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3 **Support for Policy Options to increase Vaccination Coverage in British Columbia, Canada:**  
4 **a Representative Survey**  
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## Abstract

### Background

Motivated by concerns of inadequate vaccination coverage and the potential for vaccine-preventable disease outbreaks, Canadian provinces have been discussing, implementing, and tightening policies requiring documentation of vaccination for school enrolment. This study sought to understand the acceptability of 14 potential vaccination policy levers among parents and other adults in British Columbia.

### Methods

A representative, online panel of 1,308 British Columbian adults was surveyed in April 2017. Respondents were representative of the BC population by gender, age, geographic residence, and percentage of household with children younger than 19 years of age. Robust Poisson regression was used to estimate predictors of policy endorsement.

### Results

The majority of respondents (>80%) held positive attitudes towards immunization. Policies such as mandatory vaccine documentation at school entry were supported by more than 75% of all respondents. Punitive policies, such as denial of child tax benefits for non-vaccination, were supported by fewer than 40% of respondents.

In multivariable regression, respondents with positive vaccine attitudes were significantly more likely to strongly support all potential policies. Additionally, female respondents and respondents with post-secondary education were significantly more likely to strongly support policies involving additional requirements for parents.

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3 **Interpretation**  
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6 The majority of adults in British Columbia held favourable attitudes towards vaccination and  
7 strong support existed for policies designed to support vaccination. This study provides evidence  
8 that most British Columbians are supportive of vaccination and, when presented with a wide  
9 range of options, would likely be supportive of information and requirement policy options  
10 designed to increase vaccine uptake.  
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## Introduction

Canada has limited school entry vaccination requirements. Only Ontario and New Brunswick currently have laws requiring proof of immunization, and both allow medical and philosophical/religious belief exemptions (1, 2). However, due to increasing concern regarding vaccine-preventable disease outbreaks in populations with a high percentage of parental vaccine refusals, school-based interventions to increase vaccination of children have received renewed attention (3).

For example, in Ontario, the longstanding Immunization of School Pupils Act(1) was amended such that, beginning in 2014, parents/guardians were required to provide proof of vaccination against nine diseases or file exemptions. In August 2015, the Canadian Medical Association passed a resolution recommending that all provinces require mandatory vaccine records for elementary and secondary school students, followed by a conversation between health officials and parents for those children who are inadequately vaccinated (4, 5). Finally, the 2017 Ontario Protecting Patients Act required that parents seeking non-medical exemptions for their children complete an educational session on vaccine evidence, and streamlined reporting of vaccines administered to children(6).

Despite these initiatives, recent efforts to address decreasing vaccination coverage in Manitoba have encountered resistance. Manitoba previously had a measles vaccine requirement for school enrolment, which is no longer in place. In 2018, the Manitoba School Boards Association overwhelmingly voted against a motion to lobby the provincial government to adopt stricter vaccination requirements for school enrollment (7, 8). And, in 2017 in the western province of

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3 Alberta, the provincial government declined to adopt a school vaccine mandate policy, despite  
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5 urging by the Edmonton Catholic school board to pass such a law (9).  
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9 Currently, British Columbia (BC) does not require vaccination or even vaccination  
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11 documentation for school entry under law. Immunization records of school children are collected  
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13 under a voluntary scheme at school entry. Public health staff is authorized to request student  
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15 records from the school under both the *School Act* and under the *Independent School Regulation*  
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17 for the purpose of planning delivery of health services including immunization services to  
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19 students. As coverage rates in BC children are below national average for many vaccines (10,  
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21 11), a better understanding of the acceptability of potential policy levers could provide valuable  
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23 assistance to policy makers as they search for methods to increase vaccination rates in BC.  
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25 Therefore, we examined the acceptability of policy options that have been used in various  
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27 settings globally.  
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## Methods

### *Sample and Procedures*

An existing online panel of BC adults was surveyed April 3-14, 2017 (<http://sentisresearch.com/sentisresearch>). The panel sampling frame ensured a geographically representative sample from the five regional health authorities. A total of 1,352 invitations were sent to obtain 1,002 adult respondents ages 19 and older (74% response rate). We oversampled parents of children aged 5 to 18 years to ensure adequate responses for parental questions, resulting in a total sample size of 1,308.

