

**Testing the Cultural Cognition Hypothesis in a Canadian Undergraduate Student
Population**

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Abstract

Background and Research Goals. This study aims to see the association between worldviews and HPV vaccine risk perceptions in a sample of Canadian undergraduate students enrolled in Health Sciences and Business programs at the University of Ottawa. It is a follow-up to the Kahan et al. (2010) research in the U.S. that showed the association to be present in a nationally representative U.S. sample. In addition to searching for this association in the Canadian context, this study examines whether worldviews differ between (a) men and women; and (b) students with health sciences and with business degrees. Furthermore, this study tests a set of candidate questions for supplementing the worldview questionnaire of Kahan et al. (2010).

Design and Analysis. The data for the study was collected using an Internet-based questionnaire and the study was conducted in two phases. During the first phase, a customized worldview questionnaire was administered. During the second phase, questions related to HPV and Canadian healthcare system were presented. In order to analyze the data, regression models, correlation matrices, and MANOVAs were employed.

Results. The findings of this study are that worldviews are related to HPV vaccine risk perceptions. However, though hierarchism was a better predictor than individualism in the Kahan et al. (2010) study, our present research indicates that individualism is a better predictor. Also, our findings, contrary to those of Kahan et al. (2010), suggest that the more individualistic a person is, the more likely he or she is to perceive the vaccine as being safe. With respect to gender, men were more hierarchical. Also, when females in health sciences were compared to women in business, the latter were also more hierarchical. Finally, three healthcare items were identified as possibly benefiting from refinement and inclusion in a worldview instrument more suited for the Canadian context.

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Chapter 1: Introduction

1.1 Background

Cognition is subjected to biases, and this includes judgment of the risks and benefits of an activity (Kahneman and Tversky, 1978). The present research focuses on risk perceptions related to the human papillomavirus (HPV) vaccine and one specific factor that might influence these perceptions: worldviews.

Douglas (1982) suggests that the worldviews are presented as forming a two-dimensional graph, when one of the axes is labeled “grid” and the other one is labeled “group”. The grid axis measures a propensity towards a society with well-defined roles and social structures. Individuals with high scores on this dimension are called hierarchists. For them, material benefits and duties are based on characteristics such as “gender, color, a bureaucratic office, descent in a senior clan or lineage, or point of progression through an age-grade system” (Gross and Rayner 1985, p.6). In contrast, an egalitarian world is one in which opportunities are distributed equally and not on the basis of the aforementioned social characteristics. The second axis (i.e. the group axis) seeks to measure the degree to which a society where the benefits of the individual are considered over those of society is preferred. Those high on this dimension, according to Douglas (1982) are more individualistic and prefer competition, whereas those low on this dimension are more communitarian and prefer a society where the benefits of the group are prioritized over individual benefits.

Though these worldviews might be perceived as biases, another point of view states that such worldviews might allow the individual to recognize what is truly important to him or her (e.g. Kahan et al., 2013). Whether or not these worldviews represent judgment errors or are informative to individuals, it is important to know whether decisions made by individuals are influenced by these worldviews. Indeed, there is evidence that worldviews, as defined by Douglas (1982), can influence HPV vaccine risk perceptions in the United States (Kahan et al., 2010) as well as risk perceptions in general (e.g. Rohrmann, 1994; Kahan, 2013). The main question of this study is whether this association between HPV vaccine risk perceptions and worldviews is present in Canadian society as well.

If this association is present in the Canadian context, then this study has value in informing communication strategies. Indeed, after finding the presence of the link in the US context, Kahan et al. advocated for certain risk communication strategies. One example of such a strategy is to formulate policy decisions in a way that appeals to different worldviews instead of one worldview in particular (e.g., by drawing attention to how men are impacted by the vaccine to appeal to individualists and hierarchists as well). This study will also give an idea of whether gender and disciplinary focus (undergraduate degree) distinguish world views and thus perceptions related to the HPV vaccine.

Moreover, this study aims to lay the groundwork for future work related to cultural theory in the Canadian context. The examination of newly formulated questions gives opportunity for items specific to the Canadian context to be embedded in the questionnaire.

1.2 Research Objectives and Hypotheses

The objectives of this study are related to the aim of this work. As previously mentioned, this work aims to prepare the ground for future research related to the cultural cognition theory in Canada.

The objectives of this study are threefold: (1) examine the relationship between HPV vaccine risk perceptions and worldviews in Canadian undergraduate students; (2) see whether gender and degree correlate with their worldviews; (3) to pilot test questions that might “Canadianize” and thereby supplement the questionnaire used by Kahan et al. (2010).

In accordance to the objectives, the following hypotheses were formulated:

- 1. An individual's worldviews help predict the risk/benefit ratings that apply to the HPV vaccine.*
- 2. An individual's worldviews and views of the roles that the healthcare system plays are related.*
- 3. A female respondent's worldviews differ depending on her program of study.*
- 4. A respondent enrolled in the business program has different worldviews depending on gender.*

1.3 Thesis Plan

This thesis is divided into four sections. It starts with literature review regarding HPV, its vaccine, risk perception studies, cultural theory, and cognitive biases. This is followed by a Methods section that details the sample characteristic, the measures, the analytical techniques used, as well as the procedure and the main hypotheses. The Results section provides findings related to the main hypotheses. Finally, the Discussion section presents evaluation of the main findings, outlines the limitations of the study, and presents possible future avenues of research.

Chapter 2: Literature Review

Kahneman and Tversky (1974) state that we rely on intuition and rules of thumb to make decisions. These rules of thumb are formally called “heuristics”. An example is when the ease with which we retrieve an event from memory impacts our assessment of the likelihood of that event (with greater ease of retrieval leading the subject to believe that the event in question is more likely to happen than it actually is). Indeed, individuals are prone to exaggerating the likelihood of a hijacking (which is an example with high profile, easily drawn from memory) than the likelihood of a more mundane yet more common event. Another example – which Kahneman (2003) defined as a very important factor – is when “affect” impacts perceptions of risks and benefits. Indeed, when a certain activity is perceived as having more benefits it is also perceived to have less risks. The opposite is true, with activities that are perceived as having lower benefits also being perceived as having higher risks. These perceptions are not related to actual risks and benefits, since, in actuality, activities that have more benefits also tend to have higher risks. Therefore, the initial feeling towards the activity (either good or bad) colors the perception of all aspects of this activity (Slovic, Finucane, Peters, and MacGregor, 2007). Many other heuristics exist and bias judgment.

Judgment can therefore be influenced by cognitive errors. However, when it comes to medical decisions, ethical responsibility indicates that it is important to make the best possible judgment. Policy makers and healthcare professionals have the responsibility to present information objectively and in a way that is less likely to prejudice the decisions made by patients. Judgment in medical settings and in public health, however, has been found to be impacted by heuristics (Redelmeier, Rozin, and Kahneman, 1993).

Human papillomavirus (HPV) vaccination is a timely public health issue where an individual’s judgments are likely to be vulnerable to the influence from their worldviews. Indeed, Kahan et al. (2010) found that cultural values play a role in making individuals more likely to lean towards one side or the other of the HPV vaccine debate. The present research assesses this association in a Canadian context.

The literature review is divided in three major parts: (i) HPV; (ii) HPV vaccines; and (iii) cultural theory. For the HPV section, emphasis will be on what it is, how it is thought to act, what are the human health outcomes impacted by HPV, how prevalent it is, and who is most at risk. For the HPV vaccine section, information will be given regarding the different types of HPV vaccine, the policies regulating its use in North America, the evidence for its safety, and the issues that were raised about the vaccine. As for the cultural theory section, the development of this theory will be described along with its limitations, applications, and relation to cognition.

2.1 What is HPV?

The human papillomavirus (HPV) is a common virus that can infect different parts of the body (i.e. oropharyngeal tract, anal, and genital areas). There are over 100 types of HPV and these are primarily sexually transmitted. Some types of HPV can cause warts (anal and genital). These types are low risk for cancer development. However, other types are high risk for cancer and can lead to more serious consequences such as cervical, penile, anal, and head and neck cancers (Public Health Agency, 2012). The transmission modes of all HPV types comprise “contact with infected genital skin, mucuous membranes, or bodily fluids from a partner with overt or subclinical infection” (Kaplan-Myrth and Dollin, 2007, p.693). This means that contact with an individual that has the virus (whether this individual presents the signs of infection or not) can result in the virus being transmitted.

HPV types are virus particles consisting of circular DNA molecules wrapped in a shell composed of protein molecules L1 and L2. These viruses infect differentiating epithelial cells of skin or mucosae. HPV DNA for types 16 and 18 are the most prevalent types found in cervical cancer, thus indicating that those individuals with cervical cancer often show evidence of pre-existing exposure to these two types of HPV. These types are referred to as high risk (HR) because of their association with cervical cancer. Examples of low-risk (LR) HPV types are types 6 and 11, which are low risk for the development of cancer, but cause the majority of genital warts (Malik, Khan, and Ahsan, 2014).

Most HPV infections are either subclinical or tend to regress to subclinical infections (i.e. present no signs and symptoms). However, persistent HPV infection is known to be

linked with cervical cancer. This persistence is indicated by HPV cervical intraepithelial neoplasia (CIN) which can have 3 levels of severity: CIN1 (the least severe level), CIN2, and CIN3 (the most severe level). CIN2 was thought of as an intermediary step, though its diagnosis is now contested. Indeed, the interpretation is subjective and it is difficult to distinguish between CIN types. However, lesions diagnosed as serious are more likely to persist and result in cervical cancer than to regress (Bosch, et al., 2013).

Below is a table taken from the Public Health Agency of Canada (2012) listing the cancers that are considered to be attributable to HPV in Canada during the 1997-2006 period. One note should be made that there are over 100 types of HPV and that at least 15 are potential high risk factors of cancer (Haug, 2009).

Table 1. Average Annual Number of Cases and Age-Standardized Incidence of HPV-Associated Cancers Among Persons Aged 15 Years and Older in Canada (1997-2006) and Estimated Attributable Proportion due to HPV (Public Health Agency of Canada, 2012)

Sex	Anatomical Site	Average Annual Incidence (per 100,000)	Average Annual Number of Cases	Attributable Percentage of Cancer Cases to:	
				Any HPV Type*	HPV types 16 and 18 (% of all HPV types)**
Females	Cervix	10.1	1356.8	100	70
	Vagina and vulva	4.2	651.8	40	80
	Anus	1.7	267.0	90	92
	Oral cavity	3.3	501.2	25	89
	Oropharynx	0.18	27.2	35	89
Males	Penis	1.0	127.4	50	63
	Anus	1.6	208.2	90	92
	Oral cavity	6.5	853.1	25	89
	Oropharynx	0.64	84.3	35	89

* Indicates the percentage of cases linked with HPV (all types combined)

** Indicates the percentage attributable to HPV types 16 and 18 from the cases that have already been linked with HPV

This potential link between cancer and HPV is worrisome because HPV is the most common sexually transmitted infection, with roughly 80 percent of the population over their lifetime being affected by it at some point of time (Quinn et al., 2012)¹. In Canada, overall HPV prevalence has been determined to be 16.8% (95% CI: 15.8-17.9) (Moore et al., 2009; Public Health Agency of Canada, 2012). However, HPV is not a reportable disease in Canada and estimates of prevalence are based on individual studies of specific populations (Public Health Agency of Canada, 2012).

Globally, the prevalence of HPV infection in women with normal cytology is 11-12%. This statistic ranges from more than 30% (Eastern Africa and the Caribbean) to 2% (Western Asia). Amongst females, two distinct age-related patterns of HPV incidence are noted depending on geography: (i) the first pattern shows a decrease on infections after the age of 25; (ii) a second pattern shows the same decrease after age 25 with a second peak in post-menopausal women. These patterns depend on the country studied (i.e. the second peak is observed in the developing world) (Forman, et al., 2012). It is not known whether this second peak is due to cohort effects or lesion reactivation. Indeed, it might be that the second peak observed is specific to the cohort that they examined and that this second peak will not be observed in subsequent studies. However, this second peak might also be due to actual biological causes, such as a lesion that was originally infected and then, for some reason, it was reactivated.

For men, HPV prevalence of any type increases with age suggesting that men's immune system does not respond in the same manner. Indeed, an increase in HPV type with age suggests that the immune system is not efficient in clearing the HPV infection. However, HPV detection for one or more of the high-risk HPV types is lower for men than for women (Bosch, et al., 2013).

¹ Here, an infection rate is defined as the probability of getting infected over a defined period of time (e.g. across their lifetime). Also, the disease can be reversible, which means that an individual can recover from the disease (Public Health Agency, 2007).

2.2 HPV Vaccine

There are two prophylactic vaccines that have been shown to be effective at reducing HPV infection. The first vaccine, Cervarix, is bivalent and works against HPV-16 and HPV-18, the main oncogenic types of HPV. The second vaccine, Gardasil, is quadrivalent and is also effective at reducing infection for two other types, namely, types 6 and 11 (Jit, et al., 2010) which are linked to genital warts (they are responsible for about 90% of all anogenital warts) and recurrent respiratory papillomatosis (Parkin and Bray, 2006). Both vaccines contain virus-like L1 HPV particles. Once in the immune system, antibody responses several times higher than those naturally in the immune system are observed. The vaccines do not contain recombinant DNA, which means that a person cannot get infected with the virus from the vaccination itself (Jeurissen and Makar, 2009).

In terms of vaccine safety, there are several evaluations that have been conducted (e.g. Public Health Agency of Canada, WHO's Global Advisory Committee on Vaccine Safety, Institute of Medicine), and these reviews show a safe profile. In Canada, the Public Health Agency (2009a) had received 407 reports of adverse reactions caused by the vaccine, most of which were benign and consistent with what had been observed in clinical trials (Public Health Agency of Canada, 2009b). The adverse events identified as benign were consistent with the adverse events observed in other vaccines, such as temporary pain and soreness at the injection site. However, there have been some concerns related to the efficacy and safety of the vaccine raised by individual investigators, which will be explored in the section titled "Arguments For and Against Vaccination".

Though the vaccine is considered safe by health authorities, there are contraindications for the use of HPV vaccination such as: hypersensitivity to vaccine components (e.g. latex) and pregnancy. For instance, those with anaphylactic latex allergy should not receive prefilled syringes with bivalent HPV vaccine (Public Health Agency of Canada, 2012). To date, though the vaccines have not been causally linked to adverse outcomes in pregnancy, their use is presently not recommended for pregnant women (Public Health Agency of Canada, 2012). No data is available on the effects of these vaccines for breastfeeding (Public Health Agency of Canada, 2012). Also, there are currently studies

being conducted on the side-effects that HPV vaccines can have in special populations². No conclusive data is presently available on the side-effects experienced by these populations (Public Health Agency of Canada, 2012).

Finally, a caution is made that there may be some outstanding questions about the potential for latent effects that may emerge beyond the time-frames and or populations captured by the typical follow-up times for the clinical trials. Susceptible populations such as those with autoimmune diseases or other chronic health conditions may prove to have greater susceptibility to side-effects; and HPV vaccination in some of the earlier age-groups may have benefitted from less study than the older age groups. Indeed, few females under 16 were studied in the clinical trials (Harper et al., 2013). Whether what we know about HPV vaccine safety is different from other vaccine is therefore still a matter of debate, mainly because of the characteristics of the sample studied (i.e. the target population for this vaccine was originally girls under 16, yet this is the population segment that was less studied) and potential unknown side-effects beyond the timeframe studied and in special populations.

2.3 Policies Governing HPV Vaccination

In Canada, Gardasil was the first HPV vaccine approved by Health Canada on July 2006. This vaccine requires 3 doses over the course of 6 months which makes a total cost of \$400 per vaccinated person. Shortly afterwards, the federal government invested \$300-million to help provinces organize their immunization programs. Provincial programs started across Canada in 2007 and 2008 and include those of Nova Scotia, Ontario, Québec, New Brunswick, Prince Edward Island, Newfoundland, Labrador, and British Columbia.

