); and by email at the close of the survey (Protocol A9). Under this option women provided their child's personal details and consented to linkage of the child's health and education records with data held by ALSWH about the mother.

Table A3b: Response rate by study invitation protocol

	A		B		A + B	
	Known mothers		**Women who had never reported births of children of eligible age for MatCH**		**All women**	
	N	%	N	%	N	%
ALSWH 1973–78 Cohort	6594	100.0	7653	100.0	14247	100.0
Not invited:	349	5.3	4969	64.9	5318	37.3
Deceased/withdrawn	163		1494		1657	
Other (declined substudies, infertile, lacking contact details[a])	186		3475		3661	
Invited:	6245	94.7	2684	35.1	8929	62.7
Advised not eligible	61		49		110	
Eligible invitees:	6184	100.0	2635	100.0	8819	100.0
Did not respond	3205	51.8	2551	96.8	5756	65.3
Data linkage only option	24	0.4	0	0.0	24	0.3
Survey participants	2955	47.8	84	3.2	3039	34.5

Notes: [a] For Protocol A, women could be invited if they had either a mailing address or a valid email address in the ALSWH Participant Database. For Protocol B, a valid email address was a prerequisite to invitation.

A4: Comparisons between MatCH participants and ALSWH participants who may or may not have been eligible for MatCH

Table A4a: Fully adjusted logistic regression analysis of the comparison between women with children of eligible age for MatCH who did (N=3,039) and did not (N=3,229) participate in MatCH (Odds ratios (OR), 95% Confidence interval (CI)).

Variables	OR (for participation)	95% CI
Age	0.99	0.95, 1.02
Education (Ref: Year 12 or equivalent)		
Less than year 12	0.82	0.62, 1.08
Trade/Certificate/Diploma	1.08	0.89, 1.29
University	1.79***	1.50, 2.13
Marital status (Ref: married/defacto)		
Divorced	1.29	0.95, 1.76
Never married	1.23	0.88, 1.72
Separated	0.63**	0.47, 0.84
Widowed	3.78*	1.18, 12.16
Labour force participation (Ref: Not in labour force)		
Full time	1.59***	1.37, 1.87
Part time	1.34***	1.16, 1.55
Smoking status (Ref: Never smoked)		
Current smoker	0.66***	0.54, 0.81
Ex-smoker	0.89	0.79, 1.01
Alcohol consumption (Ref: Low risk consumption)		
Non-drinker	0.89	0.75, 1.07
Risky Drinker	1.15	0.89, 1.41
Area of residence (Ref: Major city)		
Inner regional	0.92	0.81, 1.04
Outer regional	0.90	0.77, 1.07
Remote	0.88	0.63, 1.23
Self-rated health (Ref: Excellent/very good)		
Fair/Poor	0.90	0.74, 1.11
Good	0.89	0.79, 1.01
Body Mass Index (Ref: Healthy weight)		
Underweight	1.52*	1.02, 2.26
Overweight	1.00	0.88, 1.14
Obese	0.99	0.86, 1.39
Number of children (Ref: Two)		
One	0.94	0.81, 1.09
Three or more	0.97	0.85, 1.11

Overall logistic regression model Likelihood Ratio χ^2_{26} = 266.9, $p \leq 0.001$

*** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$

Table A4b. Comparison of MatCH survey participants (N=3,039) and women who had never reported births of children of eligible age for MatCH[a] and who were invited but did not participate (N=2,551) (data are from the most recent ALSWH survey the women completed).

	Participating mothers	Women who had never reported births of eligible children but who were invited and did not participate	Difference between groups, *p*
Total number (N)	3,039	2,551	
Age at invitation (mean, SD)	40.8 (1.4)	40.9 (1.4)	0.008
Last ALSWH survey completed:			
Surveys 1–6	5.7	29.9	
Survey 7	94.3	70.1	<0.001
Highest qualification			
Less than year 12 or equivalent	4.0	7.3	
Year 12 or equivalent	9.4	13.0	
Trade/apprenticeship/Cert/Dip	23.5	29.7	
University	63.0	50.0	<0.001
Marital status			
Never married	2.8	34.7	
Married/De facto	90.6	55.6	
Separated	2.8	3.8	
Divorced	3.4	5.5	
Widowed	0.4	0.4	<0.001
Live births reported[b]			
>3	8.3	1.4	
3	23.7	6.7	
2	49.2	17.0	
1	18.9	9.1	
0	0	65.9	<0.001
Employment status			
Not in labour force	15.7	8.4	
Employed part time	48.4	22.0	
Employed full time	36.0	69.6	
Smoking			
Never smoked	54.5	50.2	
Ex-smoker	37.8	31.3	
Current smoker	7.7	18.5	<0.001
Area of residence			
Major city	59.9	59.8	
Inner regional	25.3	25.2	
Outer regional	12.2	12.6	
Remote	2.5	2.4	0.958
Illicit drug use[c]			
Never used	40.4	40.7	
Ever used	59.6	59.3	0.866
Alcohol use[d]			
Non-drinker	9.8	10.2	
Low risk	84.2	82.0	
High risk	6.0	7.8	0.026

Body mass index[e]			
Underweight	2.3	2.1	
Healthy	49.1	41.8	
Overweight	27.5	25.6	
Obese	21.1	30.5	<0.001
Self-reported health			
Excellent/very good	62.2	51.9	
Good	30.2	35.0	
Fair/poor	7.6	13.1	<0.0001

[a] these women may have had older children but had never reported any children in the eligible age range for MatCH, they were invited in case they had an eligible child who was not known to the ALSWH survey team ; [b] includes all live births regardless of child's age ;   [c] illicit drugs – amphetamines, LSD, natural hallucinogens, tranquilisers, cocaine, ecstasy, inhalants, heroin or barbiturates; [d] low risk - ≤14 drinks/week, high risk - 15+ drinks/week; [e] World Health Organisation Body mass index (BMI) guidelines - underweight (<18.5 kg/m^2), healthy weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), obese (≥ 30 kg/m^2).

Table A4b shows that the women who had never reported births of children of eligible age for MatCH were more likely to be unmarried, to have never had children (or to have had them at an earlier age), to be working full time, and to have slightly poorer health indicators. This group also included a higher percentage of ALSWH survey participants who had not recently completed surveys.