Respondents received an email invitation with a survey link and provided informed consent before proceeding onto the survey. A reminder email was sent 3 days after the initial email. Respondents earned remuneration from Sentis in accordance with the company's usual incentive structure, which allows respondents to earn points redeemable for retailer gift cards. The University of British Columbia provided research ethics approval.

### *Measures*

*Support for immunization policy levers* was measured with 14 items assessing support for national and international laws and public proposals (12-14) that had been validated in a previous study.(14) We classified the policy options into four categories (Table 1): (1) *Information or service provision*: policies designed to provide information or services to parents and do not require anything of parents; (2) *Requirements*: policies that establish additional requirements for all parents or for those parents who do not vaccinate; (3) *Penalties*: policies that punish unvaccinated children or their parents; and (4) *Rewards*: policies designed to reward parents of vaccinated children. The 4-point response scale for these items ranged from 1= strongly agree to

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3 4=strongly disagree, which we recoded in reverse direction to reflect stronger endorsement in our  
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5 models.  
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8 *Demographics* included gender, age, number of children <19 years in the household, foreign  
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10 born (vs. Canadian born), education level, and household income.  
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14 *Vaccination-related practices* consisted of three binary (yes/no) items asking respondents if they  
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16 had ever delayed or ever refused a vaccine for their child (asked of parents), and ever refused a  
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18 vaccine for themselves (asked of parents and non-parents).  
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22 *Normative influences* consisted of two items assessing if the respondent had received negative  
23  
24 information about vaccines from (a) family members and (b) friends (15, 16).  
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28 *Attitudes towards vaccines* consisted of five items assessing extent of agreement with statements  
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30 regarding whether: (1) the respondent generally does what a doctor/health care provider  
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32 recommends about vaccines; (2 and 3) having children vaccinated is important for the health of  
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34 (a) others in the community and (b) the child; and (4 and 5) the respondent believes vaccines (a)  
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36 work and (b) are safe.(15, 16) Each item was coded on a 4-point scale ranging from 1=strongly  
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38 agree to 4=strongly disagree.  
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#### 41 42 ***Analysis*** 43 44

45 The total sample was weighted for households with children under 19 years of age using the  
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47 2011 Canadian census. SAS version 9.2 was used for all analyses. We present descriptive data  
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49 via weighted percentages for the total sample.  
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3 Our analyses consisted of two steps. First, we computed descriptive statistics for the study  
4 variables across two groups: total respondents and parents with children under age 19. Second,  
5 we used Poisson regression with robust variance (17) to estimate predictors of policy  
6 endorsement for those who strongly agreed with policies (versus all other responses). We  
7 selected this cut-off because it represented the highest degree of endorsement. The demographic,  
8 behavioral, normative, and attitudinal characteristics described above were examined to  
9 determine whether specific policies were more or less likely to appeal to specific population  
10 groups. For these models, the five vaccine attitude questions had high internal consistency  
11 (Cronbach's alpha=0.93) and thus were combined into a mean composite measure for vaccine  
12 attitudes and reverse coded for ease of understanding (ranging from 1=strongly disagree to  
13 4=strongly agree). The vaccination-related practices variables asking respondents if they had  
14 every delayed or refused vaccines for their child were combined into one variable with three  
15 levels: 1) parents who had delayed or refused; 2) parents who had not delayed or refused; and 3)  
16 non-parents. Any characteristic with a prevalence ratio (PR) and 95% confidence interval above  
17 1 in the multivariable model indicated the characteristic was associated with strong support for  
18 the policy, with the PR indicating the percent increase (if >1) or decrease (if <1) in the probability  
19 of support for the policy for a characteristic of interest compared to its referent or each unit  
20 change in the vaccine attitude scale.  
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## Results

Demographic characteristics of the respondents are shown in table 2. In both the total and the subset of parents with young children, just over half were female, close to 80% were born in Canada and almost 80% had education beyond secondary school. Parent respondents were younger and slightly more affluent than total respondents.