In Canada, provinces can decide how to deliver the immunization program and how to allocate the funds (Lexchin, Arya, and Singh, 2010). As a consequence, HPV immunization programs have differed in their approach. Of all the programs, Québec offered the most complete coverage with a school-based system for grade 4 girls (roughly aged 9 years of age) and coverage until the age of 18 for family physicians. That Québec's program has had the highest rates of uptake seems to suggest that the emphasis on complete coverage

² Please see the following link for some studies that are currently conducted:
<http://clinicaltrials.gov/ct2/results?term=Gardasil+>

has translated into higher immunization rates (Gowing, 2011). Indeed, the uptake rates (here defined as percentage of the target group immunized) were highest in Eastern Canada (upwards of 80 percent) whereas Ontario and provinces to its West attained only 50 to 60 percent coverage (The Canadian Press, 2009).

Though the vaccine was only recommended for women when the immunization programs started, males (between the ages of 9 and 26) have also been recently recommended for vaccination. Indeed, the Public Health Agency of Canada (2012) advised the use of the vaccine for males in this age group. Prince Edward Island was the first province to implement a publicly-funded school-based vaccination program for males (Merck, 2014). Alberta also recently extended its publicly-funded HPV vaccination program to include boys (Alberta, 2014). Since it has been approved by the Public Health Agency of Canada, the vaccine can be purchased for males with prescriptions in British Columbia, Saskatchewan, Ontario, and Québec (British Columbia Center for Disease Control, 2014; Government of Saskatchewan, 2014; Ontario Ministry of Health and Long-Term Care, 2014; CTV Montreal, 2014).

In the United States, several states (e.g. Indiana, Texas, and New York) have put in place laws that promote the HPV vaccine without making it mandatory. In the state of Virginia, it is formally required to have the HPV vaccine in the 6th grade, though parents can refuse the vaccine once they have been educated about the vaccine. In New Hampshire, the Department of Health makes the vaccine available for free for girls aged 11 to 18 (Abiola, Colgrove, and Mello, 2013).

Even though the states do not fund the HPV vaccine per se, there are several programs that make this vaccine available those who would not otherwise have access to it. These programs are Vaccines for Children (VFC) Program, Immunization Grant Program, Medicaid, and Children's Health Insurance Program (CHIP). Moreover, most people in the target group have private insurance that may help cover the costs of the vaccine in US (The Henry J. Kaiser Family Foundation, 2014).

2.4 Arguments For and Against Vaccination

There are opponents as well as proponents for the HPV vaccine. This section will outline the main arguments for each side of the debate, which revolve around: (a) coverage of HPV types provided by the vaccine; (b) proper testing of the vaccine in the target population; (c) cost-effectiveness of the vaccine (especially when compared to Pap smears); (d) conflicts of interest; (e) and the potential for increasing sexual promiscuity as a side-effect of vaccination. These issues will be explored in the next paragraphs.

The first counterargument is that neither of the vaccines protects against all types of HPV. However, the vaccine does protect against those types that have been found to have the highest association with HPV-related cancers. Studies reviewed by the Public Health Agency of Canada (2007; 2012) support this statement. Indeed, the short-term efficacy of the vaccine in the 9-13 age group is supported by clinical trial studies in these reviews that found immunogenicity (i.e. proper immune response to the virus which allows for the organism to fight off the virus), though efficacy has not been completely demonstrated. However, in girls 14-26 years of age, the vaccine has a demonstrated efficacy in clinical trials with Gardasil. These clinical trials were double-blinded, randomized and used a placebo. Whether or not they controlled for abnormal Pap test or for genital warts, these studies showed a reduction in prevalence of HPV types and a reduction in CIN lesions among 16-26 year old women (see Brown et al., 2009; Wheeler et al., 2009). In a multi-site study with the aforementioned design features, vaccine efficacy was found for females ages 15-25 years (n=1113) (Harper et al., 2004). Also, in a randomized trial (without double-blind and placebo) for 10-25 year old women (n=773), all age groups were able to create antibodies for HPV 16 and 18 (Dessy et al., 2010). However, in this review it is noted that not many females under 16 (the primary target population of this vaccine) were studied.

A second source of controversy is related to the safety of the vaccine. Safety studies before the vaccine was licensed include Gardasil trials of 500 adolescent girls (aged 10-15 years) and of 295 girls (aged 11-17 years) (Block et al., 2006; Resinger et al., 2010). In these studies, fevers occurred more frequently following the few days after vaccine administration. Compared to these numbers, more than 25,000 people of all ages participated, a sample larger than for most vaccines (see Lexchin, Arya, and Singh, 2010 as well on this topic).

The third issue has to do with uncertainty related to cost-effectiveness (Harper et al., 2013). Some questions relate to the favorability of the vaccine relative to Pap smear screening. Pap screening refers to screening of the papilloma virus and involves taking a sample of the affected area (i.e. a Pap smear) and then examining it (Harper et al., 2013). Since Pap screening is proven to be successful at identifying lesions that may potentially lead to cancer (which gives the chance for the affected HPV tissue to be removed if the lesion is not likely to regress by itself), the benefit of the HPV vaccine may be diminished. Moreover, the HPV vaccine might have a minor effect even in countries without Pap screening programs. In these countries, the incidence of cervical cancer is about 50-80/100,000 and Gardasil may, at best, reduce the incidence up to 14/100,000³ (Harper et al., 2013). Also, there is uncertainty regarding side effects, whether the reported side effects can be attributed to the vaccine, and whether the rate of reporting should be worrisome or not. Even though the rate of reporting of serious adverse events meets the guidelines for vaccine safety established by governmental bodies, this rate is higher than for other vaccines. Indeed, in an Australian study, there was a rate of 2.6 per 100,000 doses of cases of anaphylaxis likely to be due to the vaccine, which was statistically higher than similar school vaccination with meningococcal C vaccination programs, whose rate was 0.1 per 100,000 doses (Brotherton et al., 2008). Also, longer follow-up times may reveal further side effects and will inform us whether the efficacy of the vaccine is long-term.

Another argument advanced by opponents of the HPV vaccine argument is that there are concerns about possible conflicts of interest in decisions made by government and Society of Obstetricians and Gynaecologists of Canada. Indeed, some of the advisors that recommended the vaccine to the Federal government were funded by Merck (Lexchin, Arya, and Singh, 2010).

There was also some debate on whether the vaccine can increase sexual promiscuity. However, no increase in sexual promiscuity has been observed. An example of such a study is Foster, Marlow, Stephenson, Wardle, and Waller (2012). These authors used cross-

³This statistic (i.e. reduction of baseline cervical cancer incidence) is based on the assumption that Gardasil offers lifetime immunity which is not proven. This is just a liberal assumption they used for their mathematical modeling.

sectional and longitudinal surveys in England to see whether HPV vaccine influences sexual behavior. A limitation of this study (and of other studies on the influence of this vaccine on sexual behavior) is that self-reports measures were used, which might be subject to reporting bias (respondent may not be truthful in reporting their sexual activity, possibly wanting to portray a self-image that adheres to societal norms) or recall bias (i.e. respondents might not remember exactly what they did and thus give wrong information).

In summary, there are opposing views on the topic, with each side presenting different sets of arguments. Such polarity can introduce confusion, with people making their decisions often on a basis beyond health issues. This situation prompted Kahan, et al. (2007) to investigate factors influencing individual vaccination decisions. The authors posited that, in the face of such polarity of opinions, it may be difficult for an individual to determine which information to trust. As people struggle to sort through the contradictory arguments, their interpretations might be influenced by their cultural values. This notion – which is a major premise of cultural theory and of cultural cognition theory – will be explored in the next section.

2.5 Cultural Theory

As mentioned in the previous section, evidence regarding the vaccine is not conclusive. In this case, values might play a more important role in determining risk perception. This observation is in line with the cultural theory, which states that the perception of risk is connected to values, cultural and social processes (Oltedal, Moen, Klempe, and Rundmo, 2004). More precisely, cultural theory is supposed to “predict and explain what kind of people will perceive which potential hazards to be how dangerous” (Wildavsky and Dake, 1990:40).

Cultural theory fits into frameworks that attempt to understand risks and their formation. It asserts that the process for arriving at a decision regarding the risk-benefit for a particular factor such as the HPV vaccine is not based solely on logic, but incorporates values and takes into account the group dynamics in which one lives. Because of this relation to culture and social issues, the cultural theory fits into a “social/perceptual” approach to

risk. This is contrasted with risk as defined through logic and attempts to utility maximization (Tansey and O’Riordan, 1999). This latter approach is defined as “technical.”

In the following subsection, an overview of the risk perception literature (as it relates to the cultural theory) as well as the evolution of the cultural theory along with its limitations and applications will be presented.

2.5.1 Literature on Risk Perception

As mentioned before, there are two main approaches to understand risk. The first approach is called “technical.” It originated with Kaplan and Garrick (1981), which defined risk as being a function of likelihood and consequence (i.e. damage). Risk is understood as being a product of these two terms (i.e. likelihood x consequence).

Therefore, risk is related to the likelihood of an outcome and the consequences of that outcome should it occur. Kaplan and Garrick argued that Risk Analysis (i.e. efforts to quantify risk) is concerned with three main questions: (i) what can happen; (ii) how likely is it; and (iii) what are the consequences should it occur. These authors considered adding a fourth question, namely “how certain are we about the answers to the above three questions.” This last question leaves room for the impact of values and social influences. The description of these influences is assumed under the “social/perceptual” approach of risk perception theories.

Later on, Adams (1995:69), defined risk as “the probability of an adverse future event multiplied by its magnitude”:

$$R=PM$$

In the equation above, magnitude is defined as the extent of the adverse event. The above formula is a conceptual definition of risk and sees risk as dependent on two factors: (i) how often it occurs; (ii) and how negative its results are.

This objective risk is postulated to exist independent of the individual. On the other hand, subjective risk is what the individual deems the risk to be and tends to be based on qualitative factors. Some of the factors found to impact perceptions of risk for the general public are: (i) voluntariness of risk; (ii) immediacy of effect, i.e. whether the consequences of the risk occur immediately; (iii) knowledge about the risk by science, i.e. how much do we

know about the risk; control over risk; (iv) newness, i.e. are the risks new and novel or old and familiar ones; (v) chronic/catastrophic; (vi) as well as severity of consequences (Fischhoff, Slovic, Lichtenstein, Read and Combs, 2000).

Apart from identifying certain qualitative factors that influence risk perception, a great number of studies found that these factors can be summarized by two dimensions: (i) dread; and (ii) knowledge (see Boholm, 1998 for a review of studies). Dread refers to whether the danger is seen as controllable, catastrophic and dangerous to future generations. The knowledge factor refers to whether the risk is known, old, and has an immediate or delayed impact. Though there is some debate as to what these terms mean, in general, this is what these two factors are seen as representing.

One of the studies that supported the existence of these two factors is Fischhoff et al. (1978). This study asked respondents to rate 30 risks on the following qualitative dimensions of risk: voluntary, chronic, catastrophic, common, fatal, immediate, ascertainable, controllable, or novel. Subsequent factor analysis revealed the existence of the two factors which were labelled: (i) dread; (ii) knowledge. The study by Fischhoff et al. (1978) was followed by Slovic et al. (1980), which looked at risk perceptions for different hazards. The same basic factors – dread and knowledge – seemed to hold in this analysis. Note that the factors are latent in each study and, while they may load on the same types of constructs (voluntary etc.), it is hard to argue, without getting into the particulars of each study, that they found the same exact factors.

Afterwards, several cross-national comparisons of studies attempted to replicate the original findings by Fischhoff et al. (1978) and Slovic et al. (1980). These took place in Hungary (Englander et al., 1986), Norway (Teigen et al., 1988), Poland (Goszczyńska et al., 1991), and France (Karpowicz-Lazreg and Mullet, 1993). These studies showed a very similar clustering of risks along the factors of dread and knowledge. In Canada, risk perceptions related to various hazards were correlated to similar dimensions of dread and knowledge/uncertainty (Krewski, et al., 2006; Lemyre, Lee, Mercier, Bouchard, and Krewski, 2006). Also, in Canada, there were differences between Quebec respondents and the rest of Canada, with Quebec respondents having higher perceived risks overall (Krewski, et al., 2006).

Particularly informing is a study that connected cross-national comparisons of risk perception and cultural theory (Kleinhesellink and Rosa, 1991). Here, culture was defined as country of residence. Indeed, their study on samples comparing Japanese and American students aimed at identifying the support for either one of the following hypotheses:

- (1) Perceptions of risk are not connected to culture
- (2) Perceptions of risk are connected to culture

Again, two factors – dread and knowledge – were found to be present in both groups (i.e. in both Japanese and American students' sample). This finding was taken as evidence for the first hypothesis according to which perceptions of risks are not primarily determined by culture. Therefore, the clustering of the risks on two main dimensions (i.e. dread and knowledge) is similar between the two cultures. However, there were differences related to specific risks. For example, Americans tended to rate atomic risks as less known than Japanese respondents.

Though the cross-cultural comparison was informative, Douglas and Wildavsky (1982) pointed out that it might not be as helpful to explore the influence of culture by lumping individuals together on the basis of their country, province or state of affiliation. A more helpful path of exploring the connection between culture and risk perception is to define culture as the adherence to certain ways of life. According to this definition, people in the same country can have different cultural outlooks.

One study that examined the relationship between risk perception and adherence to certain ways of life is Rohrmann (1994). This study examined cross-national differences in individuals with different ideological orientations (technological, monetarian, ecological, feminist) in 3 countries: Germany, New Zealand, Australia. The findings point to ecologists and feminists being most concerned about risks whereas those that were technological had the lowest risk ratings. The monetarian group fell in the middle.

Moreover, an individual's subjective risk (perceived risk) has also been related to certain demographic factors. For example, a review by Vaughan and Nordenstam (1991) in the US found that risk perceptions are related to gender, socio-economic status, education, and ethnicity.

Subsequent studies discovered that the influence of these demographic factors could be largely explained by a rather unique demographic subgroup which manifested distinctly

different risk perceptions than the other groups. More specifically, white men in America and Europe tend to judge a wide array of hazards as having lower risk than that judged by the other groups. For example, a study by Flynn et al. (1994) examined gender with respect to perceptions of environmental risks to health. On average, white men tended to perceive less risk than the other groups. Moreover, it was determined that it is not *all* white men who have low scores; there is a small *sub-group* of white men that have more extreme attitudes. When the sub-group of men that had these very low scores was examined, they were found to be generally: better educated, have higher incomes, be more conservative, and to have more trust in government, authority and industry. These findings were replicated by Sjöberg et al. (1996) in Romanian and Bulgarian samples.

An interesting finding is that gender and ethnicity may interact as found by Kleinhesselink and Rosa (1994). In their Japanese and American sample, they found that, in some regards, American women had similar risk ratings to Japanese men. This was indeed the case for involuntariness of risk and perceived vulnerability, in the sense that Japanese men had higher scores on these dimensions than Japanese women, whereas American women rated higher on these dimensions as compared to American men. The authors of this paper saw political oppression in Japan as a possible explanation: Japanese men perceive risks as more involuntary and therefore they feel more vulnerable to these risks.

There have also been some questions regarding the impact of the media on risk perceptions (e.g. Englander et al., 1986). Indeed, people are not exposed to risk information only through direct personal experience, but also through media portrayals of these risks. People's estimation of risks may be related to media portrayals. Though this is not the focus of the current thesis, media portrayals should be considered when interpreting any results related to public risk perceptions.

In summary, in this review of the risk perception literature, it was found that, in the 1990's, risk studies started to focus on the connection between cultural theory and risk perception in an attempt to explain variations observed in previous studies. The next section presents the evolution of this cultural theory in order to help the reader understand the concepts underpinning this theory.

2.5.2 Evolution of Cultural Theory

Mary Douglas was an anthropologist researching tribal societies (Tansey and O'Riordan, 1999). Taboos and perceived dangers, she found, are used to uphold social arrangements (Tansey and O'Riordan, 1999; Douglas and Wildavsky, 1983: pp. 40-48). From this observation, Mary Douglas, together with political scientist, Aaron Wildavsky, applied the cultural theory to the US context. They showed the different possible worldviews by contrasting the “center” (i.e. “the big government”) with the “border” (i.e. a questioning of the big government). The center stood for market (innovation, individualism, progressivism) and hierarchy (maintaining social order) (Tansey and O'Riordan, 1999). In their development of the modern concept of risk, the same insight between the connection of danger and maintenance of social order was used to understand the concept of risk as it is found in present society.

