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Parental opinions towards the "No Jab, No Pay" policy in Australia

Mallory J Trent [a,*], Elissa J Zhang [b], Abrar Ahmad Chughtai [b], C. Raina MacIntyre [a]

[a] Biosecurity Program, Kirby Institute, Faculty of Medicine, University of New South Wales, Sydney, Australia
[b] School of Public Health and Community Medicine, Faculty of Medicine, University of New South Wales, Sydney, Australia

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ABSTRACT

Background: In 2016, Australia introduced the "No Jab, No Pay" legislation, which removed the option of non-medical exemptions from the vaccination requirements to receive certain family and child care tax benefits. We aimed to gauge parental support for "No Jab, No Pay" and explore how it has impacted parental attitudes towards vaccination, particularly among families that are reliant on the tax benefits linked to vaccination under "No Jab, No Pay".

Methods: An online survey distributed to parents with children under 5 in Australia assessed parental knowledge and opinions towards childhood vaccination and the "No Jab, No Pay" policy.

Results: A total of 411 parents completed the survey. The majority of parents reported their child was either fully vaccinated or they intended to fully vaccinate. Eighty-two percent of parents were in favour of "No Jab, No Pay." The belief that vaccine-preventable diseases are a significant risk to unvaccinated children was a predictor of supporting the "No Jab, No Pay" policy (AOR = 5.95, 95% CI = [3.60, 10.94], $p < 0.001$). Parents that depend on the financial benefits associated with "No Jab, No Pay" and parents that utilize child care services were significantly more likely to reconsider vaccination, if they previously hesitated or objected, because of the policy (AOR = 9.66, 95% CI = [4.98, 18.72], $p < 0.001$ and AOR = 2.09, 95% CI = [1.04, 4.17], $p = 0.04$).

Conclusion: We found that there is widespread support for "No Jab, No Pay" among parents of young children, but parents that depend on the financial benefits or utilize child care services may be disproportionately affected by the policy. Childhood vaccination coverage in Australia could best be improved by increasing access to vaccination services and by imposing significant administrative barriers to obtaining non-medical exemptions.

1. Introduction

Australia introduced the "No Jab, No Pay" legislation in 2016, removing religious or philosophical objections to vaccination from the eligibility criteria for financial benefits linked to immunisation [1,2]. Childhood immunisation is one of the most important strategies for preventing infectious disease, but its effectiveness is contingent upon high vaccine coverage of targeted populations [3,4]. Gaps in immunisation coverage can result in outbreaks of vaccine preventable diseases, such as measles [5–8].

To improve childhood vaccine coverage, the Australian government implemented a policy in 1998 that required parents to provide proof of immunisation or exemption to receive certain welfare benefits, as part of a broader Immunisation Seven Point Plan [9]. However, in recent years there has been public concern over the number of parents that have registered as "conscientious objectors" to vaccination, which increased from 1.1% in 2002 to 2.0% in 2013. Although the overall rate of conscientious objection in Australia remains at around 2%, it may be as high as 10% in certain regions [10,11]. As a result, the Australian government introduced the "No Jab, No Pay" legislation in 2016, which removed the "conscientious objection" exemption from the immunisation requirements to receive child care and family tax benefits, which are valued at up to $15,000 [2,12]. While this legislation was largely targeted towards conscientious objectors to vaccination, one of its primary objectives was to encourage all families to act to ensure that all of their children were vaccinated according to the recommended schedule [13]. In addition, several states have introduced "No Jab, No Play" policies that require children to be immunised or medically exempt to attend childcare centres [1,14]. Some states of the United States and several countries in Europe have

* Corresponding author at: Biosecurity Program, Kirby Institute, Faculty of Medicine, University of New South Wales, Kirby Institute, Wallace Wurth Building Room 644, University of New South Wales, Kensington, NSW 2052, Australia.
E-mail addresses: mallory.trent@unsw.edu.au (M.J Trent), elissa.zhang@student.unsw.edu.au (E.J Zhang), abrar.chughtai@unsw.edu.au (A.A. Chughtai), r.macintyre@unsw.edu.au (C.R. MacIntyre).

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similar mandatory vaccination schemes, and there is evidence that immunisation requirements for school entry, child care access, and welfare benefits lead to increased vaccination rates [15–21].

Parental vaccine hesitancy is a complex issue influenced by several contextual and individual factors, which may not be adequately addressed by a single policy [22–24]. In Australia, lack of access to medical services, perceived medical contraindications, lack of social support, and competing pressures may be contributing more to incomplete vaccination than conscientious objection [23,25]. Moreover, there are concerns that linking vaccination to welfare and tax benefits may disproportionately influence certain groups, such as working women and low-income families [26,27].

In this study, we aimed to gauge parental support for "No Jab, No Pay" and explore how it has impacted parental attitudes towards vaccination, particularly among families that are reliant on the tax benefits linked to vaccination under "No Jab, No Pay".

2. Methods

2.1. Study design

To determine whether the "No Jab, No Pay" policy is supported by parents and has increased parents' willingness to vaccinate their children, we conducted a survey to explore the knowledge, attitudes, and opinions of parents under five towards financial immunisation incentives. The primary outcome is parental support for the "No Jab, No Pay" policy. The secondary outcome was willingness to reconsider vaccination, if there was previous objection or hesitation to vaccination, as a result of the "No Jab, No Pay" policy.