### *Vaccination practices, normative influences, and attitudes*

Vaccination practices and normative influences (friends and family) are shown in table 2.

Comparing parents with children younger than 19 years of age (henceforth termed ‘younger parents’) to parents with older children, or respondents without children, more younger parents reported knowing friends or family members who had refused vaccines.

Attitudes towards vaccines, among the total participants and younger parents, are shown in Figure 1. For all but one vaccine attitude question, close to 90% of respondents agreed or strongly agreed with each vaccine attitude question, indicating overall that respondents held attitudes supportive of vaccination. The mean of the vaccine attitudes composite measure was 3.37 [on a 4.0 scale, standard deviation (SD)=0.61] overall and 3.30 (SD=0.62) for younger parents, which also indicates the majority held favorable attitudes towards vaccines.

### *Support for Vaccination Policies*

Figure 2 shows the proportion of respondents who either agreed or strongly agreed with fourteen specific vaccination policies. Information and service policies received the highest level of agreement (at least 70%) from all respondents as well as younger parents. Policies that establish additional requirements for parents received agreement from the majority of survey respondents

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3 (60% or higher) regardless of parental status. Rewards, or policies that provided incentives to  
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5 vaccinating parents, were supported by over half of younger parents but received less support  
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7 among total respondents ( $p < 0.005$ ). Finally, penalties were only supported by a minority of  
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9 respondents, regardless of parental status, with support for the denial of unemployment benefits  
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11 to non-vaccinating parents being particularly low (less than 20% of the respondents).  
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### 15 *Multivariable Analyses of Vaccination Policy Support*

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18 Table 3 shows the adjusted prevalence ratios obtained from multivariable models regressing  
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20 strong support for each policy on the demographic, behavioral, normative, and attitudinal  
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22 characteristics.  
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26 Demographic factors, in general, showed inconsistent associations across policies. However,  
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28 some patterns existed. Women were significantly more likely to endorse support for information,  
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30 service as well as requirement policies (e.g., vaccine record provision, signed refusal, and  
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32 education sessions), while men were significantly more likely to endorse rewards. Younger  
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34 respondents were significantly more likely to support some penalties (denying unemployment  
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36 benefits and taxing/fines) and reward policies, and younger parents were significantly more  
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38 likely to support reward policies. Lower income was associated with support for information and  
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40 service (e.g., research funding and more vaccination services), while those with higher education  
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42 (e.g., beyond secondary) had a significantly higher likelihood of support for policies making  
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44 school vaccination rates public, requiring parents provide vaccination records and signed  
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46 refusals, doctors' refusing unvaccinated patients, school bans of unvaccinated students and  
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48 denial of child tax benefits.  
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3 Regarding vaccination practices, normative influences and vaccine attitudes, having positive  
4 vaccine attitudes was the only covariate predictive of support for 13 out of 14 policies. No  
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6 behavior or normative influence was consistently associated with policy support (or non-  
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8 support). However, having normative influences that delayed or refused vaccines, or provided  
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10 negative information about vaccines, did predict greater support for information and service  
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12 policies. Parents who had delayed or refused vaccines for their child did not support requiring  
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14 signed vaccine refusal forms.  
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20 In terms of the predictors associated with the different policy categories, information and service  
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22 policies varied in terms of predictors associated with strong support, with positive vaccination  
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24 attitudes being the only common covariate associated with strong support across all but one of  
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26 these policies. This category of policy was the only one to receive strong support from  
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28 respondents who had delayed or refused vaccines for their children. In general, requirement  
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30 policies were more strongly supported by women, those with post-secondary education, and  
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32 those with positive attitudes towards vaccination. Penalty policies were strongly supported by  
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34 those with positive vaccination attitudes, men, those with higher incomes and younger age  
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36 groups. Importantly, several population groups, such as women and immigrants, were  
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38 significantly less likely to support penalty policy levers. Finally, rewards were most strongly  
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40 supported by those in younger age groups (i.e., of child-bearing age) and those with young  
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42 children.  
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## Discussion

This study provides evidence and context that most British Columbians are supportive of vaccination and would be supportive of non-punitive policy options designed to increase uptake of vaccines. In general, our respondents were pro-social, pro-vaccine, and comfortable with mild laws, such as mandated documentation, with no punishment for non-vaccination. The vast majority held favorable attitudes towards vaccination and had vaccinated themselves and/or their children. Most indicated their friends and family were vaccinated. Strong agreement existed for policies designed to support vaccination in a non-punitive way.

