

Background

- The prenatal period is an opportunity to provide information to parents about routine childhood immunization. Many parents have either made up their minds about vaccination or have begun to consider their approach to vaccination before their baby is born and those with concerns are more likely to want to start discussing vaccination sooner.
- Maternal care providers are a trusted source of information about vaccination and advice from a provider is a key determinant of parental decisions.
- In British Columbia, midwives are engaged in up to a quarter of pregnancies.
- Studies have shown that midwives and physicians may have different approaches to the topic of childhood vaccination, with midwives more often taking a neutral approach. Some midwives feel that promoting vaccination may come across as pressuring clients and is outside of their scope of practice.

Objectives

- To assess associations between the type of care provider during pregnancy and:
- complete vaccination by age 2, and
 - vaccine refusals or delays from the recommended provincial schedule.

Methods

Data sources

- BC Perinatal Data Registry (BCPDR), which contains data on up to 99% of births in BC.
- Vaccination records from BC's provincial immunization registry (PIR) and Vancouver Coastal Health's (VCH) regional immunization registry.
- Medical billing from the BC Medical Services plan (MSP)

Study population

- Children born between January 1 2010 and December 31 2015 to mothers who received prenatal care in BC and remained in BC to their second birthday.
- For VCH, early childhood vaccination record collection is undertaken at school entry so only 2010 and 2011 birth cohorts were used.

Exposure definitions (using MSP data)

- Majority-midwife care: midwife billing for pregnancy care through the third trimester (fee item 36030 OR [36034 AND 36064] OR 36031) AND midwife billing for postnatal care (fee item 36050 OR [36056 AND 36054]).
- Majority-physician care: no midwifery-specific fee items AND [physician billing for at least one prenatal visit (fee item 14090 OR 14091) OR physician billing for at least one postnatal visit (fee item P14094)].

Outcome definitions

- Up to date for age at two years old, defined by the BC routine vaccination schedule: 4 doses diphtheria/tetanus/pertussis, 3 doses hepatitis B, 1 dose measles/mumps/rubella, 3 doses polio, 1 dose varicella (or recorded exemption due to previous disease or protective antibody levels), up-to-date for pneumococcal conjugate, meningococcal C conjugate and *Haemophilus influenzae* type b (Hib) as defined by age at first dose
- Up to date for age minus the booster at two years old: defined as above but with only 3 doses diphtheria/tetanus/pertussis, 2 doses polio and at least 1 dose of Hib vaccine.
- Refusal to any or all routine vaccinations: recorded exemption with a reason of "refusal" for at least one vaccine dose (any) or all vaccines (all)
- Delay greater than 30 days for vaccinations recommended at 2, 4, 6, 12, and 18 months of age (separately, and all recommended vaccines at each milestone).
- Time to first vaccination (in days): receipt of any vaccine after 42 days old.

Analysis

- Multivariable Poisson regression with robust error variance for binary outcomes
- Cox proportional hazards model for time to first vaccination
- Analysis was conducted using R in PopDataBC's Secure Research Environment.

Results

- The analysis included 180,087 children born between January 1, 2010 and December 31, 2015.
- The mothers of 16.6% (n = 29,874) of these children had majority-midwife care and the remaining 83.4% (n = 150,213) had majority-physician care.
- Almost three quarters (73.1%) of children were up to date for age with all routine vaccines by age two (Table 1). 84.6% of children were up to date for age minus the booster.
- Fewer than 4% of children had vaccination refusals documented in their records and only 5.4% of children had no vaccines recorded by age two.
- Majority-physician care was associated with higher vaccination completion and lower refusals (Figure 1).
- Children whose mothers received majority-physician care were between 1.24 and 1.32 times more likely to receive recommended vaccines within 30 days of the milestone age than children whose mothers received majority-midwife care (Figure 2).
- In the Cox proportional hazards model, the adjusted hazard ratio (HR) for majority-physician care compared with majority-midwife care was 1.72 (95%CI 1.69 – 1.74). The proportional hazards assumption was not met (p < 0.001), however the log-log plots for key covariate of maternal care provider showed approximately parallel curves that did not cross (data not shown).

