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The associations between medical, allied and complementary medicine practitioner visits and childhood vaccine uptake

Jane E. Frawley [a,*], Hope Foley [b], Erica McIntyre [b,c]

[a] Australian Centre for Public and Population Health Research, Faculty of Health, University of Technology Sydney, Level 8, 235 Jones St, Ultimo, NSW 2007, Australia
[b] Australian Research Centre in Complementary and Integrative Medicine (ARCCIM), Faculty of Health, University of Technology Sydney, Ultimo, NSW 2007, Australia
[c] School of Psychology, Charles Sturt University, Panorama Ave, Bathurst, NSW 2795, Australia

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ABSTRACT

Background: Vaccination rates have remained steady for a number of years in Australia, however geographical areas of lower vaccine coverage remains a day-to-day challenge. The study explores parental attitudes, beliefs and intentions in relation to vaccination and examines the early effects of recent No Jab No Pay legislation.

Methods: A national survey of was conducted, using an online questionnaire. Parents from all states in Australia with at least one child aged <6 years were invited to participate.

Results: A total of 429 parents participated in the study. The substantial majority of participants reported having their youngest child's vaccination status up to date (n = 401, 93.5%). A child's vaccinations were more likely to be up to date if they had consulted a paediatrician in the previous 12-months (OR 5.01; 95%CI 1.05, 23.92; p = .043). Conversely they were less likely to be vaccinated if they were influenced by information from a complementary medicine (CM) practitioner (OR 0.03; 95%CI 0.01, 0.15; p < .001) or had visited a CM-practitioner (OR 0.09; 95%CI 0.02, 0.33; p < .001) in the previous 12-months. A total of 2.6% of parents had immunised their child as a result of the No Jab No Pay legislation, while 3.9% stated the legislation had no effect, and 1.2% said it had made them less likely to vaccinate. A further 1.2% of parents stated they are considering vaccination as a result of the legislative changes.

Conclusion: Parents who have not vaccinated their children appear to trust non-mainstream sources of information such as CM-practitioners. Further research is required to determine how to manage the challenges and opportunities of CM-practitioners as a source of vaccine information.

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1. Introduction

Vaccination has drastically reduced incidence of mortality and morbidity from infectious diseases worldwide, particularly through paediatric immunisation. Childhood vaccine uptake in Australia is high with full coverage recently reaching 92.9% for 5-year-olds [1]. Despite this overall success, areas of lower vaccine coverage remain, often clustering in geographical locations creating practice and policy concerns for public health officials. Beliefs about vaccination are not binary, falling anywhere in a broad-spectrum of intention. While some parents forgo immunisation altogether or selectively vaccinate, others cautiously follow the vaccination schedule or unreservedly vaccinate. Research highlighting the differences and reflexivity between these groups is crucial to understanding vaccine-hesitancy and rejection.

Recent legislative changes in Australia termed 'No Jab No Pay' have attempted to promote paediatric vaccination by withholding government benefits and rebates such as the Family Tax Benefit A, Child Care Benefit, and Child Care Rebate if children's vaccinations are not up-to-date [2]. With these measures, the Australian Government has removed previously allowable exemptions from vaccination requirements on grounds of religious or conscientious objection. While it is too early to understand the full impact of No Jab No Pay, recent data from the Australian Institute of Health and Welfare (AIHW) shows many geographical areas with sub-optimal vaccine coverage remain [1]. Vaccine-hesitancy traverses all communities from higher socioeconomic areas, where vaccine rejection is often thought to be more common, to lower socioeconomic areas where failure to keep up-to-date with the vaccination schedule may relate to obstacles in accessing health services [3]. Consequently, punitive financial measures may not

* Corresponding author at: Australian Centre for Public and Population Health Research, Faculty of Health, University of Technology Sydney, Level 8, 235 Jones St, PO Box 123, Ultimo, NSW 2007, Australia.
E-mail address: jane.frawley@uts.edu.au (J.E. Frawley).

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impact all communities equally. Additionally, parents with philosophical objections may be less likely to consent to vaccination under financial pressure.

Health service use in Australia is often pluralistic with many Australians seeking care from multiple sources, including medical, allied health, and complementary medicine (CM) practitioners. CM covers a substantial broad-church of health-related practices and paradigms not found within conventional medicine [4]. Commonly accessed CM in Australia includes chiropractic, massage, naturopathy and traditional Chinese medicine [4]. Although estimates vary widely according to subpopulation and locality [4], a study found almost half of the Australian population had consulted a CM-practitioner in the previous 12-months [5].