Policies directed at improving information and service—the most accommodating types of policy—garnered the most support: more than 80% of respondents supported these policy options, including respondents who had refused or delayed vaccines for their children. Such positive policies may be effective in reassuring hesitant parents, a demographic which, compared to more ardent anti-vaccine parents, has a higher likelihood of being convinced to vaccinate their children (18).

Policies involving additional requirements for parents also garnered support from a majority of respondents. This support was observed even among younger parents, who would be directly affected by these types of policies. Notably, overall agreement with mandatory vaccinations for school enrollment, a measure similar to California's policy that only allows medical exemptions, was approximately 68% among all respondents and 65% for younger parents. Poll data collected in California in May 2015, just prior to the vaccination bill being signed into law, indicated that 67% of adults and 65% of parents of public school children felt that children who have not been vaccinated should not be allowed to attend school (19). Likewise, February and June 2015 polls

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3 of BC respondents respectively found that 63% and 78% felt vaccination should be mandatory  
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5 (20, 21). Hence, the estimates found in our study indicate a stable level of majority support.  
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9 By contrast, more punitive policies, such as denial of child tax benefits or other government  
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11 benefits or services—similar to the “No job, no pay” policy (12, 22, 23) in Australia—were not  
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13 viewed favorably. Less than 15% of respondents indicated strong support and important  
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15 population groups such as women and immigrants indicated strong disagreement with such  
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17 options. The majority of respondents also disagreed with a policy to allow physicians to refuse to  
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19 see non-vaccinating families, indicating such policies may not be supported, even by those who  
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21 would not be directly affected. Implementation of an unpopular policy could potentially  
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23 undermine attempts to increase vaccine coverage, as has been seen in other jurisdictions (e.g.,  
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25 Texas (24, 25) and Italy (26)).  
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31 Small differences were found in predictors of support between parents of young children and the  
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33 general public—the exception being policies that directly benefited these parents (i.e., financial  
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35 rewards/tax breaks for being fully vaccinated), which is not unexpected in a province with high  
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37 housing and childcare costs.  
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41 These findings do need to be considered with respect to some limitations. First, our data are from  
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43 a non-probability sample. Although the sample was representative of the BC population by  
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45 geography, gender, age and proportion of household with children, using a volunteer sample may  
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47 introduce selection bias. As with any volunteer sample, those who participate may be different  
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49 from non-participants. However, we would not expect our participants to differ systematically  
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51 from non-participants in their opinions of potential vaccination policies. Additionally, public  
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53 opinion is not the only consideration when implementing public vaccine policies. Other  
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3 elements, such as resources needed to ensure proper implementation, and effectiveness of the  
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5 policy in encouraging vaccination, are also important factors.  
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9 Overall, this study highlights that vaccination is a strongly supported social norm among the  
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11 majority of British Columbians, and that several non-punitive policies might be well accepted in  
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13 this context. British Columbians expect parents to immunize their children. Depending on the  
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15 policy, specific population groups may require additional attention (e.g., communication,  
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17 assistance) to ensure acceptance once the policy is implemented. Finally, specific groups, such as  
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19 those who do not support vaccination or do not have strong attitudes in support of vaccines will  
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21 be unlikely to agree with any measures that directly affect them.  
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25 Similar, context specific research conducted in other jurisdictions would benefit public discourse  
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27 and government decision-making. Additionally, government would benefit from future research  
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29 focusing on the extent to which such policy attitudes might remain stable over time and even  
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31 compare/contrast with attitudes in other jurisdictions.  
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32 20. Majority believes vaccinations are effective; but two-in-five say the “science isn’t clear”.  
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**Table 1 Categorization of policy options**