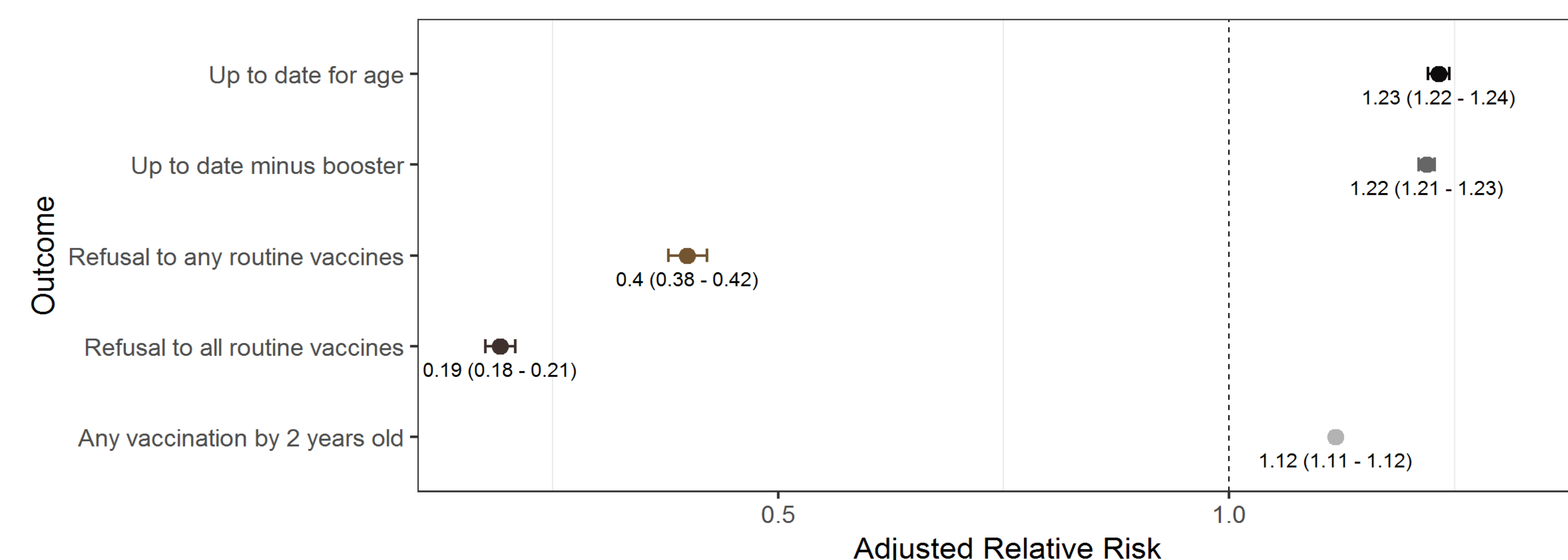


Figure 1. Relative risk of overall vaccination and refusal outcomes for majority-physician care using multivariable Poisson regression with robust error variance

All models apart from "Refusal to all routine vaccines" were adjusted for mother's age (continuous), number of previous children (continuous), multiple babies in the current pregnancy (binary), gestational age in weeks (continuous), number of prenatal visits (continuous), urban/rural area of mother's residence at the time of birth (categorical), HSDA of mother's residence at the time of birth (categorical) and infant's birth year (continuous). Refusal to all vaccines excluded birth year.