These insights on the interconnection between culture and danger resulted in the creation of the grid-group typology (Tansey and O'Riordan, 1999). The grid-group typology presents cultural values (i.e. worldviews) on a two-dimensional graph (Douglas, 1982). One of the axes is labeled “grid” and the other one is labeled “group”. The grid axis measures a propensity towards a society with well-defined roles and social structures. Individuals with high scores on this dimension are called hierarchists. For them, material benefits and duties are based on characteristics such as “gender, color, a bureaucratic office, descent in a senior clan or lineage, or point of progression through an age-grade system” (Gross and Rayner 1985, p.6). Instead of valuing class and group membership, egalitarians focus on meritocracy: an egalitarian world is one in which opportunities are distributed equally and not on the basis of the aforementioned social characteristics.

The group axis measures the extent to which a respondent favors the interests of individuals over those of the group. Low scores on this dimension indicate that social dependency and frequent interactions between members is favored. Such a view is seen as representative of “solidarity”, also known as “communitarianism”. On the other hand, high scores indicate an individualistic worldview where community cannot be relied upon nor trusted to provide the needed assistance. Instead, competition is valued and people are supposed to “fend for themselves” (Rayner, 1992, p.87).

These competing worldviews can be put on a Cartesian plane (Fig.1) as follows:

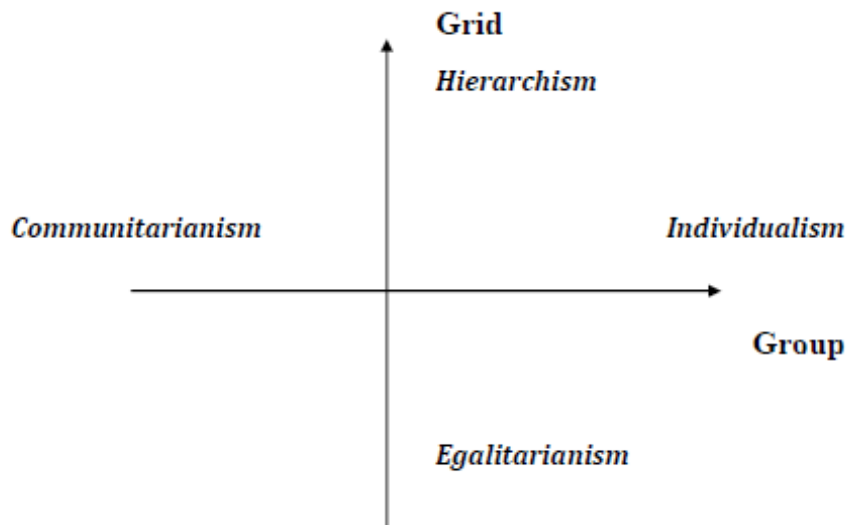


Figure 1. Depiction of Worldviews on Cartesian Grid

In Figure 1, the vertical axis represents the grid dimension along which an individual might score high (hierarchy) or low (egalitarianism). The horizontal axis represents the group dimension which can also be high (individualism) or low (communitarianism). One note is made that this Cartesian grid is sometimes presented differently, with the individualism on the left side and the communitarianism on the right side (e.g. Kahan et al., 2010).

The first empirical test of this grid-group typology and cultural theory was published by Dake (1990; 1991) –a doctoral student who studied under Douglas. For this test, Dake developed a questionnaire aimed at measuring a respondent's worldview. Kahan and colleagues refined the survey instrument developed by Dake, paying more attention to the orthogonality of items making up the scales (here, orthogonality refers to the notion of independence, wherein a set of questions whose scores move a respondent along say the grid dimension, ideally have no influence on the persons positioning along the group dimension). The dimensions of group and grid are supported by factor analyses and hierarchical cluster

analyses (Marris et al., 1998; Peters and Slovic, 1996), though these two dimensions are correlated and not completely orthogonal.

The measurement of worldviews is based on respondents' answers to questions. As an example, the following statement would score high on individualism (see Appendix 1 for similar items): "The government interferes far too much in our everyday lives". Indeed, this item is consistent with putting individual interests above group interests (i.e. an individualistic disposition).

2.5.3 Limitations/Considerations of Cultural Theory

However, like any theory, cultural theory has criticisms and limitations. The following table presents the criticisms of cultural theory (CT):

Table 2. Cultural Theory (CT) Limitations

Criticism	Explanation
Measurement instrument	It is hard to develop an appropriate measurement instrument (Olstedal, Moen, Klempe, and Rundmo, 2004; Rippl, 2002). Also, the quantitative operationalization of this theory may not work as well as the qualitative operationalization (Tansey and O'Riordan, 1999). However, the quantitative operationalization of CT can be considered as an indirect measure of culture and it shows evidence for validity (Rippl, 2002).
Prediction ability	It is unlikely that CT will be able to predict specific risk perception. It is more likely that CT will be able to predict patterns of risk perceptions across different situations (Olstedal, Moen, Klempe, and Rundmo, 2004). For example, when examining one particular issue (e.g. HPV vaccination), there might not be a significant result; however, when looking at how cultural cognition predicts a series of issues (e.g. gun control, HPV vaccination, and abortion rights), in

	general, CT should be able to make accurate predictions.
Free will	Human free will is not taken into account or considered in this theory (Olstedal, Moen, Klempe, and Rundmo, 2004; Tansey and O'Riordan, 1999). Indeed, the theory sees social processes as an important determinant in how people perceive the world. It does not say anything about personal agency.
Worldviews' stability	We do not know if the typology is static or dynamic (i.e. can people change their worldviews?) (Tansey and O'Riordan, 1999).
Heuristic tool	Heuristic tool refers to the idea that this theory and the way in which we measure worldviews are able to describe associations between worldviews and risk perceptions. However, they are not useful when trying to understand how this association was formed (e.g. we are not able to state that worldviews cause risk perceptions) (Tansey and O'Riordan, 1999).

The limitations described above will need to be considered during the discussion section of this thesis.

2.5.4 Applications of Cultural Theory

Cultural theory can inform how deliberations should be conducted. Indeed, this theory recognizes that there is a plurality of views and that:

“The significance of cultural theory for risk perception, and particularly for health-related risks, is that viewpoints about expertise, about scientific integrity, about professional reliability and integrity, and about the credibility of health-related messages will all be influenced by the interactional context in which judgements are made.” (p.72, Tansey and O'Riordan, 1999)

Since the plurality of views is important, different worldviews (and not just different values) should be represented fairly in policy discussions.

2.6 Cultural Theory and Cognition

In the 1970s, researchers started looking into psychological mechanisms underlying risk perception (Boholm, 1998). It was found that people do not always rely on logical deliberative processes when making risk estimations. Sometimes, these assessments are based on rules of thumb called heuristics. Examples of such mental shortcuts are: the affect heuristic; the representativeness heuristic; the availability heuristic; the anchoring and adjustment heuristic. The following table (based on Peters, McCaul, and Stefanek, 2006) presents definitions for each of these heuristics:

Table 3. Main Heuristics and their Definitions (Peters, McCaul, and Stefanek, 2006)

Name	Definition	Example
Affect	It is easier to base judgments on gut feelings and affect rather than to deliberately analyze an issue.	When the participants are shown pleasant stimuli (as opposed to unpleasant stimuli) for a brief period of time and, immediately after that, they are shown a neutral stimulus, their interpretation of the neutral stimulus changes so that it is more likable when it is preceded by a pleasant stimulus than when it is preceded by an unpleasant stimulus (Slovic, Finucane, Peters, and MacGregor, 2007; Winkielman, Zajonc, and Schwarz, 1997).
Representativeness	Similarity with the stereotypical image of a certain group used to	It was found that the stereotype of “a woman who gets a breast

	determine probability of being in that group	cancer” is used to determine whether one is likely to get breast cancer. Women who believed they fitted the stereotype thought they were more likely to get breast cancer (Gerend, Aiken, West, and Erchull, 2004)
Availability	Ease of memory retrieval determines probability estimations	It was found that people tended to believe that words starting with the letter k are more common than words that have k as the 3 rd letter. This is because it is easier to retrieve from memory words that begin with k than words with k as the 3 rd letter (Tversky and Kahneman, 1974).
Anchoring and adjustment	According to this heuristic, when individuals are given an irrelevant number and subsequently asked to estimate the probability or frequency of an event, this subsequent estimation is affected by the irrelevant number given before	An example would be asking someone: “Is the Mississippi River longer or shorter than 16,000 miles?” and then asking that person to estimate the length of the Mississippi River. The number chosen will have an effect evidenced by the finding that a higher anchor will give rise to higher estimates than a lower anchor would (Tversky and Kahneman, 1974).

Some of these biases relate to the present research problem because they present mechanisms that can explain the relationship between worldviews and HPV vaccine risk perceptions. However, this section does not aim to present an exhaustive review of these biases. They only aim to inform the reader that such biases exist and that they can provide mechanisms through which cultural theory is expressed.

The direct links between cognitive biases and cultural theory will be briefly described here. The way that stereotypes affect people's judgments of the person with STD is an example of the representativeness heuristic. For example, there might be a preconceived idea with regards to girls who get STDs (e.g. they have less morals) which might, in turn, make them less likely to be willing to take the vaccine or that makes practitioners think twice about recommending this vaccine.

The affect heuristic is an important cognitive bias related to the cultural theory. It is defined by Shafir et al. (1993) as a decision that is made without fully examining the issue at hand. An illustration of the affect heuristic as it links with risk perceptions is the finding that, if an activity is perceived as having high benefits it will be perceived as having low risk. The opposite is true as well, such that an activity that is perceived as having low benefits is perceived as having high risks. However, this negative relationship between risks and benefits (i.e. when benefits are perceived as low, risks are perceived as high and vice versa), is not very common in real life (Slovic, Finucane, Peters, and MacGregor, 2007). Finally, the affect heuristic might also interact with other biases. For example, affect interacts with the availability heuristic in that affect has an effect on the events that are remembered (Fiandt, Pullen, and Walker, 1999).

Beyond the links presented above between cognitive biases and cultural theory, there is also the idea of motivated cognition. According to Kahan (2013), motivated cognition is an unconscious way of thinking and reasoning that is impacted by an external goal (that is, a goal other than gaining an accurate opinion). When this external goal is defined by group membership, motivated cognition becomes identity-protective cognition: it aims to protect the identity of (and the individual's membership in) the group.

Motivated cognition – and its more specific identity-protective cognition – needs cognitive biases such as biased search and biased assimilation to operate. The first (i.e. biased search) refers to the tendency to seek out information that validates the image of the

group. The second (i.e. biased assimilation) represents the tendency to, when presented with several arguments or bits of information, pick up those that favor a certain view. The credibility heuristic is at play here also: individuals within the group are seen as more credible and trustworthy than those outside the group. Moreover, the process of naïve realism makes individuals naïve to their own biases at the same time as they are realistic about the opponent's biases (Kahan, 2013).

2.7 Cultural Cognition and the HPV Vaccination Debate in the United States and Canada

Kahan et al. (2010) conducted a study to evaluate impact of worldviews on HPV vaccine risk perceptions. In their research, three study populations (all drawn from a random sample of 1538 US citizens) were formed. The first group, which is most relevant to the present study, did not have information related to the HPV vaccine. There were two other experimental groups in this study; for each group, the information was presented differently.. The description of these two other groups goes beyond the purpose of the research discussed here. Each of the 1538 respondents had, on a previous occasion (prior to the 2nd phase questioned regarding the HPV vaccine), provided responses to the worldview questionnaire. The reported results show that, in the first group, participants' risk perceptions of the HPV vaccine were correlated with their worldviews. One of the aims of this study is to see if the same relationship between worldviews and risk perceptions hold in a Canadian context.

Indeed, the Canadian context may be different since there was no province that required all children to be vaccinated, as it was the case with some states (e.g. Virginia) in the US. However, there are certain similarities between Canada and the US. In both countries, the media presented the vaccine as a personal rather than public issue by broadcasting it as mostly a female concern, a cancer issue (which backfired since opponents of the vaccine thought the term “cancer” vaccine misrepresented the HPV vaccine), and highly political (Mah, Deber, Guttman, McGeer, and Krahn, 2011). Moreover, HPV vaccine advertisements in Canada used the idea of empowering women. Indeed, advertisements showed women that seemed self-aware and able to make choices for themselves. They also used images portraying mothers and daughters. However, the framing of the HPV vaccine as a women's

issue resulted in too few advertisements directed at men, especially when it comes to transmission of HPV between men. Therefore, by focusing on one segment of the population, the advertisements failed to communicate how other segments of the population are affected (Charles, Nicole, 2014). This might have had an impact on the overall perception and acceptance of the HPV vaccine among different subgroups of the population. This media representation of the vaccine as being primarily for vulnerable groups might have intensified differences in opinions between those with different worldviews. Indeed, egalitarians would be prone to support any efforts to help marginalized groups, whereas hierarchists would be against anything that might disturb the social order that is already in place.

Chapter 3: Methodology

3.1 Participants

The participants in this study were undergraduate students recruited from Business and Health Sciences classes. The response rate for this survey was 8.5% (sampling frame of 844 students), with a response rate of 8.3% in business (sampling frame of 541) and a response rate of 7.3% in health sciences (sampling frame of 203). There were 3 other students that participated in this study, but that did not give enough information as to which degree they were in (i.e. the respondent in question said they were doing an undergraduate degree without specifying the degree) or that did not belong to health sciences or business (i.e. they were majoring in other fields). Also, for the Business degree, a chi-square test of association showed that the proportion of females in our sample is significantly higher than the proportion of males in our sample. No data on the total number of females and males in the Health Sciences degrees was available ($\chi^2=28.81$, $p<0.01$).

In total, there were 63 participants who responded to the first phase of the survey, 47 (74.6 %) of which also responded to the second phase. Of these, 15 (23.8%) were males, and 48 (76.2%) were females. Also, all but one of the respondents were between the ages of 16 and 24. With regards to disciplinary focus of their studies, 45 (71.4%) of respondents were in business and 14 (22.2%) were in health sciences with 4 (6.4%) of respondents belonging to other faculties. In terms of year of study, the majority 42 (67%) were in their second year of university studies. Knowledge of the HPV vaccine in this sample is high, with 73% of participants responding that they knew about the HPV vaccine.

Participants were recruited through in-class presentations by a researcher. The link to a questionnaire was posted on electronic course websites.

3.2 Materials

This section briefly presents the main methods used in this research. The complete questionnaire used in the study is given in the **Appendix 1**.

Demographics. The demographics surveyed involve gender (male; female), age (16-19; 20-24; 25 or more), degree (business degree; health sciences degree; other), year of study (1st; 2nd; 3rd; 4th; 5th and other).

Other Factors That Might Influence Risk Perceptions. Other variables that were examined include familiarity (Are you familiar with the HPV vaccine and the issues surrounding its use? Yes/No), willingness (Would you be willing to take the vaccine? Yes/No), as well as previous vaccination with HPV (Have you ever been vaccinated against HPV? Yes/No).

HPV risk perceptions. Seven items related to the risks and benefits of the HPV vaccine are listed. Answer choices to the questions follow a four-point Likert scale. All items are combined into an overall score (reverse coding some items where appropriate) such that a higher score means a higher prominence of perceived risk over the perceived benefit (for the HPV vaccine).

Worldviews. The subjects' worldviews are measured on two scales: individualism scale; and hierarchism scale paralleling the aforementioned (Section 2.5.2) group and grid dimensions respectively.

Canadian healthcare system views. Five items related to the views about the healthcare system are included as well. Since there is a theoretical relationship between values and healthcare system debates, these items may be later on embedded in a worldview questionnaire specific to the Canadian context. Indeed, a means of pilot testing these items is to examine a possible association between values (as defined by the grid-group typology) and healthcare values. The following statements were crafted after consulting several papers from the health economics literature (Deber, 2000; Deber, et al., 2008; Health Council Canada, 2009; Williams, 1988). In particular we selected papers that examined health care system design or assessment in relation to ideology. Based on this literature review the Master student proposed several questions and these were narrowed down after consultation with her supervisors into a set of 5 questions. These 5 questions make up the healthcare items as listed below:

1. The best way to properly run a healthcare system is to think of it as a / business with consumers, prices, and providers.
2. Drug coverage should be part of the universal healthcare insurance.