2.2. Recruitment and sample size

We employed Survey Sampling International (https://www.surveysampling.com/), a market research company, to randomly distribute the survey link among a sample of their panel members between the ages of 18 and 60 in May of 2017. The sample was stratified to be representative of Australia in terms of gender and state/territory residence. The survey was made available on SSI's online platform to all panel members in the appropriate age range. Panel members that logged into the platform had the option to open the survey link. After clicking on the survey link, SSI panel members were screened for eligibility. Respondents were eligible for inclusion if they had at least one child less than five years of age. Responses were limited to one per family. Eligible panel members were directed to a participant information and consent page, which they had to "accept" prior to accessing the survey. We considered completion of the survey to be informed consent. All fields in the survey were required, thus preventing missing data.

Taking a conservative approach and assuming 50% prevalence of support for the "No Jab, No Pay" policy, our study required a minimum of 377 participants, with 5% precision, alpha = 0.05, and power of 80%. We aimed to recruit approximately 400 participants.

2.3. Survey questions

The questionnaire drew on our previously conducted parental opinion research, including research conducted to evaluate financial incentives when they were first introduced into Australia [28,29]. Survey questions in this study were piloted to ensure they were easily understood by the target audience. Survey questions were revised according to feedback from the pilot survey.

Data were collected using an anonymous web-based survey platform. To gauge knowledge, attitudes, and opinions towards "No Jab, No Pay", we asked parents whether (1) they had heard of the policy; (2) they supported the policy; and (3) the policy made them reconsider vaccination if they previously objected or hesitated. We asked parents, "Have you heard of the No Jab, No Pay policy?", with the option of selecting "yes", "no", or "unsure", and "Do you support the No Jab, No Pay policy?", with the option to select "yes", "no", or "undecided". To understand if the policy increased their willingness to vaccinate, the survey asked parents "Have the financial incentives tied to the 'No Jab No Pay' policy made you reconsider vaccination if you previously objected or hesitated to it?", with the option to select "yes", "no", "unsure", or "not applicable, never hesitated or objected".

To assess parental attitudes and behaviours towards vaccination, we first asked parents to describe their children's vaccination status and reasons for incomplete vaccination. To get a complete picture of their children's vaccination status, parents were presented with a list of all recommended paediatric vaccinations and asked to specify which vaccines their child had received. If they reported that their child was missing any vaccinations, they were asked to provide a reason for their incomplete vaccination, including "missed scheduled time but plan to complete later", "child had side effect and doctor advised not to be vaccinated", "other medical reason", "chose not to do it" and "other". Parents had the option to select more than one reason and were asked to provide an optional write-in explanation for their selection. We also asked parents "Have you ever registered a conscientious objection?", with the option to select "yes", "no", or "unsure"; parents could provide an optional write-in explanation if they selected "yes". To understand how parents perceived the importance of vaccination, we asked "What is your view towards childhood vaccination?", with the options "very important for children", "somewhat important for children", "not important for children", "risky for children", or "don't know enough about them to have any opinion". To understand how parents perceived the risk of vaccinations, we asked parents to rate each recommended paediatric vaccine on a scale of 1 (very low risk) to 5 (very high risk), "What risk would you consider an unvaccinated child to be for the following vaccine-preventable diseases?".

To gauge how many parents in the survey were receiving each of the three financial incentives tied to "No Jab, No Pay", we asked parents three questions about each incentive: (1) "Have you heard about this benefit?"; (2) "Are you eligible for this payment?"; and (3) "Are you receiving this payment?". For each question, parents could select "yes", "no", or "not sure". We also asked parents "Do the financial incentives above make a difference to your family?", with the options of selecting "Yes, could not afford family expenses without them", "No, can manage without these", "Unsure", or "Not eligible for these benefits".

We also collected sociodemographic and household data, including age, gender, country of birth, highest education level obtained, Aboriginal/Torres Strait Islander status, state of residence, and utilization of childcare services.

The University of New South Wales Human Research Ethics Committee approved (Approval number: HC17045) the survey instrument and study protocol prior to data collection.

2.4. Data analysis

All data were cleaned and deidentified prior to analysis using IBM SPSS Statistics Version 24.0 [30]. We used Stata version 14 [31] to complete all analyses included in this paper.

We calculated descriptive statistics of all variables of interest. We categorized parents as "needing the financial incentives" if they answered "Yes, could not afford family expenses without them" to the question "Do the financial incentives make a difference to your family?". We characterized parents as supportive of

the policy if they answered "yes" to the question "Do you support the No Jab, No Pay policy?". We categorized parents as willing to reconsider vaccination if they answered "yes" to the question "Has the "No Jab No Pay" policy made you reconsider vaccination if you previously objected or hesitated to it?", and unwilling to reconsider vaccination if they answered "no" or "unsure". Parents that answered "not applicable, never hesitated or objected" were excluded from analysis of this outcome.

Using simple and multivariable logistic regression, we examined the associations between our primary outcome, support for "No Jab, No Pay", and various predictors, including parental behaviors and attitudes towards vaccination, demographics, utilisation of child care, and dependence on financial incentives. Previous conscientious objection was excluded from the multivariable model due to it being highly correlated with the outcome variable, support for "No Jab, No Pay", since both are reflective of support/objection to compulsory vaccination. However, including it in the model did not significantly alter the results. To understand how much influence "No Jab, No Pay" may be having on vaccination behavior, we conducted simple and multivariable logistic regression assessing the relationship between various predictors (dependence on financial incentives, parental attitudes and behaviors towards vaccination, demographics) and willingness to reconsider vaccination if previously hesitated (outcome) among parents that previously hesitated or objected to vaccination. We used forward and backward stepwise model selection, using a significance level of 0.1 for addition to and removal from the model, combined with likelihood ratio tests to select characteristics to include in multivariable regression models. These relationships are expressed as odds ratios (OR) at a 95% confidence interval (CI). A p-value less than or equal to 0.05 was considered significant.