<b>Information or Service Provision</b>	<b>Requirements</b>	<b>Penalties</b>	<b>Rewards</b>
The government should invest more money in research to ensure that vaccines are safe	At school entry, all parents should be required to provide records showing whether their child has been vaccinated	Parents should be denied their monthly Canada child tax benefit until their children receive all age-recommended vaccinations	Parents should receive a financial reward if their children have received all age-recommended vaccinations
Parents need access to more information about childhood vaccinations	Parents who refuse vaccinations for their children should be required to sign a vaccine refusal form	Parents who lose their jobs should be denied unemployment benefits until their children receive all age-recommended vaccinations	Parents should receive a special tax break/credit if their children have received all age-recommended vaccinations
School vaccination rates should be made public	Parents who refuse vaccinations for their children should be required to attend an education session;	Parents should be required to pay a special tax/fine if their children have not received all age-recommended vaccinations	
More child vaccination-related services should exist	Children should not be allowed to attend public schools without all age-recommended vaccines without a documented medical reason for not being vaccinated	Doctors should be allowed to refuse to see families who choose not to vaccinate their children	

**Table 2 Characteristics of population**

	<b>Parents with children &lt;19 years of age (N=587)</b>	<b>Total (N=1308)</b>
	<b>N (%)</b>	<b>N (%<sup>a</sup>)</b>
Female	332 (56.6)	726 (55.2)
Age group in years		
18-24	17 (2.9)	63 (5.4)
25-34	171 (29.1)	301 (21.2)
35-44	180 (30.7)	251 (15.7)
45-54	135 (23.0)	259 (18.8)
55-64	70 (11.9)	220 (18.3)
65+	14 (2.4)	214 (20.6)
Children <19 years of age	587 (100)	587 (28.2)
Foreign born	125 (21.3)	274 (20.8)
Education level		
Secondary/high school or lower	121 (20.6)	303 (24.0)
College/trade/technical degree	228 (38.8)	494 (37.4)
University degree or higher	233 (39.7)	496 (37.4)
Prefer not to answer	5 (0.9)	15 (1.2)
Annual household income		
< C\$35,000	59 (10.1)	174 (14.3)
C\$35,000-C\$74,999	150 (25.6)	390 (31.1)
C\$75,000-C\$99,999	140 (23.9)	258 (18.5)
C\$100,000 or more	185 (31.5)	333 (23.5)
Prefer not to answer	53 (9.0)	153 (12.5)
Vaccination Practices		
Delay or refused vaccine for child	153 (26.1)	172 (19.2 <sup>b</sup> )
Refused for self	118 (20.1)	255 (19.3)
Normative influences		
Family member refused for self	124 (21.1)	258 (19.3)
Family member delayed or refused for child	138 (24.0)	242 (17.0)
Friend refused for self	184 (31.4)	378 (28.2)
Friend delayed or refused for child	254 (43.3)	427 (29.4)
Heard negative vaccine information	447 (76.1)	987 (75.2)
From family	122 (20.8)	235 (17.1)
From friends	209 (35.6)	450 (34.0)

- a. Population percentages for the total weighted for households with children under 19 years of age.
- b. Percentage based on respondents with children (n=892)

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Figure 1: Proportion of respondents who agree with positive vaccine statements