3. An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those socially advantaged and disadvantaged.
4. Policy decisions should be based more on the formal approaches of policy makers than on the values of the general population.
5. Patients should be given more decision-making power when it comes to their own health and lifestyle.

Respondents were asked to rate the validity of the above statements on a scale of 1 to 5. The justification for selecting each of these propositions will be explained in turn.

1. The best way to properly run a healthcare system is to think of it as a business with consumers, prices, and providers.

This issue was examined by Williams (1988) and Deber (2000). According to Williams (1988), two ideological positions underlie opinions over who should receive care and who should pay. These viewpoints are denoted as “libertarian” and “egalitarian”. The libertarian view is related to market values and seeks to maximize what people with high income get for healthcare. In other words, willingness and ability to pay should determine healthcare access and benefits. Under this view, the healthcare system should follow the business model. The egalitarian, on the other hand, views healthcare as a basic right to which everyone is entitled. Under this view, ability to pay should not determine the level of care received; need should determine healthcare access and benefits. The egalitarian does not agree with the analogy between healthcare and business models.

Consequently, if the respondent agrees to the above statement, this would place him as a hierarchical-individualist on the grid-group framework.

2. Drug coverage should be part of the universal healthcare insurance.

All provinces/territories have offered universal health since around 1980, the date when Medicare was established in all provinces and territories. Under this federally mandated plan, the provinces each have the responsibility to fund (and assure the accessibility of) medically necessary care. The provinces can extend to other services as well, but do not have to. The question here is related to whether drugs should be also included in the benefits that all citizens should have access to regardless of income. Therefore, someone who holds the value that society should help the group and that all citizens should have the same access to

services regardless of their status in society is theoretically more likely to be communitarian and egalitarian than someone who does not agree with this.

The respondent's agreement to the above statement would indicate a communitarian and egalitarian attitude.

3. An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those socially advantaged and disadvantaged.

The above statement was articulated in Deber et al. (2008). This is an outcome of a socialized, equitable system and is meant to appeal to those that are more egalitarian and communitarian.

4. Policy decisions should be based more on the formal approaches of policy makers than on the values of the general population.

The question here is whether experts should have more decision power than others in policy decisions. This is about trust in authority and about delegation of decisions to those with a higher status in a particular area. Therefore, someone who agrees with this statement should theoretically be more hierarchical. At the same time, a formal approach to policy decisions would be more likely to consider the benefits and negative impacts for the group as a whole, whereas consulting the public is about empowering the voice of individuals. Therefore, someone who agrees with the above statement (i.e. that policy decisions should be based on expert opinion and formal approaches) would also be more likely to be communitarian.

5. Patients should be given more decision-making power when it comes to their own health and lifestyle.

The above sentence makes reference to the concept of patient-centred care. This concept is defined as (Ontario Medical Association, 2009):

“A patient-centred care system is one where patients can move freely along a care pathway without regard to which physician, other health-care provider, institution or community resource they need at that moment in time. The system is one that considers the individual needs of patients and treats them with respect and dignity.”

There are, however, issues with the implementation of this concept in actual practice. For example, communicating risks to the patient may be difficult because the patient does not

have the same level of health literacy as the doctor. Moreover, to be able to participate in one's care, the individual must have some basic ability to make decisions. This ability might be impaired in some individuals. Other barriers to the implementation of patient-centred care are related to systemic barriers (e.g. hospital departments might not communicate well with each other) (Hanna, 2010).

Since this item is about empowering of individual patients, it should, theoretically, appeal more to those who are individualistic in their orientation. This item is also about giving voice to those with a lower status (such as normal individuals who are patients) versus giving decision making power to authority figures (such as doctors). Therefore, theoretically, someone who agrees with this item would be more egalitarian.

The following table summarizes the categorization of individuals on the grid-group typology based on their response to the healthcare questions:

Table 4. Healthcare Statement and Grid-Group Typology

Statement	Classification
1. The best way to properly run a healthcare system is to think of it as a business with consumers, prices, and providers.	Someone who agrees with the statement on the left would theoretically be: <i>Hierarchical-Individualist</i>
2. Drug coverage should be part of the universal healthcare insurance.	Someone who agrees with the statement on the left would theoretically be: <i>Egalitarian-Communitarian</i>
3. An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those socially advantaged and disadvantaged.	Someone who agrees with the statement on the left would theoretically be: <i>Egalitarian-Communitarian</i>
4. Policy decisions should be based more on the formal approaches of policy makers than on the values of the general population.	Someone who agrees with the statement on the left would theoretically be: <i>Hierarchical-Communitarian</i>
5. Patients should be given more decision-making power when it comes to their own	Someone who agrees with the statement on the left would theoretically be:

3.3 Procedure

After an in-class presentation in several business and health sciences undergraduate classes, an e-mail was sent to students in these classes with a link to the bilingual online survey or, in some cases, this link was made available on the course website. The Master student presented the research study (the presentation was approved by the Ethics Committee) by outlining the goal of the study, the time involved, as well as the compensation. This last part (i.e. compensation) involved the automatic placement (although respondents could choose to withdraw) of the participant's name in a draw to win a \$30 iTunes gift certificate, with about 20% chances of winning. Several reminders were sent when the deadline for completing the survey was approaching.

Only the participants that responded to the first phase of the survey were sent an invitation to the second phase of the survey. The measures collected in the first phase were demographics and worldview questionnaire. For the second phase, the measures collected were healthcare system and HPV vaccine risk perceptions.

3.4 Design and Statistical Methods for Each Hypothesis

The Kahan et al. (2010) study that examined the link between HPV vaccine risk perceptions and worldviews used a two-phase online survey. The present study used a similar two-phase design. During the first phase of the present study, questions related to demographics, other related factors, and worldviews were asked. During the second phase, questions related to healthcare items as well as HPV vaccine risk perceptions were asked.

Also, several hypotheses have been formulated from the literature review presented in the previous chapter:

1. **Cultural worldviews and perceptions of the HPV vaccine are related.**

For this hypothesis, a quasi-experimental design was used. An experimental design is one where subjects are randomly assigned to the different conditions of the variables

measured. For example, a random assignment would be when patients with tuberculosis are randomly assigned to Treatment 1 or Treatment 2 and then compared with respect to the amount of improvement they make in their condition. However, random assignment cannot be achieved in the present situation since subjects cannot be randomly assigned to the different worldviews.

Also, this is a between-groups design. Therefore, there are two or more groups (i.e. communitarian-egalitarians, communitarian-hierarchists, individualist-egalitarians, individualist-hierarchists) and, furthermore, one individual cannot belong to more than one of these groups. In the present context, given that it is not possible for an individual to belong to more than one group at a time (i.e. we suppose that a communitarian-egalitarian cannot also be an individualist-hierarchist), the only option available with respect to the worldviews variable was a between-subjects design.

The main independent variables used are hierarchism and individualism. Together, they make up a person's worldviews. For the hierarchism dimension, a low score indicates an egalitarian attitude and a high score indicates a hierarchical attitude. For the individualism dimension, a low score indicates a communitarian attitude and a high score indicates an individualistic attitude. The dependent variable is the score on the HPV vaccine risk perception scale.

This hypothesis was examined using a scatter-plot graphical display and tested more rigorously using multiple regression. A multiple regression technique is used when there are multiple independent variables and one dependent variable where the dependent variable approximates an interval-ratio scale (Cohen, Cohen, West, and Aiken, 2003).

2. Gender and degree are related to worldviews

For this hypothesis, a quasi-experimental between-subjects design was used as well. Because of the unusual nature of our sample (all men were in just one of the two faculties namely Management, leaving no men in the Health Sciences faculty) the hypothesis related to gender could not be examined directly. However, the following hypotheses were formulated so as to accommodate the sample outcome:

a. Female respondents have different worldviews depending on the program of study.

b. Male and female respondents enrolled in the business program have different worldviews.

Graphical displays were first created. After this, each of the hypotheses were examined through a MANOVA. MANOVA is used when there are two or more dependent variables that approximate an interval-ratio scale and when there is at least one independent variable that is categorical (Polit, 1996; Tabachnick and Fidell, 1989). This procedure tests whether there is a difference between the groups identified in the independent variable(s). The independent variable in this context are the gender/degree interactions. The dependent variables are the worldview measures. In other words, the following questions are asked for each of the hypotheses respectively:

- i. Is there a difference between females in health sciences and females in business when both dimensions (i.e. hierarchism and individualism) are considered together?
- ii. Is there a difference between male and female respondents in business when both dimensions (i.e. hierarchism and individualism) are considered together?

After the MANOVA procedure, several one-way ANOVAs were conducted to see which worldview dimension (i.e. hierarchism or individualism) was mainly responsible for the difference between groups. Following up the MANOVA with several ANOVAs is a common and recommended procedure (Polit, 1996; Tabachnick and Fidell, 1989).

3. There is a relationship between cultural worldviews and healthcare questions.

In this hypothesis, we are testing whether a combined scale from the healthcare items predicts worldviews. A graphical display between the cultural worldviews and the healthcare questions is presented in the results section.

For this hypothesis, a nonexperimental between-subjects design was used. This means that the design does not allow for an examination of a causal relationship (i.e. it is not an experiment) and that participants cannot belong to more than one identified group (i.e. the participant cannot be both a communitarian-egalitarian and an individualist-hierarchist). The healthcare scale has a possible range of 0 to 18. This is because only 3 questions from the 5 questions were included based on the reliability analysis. There are two dependent variables: the hierarchism and individualism dimensions.

Inspection of a correlation matrix was used to examine this hypothesis.

Chapter 4: Results

In the Methods section, several hypotheses have been formulated. This section will address each of these hypotheses. A note should be made that a reliability analysis was conducted before answering each hypothesis. A reliability analysis answers the question of whether the measures used are likely to give consistent results over time. This analysis looks at the correlations between items; if the items measure what they are supposed to measure (e.g. hierarchism), they should correlate to some extent with each other. The statistic Chronbach's alpha is usually used to determine whether the correlations between items are high enough for them to be considered as measuring the same construct and the established cut-off point in social sciences for this statistic is 0.70 or higher (see Schmitt, 1996). Any items that brought this alpha statistic lower than 0.70 were deleted. In this way, only items deemed reliable were kept and used for subsequent analyses. More details on how this procedure was conducted are given in **Appendix 2**. Also, a description of all continuous and categorical variables is presented in **Appendix 3** and **4** respectively.

Moreover, as part of the data screening procedures, a quality check was done to ensure that the participants understood the questions they were answering and that they did not respond randomly. Descriptive statistics and examination of graphs for each participant were used. This quality data checking involved (a) reviewing responses for each participant to see whether the participant in question only answered the leftmost or rightmost option (such a pattern may indicate a respondent who was intent on filling out the survey without reading the questions); (b) reviewing responses for each participant to see whether the participant in question left too many unanswered questions; (c) reviewing responses for each participant to see whether they responded similarly to questions that were asking the same question in different ways. For the third component, the following pairs of items were examined for each participant:

- a) For the hierarchism scale, the first pair is:
 - a. We have gone too far in pushing equal rights in this country.
 - b. It seems like immigrants, blacks, women, homosexuals and other groups don't want equal rights, they want special rights just for them.

- b) For the hierarchism scale, the second pair is:
 - a. Our society would be better off if the distribution of wealth was more equal.
 - b. We need to dramatically reduce inequalities between / the rich and the poor, immigrants and Canadians, men and women.
- c) For the individualism scale, the first pair is:
 - a. The government interferes far too much in our everyday lives.
 - b. The government should stop telling people how to live their lives.
- d) For the individualism scale, the second pair is:
 - a. The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.
 - b. Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.
- e) For the HPV vaccine risk perception scale, the following two items were expected to be rated differently:
 - a. The HPV vaccine is safe for use among young women.
 - b. Universal HPV vaccination program for girls will likely endanger their health.

There were no healthcare items that were asking the exact same question and therefore it was not possible to include them in this final stage of quality checking. However, this scale was examined for the first two stages mentioned above (i.e. tendency to respond only leftmost or rightmost and missing values).

The results show that there were 3 respondents that checked the leftmost option for the hierarchism scale. However, these participants did not give random answers for the other scales in this survey. One of these respondents did not participate in the second stage of our survey and therefore had missing values for the HPV vaccine risk perception scale and the healthcare items. The other two respondents did not have missing values.

Since the different scales use different types of Likert scales (e.g., the HPV vaccine scale ranges from 0 to 4, whereas the hierarchism and individualism items range from 0 to 6), the bank of responses for each of the measure was examined separately with graphs and frequency tables showing the frequency for each of the possible ratings (e.g. frequency of response "1", "2", "3", and "4" for the HPV vaccine risk perception scale). The minimum and maximum value for the different scales was also examined. It is not clear why these

respondents showed a pattern for the hierarchism scale, but not for the other scales. One possible explanation is related to the hierarchism questions appearing at the beginning, right after the demographics on a single page. The individualism questions appear afterwards on a different page. These participants may have started by not being engaged in the survey and clicking randomly and, after completing this page, they may have decided to actually pay attention to the survey.

It was also noticed that other two respondents gave the same rating to the HPV vaccine risk perception items mentioned above. Indeed, out of an agreement scale of 1-4, where 1 is strongly disagree and 4 is strongly agree, these respondents rated both items as a 2. However, these items are not completely opposite and it is possible to think that the vaccine itself is not completely safe, but that making the vaccine universally available and free of charge to girls will not necessarily result in their health being threatened. It is also possible that a Likert scale that would have had more categories (the present one only goes from 1 to 4) might have resulted in these participants giving slightly different responses. Given that the responses of these participants were in the middle and that they showed no other biased patterns in the survey, it is not clear that these participants misunderstood the question. No other patterns were observed in this data quality checking.

4.1. Cultural worldviews and perceptions of the HPV vaccine are related.

The first hypothesis asserts that there are statistically significant relationships between the two worldview dimensions (i.e. individualism and hierarchism) and HPV vaccine risk perceptions.

As a first step in the examination of this hypothesis, histograms (hierarchism; individualism; HPV vaccine risk perception) and scatterplots (hierarchism and individualism; hierarchism and HPV vaccine risk perception; individualism and HPV vaccine risk perception) were created.

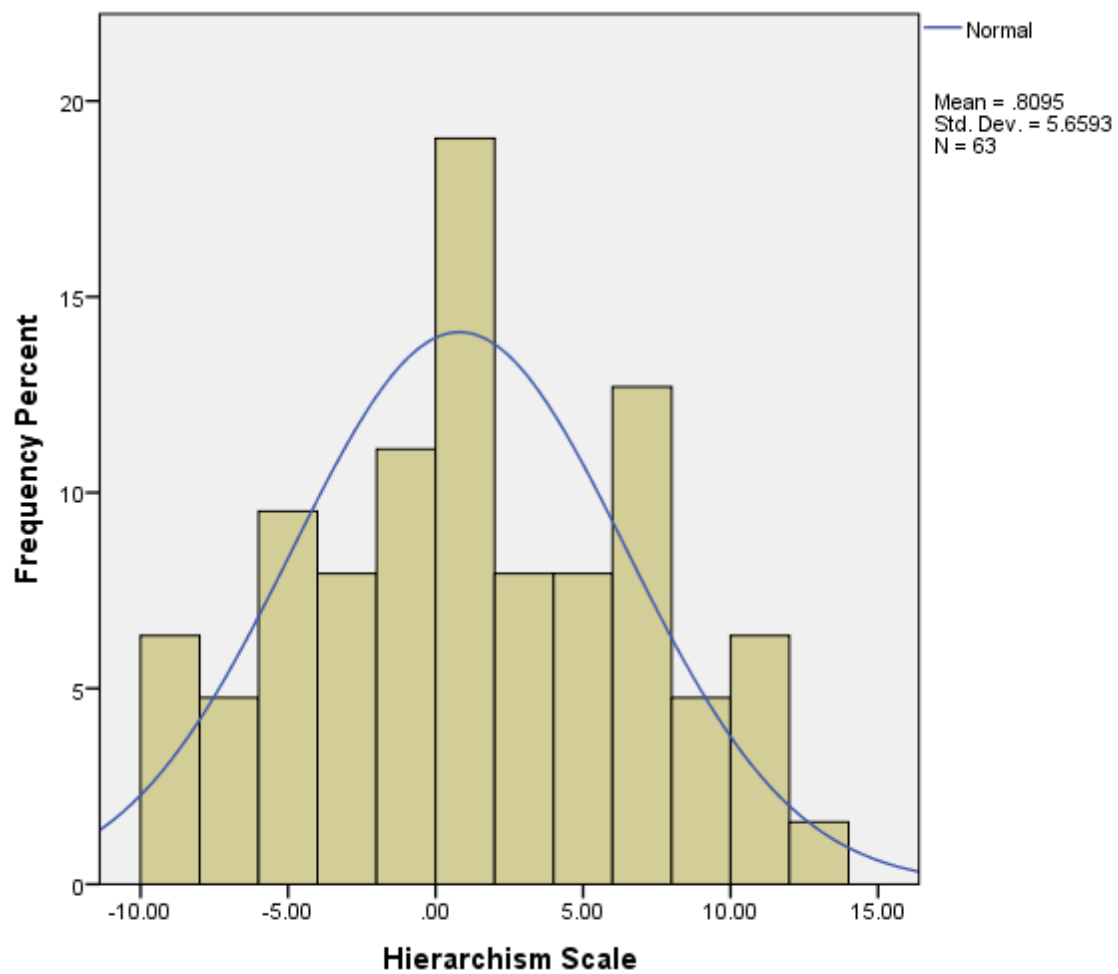


Figure 2. Histogram of Hierarchism

As can be seen in the above histogram, the hierarchism scale range is from -9 to 12, thus displaying good contrast (with minimum possible score of -9 and maximum possible score of 21).