Data from international studies have shown parents with concerns about vaccination are more likely to trust advice from CM-practitioners when seeking information about childhood immunisation [6]. Similarly, a recent Australian pilot study found children were less likely to be vaccinated if they had visited a CM-practitioner in the past 12-months [7]. Despite this finding and assertions by some that advice given by CM-practitioners may be contributing to vaccine rejection amongst parents [8], the nature of these conversations remains elusive.

While some international research exploring parental attitudes to vaccination has occurred, there is a dearth of published literature examining the attitudes, concerns, information-seeking and decision-making behaviours of Australian parents regarding vaccination, as noted recently in the *Medical Journal of Australia* [3]. It is, therefore, crucial to explore enablers and barriers to paediatric vaccination in Australia to assist development of appropriate communication strategies for effective parental decision-making. In direct response, the current study aims to determine: the attitudes and beliefs of parents towards childhood vaccination, the information sources parents are influenced by when making decisions about vaccination, and the effect of recent Australian legislative changes on parents' intentions to immunise their children.

2. Methods

2.1. Study design and participants

A quantitative, cross-sectional survey was piloted amongst 60 individual parents, representing 60 households from an area with low vaccine coverage in New South Wales. Subsequently, Australian parents were recruited nationwide via an online platform. The inclusion criteria for this study were Australian parents whose youngest child was aged up to 6 years. Exclusion criteria included non-Australian residents, adults without children and parents with children older than 6 years. A total of 785 parents completed the survey (response rate 12.5%), of which 429 met the inclusion criteria. Ethics approval was gained from University of Technology Sydney (ETH16-0666).

2.2. Materials

A questionnaire was adapted from previous instruments used in international research to examine parental attitudes to vaccination [9,10]. Items collected sociodemographic data alongside parental health service use and information seeking practices concerning vaccination for their youngest child. Beliefs about vaccination were measured using 13 items (Table 4) that were rated on a five-point Likert Scale (1 = strongly disagree to 5 = strongly agree). Item one was presented in a negative direction, requiring reverse coding. Tests of internal consistency found the combination of these items to be an excellent measure of beliefs about vaccination (M = 2.02, SD = 0.753, Cronbach's $\alpha = 0.91$, McDonald's $\omega = 0.92$).

An external research company (Stable Research) recruited parents across all states and territories of Australia in accordance with Australian Bureau of Statistics population data, attempting to represent each state/territory. Stable Research is an online platform that invites all adult members of the Australian public to participate in research. They are sent an email invitation to participate in a project when their profile is matched to the researcher's recruitment criteria. Participants earn points for every survey they complete and the amount of points attained are determined by the time it takes to complete the survey and the depth of knowledge required. Each survey invite tells participants how many points they will earn, and once a certain amount of points accumulate, they are redeemable as a gift voucher. Stable Research sent unique invitation emails to 6255 parents with at least one child in their care aged up to 6-years.

2.2.1. Participant sociodemographics

Sociodemographic items included parent's gender, age, state of residence, marital status and education. Parents were also asked whether they held a Health Care Card (entitles the family to government subsidies for health care, prescription medicines and other public services such as transport).

2.2.2. Vaccination status

Vaccination status of the child was recorded alongside reasons for not vaccinating (if applicable) and whether or not recent changes to legislation (regarding tax rebates, Child Care Benefit and Child Care Rebate (No Jab No Pay)) have influenced vaccination decisions. Vaccination status was recorded as either up-to-date or not up-to-date according to the current Australian Childhood Vaccination Schedule.

2.2.3. Parental attitudes toward vaccination

Likert scales using five-point measures from "strongly disagree" to "strongly agree" rated parental attitudes and beliefs about vaccination. Items covered issues such as the perceived value of vaccines (e.g. *Vaccines are important for my child*), perceived vaccine safety (e.g. *Vaccines contain ingredients that can cause harm*) and perceived vaccine efficacy (e.g. *There are better ways to protect children than vaccines*).

2.2.4. Health service utilisation

Respondents were asked to identify which information sources were influential in their decisions about vaccination for their youngest child. Visits to medical, allied health and CM-practitioners were recorded to explore health service use.

2.3. Data analysis

Raw data were extracted in an electronic spreadsheet and imported into statistical analysis software. Frequencies and proportions were calculated to describe sample sociodemographics, health service use, influence from information sources, and parental concerns and attitudes toward vaccination. Chi-square tests of association were conducted to assess relationships between socioeconomic and health-seeking factors, and vaccine uptake for the family's youngest child. Cramer's V was used to determine effect size.

Stepwise logistic regression was applied to produce the most parsimonious model predicting vaccination status. Demographic and health service use variables were entered into a model, with a stepwise backwards elimination process employed, using a likelihood ratio test. Statistical significance was set at $p < .05$ for all analyses. Analyses were conducted using STATA 14.1 software (StataCorp LP, College Station, TX, USA).

