



## Validation of the vaccine conspiracy beliefs scale



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### ABSTRACT

**Background:** Parents' vaccine attitudes influence their decision regarding child vaccination. To date, no study has evaluated the impact of vaccine conspiracy beliefs on human papillomavirus vaccine acceptance. The authors assessed the validity of a Vaccine Conspiracy Beliefs Scale (VCBS) and determined whether this scale was associated with parents' willingness to vaccinate their son with the HPV vaccine.

**Methods:** Canadian parents completed a 24-min online survey in 2014. Measures included socio-demographic variables, HPV knowledge, health care provider recommendation, Conspiracy Mentality Questionnaire (CMQ), the seven-item VCBS, and parents' willingness to vaccinate their son at two price points.

**Results:** A total of 1427 Canadian parents completed the survey in English (61.2%) or French (38.8%). A Factor Analysis revealed the VCBS is one-dimensional and has high internal consistency ( $\alpha=0.937$ ). The construct validity of the VCBS was supported by a moderate relationship with the CMQ ( $r=0.44$ ,  $p < 0.001$ ). Hierarchical regression analyses found the VCBS is negatively related to parents' willingness to vaccinate their son with the HPV vaccine at both price points ('free' or '\$300') after controlling for gender, age, household income, education level, HPV knowledge, and health care provider recommendation.

**Conclusions:** The VCBS is a brief, valid scale that will be useful in further elucidating the correlates of vaccine hesitancy. Future research could use the VCBS to evaluate the impact of vaccine conspiracies beliefs on vaccine uptake and how concerns about vaccination may be challenged and reversed.

### 1. Introduction

Fear and mistrust in vaccines have existed since inoculation was introduced [1–3]. Currently, conspiracy beliefs about vaccines are widely endorsed [4–10]. For example, the belief that vaccines can cause autism has no basis in empirical evidence [11]; yet, a nationally representative survey of 1351 Americans found that 56% of those surveyed reported that they 'agree' or 'neither agree nor disagree' that 'doctors and the government still want to vaccinate children even though they know these vaccines cause autism and other psychological disorders' [12].

Recent research has indicated that belief in conspiracies can impact individual health decisions [13,14]. In various areas of medical research, conspiracy beliefs have been associated with behavioural outcomes such as decreased HIV treatment adherence, decreased condom use, and increased use of alternative medicines [12,15]. Specific to vaccination conspiracies, a study of 89 British parents found that belief in vaccine conspiracy theories was significantly associated with the likelihood that parents would not vaccinate a fictitious infant

[16]. Despite the concern that conspiracy beliefs may be central to the anti-vaccination movement and recent outbreaks of infectious diseases, there has been a scarcity of research examining vaccine conspiracies [17].

A standardized, validated measurement tool would help advance our understanding of the impact of vaccine conspiracy beliefs on vaccine hesitancy and uptake rates. Measures do exist that examine general (non-vaccine) conspiracy beliefs [10,13,14,18,19], and other (not conspiracy specific) vaccine attitudes [20–25]. However, to the authors' knowledge, no validated scale exists that explicitly evaluates vaccine conspiracy beliefs even though vaccine conspiracy beliefs are likely to influence vaccine intentions beyond other known predictive factors such as socio-demographic, vaccine knowledge, and health care provider's recommendation [26–28]. The purpose of this study is therefore to develop and validate the Vaccine Conspiracy Beliefs Scale (VCBS) by investigating the scale's structure and internal consistency, construct validity, and criterion validity (i.e. whether the VCBS is associated with parents' willingness to vaccinate their child). Examining conspiracy beliefs with regard to the HPV vaccine is

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particularly useful as uptake rates for the HPV vaccine are not reaching desired rates [29–31], are lower than other recommended vaccines [32,33], and content analyses of websites and qualitative research indicates that conspiracy beliefs are an important contributor to the decision to vaccinate one's child with the HPV vaccine [5,7,34–36].

## 2. Methods

### 2.1. Study design

Data collected in this study was part of a larger two-wave longitudinal examination of Canadian parents HPV vaccine decision-making for their sons. This study reports upon additional items that were included in the questionnaire at the second time point to evaluate vaccine conspiracy beliefs.

The online survey was offered in English and French (i.e. Canada's official languages). A specialized translation firm translated the survey into French, and bilingual healthcare professionals also reviewed the translation results. Each survey was personalized so that parents responded to questions that specifically included their son's name. Data collection was conducted between October and November 2014. The survey took approximately 24 minutes to complete and was designed so that there would be no missing data, as participants were required to answer all questions on a page before continuing. After the survey was complete, participants were thanked and debriefed.

A detailed description of the study design is reported elsewhere [37]. The Institutional Review Board at the Jewish General Hospital (Montreal, Canada) approved the study.