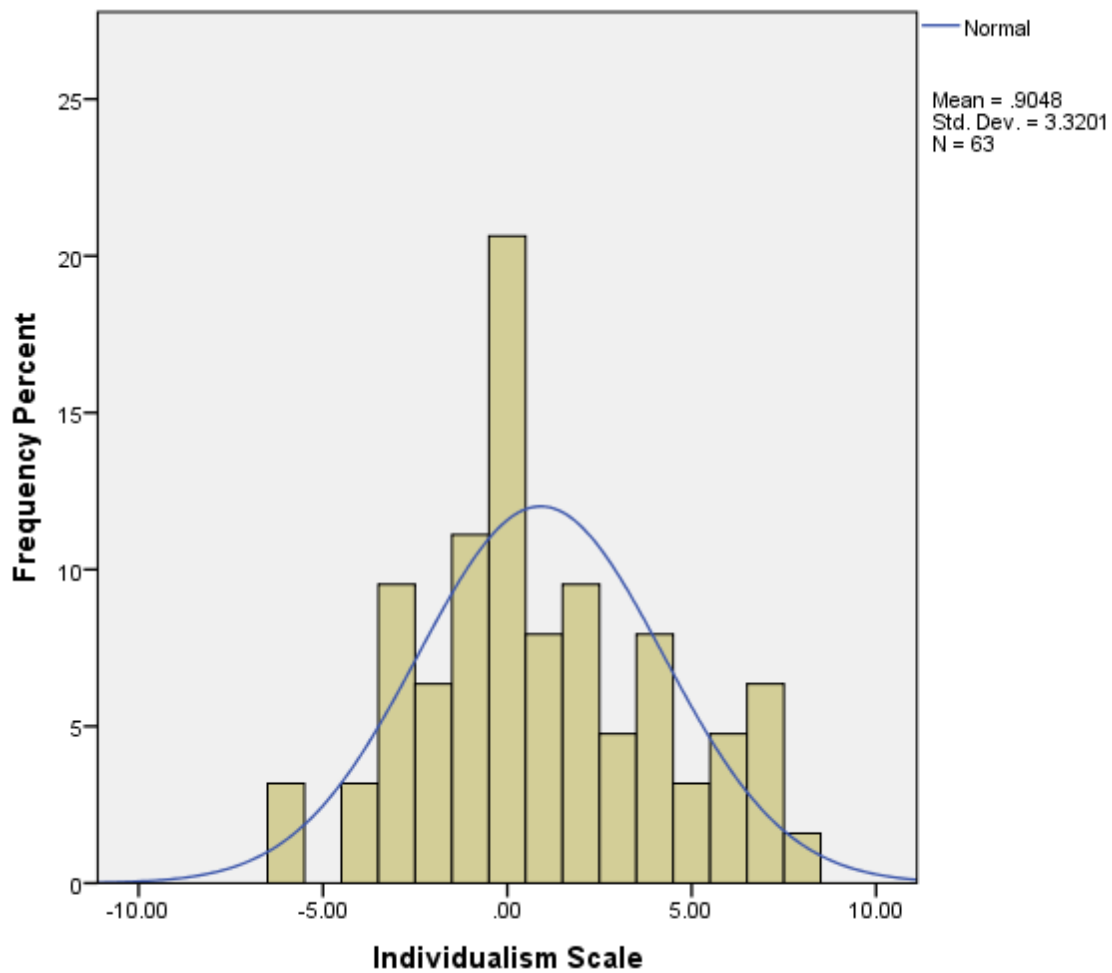


Figure 3. Histogram of Individualism

The individualism scale, on the other hand, has a slightly more restricted range; going from an observed minimum of -6 to a maximum of 8, it starts from -6 to 8 and appears slightly asymmetric (with a minimum possible score of -10 of and a maximum possible score of 10).

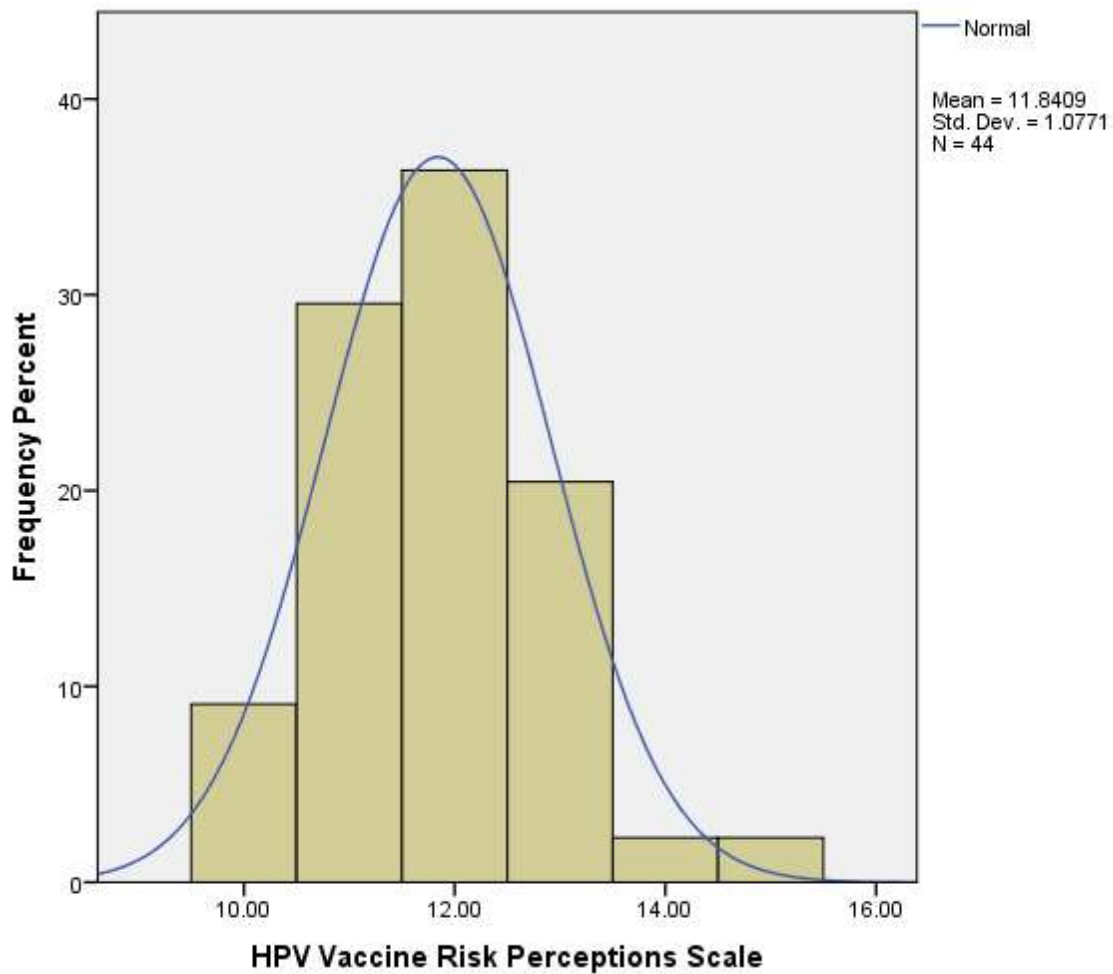


Figure 4. Histogram of HPV Vaccine Risk Perceptions

The HPV vaccine risk perception scale has the least contrast having a range of 5 units (min=10, max=15). The minimum possible score of this variable is 5 and the maximum possible score is 20. Because the range of this variable is so restricted, it might be difficult to observed meaningful differences in risk perceptions.

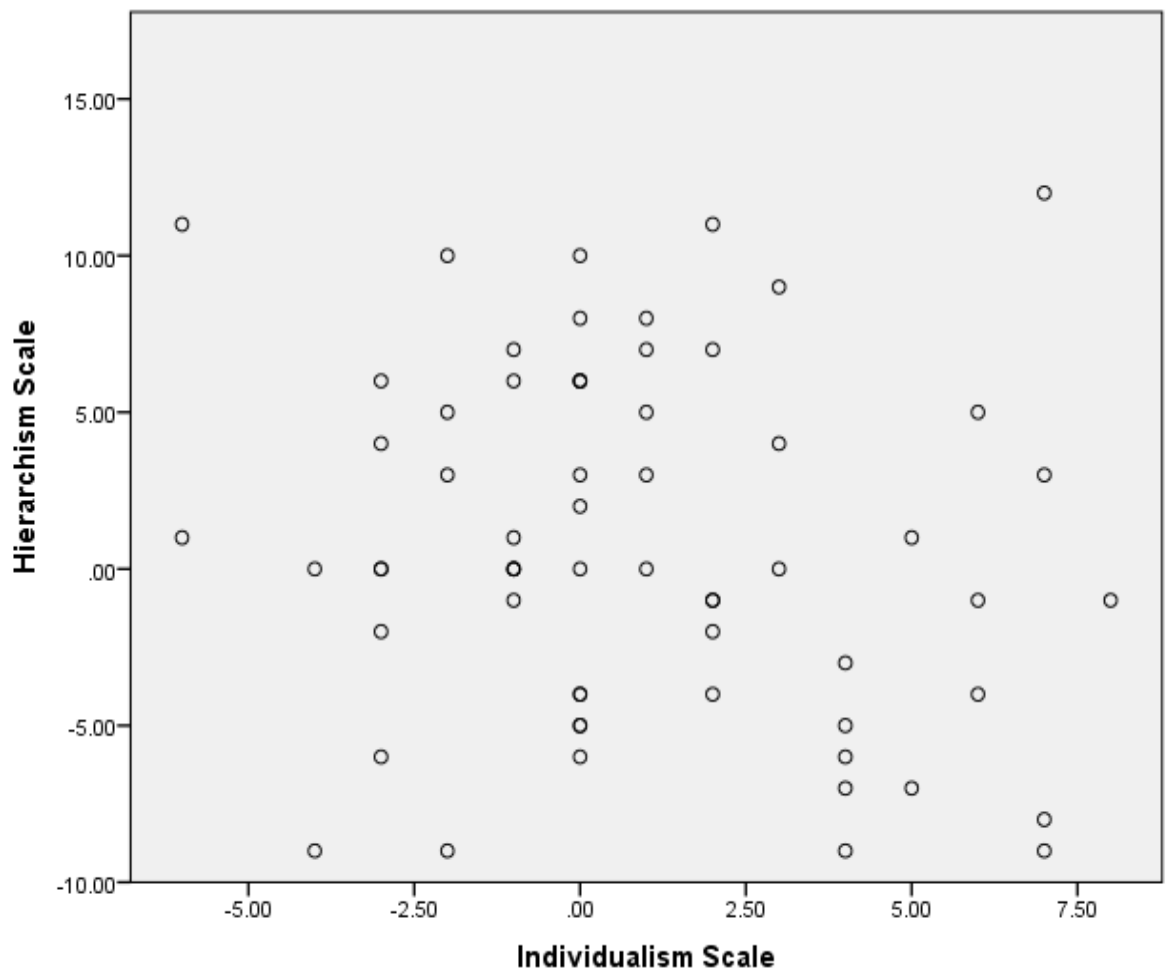


Figure 5. Scatterplot between Hierarchism and Individualism

In the scatterplot above, there does not seem to be any clear relationship between hierarchism and individualism. We expect a correlation of nearly zero, which would be consistent with the assertion that our two scales are roughly orthogonal to one and another.

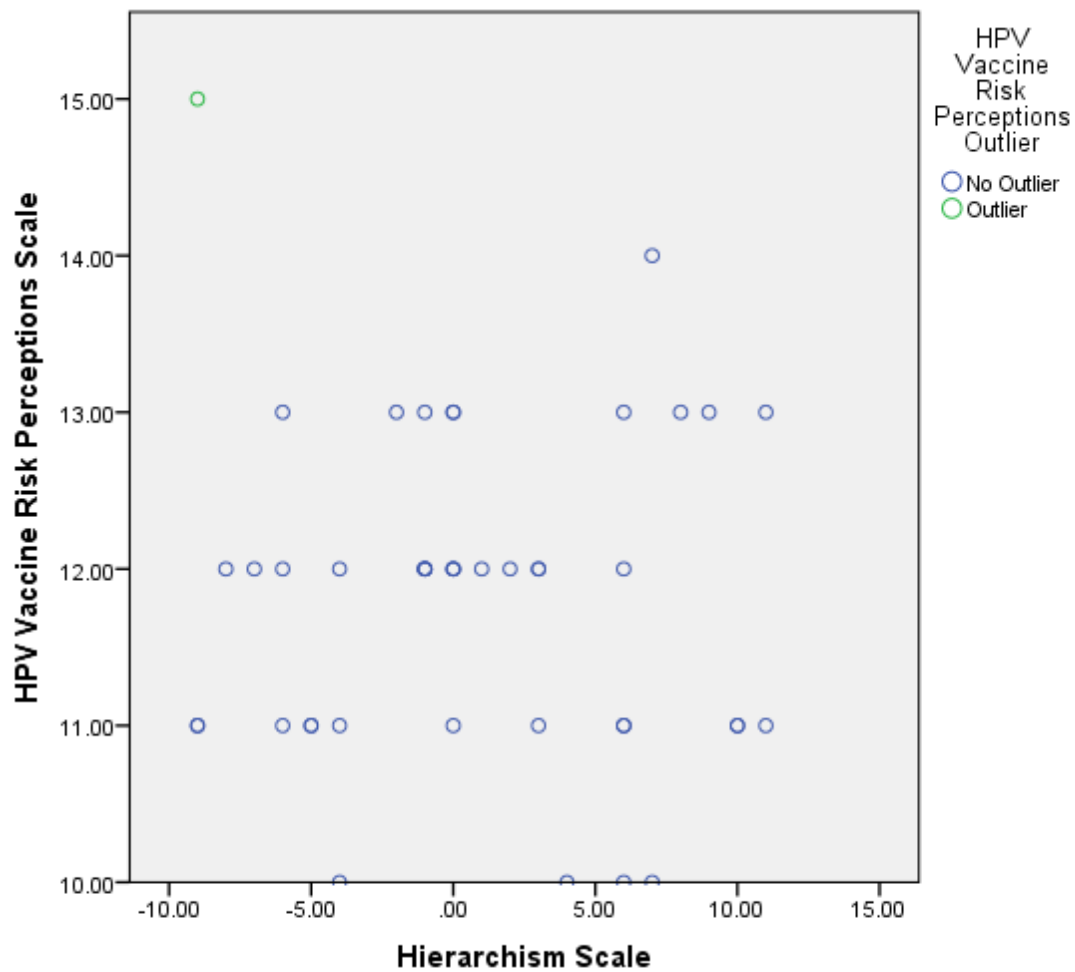


Figure 6a . Scatterplot between Hierarchism and HPV Vaccine Risk Perceptions

There seems to be a slight positive relationship between hierarchism and HPV vaccine risk perception, though this relationship is not clear, and subject to change with the inclusion or exclusion of a single datum (the datum is in green). This relationship was also examined by gender in the next graph:

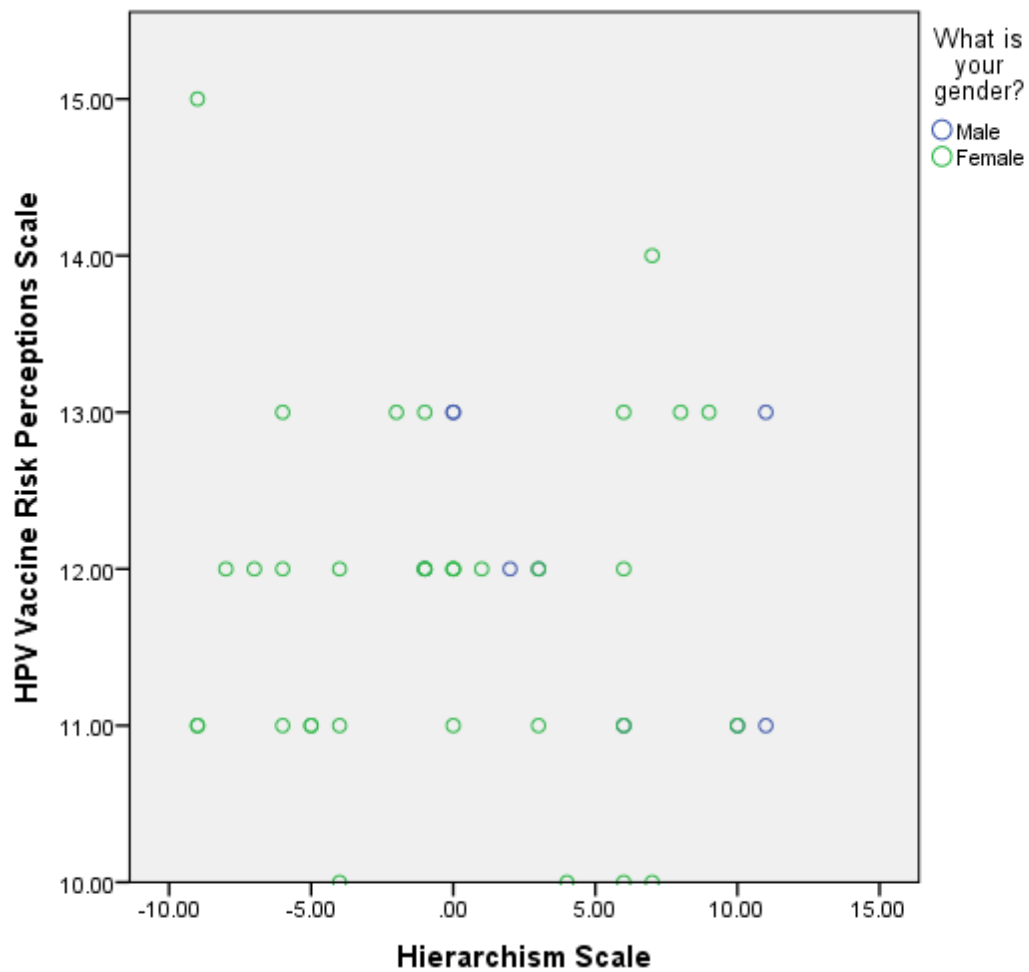


Figure 6b. Scatterplot between Hierarchism and HPV Vaccine Risk Perceptions by Gender

A note should be made that this graph is two dimensional and does not present the points that are overlapping each other. It can still be seen that, for women (green points), there seems to be an overall positive relationship between hierarchism and HPV vaccine risk perceptions and that for men (blue points), there seems to be a slight negative relationship, though there are not enough points to be clear on this latter relationship.

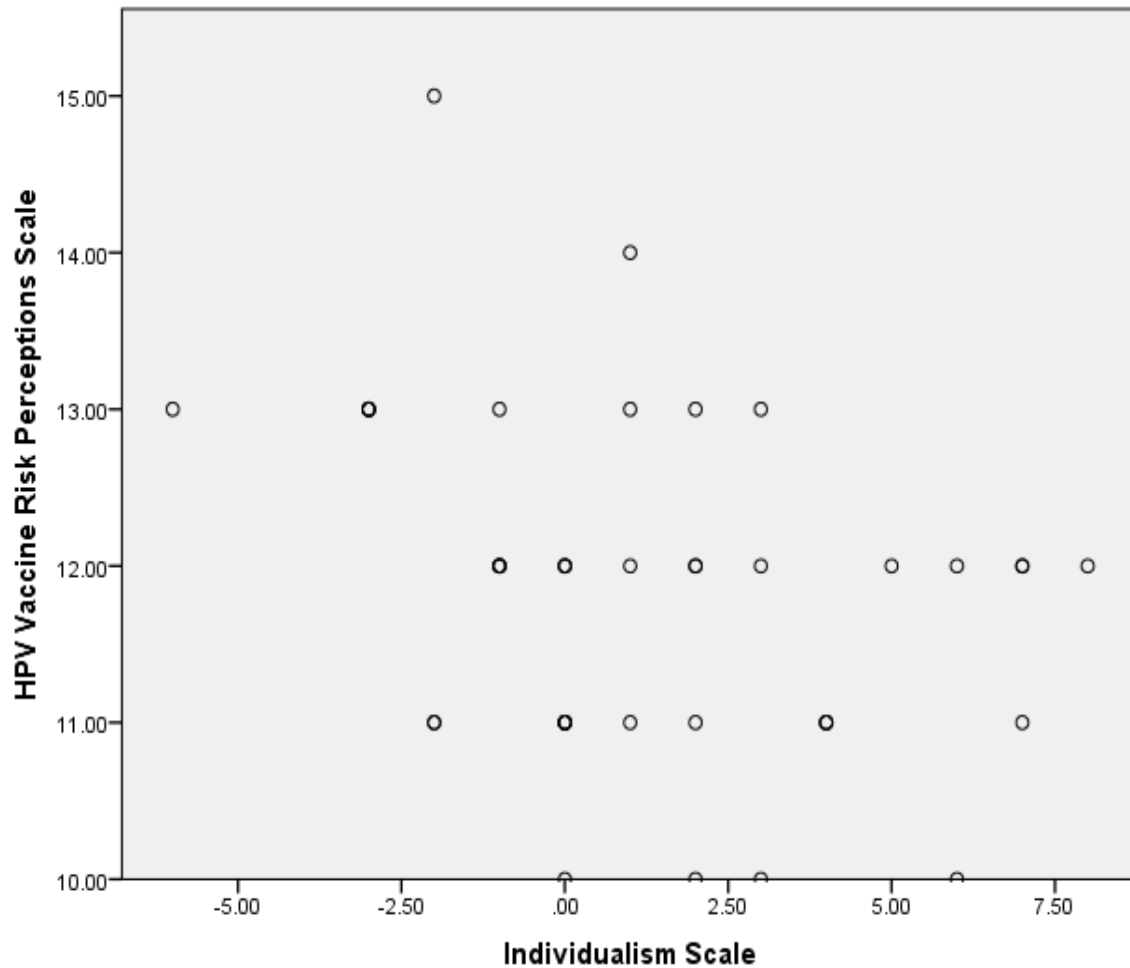


Figure 7. Scatterplot between Individualism and HPV Vaccine Risk Perceptions

In this scatterplot, there seems to be a slight negative relationship between the individualism scale and HPV vaccine risk perception. While this association is weak, it seems stronger than the relationship between hierarchism and HPV vaccine risk perceptions. The graph for gender did not show any potential pattern as it did for the hierarchism scale and will therefore not be introduced here.

After examining the graphical displays, Pearson correlations were estimated between cultural worldviews and HPV vaccine perceptions (Table 5):

Table 5. Correlation Matrix for the Worldview Dimensions and HPV Vaccine Risk Perceptions

Variable	1. HPV Vaccine Risk Perceptions	1. Hierarchism
1. HPV vaccine risk perceptions ^a		
2. Hierarchism ^b	-0.06	
3. Individualism ^b	-0.33*	-0.18

* $p < 0.05$ (2-tailed); ^a $n=47$; ^b $n=63$;

Inspection of this table shows that individualism is statistically significantly correlated with HPV vaccine perceptions ($r = -0.33$, $p < 0.05$), whereas the correlation between hierarchism and the HPV risk score is rather muted and does not meet the same criterion for statistical significance ($r = -0.06$, non-significant). The negative sign on the correlation observed between the risk and individualism scores appears to be at odds with what the theory would predict and with the work of Kahan (as will be discussed in the Discussion Section). The negative sign implies that as a subject scores higher on the individualism scale, their HPV risk scores tend to be lower. Theory would have predicted that communitarians (scoring low on the individualism scale) would be most welcoming of the HPV vaccine, and thus more inclined to rate the risks as low. Likewise theory would have predicted that those scoring high in the individualism scale would have rated the risk to be high. Therefore this statistically significant correlation is at odds with theory and the findings of Kahan. However, the Kahan et al. (2010) study also found that individualism, when taken by itself, it does not have a statistically significant relationship with HPV vaccine risk perceptions. It is harder to draw meaning from the correlation between hierarchism and the risk scores, because of its muted size.

Following these results, the question was whether the relationship between individualism and HPV vaccine risk perceptions is still statistically significant after hierarchism is taken into account. In other words, if hierarchism is considered as a covariate, is the relationship between individualism and HPV vaccine risk perceptions still present?

To answer this latter question, a multiple regression using the hierarchical method of entry was used with hierarchism entered in Step 1 and individualism entered in Step 2. The results are presented in Table 6:

Table 6. Variance in HPV Vaccine Risk Perceptions Explained By Individualism And Hierarchism

Step Predictor	n	Cum R ²	R ² Change	Beta	t	p	Bivariate r
Constant				12.03 ^a	71.09	0.00	
Hierarchism	47	0.004 ^b	0.004	-0.04	-1.34	0.19	-0.06
Individualism	47	0.15 ^c	0.14	-0.14	-2.62	0.01	-0.33

^aBetas are shown for the last step; ^bAdj. R²=0.09; ^cAdj. R²=0.11

As it can be seen, the model with hierarchism alone is not significant. This is consistent with the correlation matrix (Table 6). Moreover, the individualism variable is still significant even after the effects of the hierarchism variable are taken into account. Indeed, the individualism variable adds a significant F change ($p=0.01$). This result indicates that the level of individualism that someone possesses can predict (albeit imperfectly) whether that person is likely to see the vaccine as risky and that this is still the case even after any hierarchistic tendencies of that individual are considered. More specifically, if someone is more individualistic (i.e. believes that individuals should make their own way through life and that government should have limited power), he or she will be, according to these results, more likely to view the vaccine as safe.

However, there are several assumptions when it comes to the multiple regression procedure (Cohen et al., 2003), namely: (a) correct specification of the form of the relationship between independent variables and dependent variables; (b) correct specification of the independent variables in the regression model; (c) no measurement error in the independent variable (perfect reliability); (d) constant variance of residuals (homoscedasticity); (e) independence of residuals; (f) normality of residuals. An explanation of each assumption and how to deal with it is given in **Appendix 5**.

In examining the assumptions for this model, it was noticed that there was a possible violation of the heteroscedasticity assumption. In cases where this assumption may not be satisfied, robust regression may be used (Wilcox, 2008). The following table presents the results from this analysis:

Table 7. Multiple RegressionTable

Independent Variables	Coefficient	t	P
Constant	12.03	66.56	0.00
Individualism	-0.14	-2.26	0.03
Hierarchism	-0.04	-0.98	0.33
R ²	0.15		
F(2,41)	2.85		

As it can be seen in the above table, the R² is still around .15 and, as Table 7 indicates, individualism is still a statistically significant predictor at the 0.05 level whereas hierarchism is not. Therefore, the findings in the first regression model are replicated in the robust regression model.

4.2. Gender and degree are related to worldviews

As the literature review (see Section 2.5.1) outlined, there are reasons to anticipate a correlation between gender and world-views, as well as disciplinary focus (as indicated by home faculty). In the case of gender, the aforementioned “white male effect” suggests that there is a difference between males and females. With respect to degree, different domains might appeal to certain worldviews and to distinct values.

Since all males were in business, it was not possible to examine the gender hypothesis directly. To adapt to the unbalanced sample (recall that all males are in business), two variables were created for : (a) degree (i.e., females in business versus females in health sciences); and (b) gender (i.e. males in business versus females in business). Differences in worldviews were then examined through MANOVAs. This procedure is used when there are two or more continuous dependent variables and one or more categorical independent variables (Polit, 1996; Tabachnick and Fidell, 1989). In this case, the two dependent

variables are individualism and hierarchism (i.e. the worldviews dimensions). The independent variables are, for each MANOVA: a) degree (restricting the sample to females); b) gender (restricting the sample to business students). The research question answered through this procedure is whether there are differences between groups (e.g. females in business versus females in health sciences) when the two dependent variables are considered together.

a. Female respondents have different worldviews depending on a program of study.

The following scatterplots were created to get a sense of the relationship between program of study and worldviews:

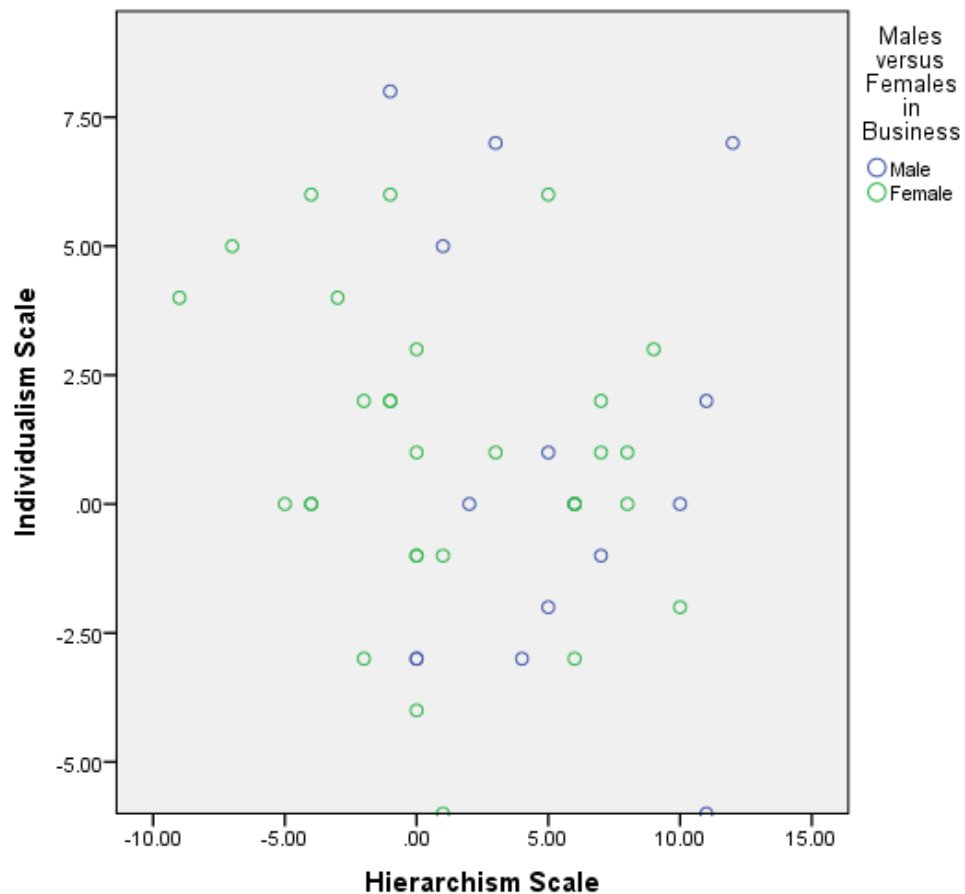


Figure 8. Relationship between Worldviews and Gender

There appears to be a mild negative association between the two world view scales when one restricts attention to the females alone, while the fewer data points for males reveal even less of a pattern.