3. Results

3.1. Sample sociodemographics

The majority of participants were female (72.3%) and married (70.4%). Participants were most commonly aged 31–36 years (39.9%), with 31% aged 37–42 and 13.8% aged 26–30. All states and territories were represented as follows: New South Wales (31.9%), Victoria (22.8%), South Australia (15.9%), Queensland (13.8%), Western Australia (9.6%), Australian Capital Territory (4.2%), Tasmania (1.4%) and Northern Territory (0.5%). More than half of participants (50.8%) held a bachelor degree or higher. The substantial majority reported having their youngest child's vaccination status up-to-date (n = 401, 93.5%). No statistically significant differences regarding sociodemographics were found between parents whose child's vaccination status was up-to-date and those whose child's was not (Table 1). In total, 30.5% of parents held a Health Care Card.

3.2. Health service utilisation

A substantial majority of participants (96.7%) had taken their youngest child to consult at least one medical practitioner, most commonly a general practitioner (GP) (94.6%) in the previous 12-months. A total of 17.3% of children visited an allied health practitioner, most commonly a speech pathologist (9.8%) in the previous 12-months. Visits to CM-practitioners were reported less commonly with 12.6% of participants taking their youngest child to at least one CM, most commonly a chiropractor (6.5%), naturopath/herbalist (2.6%), or nutritionist (2.1%).

No statistically significant relationship was found between a child's vaccination status and consulting with a medical practitioner. However, there was a significant weak association between a child's vaccination status being up-to-date and visiting an allied health practitioner ($p = .048$). Conversely, a significant moderate association was found between a child's vaccination status not being up-to-date and the child having consulted at least one CM-practitioner ($p < .001$). Weak to moderate associations between lower vaccine uptake and consultation with a CM-practitioner were apparent across many distinct CM-practitioner groups including naturopaths/herbalists ($p = .005$), chiropractors ($p < .001$), homoeopaths ($p < .001$) and traditional Chinese medicine practitioners ($p < .001$). Consistent with these findings was a moderate significant association between the child having up-to-date vaccination status and not visiting any CM-practitioner in the previous 12-months ($p < .001$). See Table 2 for summary statistics including effect size.

3.3. Influence of information sources on decision to vaccinate

Vaccine information sources reported as influential were GPs (78.3%), friends/family (55.7%), nurses/midwives (43.4%), government websites (33.3%), paediatricians (30.5%), parenting groups (16.8%), non-government websites (13.1%), newspapers/magazines (8.4%), CM-practitioners (6.3%) and pharmacists (4.4%). A statistically significant relationship was found between vaccine uptake and being influenced by a paediatrician ($p = .001$) or GP ($p = .019$) (Fig. 1). Conversely, a statistically significant relationship was found between child vaccination status not being up-to-date and being influenced by a CM-practitioner ($p < .001$), non-government

Table 1
Sample demographics and relationship between characteristics and vaccination status of youngest child.

	Total		Vaccinations up-to-date		Vaccinations not up-to-date		*p value*[a]
	n = 429	%	n = 401	%	n = 28	%	
Gender of parent							*0.590*
Female	310	72.3	291	72.6	19	67.9	
Male	119	27.7	110	27.4	9	32.1	
Age of parent							*0.834*
Up to 25 years	21	4.9	20	5.0	1	3.6	
26–30 years	59	13.8	56	14.0	3	10.7	
31–36 years	171	39.9	157	39.2	14	50.0	
37–42 years	133	31.0	125	31.2	8	28.6	
43+ years	45	10.5	43	10.8	2	7.1	
Location (by state)							*0.313*
NSW	137	31.9	129	32.2	8	28.6	
ACT	18	4.2	18	4.5	0	0	
QLD	59	13.8	51	12.8	8	28.6	
VIC	98	22.8	93	23.2	5	17.9	
SA	68	15.9	65	16.2	3	10.7	
TAS	6	1.4	6	1.5	0	0	
NT	2	0.5	2	0.5	0	0	
WA	41	9.6	37	9.2	4	14.3	
Marital status							*0.956*
Never married	30	7.0	27	6.7	3	10.7	
Married	302	70.4	283	70.6	19	67.9	
De facto (opposite sex)	53	12.4	50	12.5	3	10.7	
De facto (same sex)	6	1.4	6	1.5	0	0	
Separated	21	4.9	19	4.7	2	7.1	
Divorced	15	3.5	14	3.5	1	3.6	
Widowed	2	0.5	2	0.5	0	0	
Educational level of parent							*0.897*
High school (up to year 12 or equivalent)	72	16.8	68	17.0	4	14.3	
Trade/apprenticeship, certificate, diploma	139	32.4	129	32.2	10	35.7	
University (bachelor degree or higher)	218	50.8	204	50.9	14	50.0	
Health Care Card held	131	30.5	121	30.2	10	35.7	*0.538*

Statistical significance = $p < 0.05$.