### 2.2. Participants

Participants were recruited by email invitations from Leger Marketing, a polling and market research firm with a panel of 400,000 Canadians across 10 provinces. Eligibility criteria for this study included being a parent of a 9–16 year old boy, residence in a Canadian province, fluency in English or French, Internet access, and participation in the first of this two-wave longitudinal study. Participants were compensated \$3.00 for their participation.

### 2.3. Survey measures

All participants completed initial socio-demographic items including parental gender (binary), level of education (binary), age, and household income.

#### 2.3.1. HPV knowledge

Waller et al.'s 16-item General HPV Knowledge scale was used ( $\alpha=0.849$ ) [38]. Participants responded whether they believed items were 'true', 'false', or 'don't know'. Sample items include 'men cannot get HPV' (false) or 'HPV can cause genital warts' (true). The combination number of correct items was calculated to compute a total HPV knowledge score.

#### 2.3.2. Health care provider (HCP) recommendation

Parents were asked "have you ever talked with a doctor/health care provider about the HPV vaccine for <son's name>?". Parents' responses were recoded to identify a positive recommendation (i.e. 'yes, and he/she recommended that <son's name> get the HPV vaccine') versus other responses.

#### 2.3.3. General conspiracy beliefs

General conspiracy beliefs were assessed using the Conspiracy Mentality Questionnaire (CMQ), a 5-item measure designed to assess an individual's tendency to engage in general (i.e. not vaccine specific) conspiracy ideation ( $\alpha=0.84$ ) [14]. Participants rated how true they thought a given item was on an 11-point scale that ranges from

'certainly not' (0%) to 'certain' (100%). A sample item includes, 'I think that many very important things happen in the world, which the public is never informed about'. This questionnaire was chosen because compared to other measures of general conspiracy beliefs, it has been validated in a large cross-cultural sample, and was found to be stable across time [14].

#### 2.3.4. Vaccine conspiracy beliefs scale

A scan of the literature revealed one study that included items that assessed vaccine-specific conspiracy belief. Ten items were used by Jolley and Douglas to examine the efficacy of a conspiracy theory manipulation task [16]. To develop the VCBS, we retained six of ten items from Jolley and Douglas [16] that specifically referred to a conspiracy (i.e. a deception or collusion rather than a fear or general attitude). Lastly, one additional item (i.e. "the government is trying to cover up the link between vaccines and autism") was added in this study given this is a commonly held conspiracy belief (see Oliver et al. [12]). Participants indicated how much they agree or disagree with a given statement on a 7-point scale that ranges from 'strongly disagree' (1) to 'strongly agree' (7). The reading age of the VCBS is a Grade 9 level [39]. An average score was calculated. A copy of the scale is available (see [Supplementary material](#)).

#### 2.3.5. Willingness to vaccinate

Two items were used to investigate parents' willingness to vaccinate their sons as a function of cost (i.e. the study's outcome variables). Parents were asked to 'please indicate how willing you would be to get all the HPV vaccine doses for <son's name> if vaccinating <son's name> against HPV would...' (1) '...be free?' or (2) '...cost \$300?'. These items were measured on a 5-point Likert scale from 'extremely unwilling' (1) to 'extremely willing' (5). These cost outcomes (i.e. 'free' and '\$300') were chosen because in Canada the vaccine is either provided for free (i.e. depending on the child's age, gender, and province) in school-based programs, or the vaccine costs parents approximately \$300 (CAD).

### 2.4. Statistical analysis

Using G\*Power software (version 3.1), a sample size of 1099 would be sufficient to detect a small effect ( $f^2=0.02$ ) using multiple regression on 7 independent variables with  $\alpha=0.05$  and  $\beta=0.05$ .

To examine the scale's structure and internal consistency, a Factor Analysis was conducted and Cronbach's alpha was examined. The descriptive statistics, item-total correlation coefficients, and each item's loading onto Factor 1 are reported. The percentage of total variance of each component and the eigenvalues are also reported.

Construct validity was evaluated by examining the (convergent and discriminant) relationship between the VCBS and CMQ.

To determine the criterion (i.e. concurrent) validity of the VCBS, Pearson correlations between each predictor (i.e. gender, age, level of education, household income, HPV knowledge, HCP recommendation, and vaccine conspiracy beliefs) and outcome variables (i.e. willingness to vaccinate one's son as a function of cost) were evaluated. In order to examine the unique contribution of the VCBS (within the context of the other variables in the model) to predict parents' willingness to vaccinate their son, two separate linear hierarchical regression analyses [40] were conducted (at each price point: '\$0' and '\$300'). All tolerance coefficients in the regression results were greater than .83, indicating no issues of multicollinearity. All statistical analyses were conducted using SPSS Version 22 for Mac OS X (IBM Corp., 2013).

## 3. Results

### 3.1. Sample characteristics

A total of 1608 parents responded to an online questionnaire.

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