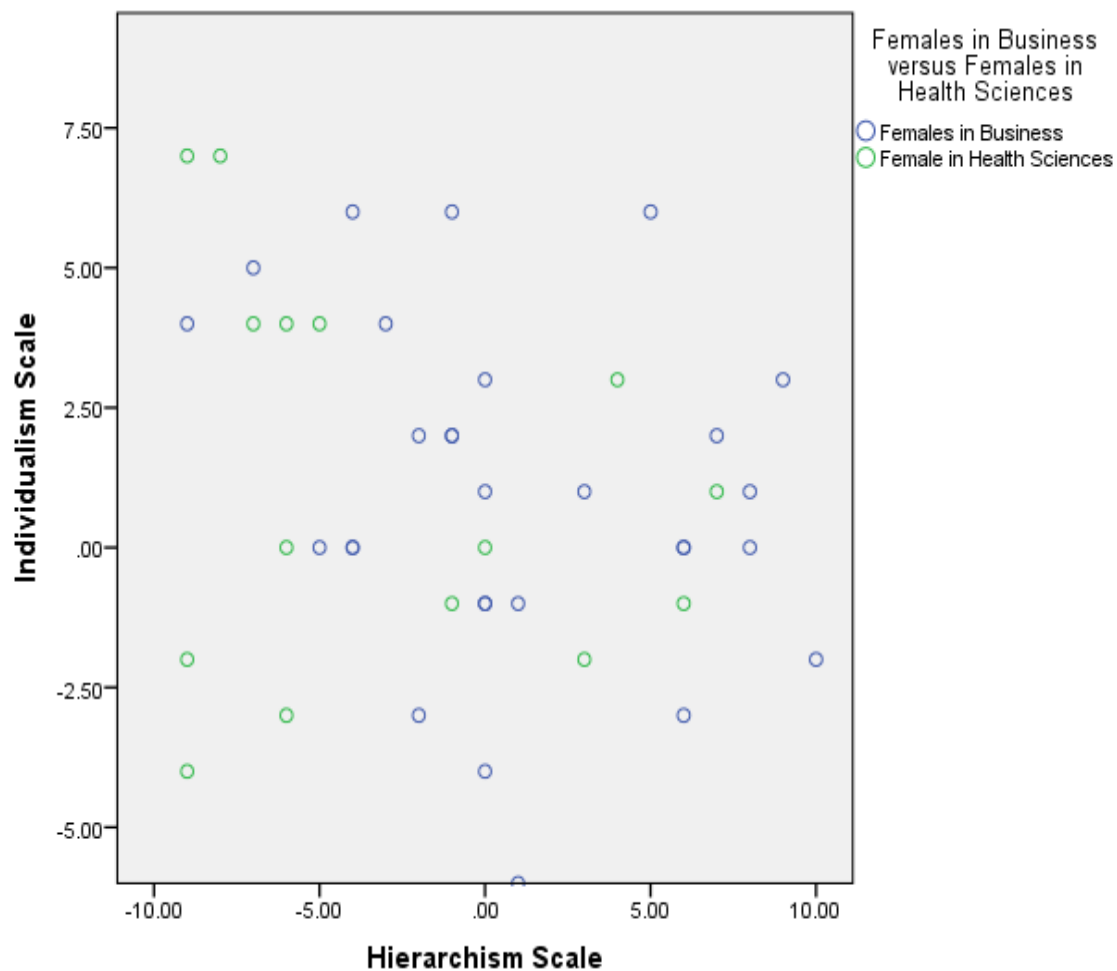


Figure 9. Relationship between Worldviews and Degree

In the above graph, there seems to be a slight negative relationship between hierarchism and individualism when we observe only females in business. This is not the case for females in Health Sciences.

The following table presents the means and standard deviations for each of the dependent variable by group:

Table 8. Descriptive Statistics for the Dependent Variables (MANOVA)

Dependent Variable	Independent Variable (Group)	Mean	Standard Deviation	N
Individualism Scale	Females in Business	0.93	3.01	29
	Females in Health Sciences	1.13	3.50	15
	All females? Or all subjects (same question applies in this context elsewhere)	1.00	3.15	44
Hierarchism Scale	Females in Business	0.93	4.99	29
	Females in Health Sciences	-3.07	5.73	15
	Total	-0.43	5.53	44

For females in business, the mean of the hierarchism variable is positive (.93), whereas for females in health sciences, the mean of the hierarchism variable is negative (-3.07). The hierarchism variable was coded so that a score of 0 and above would correspond to a hierarchical worldview and so that a negative score would correspond to an egalitarian worldview. Therefore, it seems that the means of the hierarchism variable suggests that females in business are more hierarchical than females in health sciences.

Also, for the “females in business versus females in health sciences” variable, Pillai’s trace value is 0.122 ($F=2.37$, $df=2$, $p=0.07$). This means that, when both worldviews are considered together, degree would be statistically significant at the $p=0.10$ level but not at the more traditional $p=0.05$ level.

The One-Way ANOVAs below show that the hierarchism dimension is statistically significant ($p=0.02$), but not the individualism dimension ($p=0.84$):

Table 9. One-Way ANOVAs for Each Dependent Variable

Dependent Variable	Females in Business versus Females in Health Sciences (Sum of Squares Between)	F	p
Individualism	0.41	0.04	0.84
Hierarchism	158.000	5.73	0.02

Even though there is no statistically significant difference between females in health sciences and females in business when the two worldviews are considered together, there is a difference in worldviews with respect to hierarchism. Indeed, females in health sciences are more egalitarian than females in business. Also, the “sum of squares between” term shows how much the groups differ from their grand mean. If these groups are close to their grand mean, then there is not much difference between these two groups and the probability that the results that we got occurred simply by chance is high. For individualism, the “sum of squares between” term is very low (0.41) and the likelihood of having this result by chance is high ($p=0.84$). For hierarchism, on the other hand, the “sum of squares between” term is high (158) and the likelihood of having this result by chance is low ($p=0.02$).

For the MANOVA procedure, there are certain assumptions that need to be met, namely: (a) random sample; (b) multivariate normal distribution; (c) homogeneity of variance-covariance matrices; (d) linearity between pairs of dependent variables; (e) more cases than dependent variables. However, the MANOVA procedure is robust to violations of the multivariate normal distributions as long as there are at least 20 cases (Polit, 1996). Box’s M statistic is used to test the covariance equality assumption. For the first hypothesis, this assumption has been met Box’s M statistic for the equality of covariance assumption is 0.85 ($F=0.27$, $p=0.85$).

There are certain assumptions, similar to that of MANOVA, to be considered for the one-way ANOVAs, such as: (a) random sample from the population of interest; (b) dependent variable is normally distributed; (c) equal variances of both groups; (d) for between-subjects designs, it is assumed that the individuals composing the sample have been selected independently of each other. ANOVA is generally robust to normality and equal

variances (Polit, 1996). Also, Levene's test is used to test the variance equality assumption with a nonsignificant result meaning that the homogeneity assumption has been met. Levene's test for equality of variance is nonsignificant both for hierarchism ($F=1.16$, $p=0.29$) and individualism ($F=1.16$, $p=0.29$). This means that the homogeneity assumption has been met.

b. Male and female respondents enrolled in business program have different worldviews.

The following table presents the means and standard deviations for each of the dependent variable by group:

Table 10. Descriptive Statistics for the Dependent Variables (MANOVA)

Dependent Variable	Independent Variable (Group)	Mean	Standard Deviation	n
Individualism Scale	Males in Business	0.80	4.23	15
	Females in Business	0.93	2.96	30
	Total (all business)	0.89	3.39	45
Hierarchism Scale	Males in Business	5.07	4.37	15
	Females in Business	1.13	5.04	30
	Total (all business)	2.44	5.13	45

In Table 10, males in business seem to have a higher mean for hierarchism than females in business and a slightly lower individualism mean than females in business. This means that men seem to be more hierarchical than women, but that men seem to be slightly more communitarian than women.

In order to properly test the differences in worldviews between men and women in business, a One-Way ANOVA was run. For this procedure, the assumption of equality of covariance matrices and equality of variance are satisfied. The Box's M statistic for the equality of covariance matrices assumption is not significant, which means the assumption of equality had been met: 3.33 ($F=1.04$, $p=0.37$). For the One-Way ANOVAs, the Levene's test for equality of variance between the two groups (i.e. males and females in business degrees)

is not statistically significant both for hierarchism ($F=0.57$, $p=0.46$) and individualism ($F=2.83$, $p=0.10$). This means that the equality of variance assumption has been met.

Moreover, the table below shows that the hierarchism dimension is again significant:

Table 11. One-Way ANOVAs for Each Dependent Variable

Dependent Variable	Males in Business versus Females in Business (Sum of Squares Between)	F	P
Individualism	0.18	0.02	0.90
Hierarchism	154.71	6.64	0.01

For the “males in business versus females in business” variable, Pillai’s trace value is 0.14 ($F=3.30$, $df=2$, $p=0.05$). Therefore, there is a difference between males in business and females in business when (a) both dimensions of worldviews are considered together; and (b) this difference is largely due to the hierarchism dimension. Thus restricting attention to business students, females in business tend to be more egalitarian than men.

4.3. Cultural worldviews and views of the roles that the healthcare system plays are related.

The third hypothesis concerned the newly developed healthcare system questions and their relation to worldviews. The rationale for having this hypothesis is that worldviews inform trends more strongly than they do individual controversies. That is, it will be easier to see the relationship between worldviews and several healthcare controversies when these controversies are examined all at once instead of one by one. This gives a rough indication as to whether healthcare debates and worldviews are related.

The healthcare scales are created by summing the Likert scale scores for each healthcare item (reverse coding when necessary). Indeed, these items were originally designed with the purpose of them being able to supplement worldview questions.

Two healthcare scales were created: one for the hierarchism dimension; and one for the individualism dimension. The way in which the items were formulated did not allow a

prediction for both worldviews' scales in the same direction. For example, a higher score on the healthcare item would lead to a higher score on the individualism dimension though it might lead to a lower score on the hierarchism dimension. Because of this, the items had to be added differently depending on which worldview variable (i.e. individualism or hierarchism) was predicted.

Scatterplots were created between (a) hierarchism and the combined healthcare scale for hierarchism; and (b) individualism and the combined healthcare scale for individualism:

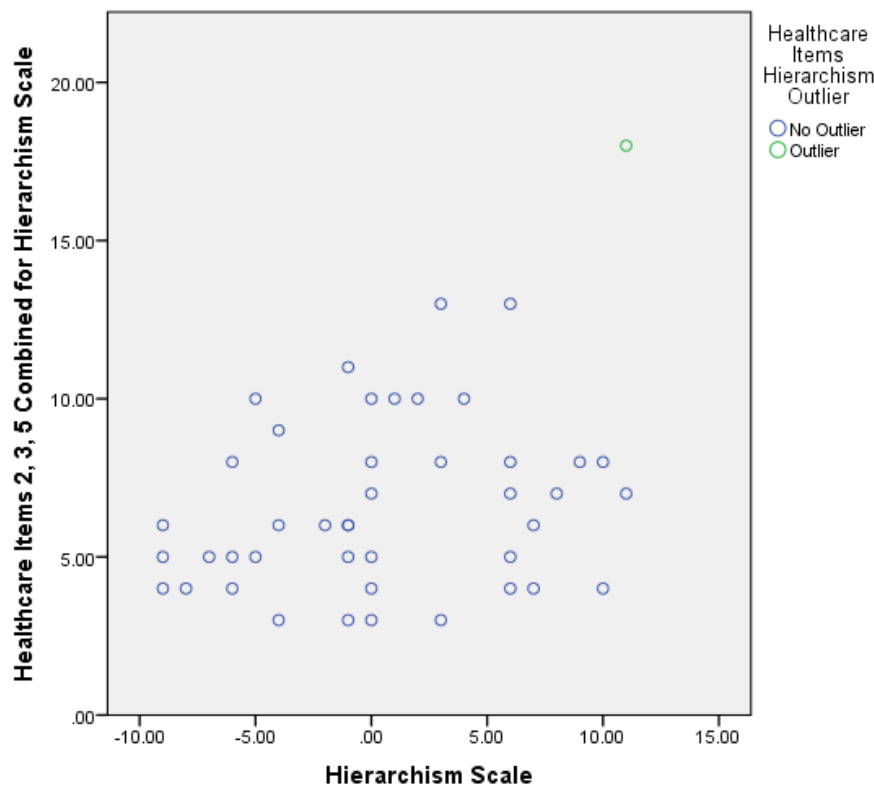


Figure 10. Hierarchism and the Combined Healthcare Scale for Hierarchism

As can be seen in the above graph, though there is a positive association (albeit not a strong one), but a potentially influential datum is apparent in this graph. When this data point is removed the Pearson correlation coefficient drops to $r=.22$, which is not statistically significant at the .05 level. Since there are not enough data points, it is hard to say whether there is a relationship or not. It might be that this outlier gives pertinent information about

the actual relationship in the population. This will need to be examined with a larger sample size. Also, when examined by gender and attention is restricted to women, there is a slight positive correlation. The correlation is less clear for men.

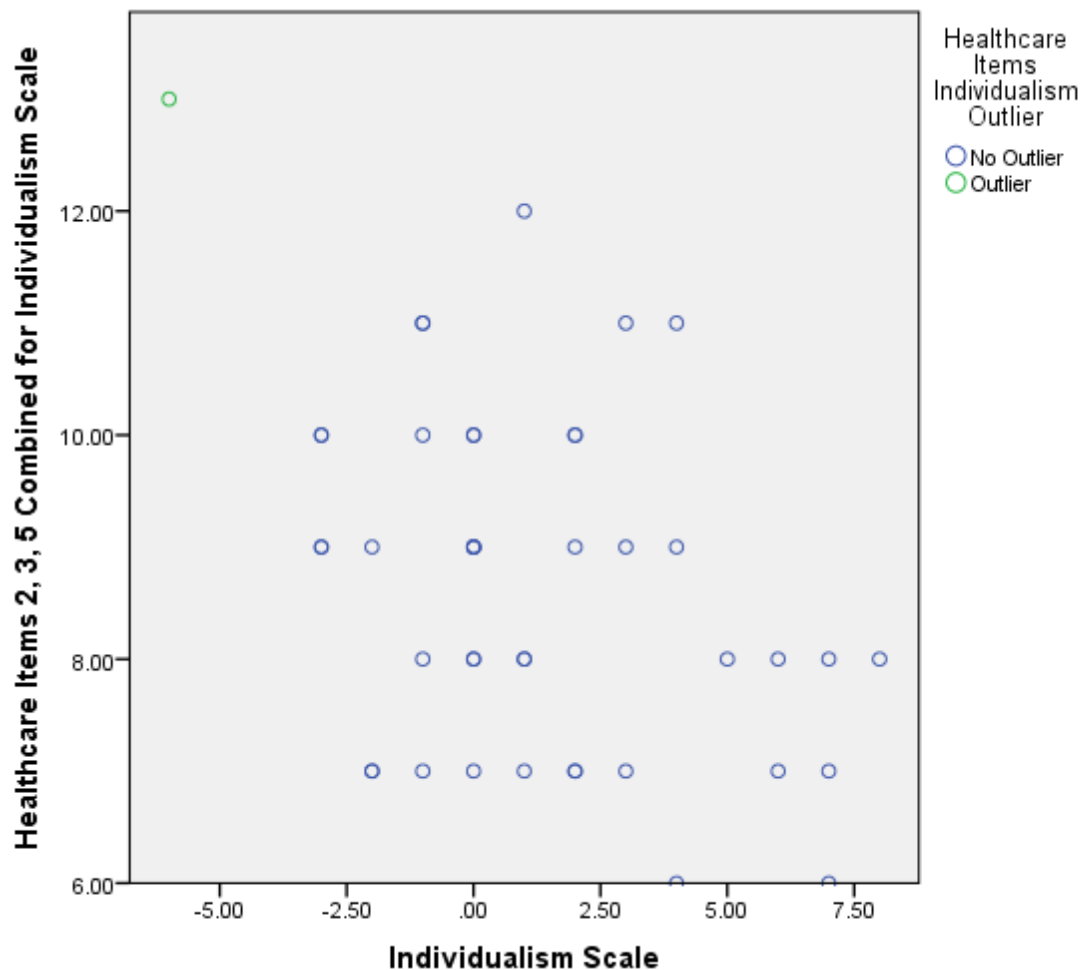


Figure 11. Individualism and the Combined Healthcare Scale for Individualism

There seems to be a slight negative association between the individualism scale and the combined healthcare items scale for individualism. Again our limited sample size may be constraining our ability to reveal what may be a true underlying correlation. Also, this graph does not display data points that pile on top of each other. There is also a potential influential data point (identified with green). When examined by gender, the data points identifying women show a slight negative relationship, whereas for men, this relationship is not clear. Yet, for our health-care items to be suitable proxies for the Kahan et al individualism scale,

we would need to see a strong correlation; something which would surely have resulted in a stronger observed relationship than what we have observed in Figure 10.