[a] Difference in sociodemographics between parents of children whose vaccination status is up-to-date and parents of children whose vaccination status is not up-to-date, calculated using chi-square analysis.

Table 2
Visits to health practitioners over previous 12-months and relationship with vaccination status of youngest child.

Type of health practitioner visited	Total		Vaccinations up-to-date		Vaccinations not up-to-date		*p value*	*Effect size*[a]
	n = 429	%	n = 401	%	n = 28	%		
Medical practitioner								
GP	406	94.6	381	95.0	25	89.3	*.193*	–
Paediatrician	113	26.3	109	27.2	4	14.3	*.134*	–
Community health nurse	132	30.8	122	30.4	10	35.7	*.558*	–
Other medical specialist	80	18.7	71	17.7	9	32.1	*.058*	–
Any medical practitioner	415	96.7	389	97.0	26	92.9	*.232*	–
None of the above	14	3.3	12	3.0	2	7.1	*.232*	–
Allied health practitioner								
Speech pathologist	42	9.8	42	10.5	0	0	*.071*	–
Physiotherapist	14	3.3	14	3.5	0	0	*.315*	–
Occupational therapist	13	3.0	13	3.2	0	0	*.333*	–
Counsellor	9	2.1	9	2.2	0	0	*.423*	–
Psychologist	14	3.3	14	3.5	0	0	*.315*	–
Dietician	11	2.6	10	2.5	1	3.6	*.727*	–
Any allied health practitioner	74	17.3	73	18.2	1	3.6	*.048*	*0.10*
None of the above	355	82.8	328	81.8	27	96.4	*.048*	*−0.10*
Complementary medicine practitioner								
Naturopath/herbalist	11	2.6	8	2.0	3	10.7	*.005*	*−0.14*
Nutritionist	9	2.1	9	2.2	0	0	*.423*	–
Chiropractor	28	6.5	18	4.5	10	35.7	*<.001*	*−0.31*
Osteopath	5	1.2	5	1.3	0	0	*.552*	–
Massage therapist	4	0.9	4	1.0	0	0	*.595*	–
Homoeopath	7	1.6	4	1.0	3	10.7	*<.001*	*−0.19*
Traditional Chinese medicine practitioner	3	0.7	1	0.3	2	7.1	*<.001*	*−0.20*
Other complementary medicine practitioner	4	0.9	4	1.0	0	0	*.595*	–
Any complementary medicine practitioner	54	12.6	41	10.2	13	46.4	*<.001*	*−0.27*
None of the above	375	87.4	360	89.8	15	53.6	*<.001*	*0.27*

Statistical significance = $p < 0.05$.
[a] Effect size has been calculated using Cramér's V.

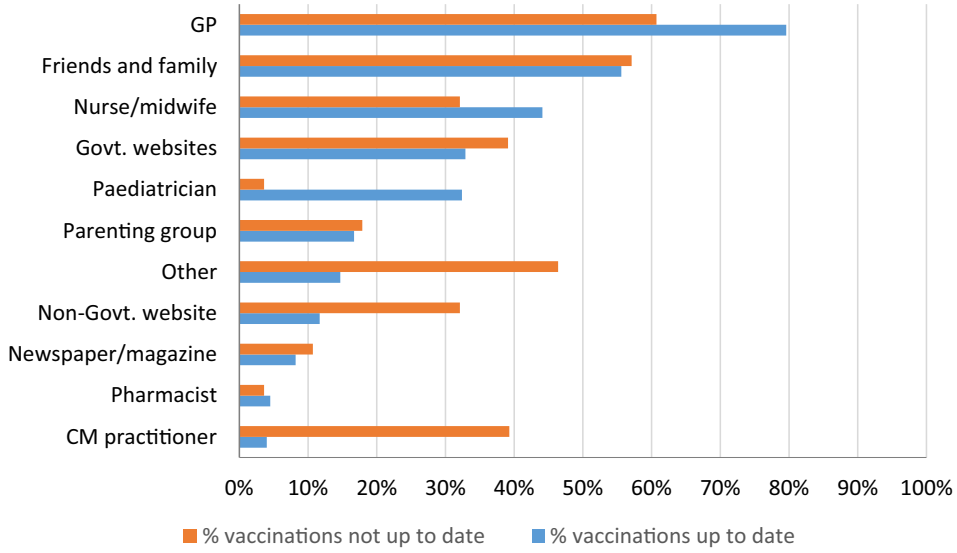

Fig. 1. Influential information sources used in relation to vaccination. Note: Vaccination status was more likely to be up-to-date if parents were influenced by information from a paediatrician ($p = .001$) and less likely if influenced by a CM-practitioner ($p < .001$) or 'other' source ($p < .001$).

website ($p = .002$) or information source other than those listed ($p < .001$).