3. Results

A total of 1727 SSI panel members clicked the link for the survey. 1316 of those panel members did not meet the inclusion criteria because they did not have a child under five years old, resulting in a final sample of 411 respondents.

Table 1 summarizes the respondents' demographic and household characteristics, both for the full sample and stratified by support for "No Jab, No Pay". More than half of respondents were utilizing either child care centres or family day care. Approximately 44% of respondents reported that they needed the financial incentives tied to "No Jab, No Pay" to afford their family expenses.

When asked about their views on vaccination, 348 respondents (84.7%) said that vaccines were very important for children, and 35 (8.5%) said that vaccines were somewhat important for children. Less than 1% said that vaccines were not important for children, and 13 (3%) said that vaccines were risky for children. 76.6% of respondents indicated that their children were fully up-to-date on their immunisations, and 12.4% indicated that although they had missed the scheduled time for vaccination, they were planning to complete it later. Thirty (7.3%) respondents indicated that their doctor advised against fully vaccinating their child due to a medical reason, and 18 (4.4%) did not plan to fully vaccinate. Forty-five (11.5%) respondents reported that they had previously registered a conscientious objection. Among parents surveyed, 82% (337/411) were supportive of the No Jab, No Pay policy. Of the 225 participants that reported previously having some hesitation or objection to vaccination, 32% said that their willingness to reconsider vaccination increased as a result of the financial incentives tied to No Jab, No Pay.

Parents were asked to rate the risk of various vaccine-preventable diseases for unvaccinated children. These responses are summarized in Fig. 1. The percentage of respondents that rated risk as "high" or "very high" was 75.4% for measles, 74.9% for varicella, 74.2% for pertussis, 71.8% for mumps, 68.6% for influenza, 69.1% for rubella, 63.8% for tetanus, 62.3% for diphtheria, and 60.1% for Hepatitis A. Women, compared to men, had higher odds of perceiving the risk of measles to an unvaccinated child as high or very high (OR = 1.79, 95% CI = [1.21, 2.66], p = 0.01). Parents that needed the financial incentives, compared to parents that did not, had higher odds of perceiving the risk of measles to an

Table 1
Demographic and family characteristics by support for the "No Jab, No Pay" policy.

		In favor of "No Jab, No Pay" policy					
	Total sample (N = 411)	Yes[1] (n = 337)	No[2] (n = 74)	OR (95% CI)[3]	p-value	AOR[4] (95% CI)	p-value
Age, mean (IQR)	33.9 (29, 39)	34.2 (29, 39)	32.4 (27, 37)	1.03 (1.00, 1.06)	0.08	1.01 (0.98, 1.05)	0.43
Female, frequency (%)	213 (51.8%)	186 (55.2%)	27 (36.5%)	**2.14 (1.28, 3.61)**	**<0.001**	1.47 (0.83, 2.60)	0.19
Born in Australia	322 (78.4%)	265 (78.6%)	57 (77.0%)	1.10 (0.60, 2.00)	0.76	1.34 (0.68, 2.61)	0.38
Aboriginal/TSI	20 (4.9%)	16 (4.8%)	4 (9.4%)	0.87 (0.28, 2.69)	0.81	1.99 (0.55, 7.18)	0.29
Tertiary degree	199 (48.4%)	165 (49.0%)	34 (46.0%)	1.13 (0.68, 1.87)	0.64	1.83 (0.98, 3.43)	0.06
State							
New South Wales	133 (32.4%)	104 (30.9%)	29 (39.2%)	0.68 (0.38, 1.22)	0.20	0.72 (0.38, 1.37)	0.31
Victoria	103 (25.1%)	86 (25.5%)	17 (23.0%)	0.96 (0.50, 1.86)	0.83	1.08 (0.52, 2.23)	0.99
Other[5]	175 (42.6%)	147 (43.6%)	28 (37.8%)	(reference)	–	(reference)	–
Child attends child care centre or family daycare	237 (57.7%)	199 (59.1%)	38 (51.4%)	1.37 (0.82, 2.26)	0.23	1.52 (0.86, 2.68)	0.15
Needs financial benefits to afford family expenses[6]	182 (44.3%)	160 (47.5%)	22 (29.7%)	**2.14 (1.24, 3.68)**	**<0.001**	1.65 (0.91, 3.00)	0.91
Perceives risk of measles as high/very high to unvaccinated child[7]	310 (75%)	280 (83.0%)	30 (40.5%)	**7.20 (4.18, 12.42)**	**<0.001**	**5.56 (3.14, 9.83)**	**<0.001**
Previously registered a conscientious objection[8]	45 (11.5%)	27 (8.3%)	18 (26.9%)	**0.25 (0.13, 0.48)**	**<0.001**	**0.42 (0.20, 0.89)**	**0.04**

[1] Participant responded "Yes" to the question *"Do you support the No Jab, No Pay policy?"*.
[2] Participant responded "No" or "Unsure" to the question *"Do you support the No Jab, No Pay policy?"*.
[3] Obtained using one-way logistic regression models to estimate the odds ratio of supporting the No Jab, No Pay policy as a function of each characteristic.
[4] Obtained using multivariate logistic regression controlling for gender, previous conscientious objection, needing financial benefit to afford family expenses, and perception of risk of measles to an unvaccinated child.
[5] Reference category.
[6] Participant responded "Yes, I could not afford family expenses without them" to the question "Do the financial incentives above make a difference to your family?".
[7] Response to the question "On a scale of one to five, what risk would you consider an unvaccinated child to be for the following vaccine-preventable diseases? One being very low risk and five being very high risk".
[8] Self-reported.