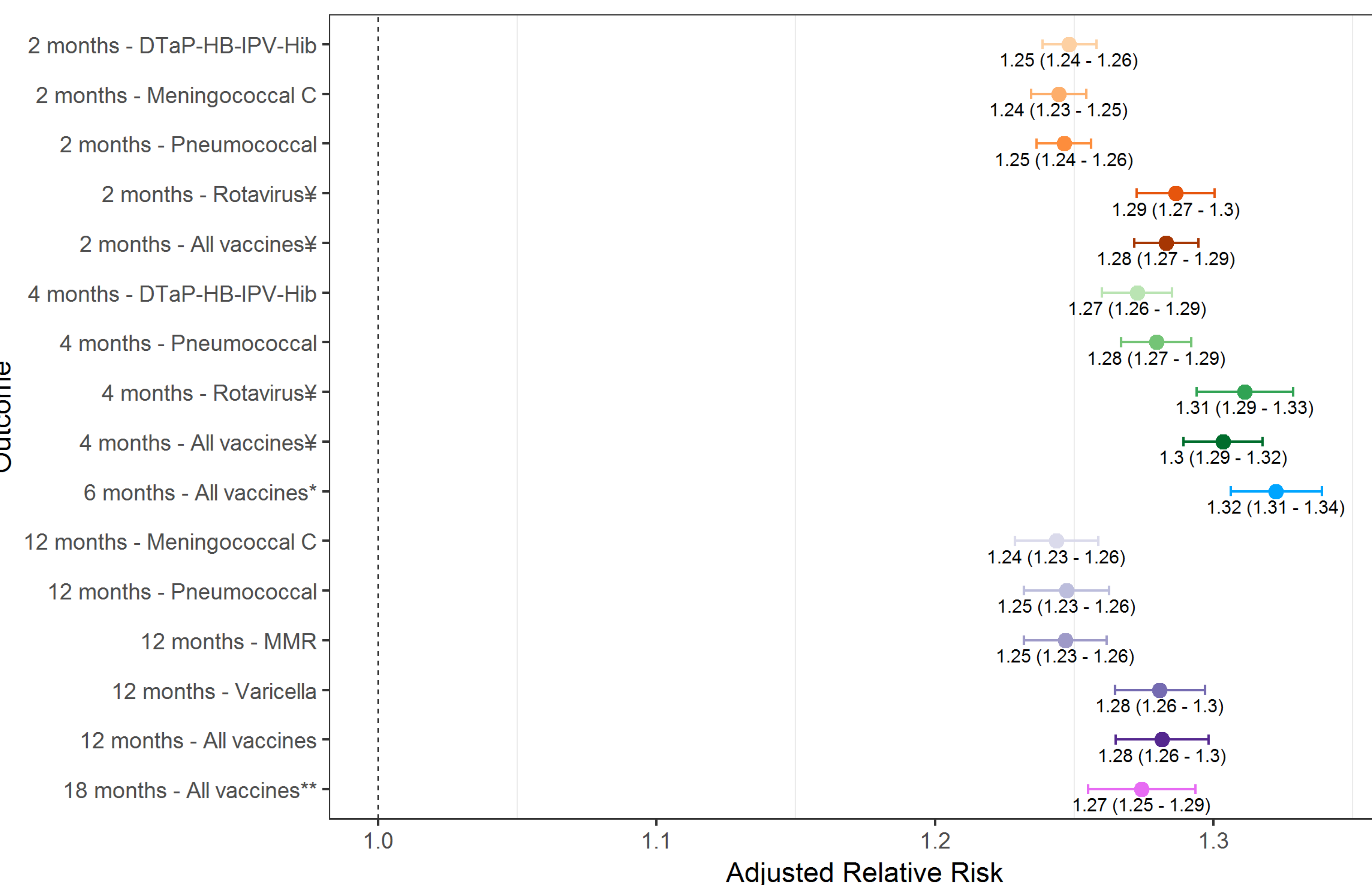


Table 1. Descriptive summaries of vaccination outcomes by majority prenatal care provider

	Majority-midwife care		Majority-physician care		Total	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Total	29,874		150,213		180,087	
Up to date for age	18,576	62.3% (61.3%-63.1%)	113,112	75.3% (74.9%-75.7%)	131,688	73.1% (72.7%-73.5%)
Up to date for age minus booster	21,502	72.0% (71.0%-73.0%)	130,796	87.1% (86.6%-87.6%)	152,298	84.6% (84.1%-85.0%)
Refusal to any routine vaccines	2,348	7.9% (7.5%-8.2%)	4,539	3.0% (2.9%-3.1%)	6,887	3.8% (3.7%-3.9%)
Refusal to all routine vaccines	1,158	3.9% (3.7%-4.1%)	1,395	0.9% (0.9%-1.0%)	2,553	1.4% (1.4%-1.5%)
No vaccines received by 2 nd birthday	4,088	13.7% (13.3%-14.1%)	5,735	3.8% (3.7%-3.9%)	9,823	5.4% (5.3%-5.6%)
Time to first vaccination (days)	68	63-84	65	62-72	65	62-74

Figure 2. Relative risk of milestone vaccination outcomes for majority-physician care using multivariable Poisson regression with robust error variance

All models were adjusted for mother's age, number of previous children, multiple babies in the current pregnancy, gestational age in weeks, number of prenatal visits, urban/rural area of mother's residence at the time of birth, HSDA of mother's residence at the time of birth and infant's birth year.

¥ Rotavirus was assessed from the 2012 birth cohort onward. The combined 2- and 4-month milestones did not include rotavirus for the 2010 and 2011 cohorts
* All vaccines at the 6-month milestone includes only third dose of DTaP-HB-IPV-Hib
** All vaccines at the 18-month milestone includes only booster dose of DTaP-IPV-Hib

Conclusion

- Majority-midwife care during pregnancy was associated with a higher likelihood of delayed vaccination, lower overall vaccination completion rates, and greater refusals than majority-physician care.
- A causal association between provider type and infant immunization cannot be concluded from our study, as parents inclined to delay or refuse vaccines may prefer the care of a midwife and our study did not capture parental intent to vaccinate.
- Due to the increasing contribution of midwifery to prenatal care in BC, our findings support the need to further investigate the extent to which midwives engage and communicate with parents about routine childhood vaccination and to strengthen supports for immunization training and links to public health.

Acknowledgements

We would like to acknowledge Vancouver Coastal Health for providing vaccination data and to PopDataBC for supporting the data linkage and access to MSP data and providing a secure analysis environment.