3.4. Parental concerns and vaccination decisions

A substantial majority of participants reported giving their child all vaccinations without having any concerns (76.2%); however, a notable number of parents held minor concerns (15.6%) despite having given all vaccines to their child. Overall, 2.6% of parents had their child immunised after introduction of No Jab No Pay, while 3.9% stated the legislation had no effect, and 1.2% said it had made them less likely to vaccinate. A further 1.2% of parents stated they are considering vaccination due to the legislation.

The most common reason for not vaccinating was 'I feel the risks associated with vaccination outweigh the benefits' (42.9%), followed closely by 'I am concerned about side effects related to childhood vaccinations' (39.3%) and 'I don't believe vaccines are safe' (35.7%) (Table 3).

Table 3
Parental concerns and decision to vaccinate.

	n	%
I gave all vaccinations and have no concerns	327	76.2
I gave all vaccinations but have minor concerns	67	15.6
I gave all vaccinations and have a lot concerns	7	1.6
I delayed and/or excluded vaccines	15	3.5
I did not vaccinate my child	13	3.1
Have the recent changes to legislation[a] had any influence on your youngest child's vaccination status or on your intention to vaccinate/not vaccinate?	**n**	**%**
My child's vaccinations were already up to date	391	91.1
No influence, have not vaccinated my child	17	3.9
Yes, my child's vaccinations are now up to date	11	2.6
It has made me less likely to vaccinate	5	1.2
I am considering vaccination	5	1.2
If your youngest child's vaccinations are not up to date according to the Australian vaccination schedule please indicate why	**n**	**%[b]**
I feel the risks associated with vaccination outweigh the benefits	12	42.9
I am concerned about side effects related to childhood vaccinations	11	39.3
I don't believe vaccines are safe	10	35.7
Other	7	25.0
I want to vaccinate my child but do not agree with the current schedule	6	21.4
I don't believe vaccines work	6	21.4
I don't believe vaccines are necessary	5	17.9
I intend to vaccinate my child but haven't taken him/her yet due to time pressures	5	17.9
I want my child to receive some vaccines but not others	5	17.9
My child had a reaction to a vaccine	4	14.3
I would like to learn more about vaccines before making this decision	2	7.1

[a] Regarding tax rebates, Child Care Benefit, the Child Care Rebate (no jab no pay).
[b] Percentage of those whose child's vaccinations are not up to date

3.5. Parental attitudes surrounding vaccination

The majority of parents agreed with the statement *'Vaccines are important for my child*' (87.9%). Parental attitudes toward vaccination were largely aligned with their decision to vaccinate or not vaccinate, evidenced by the statistically significant relationship between attitudes and vaccination status across all thirteen statements within this measure; although, the magnitude of the relationships varied from weak to relatively strong (Table 4). However, some statements were nuanced in the frequency of responses, particularly among those respondents whose child's vaccination status was up-to-date. For example, of the 69 respondents who agreed/strongly agreed with the statement *'Vaccines contain ingredients that can cause harm*', 69.6% had vaccinated their child. Similarly, of the 66 respondents who agreed/strongly agreed with the statement *'Children get too many vaccines during the first two years of life*', 66.7% had vaccinated their child. Of the 44 respondents who disagreed/strongly disagreed that *'Vaccines are important for my child*', 68.2% had vaccinated their child.

Logistic regression found children's vaccinations were more likely to be up-to-date if the child had consulted a paediatrician in the previous 12-months. Vaccination status was less likely to be current if the child had visited a CM-practitioner in the same period. Vaccination was also less likely if the parent found information from a CM-practitioner or 'other source' influential (Table 5).

4. Discussion

This study reports information sources and health services that parents use when making decisions about vaccination, their attitudes towards vaccination, and the effect of recent Australian legislative changes (No Jab No Pay) on parents' intentions regarding vaccination. The majority of parents in this study (93.5%) reported their youngest child's immunisation status was up-to-date, which reflects the Australian population rate of 92.9% for 5-year-olds [1]. Our study found parents use a range of sources to inform decisions about vaccination with GPs being the most frequently used. This is an expected finding in line with previous research [7]; GPs are primary care practitioners who have regular contact with parents and their children, with the majority of Australian children receiving vaccinations at GP clinics [11]. Additionally, we found children who consulted a paediatrician were more likely to be fully vaccinated. This study emphasises the important role GPs and paediatricians play in educating parents about childhood vaccination.