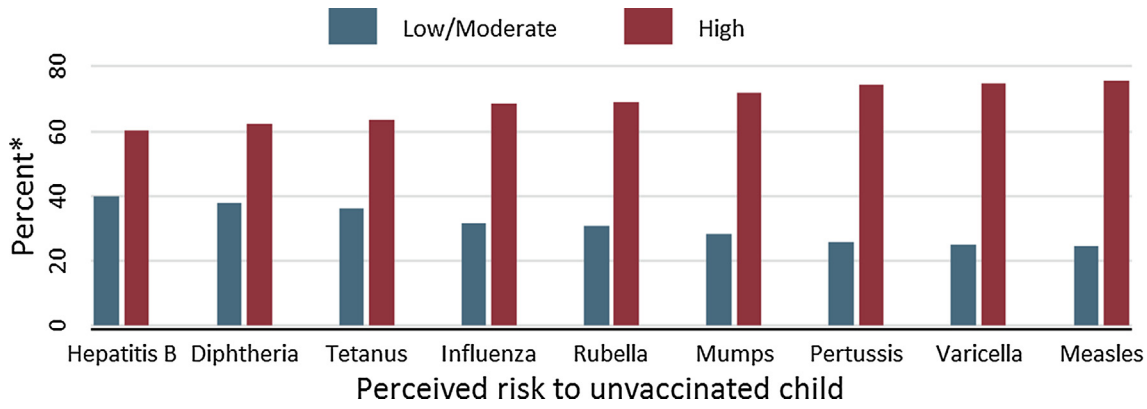

Fig. 1. Parental perceptions[1] of risk of vaccine-preventable diseases for unvaccinated children (N = 411). [1]Response to the question "On a scale of one to five, what risk would you consider an unvaccinated child to be for the following vaccine-preventable diseases? One being very low risk and five being very high risk". * Percentage of parents (N = 411) that responded Low/Moderate vs. High for each vaccine-preventable disease.

unvaccinated child as high or very high (OR = 2.42, 95% CI = [1.49, 3.93], p = <0.001).

3.1. Support for No Jab, No Pay

The odds ratios of supporting the policy as a function of various covariates are listed in Table 1, both unadjusted and adjusted for gender, needing the financial incentives, and perceived risk of measles to unvaccinated child. The odds of supporting the policy were more than twice as high among females compared to males (OR = 2.14, 95% CI [1.28, 3.61], p < 0.01), however this was not significant after controlling for disease risk perception and needing the financial incentives (AOR 1.62, 95% CI [0.92, 2.84], p = 0.09). Parents that reported a previous conscientious objection had significantly lower odds of supporting the policy (AOR = 0.42, 95% CI = [0.20, 0.89], p = 0.02). The odds of supporting "No Jab, No Pay" did not vary significantly by age, country of birth, education level, Aboriginal/Torres Strait Islander status, or state of residence.

The odds of supporting No Jab, No Pay did not differ significantly between parents that utilize child care services compared to parents that do not (OR = 1.37, 95% CI = [0.82, 2.26], p = 0.23). The odds of supporting the policy were more than twice as high among parents that reported needing the financial incentives to afford their family expenses (OR = 2.14, 95% CI = [1.24, 3.68], p < 0.001), however this was not significant after controlling for gender and risk perception of measles (AOR = 1.52, 95% CI = [0.85, 2.74], p = 0.16).

Parents that perceived the risk of measles to an unvaccinated child as high or very high had significantly higher odds of supporting "No Jab, No Pay" compared to parents that perceived the risk as moderate, low, or very low (AOR = 5.95, 95% CI = [3.60, 10.94], p < 0.001).

3.2. Willingness to reconsider vaccination

Table 2 summarizes the results of simple and multivariable logistic regression exploring the relationship between various

Table 2
Univariate and multivariate analysis of willingness to reconsider vaccination after "No Jab, No Pay" if previously hesitated or objected.

	Willing to reconsider vaccination[1] after "No Jab No Pay" if previously hesitated or objected (N = 225)					
	Yes[2] (n = 73)	No[3] (n = 152)	OR (95% CI)[4]	p-value	AOR (95% CI)[5]	p-value
Age, mean (IQR)	33 (27, 37)	33 (27, 38)	1.00 (0.96,1.03)	0.86	1.02 (0.98, 1.06)	0.43
Female, frequency (%)	35 (48.0%)	67 (44.1%)	1.17 (0.67, 2.05)	0.59	0.93 (0.48, 1.79)	0.83
Born in Australia	61 (83.6%)	121 (79.6%)	1.30 (0.63, 2.71)	0.48	1.10 (0.47, 2.55)	0.83
Aboriginal/TSI	8 (11.0%)	8 (5.3%)	2.22 (0.80, 6.16)	0.13	2.43 (0.70, 8.41)	0.16
Tertiary degree	57 (78.1%)	121 (79.6%)	0.91 (0.46, 1.80)	0.79	0.91 (0.41, 2.03)	0.82
State						
New South Wales	27 (37.0%)	48 (31.6%)	1.73 (0.89, 3.38)	0.10	1.74 (0.81, 3.76)	0.16
Victoria	23 (31.5%)	33 (21.7%)	**2.15 (1.06, 4.38)**	**0.04**	**2.32 (1.00, 5.38)**	**0.05**
Other[6]	23 (31.5%)	71 (46.7%)	Reference	–	Reference	–
Child attends child care centre or family daycare	54 (74.0%)	85 (55.9%)	**2.24 (1.21, 4.14)**	**0.01**	**2.09 (1.04, 4.17)**	**0.04**
Needs financial benefits to afford family expenses[7]	56 (76.7%)	38 (25.0%)	**9.88 (5.13, 19.03)**	**<0.001**	**9.66 (4.98, 18.73)**	**<0.001**
Perceives risk of measles as high/very high to unvaccinated child[8]	49 (67.1%)	98 (64.5%)	1.13 (0.62, 2.03)	0.70	0.74 (0.36, 1.50)	0.40
Previously registered a conscientious objection	19 (26.0%)	26 (17.1%)	1.65 (0.84, 3.26)	0.15	1.43 (0.64, 3.20)	0.39