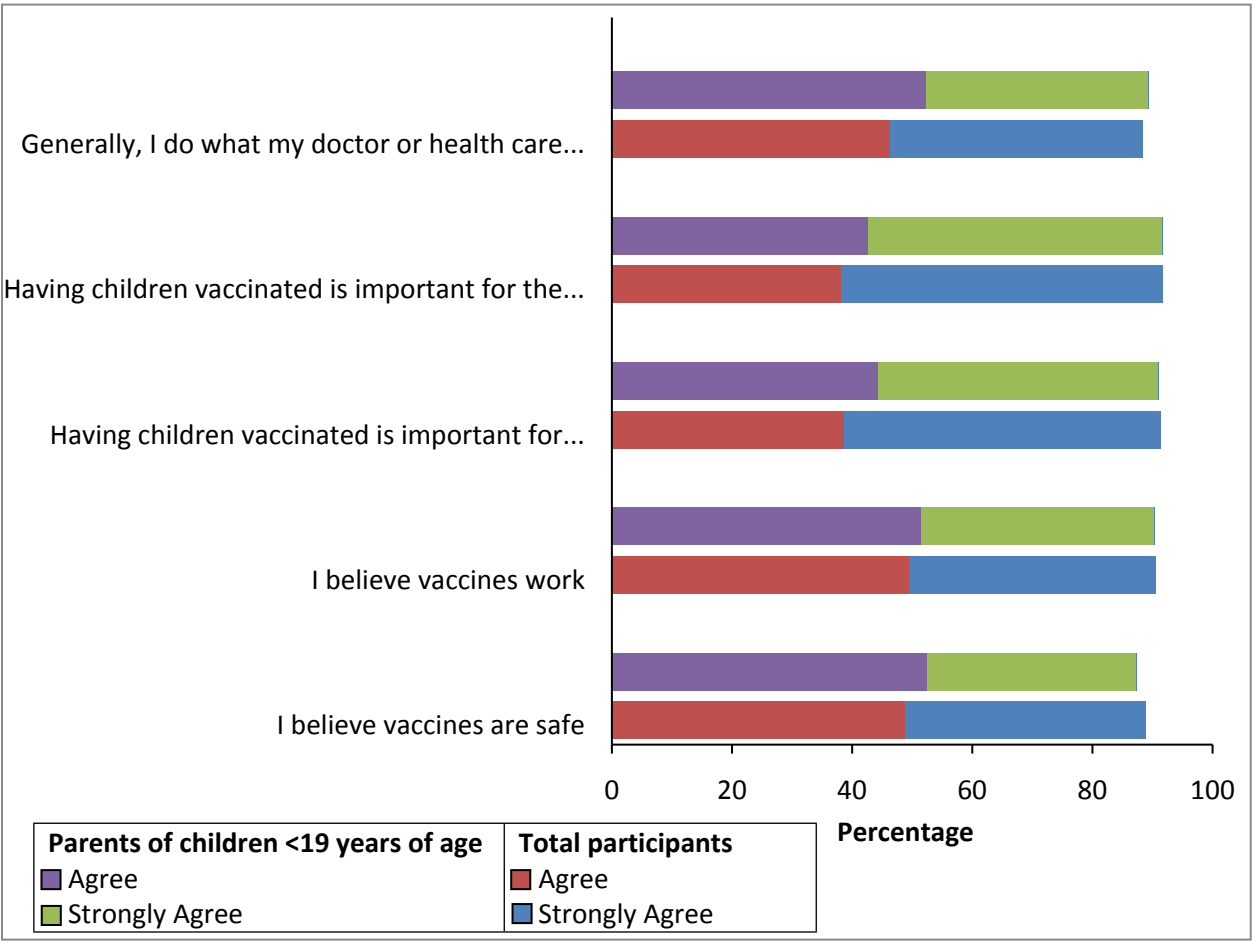