Children were less likely to be fully vaccinated if their parent's decision-making was influenced by information from a CM-practitioner. Similarly, previous research has found obtaining vaccination information from a CM-practitioner is associated with poor vaccine uptake [12] and it is feasible that this relationship is related to trust. Trust and distrust are embedded in both rational and emotional paradigms, informed by health experiences and social contexts [13]. Parents who are wary of vaccination may be more likely to distrust conventional information sources such as medical practitioners and government bodies [14]. Qualitative research provides some insight into the continuum of trust, finding many parents who reject vaccination have an absolute worldview that government, doctors, research and society are tainted and motivated by profit, particularly the profit motive of pharmaceutical companies [15]. This belief may cause parents to disregard information originating from these sources, which in the case of vaccine information, leaves very few remaining sources.

Unvaccinated children were more likely to have consulted a CM-practitioner; a finding consistent with recent Australian studies reporting associations between reduced vaccine uptake and consultation with CM-practitioners [7,12,16]. A review of CM-practitioner attitudes to vaccination found that while some CM-practitioners do not support vaccination, many accept this public health agenda [6]. There is, however, a dearth of information about how CM-practitioners communicate with parents about immunisation and this information is critical to understanding this important finding. It is unclear from our results whether CM-practitioners are advising against vaccination, or if other factors are responsible, such as parental ideology and health care preferences [16].

Concerns about pharmaceutical medicine safety and post-modern beliefs (e.g., rejection of authority) can be associated with CM use [17]. These beliefs may translate to vaccine-hesitancy, and parents may trust advice from a CM-practitioner about vaccination if they value this form of health care more broadly. Browne et al. (2015) suggests the use of scientific evidence directly related to vaccination may not benefit individuals who have an anti-authoritarian, unconventional cultural orientation, and it may be more useful to build overall confidence in evidence-based approaches to health [16]. It is important to ensure parents who distrust conventional sources of vaccine information have access to credible information that is culturally appropriate and aligned with their health care preferences. Future research could determine the character and importance of culturally appropriate resources for parents who prefer CM approaches. The information needs of CM-practitioners who are pro-immunisation must also be determined to harness this workforce and enable evidence-based conversations with vaccine-wary parents to improve vaccine uptake.

Safety was the most common concern for parents in our study who had not fully vaccinated their child. These beliefs reflect previous findings emphasising safety concerns as the most commonly reported reason for vaccine-hesitancy and refusal [9,12]. Weight-

Table 4
Parental attitudes toward vaccination for youngest child and relationship between attitudes and child's vaccination status.

		Total		Vaccinations up-to-date		Vaccinations not up-to-date			
		n	%	n	%	n	%	p value	*Effect size*[a]
Vaccines are important for my child	*Disagree/strongly disagree*	44	10.3	30	68.2	14	31.8	*<.001*	0.48
	Neutral	8	1.9	3	37.5	5	62.5		
	Agree/strongly agree	377	87.9	368	97.6	9	2.4		
My child's immune system is more sensitive than most	*Disagree/strongly disagree*	202	47.1	192	95.1	10	5.0	*.024*	0.13
	Neutral	154	35.9	146	94.8	8	5.2		
	Agree/strongly agree	73	17.0	63	86.3	10	13.7		
Children's immune systems could be weakened by vaccines	*Disagree/strongly disagree*	291	67.8	284	97.6	7	2.4	*<.001*	0.52
	Neutral	97	22.6	95	97.9	2	2.1		
	Agree/strongly agree	41	9.6	22	53.7	19	46.3		
The pain of a vaccine needle is too great for my child	*Disagree/strongly disagree*	354	82.5	337	95.2	17	4.8	*.004*	0.16
	Neutral	54	12.6	45	83.3	9	16.7		
	Agree/strongly agree	21	4.9	19	90.5	2	9.5		
Children get too many vaccines during the first two years of life	*Disagree/strongly disagree*	296	69.0	292	98.7	4	1.4	*<.001*	0.46
	Neutral	67	15.6	65	97.0	2	3.0		
	Agree/strongly agree	66	15.4	44	66.7	22	33.3		
Vaccines contain ingredients that can cause harm	*Disagree/strongly disagree*	249	58.0	245	98.4	4	1.6	*<.001*	0.42
	Neutral	111	25.9	108	97.3	3	2.7		
	Agree/strongly agree	69	16.1	48	69.6	21	30.4		
Vaccines are given to children to prevent diseases that are not serious	*Disagree/strongly disagree*	347	80.9	335	96.5	12	3.5	*<.001*	0.26
	Neutral	39	9.1	31	79.5	8	20.5		
	Agree/strongly agree	43	10.0	35	81.4	8	18.6		
Vaccines are given to children to prevent diseases that are not common	*Disagree/strongly disagree*	241	56.2	232	96.3	9	3.7	*.029*	0.13
	Neutral	74	17.3	67	90.5	7	9.5		
	Agree/strongly agree	114	26.6	102	89.5	12	10.5		
Children should get natural immunity from diseases rather than from vaccines	*Disagree/strongly disagree*	339	79.0	332	97.9	7	2.1	*<.001*	0.39
	Neutral	55	12.8	46	83.6	9	16.4		
	Agree/strongly agree	35	8.2	23	65.7	12	34.3		
Vaccines can cause autism	*Disagree/strongly disagree*	312	72.7	303	97.1	9	2.9	*<.001*	0.37
	Neutral	94	21.9	85	90.4	9	9.6		
	Agree/strongly agree	23	5.4	13	56.5	10	43.5		
Vaccines can cause allergies	*Disagree/strongly disagree*	243	56.6	238	97.9	5	2.1	*<.001*	0.33
	Neutral	136	31.7	127	93.4	9	6.6		
	Agree/strongly agree	50	11.7	36	72.0	14	28.0		
There are better ways to protect children than vaccines	*Disagree/strongly disagree*	331	77.2	326	98.5	5	1.5	*<.001*	0.51
	Neutral	72	16.8	63	87.5	9	12.5		
	Agree/strongly agree	26	6.1	12	46.2	14	53.9		
Serious side-effects from vaccines are too common for me to accept	*Disagree/strongly disagree*	344	80.2	339	98.6	5	1.5	*<.001*	0.50
	Neutral	57	13.3	48	84.2	9	15.8		
	Agree/strongly agree	28	6.5	14	50.0	14	50.0		