[1] Results of univariate and multivariate logistic regression to estimate the odds ratio of being willing to reconsider vaccination as a result of "No Jab No Pay" policy if previously hesitated.
[2] Answered "Yes" to the question "Have any of the financial incentives related to "No Jab, No Pay" made you reconsider vaccination if you previously objected or hesitated to it?".
[3] Answered "No" or "I don't know" to the question "Have any of the financial incentives related to "No Jab, No Pay" made you reconsider vaccination if you previously objected or hesitated to it?".
[4] Obtained using one-way logistic regression models to estimate the odds ratio of being willing to reconsider vaccination if previously hesitated or objected as a function of each covariate.
[5] Obtained using multivariate logistic regression models controlling for utilizing child care services and needing financial incentives tied to "No Jab, No Pay".
[6] Reference category.
[7] Participant responded "Yes, I could not afford family expenses without them" to the question "Do the financial incentives above make a difference to your family?".
[8] Response to the question "On a scale of one to five, what risk would you consider an unvaccinated child to be for the following vaccine-preventable diseases? One being very low risk and five being very high risk".

covariates and being willing to reconsider vaccination as a result of the financial incentives tied to "No Jab, No Pay" if there was previous hesitation or objection (n = 255). The odds of being willing to reconsider vaccination were more than nine times higher among respondents that reported needing the financial incentives (AOR = 9.66, 95% CI = [4.98, 18.72], p < 0.001). Parents that reported utilizing child care centres or family day care had more than twice the odds of being willing to reconsider vaccination compared to parents that did not (AOR = 2.09, 95% CI = [1.04, 4.17], p = 0.04). Respondents residing in Victoria had higher odds of reconsidering vaccination compared to respondents from New South Wales and other states (AOR = 2.32, 95% CI = [1.00, 5.38], p = 0.05). Willingness to reconsider vaccination if previously objected or hesitated did not vary significantly by gender, age, country of birth, education level, Aboriginal/Torres Strait Islander status, or previous registered conscientious objection, risk perception of measles to an unvaccinated child.

4. Discussion

We found that there was generally wide support for the "No Jab, No Pay" policy, which was higher among females but otherwise consistent across the study population. This is not surprising given that most of the study population believes that childhood vaccines are important and vaccine-preventable diseases are a serious risk to unvaccinated children. Most parents with an unvaccinated child reported that they planned to fully immunise. Therefore, logistical barriers to vaccination are likely contributing more to incomplete vaccination in our study population than negative opinions and beliefs. This is consistent with a previous study in Australia, which found that lack of access to medical services, lack of social support, psychological well-being, and competing pressures contributed to incomplete vaccination more than parental vaccine objection [23]. Worryingly, 7.3% respondents indicated that their doctor advised against fully vaccinating their child due to a medical reason, but this is much higher than the rate of genuine medical contraindications [32,33].

A survey among pregnant women in Italy from September 2016 to May 2017 explored maternal attitudes towards compulsory vaccination. Like our study, they found that just over 80% of participants were in favour of compulsory vaccination. However, they observed significant variation in the level of support by region and age group, which was not seen in our study [34]. Unsurprisingly, parents that believe vaccine-preventable diseases are a serious risk to unvaccinated children were significantly more likely to support the policy. An association between perceived risk of vaccine-preventable diseases and willingness to vaccinate has been observed in other contexts [22,35,36]. We found that parents that need the financial incentives tied to "No Jab, No Pay" to make ends meet were more likely to support the policy.

The purpose of the "No Jab, No Pay" legislation was to improve overall childhood vaccination rates in Australia [2]. However, childhood vaccination coverage is already quite high; the 2017 estimate for five year-old children is 94.0%, just below the coverage target of 95% [37,38]. Though this represents a slight increase from the 2015 estimate before the introduction of the policy, coverage rates for five year-olds have been increasing every year for more than a decade [38], and against this background increase, it is unclear whether the increase is really due to "No Jab, No Pay".

While this policy is well-intentioned, there are questions about its effectiveness and ethics that remained unanswered. Mandatory vaccination requirements without the option of a personal or religious exemption may have negative consequences, especially in a country without a no-fault vaccine injury compensation scheme [24,26]. Several countries, such as the United States, have public programs to provide compensation to individuals that experience serious vaccine-associated adverse events as a result of compulsory vaccination [39]. Such a program does not exist in Australia, thus adding to the risk of the "No Jab, No Pay" policy [39,40]. Australia is also unique in linking immunisation to financial welfare benefits, and the "No Jab, No Pay" policy might be disproportionately affecting lower-income families, who may be more likely to vaccinate because they depend on the financial benefits linked to immunisation. Vaccine refusers are more likely to be from high-income areas, and thus may be able to forego the tax benefits altogether to avoid vaccination [11,41].