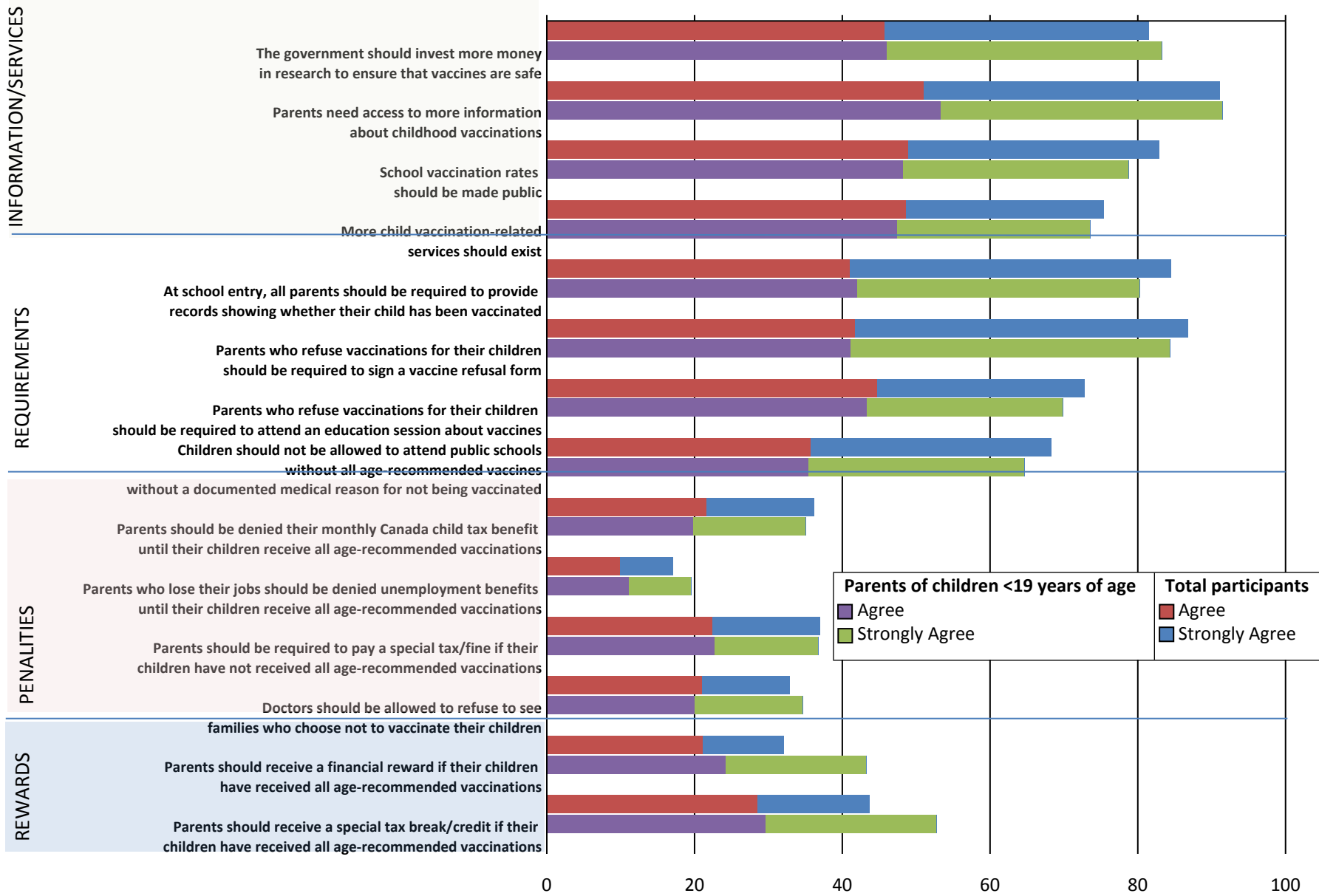