Statistical significance = $p < 0.05$.
[a] Effect size has been calculated using Cramér's V.

Table 5
Predictors of vaccination status[a].

	Odds ratio	95% CI	p value
Visit to a paediatrician in the previous 12 months			
No	1	–	–
Yes	5.01	1.05, 23.92	=.043
Visit to a complementary medicine practitioner in the previous 12 months			
No	1	–	–
Yes	0.09	0.02, 0.33	<.001
Influenced by information from a complementary medicine practitioner			
No	1	–	–
Yes	0.03	0.01, 0.15	<.001
Influenced by information from an 'other' source			
No	1	–	–
Yes	0.10	0.03, 0.31	<.001

[a] Adjusted for age, education, state of residence, gender, marital status.

ing outcomes from action more negatively than outcomes from inaction (omission bias) [18], may further complicate this concern. In the case of parents making decisions about immunisation, some parents predict they will feel additional regret and grief if a serious adverse event results from their decision to vaccinate as opposed to the child contracting a vaccine-preventable disease due to 'bad luck' [19]. Omission bias is increased when there is greater perceived risk to a particular individual [18], such as the child of a parent.

Our study found contradictions between vaccine-related attitudes and reported behaviours. While the majority of parents had vaccinated their children, some parents had differing attitudes to vaccination. These beliefs primarily related to the impact on their child, agreeing with the statements 'my child's immune system is more sensitive than most', 'vaccines contain ingredients that cause harm', and 'children get too many vaccines during the first two years of life'. Even though some parents report concerns about vaccination, they appear to be making a considered decision that vaccination benefits outweigh potential harms; however, access to quality information to address their concerns is still warranted. The reason some parents with concerns vaccinate their children while others do not remain intangible. Future research could examine differences between these two groups to determine why some parents with safety concerns vaccinate their children while others reject immunisation.

The majority of parents in this study who had not fully vaccinated their child reported the No Jab No Pay legislation had no influence on their decisions surrounding childhood vaccination. This is consistent with recent suggestions that financial incentives are unlikely to influence parents who reject vaccination [20]. A minority of parents reported this new legislation reduced their likelihood of vaccinating their child. This concerning finding suggests the legislative changes may be further deterring some parents from vaccinating their children. Reasons for this are unclear; however, this behaviour may relate to ideological conflict for parents who believe they have authority over their child's health and for whom safety concerns are insurmountable. It is critical to further explore this finding as it suggests the No Jab No Pay policy has created an additional barrier to vaccination for some parents.

There are limitations that must be considered. Firstly, our response rate was small (12.5%) and as this was a cross-sectional convenience sample, results may not be generalisable to the broader Australian population. Overall, there were a comparatively small number of unvaccinated children making it difficult to draw conclusions from group comparisons. Self-report determined vaccination status, and research has found parents often overestimate compliance [21]. It was not possible to verify this using the Australian Immunisation Register. Despite these limitations, the findings reported here will inform future research using a larger, nationally-representative sample of Australian parents.