Evidence on the effectiveness of compulsory vaccination policies is mixed, but generally there is an increase in vaccination coverage when vaccination is linked with school entry or financial penalties [16,17,19]. We found that people who rely on the financial incentives and those who use childcare services were more likely to reconsider vaccination following the policy. Importantly, we found that among respondents that reported previous hesitation or objection to vaccination, about one third indicated that the financial incentives tied to the "No Jab, No Pay" policy have made them reconsider vaccination. Though this indicates that the policy has been successful, one must also consider whether the increased willingness is due to improved parental opinions about vaccination, or whether families are simply being pressured to vaccinate by the threat of losing tax and welfare benefits. In our study, approximately 44% of people reported that they needed the financial incentives tied to "No Jab, No Pay" to afford their family's expenses. While they were more likely to support the policy, they were also significantly more likely to report being willing to reconsider vaccination if they previously hesitated or objected, compared to participants that did not rely on the financial incentives. This suggests that parents may be reconsidering vaccination not because they have changed their minds about vaccines, but because they cannot afford to go without the childcare and family tax benefits. While the choice to opt out does still exist, the value of the tax benefits can be upwards of $15,000 AUD, and thus lower income families may not be able to forego the benefits and still make ends meet. While a higher-income family may be able to still make a choice to opt out, we argue that lower-income families may not. Thus, "No Jab, No Pay" may be disproportionately affecting lower-income families. To avoid this, one solution may be to allow for conscientious objection, but make it difficult to obtain. Studies in the United States have shown that states with complex conscientious objection procedures had fewer non-medical exemptions and lower incidence of vaccine-preventable diseases compared to states where obtaining a non-medical exemption was relatively easy [42–44]. This would encourage parents that are hesitant or have competing priorities to vaccinate, without applying undue pressure on parents that truly object to vaccination but cannot afford to go without the tax and welfare benefits.

The benefits and risks of compulsory vaccination policies must be carefully weighed, especially when the incremental gains are relatively small, as is the case when baseline vaccination rates were over 90% prior to the policy. In the event of unforeseen adverse effects, such policies might erode public trust in the government and healthcare providers, which could ultimately lower vaccination rates [45,46]. Unforeseen problems with licensed vaccines are not unprecedented. The first rotavirus vaccine in the US was withdrawn in 1999 after it was associated with intussusception in post-licensure surveillance [47]. In 1955, many children developed poliomyelitis after receiving polio vaccines from Cutter Laboratories that were not fully inactivated, which resulted in reduced vaccination rates against poliomyelitis and increased concerns about vaccine safety [48]. Therefore, it is important to consider the trade-off between amount of gain and risk that comes with eliminating conscientious objections in Australia. Given that

only 2% of Australians were registered as conscientious objectors, and that the majority of under-immunisation is caused by logistical barriers, the amount of gain may not outweigh the risk involved or erosion of public trust in vaccination programs in the event of unforeseen adverse events [11,49].

Whether the impact of the policy will be sustained is also questionable. A study in the United States examined trends in varicella vaccination coverage following the implementation of school and day care entry mandates. While there was an observed increase in coverage, this effect appears to peak after two years and then taper off [16]. This may indicate that people find "work arounds" to circumvent the policy. In addition, another study in the United States found that after California banned personal belief exemptions in 2016, there were notable increases in medical exemptions in areas that previously had high rates of personal belief exemptions [50]. Thus, policies that seek to remove the option of conscientious objection may not be reaching their target group, because vaccine objectors may instead be opting to find general practitioners willing to grant medical exemptions. Further research is needed to determine whether the "No Jab, No Pay" policy will result in substantial, long-term increases in vaccination coverage.

This study was not without limitations. The survey was only administered in English, and thus there may be bias for English-speakers. The reported rates of registered conscientious objection were far higher than the rates in the Australian Childhood Immunisation Register, suggesting that some recall bias may be present or that the sample was biased. A market research company recruited participants for this survey from its nation-wide panel. Online panels are an easy, cost-effective means of conducting survey research, but can be biased depending on how the market research company recruits panel members [51,52]. Furthermore, since panel members self-selected whether to complete the survey, it is possible that panel members with negative attitudes towards vaccination were more likely to complete the survey, thus resulting in unusually high rates of conscientious objection. An additional source of potential bias is the positive wording of question related the primary outcome, "do you support the No Jab, No Pay policy?". Research has shown that positive or negative wording of survey questions can influence responses; people generally are less likely to agree to a positively-worded question than to disagree to a negatively-worded question [53,54]. Although our results were consistent with similar studies [34], it is possible that our measure of support for the policy was biased and true support for the policy may be higher than what we have shown here. The survey also lacked a specific measure for socioeconomic status, which made it difficult to control for this during multivariable analysis. We opted instead to use the question "do the financial incentives above make a difference to your family?" as a proxy for socioeconomic status. We found that respondents that identified as Aboriginal or Torres Strait Islander were less likely to support the policy, but this was not significant – however, the sample size of Aboriginal or Torres Strait Islander people was very small. This is an area that should be studied further to understand the specific concerns of Aboriginal or Torres Strait Islander people and the impact of this policy on their communities.

5. Conclusion

Australia has nearly reached its childhood vaccination coverage target of 95% [37]. To improve coverage rates further, the Australian government implemented "No Jab, No Pay", which removed the option of conscientious objection to vaccination requirements for certain welfare benefits [2]. While we found that there is widespread support for this policy among parents of young children, our results raise certain ethical questions. Parents that rely on the welfare benefits or that utilize child care services were more likely to reconsider vaccination in response to "No Jab, No Pay", implying that the policy disproportionately impacts certain groups. We also found that most parents whose children were incompletely immunised were not against vaccination but had simply missed the scheduled time, suggesting problems with access to medical services or other logistical barriers. A surprisingly high proportion (7.3%) of respondents indicated that their doctor advised against fully vaccinating their child due to a medical reason, and this should be further investigated, as genuine medical contraindications to vaccination are very rare. There are many ways to improve childhood vaccination coverage in Australia which may be less risky than removing exemptions for conscientious objectors. These include increasing access to vaccination services and greater administrative barriers to obtaining conscientious objections.