Figure 2: Proportion of respondents who agree with 14 vaccination policies



**Table 3: Prevalence ratios for strongly agreeing with specific vaccination policies regressed on population characteristics and vaccine attitudes**

	Information and services				Requirements				Penalties				Rewards		
	More government funded research	More information access	More vaccination services	School coverage rates public	Parents provide vaccination records	Parents provide signed refusal	Parent education sessions	Ban from school	Deny child tax benefit	Deny unemployment benefits	Tax or fine	Doctor refuse unvaccinated patients	Allow doctors to break or credit	Special tax	Financial reward
Sample N	1308	1300	1304	1289	1285	1285	1300	1289	1285	1300	1304	1289	1304	1304	
Female	NS	1.18 <sup>a</sup>	NS	NS	1.21 <sup>b</sup>	1.23 <sup>b</sup>	1.24 <sup>b</sup>	NS	0.68 <sup>b</sup>	0.61 <sup>b</sup>	NS	NS			
Age	NS	NS	NS	NS	NS	NS	NS	NS	NS						
18-24										2.81 <sup>b</sup>	1.7	3.26 <sup>b</sup>	2.20 <sup>a</sup>	5.26 <sup>b</sup>	
25-34										2.03 <sup>a</sup>	1.83 <sup>b</sup>	3.22 <sup>c</sup>	2.06 <sup>b</sup>	4.57 <sup>b</sup>	
35-44										1.74	1.63 <sup>a</sup>	2.62 <sup>b</sup>	1.36	2.73 <sup>b</sup>	
45-54										1.48	1.48	1.93 <sup>a</sup>	1.06	2.26 <sup>a</sup>	
55-64										1.31	1.33	2.12 <sup>a</sup>	0.73	1.15	
65+										Referen ce	Referen ce	Referen ce	Referen ce	Referen ce	
Children <19 years of age	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.75 <sup>c</sup>	1.97 <sup>b</sup>	
Immigrant	1.34 <sup>b</sup>	NS	NS	NS	NS	NS	NS	0.80 <sup>a</sup>	NS	NS	NS	NS	NS	1.60 <sup>b</sup>	
Income		NS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
100K or more	Referen ce		Referen ce	NS											
75K<100k	1.18		0.99												
35k<75k	1.38 <sup>b</sup>		1.37 <sup>b</sup>												
<35K	1.43 <sup>b</sup>		1.40 <sup>a</sup>												
Education	NS	NS	NS				NS				NS	NS	NS	NS	
Secondary or lower				Referen ce	Referen ce	Referen ce		Referen ce	Referen ce				Referen ce		
College/trade/technical degree or diploma				1.23	1.22 <sup>b</sup>	1.11		1.22 <sup>a</sup>	1.65 <sup>b</sup>				1.99 <sup>b</sup>		
University degree				1.42 <sup>b</sup>	1.25 <sup>b</sup>	1.23 <sup>b</sup>		1.19	2.0 <sup>b</sup>				1.66 <sup>a</sup>		



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2	or higher														
3	Positive vaccine														
4	attitudes (composite														
5	measure)	NS	1.42 <sup>c</sup>	4.81 <sup>c</sup>	3.47 <sup>c</sup>	3.67 <sup>c</sup>	2.52 <sup>c</sup>	3.91 <sup>c</sup>	4.92 <sup>c</sup>	5.73 <sup>c</sup>	6.48 <sup>c</sup>	8.26 <sup>c</sup>	6.63 <sup>c</sup>	2.73 <sup>c</sup>	2.81 <sup>c</sup>
6	Delayed or refused														
7	vaccine for their child	1.2 <sup>a</sup>	1.33 <sup>b</sup>	NS	NS	NS	0.78 <sup>a</sup>	NS	NS	NS	NS	NS	NS	NS	
8	Refused vaccines for														
9	themselves	1.39 <sup>c</sup>	1.37 <sup>b</sup>	NS	NS	NS	NS	NS	1.40 <sup>b</sup>	NS	NS	NS	NS	NS	
10	Friend delayed or														
11	refused vaccine for														
12	their child	NS	1.22 <sup>b</sup>	NS	NS		NS	NS	NS	NS	NS	NS	NS	NS	
13	Family member														
14	delayed or refused														
15	vaccine for														
16	themselves	NS	NS	NS	1.34 <sup>b</sup>		NS	NS	NS	NS	NS	NS	NS	NS	
17	Friend delayed or														
18	refused vaccine for														
19	themselves	NS	NS	1.25 <sup>b</sup>	NS		NS	NS	NS	NS	NS	NS	NS	NS	
20	Negative information														
21	about vaccines from														
22	family	1.22 <sup>b</sup>	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

<sup>a</sup>≤0.05

<sup>b</sup>p<0.01

<sup>c</sup>p<0.0001

NS=not significant at = 0.05

"Negative information about vaccines from friends" and "Family member delayed or refused vaccine for their child" were not significant predictors in any multivariate model and are not shown in the table.

"Delayed or refused vaccine for their child" was modeled with three levels: 1) referent group was parents who did not delay/refuse vaccines; 2) estimate shown in table is for parents who did delay/refuse vaccines; 3) individuals without children (not shown in table).