5. Conclusion

This study confirms findings from previous research demonstrating an association between consultation with CM-practitioners and vaccine-hesitancy. Our findings suggest parents who do not fully vaccinate their children trust information about vaccination received from a CM-practitioner. Some parents' approaches to vaccination may be better supported by access to sources of reliable information they trust; consequently, further research is needed to determine if CM-practitioners are confident to engage in evidence-based conversations with parents about vaccination. This study also found the No Jab No Pay legislation has caused a minority of parents to be less likely to vaccinate their child. This finding needs to be further explored in larger general population studies, as this is an important unintended consequence of the new legislation, which may be a further barrier to vaccination.

Declaration of interest

Conflicts of interest: none.

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References

[1] AIHW. Healthy Communities: Immunisation rates for children in 2015–16; 2017. <http://www.myhealthycommunities.gov.au/our-reports/immunisation-rates-for-children/june-2017> [accessed 20.01.17].
[2] Australian Government Department of Health. No Jab, No Pay – New Immunisation Requirements for Family Assistance Payments. <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/67D8681A67167949CA257E2E000EE07D/$File/No-Jab-No-Pay-FSheet.pdf>.
[3] Beard FH, Hull BP, Leask J, Dey A, McIntyre PB. Trends and patterns in vaccination objection, Australia, 2002–2013. Med J Aust 2016;204:275.
[4] Reid R, Steel A, Wardle J, Trubody A, Adams J. Complementary medicine use by the Australian population: a critical mixed studies systematic review of utilisation, perceptions and factors associated with use. BMC Complement Altern Med 2016;16:176.
[5] Xue CC, Zhang AL, Lin V, Da Costa C, Story DF. Complementary and alternative medicine use in Australia: a national population-based survey. J Altern Complement Med 2007;13:643–50.
[6] Wardle J, Frawley J, Steel A, Sullivan E. Complementary medicine and childhood immunisation: a critical review. Vaccine 2016;34:4484–500.
[7] Frawley JE, Anheyer D, Davidson S, Jackson D. Prevalence and characteristics of complementary and alternative medicine use by Australian children. J Paediatr Child Health 2017;53:782–7.
[8] Ernst E. Complementary/alternative medicine for disease prevention: the good, the bad and the ugly. Prev Med 2009;49:77.
[9] Yaqub O, Castle-Clarke S, Sevdalis N, Chataway J. Attitudes to vaccination: a critical review. Soc Sci Med 2014;112:1–11.
[10] Larson HJ, Jarrett C, Schulz WS, Chaudhuri M, Zhou Y, Dube E, et al. Measuring vaccine hesitancy: the development of a survey tool. Vaccine 2015;33:4165–75.
[11] Australian Government. The Australian Immunisation Handboo; 2017. <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook10-home~handbook10part2> [accessed 21.01.17].
[12] Chow MYK, Danchin M, Willaby HW, Pemberton S, Leask J. Parental attitudes, beliefs, behaviours and concerns towards childhood vaccinations in Australia: a national online survey. AJP 2017;46:145–51.
[13] Brown PR, Meyer SB. Dependency, trust and choice? Examining agency and 'forced options' within secondary-healthcare contexts. Curr Sociol 2015;63:729–45.
[14] Dubé E, Vivion M, MacDonald NE. Vaccine hesitancy, vaccine refusal and the anti-vaccine movement: influence, impact and implications. Expert Rev Vaccines 2015;14:99–117.
[15] Attwell K, Leask J, Meyer SB, Rokkas P, Ward P. Vaccine rejecting parents' engagement with expert systems that inform vaccination programs. J Bioeth Inq 2017;14:65–76.
[16] Browne M, Thomson P, Rockloff MJ, Pennycook G. Going against the herd: psychological and cultural factors underlying the 'vaccination confidence gap'. PLoS One 2015;10:e0132562.
[17] McIntyre E, Saliba AJ, Wiener KKK, Sarris J. Prevalence and predictors of herbal medicine use in adults experiencing anxiety: a critical review of the literature. Adv Integr Med 2015;2:38–48.
[18] Brown KF, Kroll JS, Hudson MJ, Ramsay M, Green J, Vincent CA, et al. Omission bias and vaccine rejection by parents of healthy children: implications for the influenza A/H1N1 vaccination programme. Vaccine 2010;28:4181–5.
[19] Voinson M, Billiard S, Alvergne A. Beyond rational decision-making: modelling the influence of cognitive biases on the dynamics of vaccination coverage. PLoS One 2015;10:e0142990.
[20] Beard FH, Leask J, McIntyre PB. No Jab, No Pay and vaccine refusal in Australia: the jury is out. Med J Aust 2017;206:381–3.
[21] Miles M, Ryman TK, Dietz V, Zell E, Luman ET. Validity of vaccination cards and parental recall to estimate vaccination coverage: a systematic review of the literature. Vaccine 2013;31:1560–8.

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