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Author Contributions

Mallory Trent was responsible for data analysis and drafting the manuscript. Elissa Zhang contributed to the design and implementation of the study, data management, and reviewing the manuscript. Abrar Chughtai contributed to data analysis and manuscript writing. C. Raina MacIntyre was responsible for conception and design of the study, supervision and oversight of data collection and analysis, and manuscript writing. All named authors read and approved the final version of manuscript prior to submission.

Declaration of Competing Interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

References

[1] National Centre for Immunisation Research & Surveillance. No Jab No Play, No Jab No Pay Policies; 2017.
[2] Australian Government Department of Health. No Jab, No Pay – New immunisation requirements for family assistance payments; 2017.
[3] National Immunization Program, US Centers for Disease Control and Prevention. Impact of vaccines universally recommended for children—United States, 1900–1998. JAMA 1999;281(16):1482–3.
[4] Doherty M, Buchy P, Standaert B, Giaquinto C, Prado-Cohrs D. Vaccine impact: benefits for human health. Vaccine 2016;34(52):6707–14.
[5] Phadke VK, Bednarczyk RA, Salmon DA, Omer SB. Association between vaccine refusal and vaccine-preventable diseases in the United States: a review of measles and pertussis. JAMA 2016;315(11):1149–58.
[6] Saul N, Gilmour R, Spokes P. Annual vaccine-preventable disease report for New South Wales, Australia, 2014. West Paci Surv Res J: WPSAR 2017;8(2):5–11.
[7] Najjar Z, Hope K, Clark P, Nguyen O, Rosewell A, Conaty S. Sustained outbreak of measles in New South Wales, 2012: risks for measles elimination in Australia. West Paci Surv Res J: WPSAR 2014;5(1):14–20.
[8] Omer SB, Salmon DA, Orenstein WA, deHart MP, Halsey N. Vaccine refusal, mandatory immunization, and the risks of vaccine-preventable diseases. New Eng J Med 2009;360(19):1981–8.
[9] National Centre for Immunisation Research & Surveillance. Significant events in immunisation policy and practice* in Australia; 2017.
[10] Australian Government Department of Health. National vaccine objection (conscientious objection) data 1999–2015; 2018.
[11] Beard FH, Hull BP, Leask J, Dey A, McIntyre PB. Trends and patterns in vaccination objection, Australia, 2002–2013. Med J Aus 2016;204(7):275.

[12] Australian Government Department of Education and Training. Child Care Fee Assistance – summary of rate changes from July 2017; 2017.
[13] Klapdor M, Grove A. Budget review 2015–16: 'No Jab No Pay' and other immunisation measures. Parliament of Australia, Department of Parliamentary Services; 2015.
[14] Fraser AC, Williams SE, Kong SX, Wells LE, Goodall LS, Pit S, et al. Health amendment (vaccination of children attending child care facilities) act 2013: its impact in the Northern Rivers. NSW Pub Health Res Pract 2016;26(2).
[15] Haverkate M, D'Ancona F, Giambi C, Johansen K, Lopalco PL, Cozza V, et al. Mandatory and recommended vaccination in the EU, Iceland and Norway: results of the VENICE 2010 survey on the ways of implementing national vaccination programmes. Eurosurveillance 2012;17(22):20183.
[16] Abrevaya J, Mulligan K. Effectiveness of state-level vaccination mandates: evidence from the varicella vaccine. J Health Econ 2011;30(5):966–76.
[17] Adams J, Bateman B, Becker F, Cresswell T, Flynn D, McNaughton R, et al. Effectiveness and acceptability of parental financial incentives and quasi-mandatory schemes for increasing uptake of vaccinations in preschool children: systematic review, qualitative study and discrete choice experiment. Health Technol Asses (Winchester, Eng) 2015;19(94):1–176.
[18] Hall J, Kenny P, King M, Louviere J, Viney R, Yeoh A. Using stated preference discrete choice modelling to evaluate the introduction of varicella vaccination. Health Econ 2002;11(5):457–65.
[19] Kerpelman LC, Connell DB, Gunn WJ. Effect of a monetary sanction on immunization rates of recipients of aid to families with dependent children. JAMA 2000;284(1):53–9.
[20] Lawrence GL, MacIntyre CR, Hull BP, McIntyre PB. Effectiveness of the linkage of child care and maternity payments to childhood immunisation. Vaccine 2004;22(17):2345–50.
[21] Bond L, Davie G, Carlin JB, Lester R, Nolan T. Infectious disease: increases in vaccination coverage for children in child care, 1997–2000: an evaluation of the impact of government incentives and initiatives. Aus New Zeal J Pub Health 2002;26(1):58–64.
[22] MacDonald NE. Vaccine hesitancy: definition, scope and determinants. Vaccine 2015;33(34):4161–4.
[23] Pearce A, Marshall H, Bedford H, Lynch J. Barriers to childhood immunisation: findings from the longitudinal study of Australian children. Vaccine 2015;33(29):3377–83.
[24] Salmon DA, MacIntyre CR, Omer SB. Making mandatory vaccination truly compulsory: well intentioned but ill conceived. Lancet Infect Dis 2015;15(8):872–3.
[25] Thomas S, Cashman P, Islam F, Baker L, Clark K, Leask J, et al. Tailoring immunisation service delivery in a disadvantaged community in Australia; views of health providers and parents. Vaccine 2018;36(19):2596–603.
[26] MacIntyre CR. Banning unvaccinated kids from child care may have unforeseen consequences. The Convers 2017. https://theconversation.com/banning-unvaccinated-kids-from-child-care-may-have-unforeseen-consequences-74437.
[27] Haire B, Komesaroff P, Leontini R, Raina MacIntyre C. Raising rates of childhood vaccination: the trade-off between coercion and trust. J Bioethic Inq 2018;15(2):199–209.
[28] Lawrence GL, Hull BP, MacIntyre CR, McIntyre PB. Reasons for incomplete immunisation among Australian children. A national survey of parents. Aus Family Phys 2004;33(7):568–71.
[29] Lawrence GL, MacIntyre CR, Hull BP, McIntyre PB. Effectiveness of the linkage of child care and maternity payments to childhood immunisation. Vaccine 2004;22(17–18):2345–50.
[30] IBM Corp. IBM SPSS statistics for windows version 24.0. Armonk (NY): IBM Corp. Released; 2016.
[31] StataCorp. Stata statistical software: release 14. College Station, TX, StataCorp. LP, 2015.
[32] McNeil MM, Weintraub ES, Duffy J, Sukumaran L, Jacobsen SJ, Klein NP, et al. Risk of anaphylaxis after vaccination in children and adults. J Allergy Clin Immunol 2016;137(3):868–78.
[33] Stadlin S, Bednarczyk RA, Omer SB. Medical exemptions to school immunization requirements in the United States—association of state policies with medical exemption rates (2004–2011). J Infect Dis 2012;206(7):989–92.
[34] Gualano MR, Bert F, Voglino G, Buttinelli E, D'Errico MM, De Waure C, et al. Attitudes towards compulsory vaccination in Italy: results from the NAVIDAD multicentre study. Vaccine 2018;36(23):3368–74.
[35] Harmsen IA, Lambooij MS, Ruiter RAC, Mollema L, Veldwijk J, van Weert YJWM, et al. Psychosocial determinants of parents' intention to vaccinate their newborn child against hepatitis B. Vaccine 2012;30(32):4771–7.
[36] Larson HJ, Jarrett C, Eckersberger E, Smith DMD, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. Vaccine 2014;32(19):2150–9.
[37] Australian Government Department of Health. Childhood immunisation coverage; 2018.
[38] Australian Government Department of Health. Historical coverage data tables for all children; 2018.
[39] Looker C, Kelly H. No-fault compensation following adverse events attributed to vaccination: a review of international programmes. Bullet. World Health 2011;89:371–8. https://doi.org/10.2471/BLT.10.081901.
[40] Haire B, Komesaroff P, Leontini R, Macintyre CR. Raising rates of childhood vaccination: the trade-off between coercion and trust. J. Bioethic. Inq. 2018;15(2):199–209.
[41] Birnbaum MS, Jacobs ET, Ralston-King J, Ernst KC. Correlates of high vaccination exemption rates among kindergartens. Vaccine 2013;31(5):750–6.
[42] Blank NR, Caplan AL, Constable C. Exempting schoolchildren from immunizations: states with few barriers had highest rates of nonmedical exemptions. Health Aff (Proj Hope) 2013;32(7):1282–90.
[43] Omer SB, Richards JL, Ward M, Bednarczyk RA. Vaccination policies and rates of exemption from immunization, 2005–2011. New Engl J Med 2012;367(12):1170–1.
[44] Omer SB, Pan WY, Halsey NA, et al. Nonmedical exemptions to school immunization requirements: secular trends and association of state policies with pertussis incidence. JAMA 2006;296(14):1757–63.
[45] Lee C, Whetten K, Omer S, Pan W, Salmon D. Hurdles to herd immunity: distrust of government and vaccine refusal in the US, 2002–2003. Vaccine 2016;34(34):3972–8.
[46] Salmon DA, Moulton LH, Omer SB, DeHart MP, Stokley S, Halsey NA. Factors associated with refusal of childhood vaccines among parents of school-aged children: a case-control study. Arch Pediatr Adol Med 2005;159(5):470–6.
[47] Vesikari T. Rotavirus vaccination: a concise review. Clin Microbiol Infect 2012;18:57–63.
[48] Nathanson N, Langmuir AD. The Cutter incident. Poliomyelitis following formaldehyde-inactivated poliovirus vaccination in the United States during the Spring of 1955. II. Relationship of poliomyelitis to Cutter vaccine. 1963. Am J Epidemiol 1995;142(2):109–40 [discussion 7–8].
[49] Australian Government Department of Health. Immunisation coverage annual report, 2014. Commun Dis Intell 2017;41(1).
[50] Delamater PL, Leslie TF, Yang Y. Change in medical exemptions from immunization in California after elimination of personal belief exemptions. JAMA 2017;318(9):863–4.
[51] Erens B, Burkill S, Couper MP, Conrad F, Clifton S, Tanton C, et al. Nonprobability web surveys to measure sexual behaviors and attitudes in the general population: a comparison with a probability sample interview survey. J Med Int Res 2014;16(12):e276-e.
[52] Baker R, Blumberg SJ, Brick JM, Couper MP, Courtright M, Michael Dennis J, et al. Research synthesis AAPOR report on online panels. Pub. Opin. Quart. 2010;74(4):711–81.
[53] Kamoen N, Holleman B, Mak P, Sanders T, van den Bergh H. Agree or disagree? Cognitive processes in answering contrastive survey questions. Dis Process 2011;48(5):355–85.
[54] Holleman B, Kamoen N, Krouwel A, van de Pol J, de Vreese C. Positive vs. negative: the impact of question polarity in voting advice applications. PLoS ONE 2016;11(10):e0164184.