For this hypothesis, Pearson correlations were examined between the healthcare views scale and the worldviews' scales:

Table 12. Correlation Matrix for the Worldview Dimensions and Healthcare Views

Variable	1	2	3
1. Healthcare Items Scale (Combined for Hierarchism Scale) ^a			
2. Healthcare Items Scale (Combined for Individualism Scale) ^a	0.62 ^{**}		
3. Hierarchism ^b	0.33 [*]	0.18	
4. Individualism ^b	-0.32 [*]	-0.41 ^{**}	-0.18

*p<0.05 (2-tailed); **p<0.01 (2-tailed); ^an=44; ^bn=63;

The observed correlations summarized in Table 12 are not what we expected. We attempted to derive a set of health-care questions that would serve as a proxy for the individualism scale and another set (of partly overlapping) healthcare questions that would serve as a proxy for the hierarchism scale. Had we succeeded in deriving suitable proxies the correlations between the healthcare scales and their original counterparts would have been both positive and strong (values on the order of +0.8 or higher would have been affirming). Instead we observed low strength of associations, and conspicuously a negative sign in the case of the individualism scale our health-care proxy. This negative sign implies a direction of association that is opposite to what we would expect. While the weak association (in the case of the hierarchism comparisons) and the weak and negative association (in the case of the individualism scales) suggest a reason to revisit the rationale used to formulate the health-care proxies, the statistical significance of these associations may be instructive about the possible presence of real underlying correlations that could, once better understood, be capitalized upon in future work.

Chapter 5: Discussion

This study shares the same rationale as that which motivated Kahan et al.'s (2010) study and introduces items better reflecting Canadian healthcare system reality. This previous study utilized a longitudinal study with two phases: during the first phase, data on worldviews were collected; during the second phase, data on HPV vaccine risk perceptions were collected. It also used a between-subjects design. Moreover, there were two main independent variables: 1) worldviews; and 2) presentation of arguments, in which there were three conditions: a) no argument was presented; b) pro and con arguments presented; c) pro and con arguments along with attribution of these arguments to authors whose worldviews were either similar or different than the participant in question. The dependent variable was HPV vaccine risk perceptions. In this previous study, there were three hypotheses:

1. Different worldviews lead to different HPV vaccine risk perceptions.

- a. Individualism and hierarchism lead to a perception of the HPV vaccine as being risky*
- b. Communitarianism and egalitarianism lead to a perception of the HPV vaccine as being less risky*

2. The presentation of pro and con arguments lead to the arguments being assimilated differently depending on the individual's worldviews

3. The effect of the arguments in hypothesis 2 will depend on whether these arguments are made by people with similar worldviews with the participant in question

This previous investigation found that worldviews can statistically predict HPV vaccine perceptions. This is particularly true when both dimensions of worldviews (individualism and hierarchism) are considered together in this prediction. The correlations between the individual and hierarchical scales and the risk scales were however rather moderate to small. In this research, the hierarchism scores are better at predicting HPV

vaccine risk perceptions than individualism scores (the beta coefficient for hierarchism=0.38 and the beta coefficient for individualism=0.09). The Kahan et al. (2010) study also looked at other factors such as the influence of the presentation of arguments and whether the effect of these arguments were dependent on whether the person presenting them shared similar (or different) values with the respondent. However, the presentation of arguments is not relevant to the present study and will not be discussed here.

Compared to the Kahan et al. (2010) study, our research found that individualism (and not hierarchism) is a better predictor of HPV vaccine risk perception scores. However, the present study found a *negative* relationship between the individualism scale and the HPV vaccine risk perceptions whereas the Kahan et al. (2010) study posited and found a positive relationship. For the hierarchism scale in the present study, the coefficient was negative, whereas, in Kahan et al. (2010) study, this coefficient was positive. A negative relationship implies that, the more hierarchical and individualistic a person is, the more likely she is to perceive the vaccine as being safer. The original hypothesis proposed by Kahan was that there would be a positive correlation between the risk score and each of the worldview scales (i.e. the individualism and the hierarchism scales). A positive relationship between worldviews and HPV vaccine risk perception implies that, the more hierarchical and individualistic a person is, the more likely she is to perceive the vaccine as being dangerous.

The differences between the current study and the Kahan et al. (2010) study could be due to four things: 1) sample bias; 2) the Canadian context is different; 3) students (not being as influenced by patriarchal or matriarchal reservations regarding a daughter's promiscuity); 4) chance (which has a bigger role when one has a small sample size).

Sample bias refers to our sample being biased and not reflecting the perceptions of the Canadian population. Indeed, the current sample uses undergraduates from only two faculties in the same university. The opinions they expressed might not represent those of the population. There might also be differences in the way in which the vaccine was framed in Canada versus United States (US); indeed, mandatory vaccination was passed in certain States in US but not in Canada, which might have generated more backlash and an image of the HPV vaccine as being more controversial in the US. The third possible explanation is that the majority of respondents were between 16 and 24 years of age and therefore less likely to be married and have children. The HPV example in particular, to the extent that it

relies upon parental impulses (e.g. concerns for promiscuity), may not have been an ideal example to try replicate in an exclusively university student context. The differences in age groups with respect to risk perceptions were not discussed in the Kahan et al. (2010) study. Finally, as in any research, the observed statistically significant relationships might have occurred by chance.

After looking at the relationship between worldviews and HPV vaccine risk perception, we examined the relationship between worldviews and (a) gender; as well as (b) university degree.

The findings in this study point to a difference between females in health sciences and females in business. Those in business tended to be more hierarchical (statistically significant finding), whereas those in health sciences tended to be more individualistic (not statistically significant finding). This result might be due to women in business choosing their profession because they aspire to be managers and are okay with the idea of there being a hierarchy and trust in authority. Women in health sciences, on the other hand, might have been attracted to this field because they see more benefit to empowering specific individuals through their care and are not as concerned with the external structures of society. This particular hypothesis was not examined in the Kahan et al. (2010) study.

When females in business were compared with males in business, the males tended to be more hierarchical (statistically significant result) and more individualistic (not statistically significant result). This finding is in line with the observation that men tend to be more individualistic and hierarchical than women that was observed in the literature (e.g. Slovic et al., 1980).

Finally, it was also found that scales that combined responses on healthcare items were effective in predicting worldview scores of subjects, though, for the individualism scale, this relationship was negative (the opposite relationship that we expected) . For the hierarchism scale, this relationship is less clear since there is a data point that can be classified as an outlier. This possible relationship between a combination of healthcare items and worldviews suggests that worldviews may be useful in predicting patterns of risk perceptions in healthcare controversies. It also suggests that there is value in refining the healthcare items used in this study and possibly introducing them in the worldview

instrument. This would possibly create an instrument that is more pertinent to the Canadian context.

The following items were used to create the healthcare items scale:

Table 13. Healthcare Items Used to Create Healthcare Scale

Item Number	Item Statement
Healthcare Item 2	Drug coverage should be part of the universal healthcare insurance
Healthcare Item 3	An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those socially advantaged and disadvantaged
Healthcare Item 4	Patients should be given more decision-making power when it comes to their own health and lifestyle

Finally, as it was mentioned in the Introduction section, this research serves several goals on the advancement of knowledge: (a) replication of results regarding the relationship between worldviews and HPV vaccine risk perceptions in a Canadian context ; (b) an investigation of the influence of gender and degree on this relationship for the Canadian context; (c) the inclusion and testing of newly developed items.

There are some differences with regard to the Kahan et al. (2010) study (i.e. the worldviews predict HPV vaccine risk perception in a different direction than this previous study; individualism, and not hierarchism, is a more important predictor). However, the idea that worldviews are related to HPV vaccine risk perception was replicated (though the correlations are not strong). Gender, as it was expected, was related to worldviews in that males tended to be more hierarchical and individualistic. Women in business were more hierarchical and, those in health sciences, tended to be more individualistic. Also, in this study, three healthcare items were identified as possible candidates for their inclusion in a revised worldview questionnaire for the Canadian context.

5.1 Limitations

The limitations in this study fall in the following categories: (a) limitations related to data; (b) limitations related to methodology; (c) limitations related to the cultural cognition theory. Each of these will be examined one by one.

5.1.1 Limitations Related to Data

The generalizability of our findings is limited because of the small sample and small response rate, as well as because our data has the following characteristics: (a) all males are in business; (b) most males are in their 2nd year; (c) there is a difference in hierarchism and individualism between males and females; (d) the great majority of respondents are between 17 and 25 years of age. Moreover, the statistical tests require that the sample has been randomly selected in order for the findings to be generalized to the population of interest. This assumption – that is often encountered in research – is difficult to meet because participants self-select themselves. Non-response bias is also a possible consequence of a research study where the participants are self-selected. It occurs when the participants who responded to the study or survey are different, in a way that impacts the generalizability of results, from those who did not participate, but could have participated (Sedgwick, 2014). In this study, given that the advertisement of this research involved short in-class presentations about the study performed by the Master student of this thesis, the respondents who did participate in the survey may have been more egalitarian. If the professor of the class would have presented the study in question, the respondents may have been more hierarchical. The non-response bias is more likely to occur in studies with a modest response rate. In conclusion, the small response rate means that the generalizability of the results to all undergraduates in the targeted programs should be made with caution.

5.1.2 Limitations Related to Methodology

Another limitation is that this is a quasi-experimental design, which means that it is not possible to establish a cause and effect relationship between worldviews and risk perceptions. It is only possible to establish that there is a relationship. Moreover, risk perception is a complex phenomenon and it is unlikely that only one single factor can explain

the differences in risk perception. Indeed, though the results were statistically significant, this only accounted for a small proportion of the total variation in risk perception (namely, %). It is also important to note that this small proportion of explanation is partly attributed to the low range of the HPV vaccine risk perception variable. Indeed, a better range means that there are finer differences made between respondents which in turn gives the opportunity for better prediction. Moreover, the introductory paragraph to the HPV vaccine risk perception scale, though it was designed to be neutral, might have had a framing effect.

5.1.3 Limitations Related to the Cultural Cognition Theory

Culture is a complex concept and can be defined in many ways. Though the present work focuses on culture as defined by the authors in this paper (Kahan et al., 2010; Douglas and Wildavsky, 1983; Douglas, 1982; Douglas and Wildavsky, 1982), culture and its expression can be operationalized through different cultural values. In particular, Hofstede (2001), through the analysis of preferences and attitudes of employees in different nations, found four basic dimensions of cultural values: (1) individualism versus collectivism; (2) large versus small power distance; (3) strong versus weak uncertainty avoidance; (4) masculine versus feminine values. The first two dimensions would correspond to the individualism and hierarchism scales respectively. One difference is that some of the Hierarchism items used in this scale would indicate that hierarchical individuals are more likely to be sexist or racist. Also, Hofstede's conceptualization of individualism refers more to ties between individuals and not to the government in relation to the individual. For more literature of different views on culture and values, see the works of Hofstede (2001), Hofstede, Hofstede, and Minkov (2010), as well as Inglehart (1990).

As it relates to the current work, it is only important to acknowledge that there are different perspectives on culture. It can be also said that future work expanding on this pilot study, should consider these modern perspectives when assessing, developing, and implementing a questionnaire on worldviews, so that the measure used can be most suited to the present socio-cultural environment. Another limitation that arises from this potential mismatch between the measure used and the socio-cultural environment is that respondents may not have been as engaged in the study as they could have been because they did not see

how a stance on discrimination relates to hierarchism or how a stance on how much government should be involved in citizens' life relates to individualism (i.e. face validity). However, preliminary data checking (as presented in the Results section) shows that respondents were reasonably engaged when responding to this survey.

Another factor that needs to be considered concerns the limitations of cultural theory considered by its critics (see Table 2 Chapter 2 for more details on these limitations). These challenges are the following: (a) a qualitative measure of worldviews rather than a quantitative one might be more appropriate; (b) cultural theory might be more suitable for predicting patterns of risk perceptions across different situations as opposed to a single situation; (c) free will is not considered in this theory; (d) it is not known whether a person's worldviews can change with time; (e) this typology might allow us to predict risk perceptions, but is not necessarily suitable for analyzing risk perceptions.

Though qualitative methods can give more insight into the perception of the individual, the measurement tool used here has been validated before and refined over the last 25 years.

Also, the fact that cultural theory is seen as more likely to explain patterns of risk perceptions as opposed to risk perceptions related to specific situations, means that this theory might produce more significant results when several public health issues are considered in relation to worldviews. Therefore, if this research is brought to the national level, it is recommended to ask about other healthcare debates as well.

Moreover, it needs to be recognized that cultural theory sees risk perceptions as connected to cultural and social processes. However, in doing that, the theory neglects individual differences and does not consider free will and the stability of worldviews over time.

5.2 Other Considerations: The Effect of Media on Risk Perceptions

In the literature review section, the impact of the media on risk perceptions was identified as an important consideration. Indeed, media might influence the relationships between worldviews and HPV vaccine risk perceptions.

There is a documented impact of the media on risk perceptions (e.g., Englander et al., 1986). This is particularly important for risks that are not personally experienced and,

therefore, knowledge of the risk in question is dependent on external information sources. For example, in Canada, the vaccine has been mainly advertised as being a personal concern (mostly a female concern) more than as a public health issue (Mah, Deber, Guttman, McGeer, and Krahn, 2011). This might explain why individualism is a better predictor in the Canadian context and why individualists would perceive the vaccine as safer. In the United States context, the vaccine seems to have been portrayed as being more controversial with more opposition from religious groups that painted a picture of the HPV vaccine as being a moral issue (Kahan et al., 2010).

5.3 Future Research and Implications of This Study

Since there are different worldviews, these should all be fairly represented in policy decisions. Also, the recognition that worldviews may influence views on a topic might make everyone more tolerant of each other's views. Whether worldviews are biasing or informing individuals about what they care the most, the recognition of the role that worldviews play is important in policy discussions can create more trust between different parties.

This insight regarding representativeness of different worldviews can be applied to the issue at hand. One of the main findings in the present study is that individualism predisposition can influence perceptions of the vaccine. There is therefore a need to emphasize benefits for individualists and communitarians and not present the information about the vaccine as benefiting one group over the other. A promising avenue of research would therefore consist of risk communication and framing procedures for the HPV vaccine in particular.

Moreover, a replication of this pilot study at the national level would also be needed in order to confirm the studies from this research. In this replication, relevant demographics should be controlled for. In this study, the validity of the healthcare questions could be more thoroughly tested. Also, as it was mentioned before in section 5.2, it might be more beneficial to assess several healthcare controversies at one time in relation to worldviews. This is because the cultural theory might be more able to predict risk perceptions across controversies than specific debates.

This future work should also consider adding an “argument” condition in the design of the study, similar to Kahan et al. (2010) study. Indeed, having a condition where the respondent is presented with a text (for or against) of the issue at hand, should theoretically increase the positions of the respondents. In this way, there would be more variability in responses and it would be easier to detect statistically significant results. In a small sample size study such as ours, this would have been particularly advisable.

Since students in business are more likely to be in management positions later on (and can therefore act as key persons for promoting certain healthcare initiatives), it is important to consider how their worldviews differ from other groups. Also, educating those in healthcare-related professions on the different outlooks that people hold and how this might relate to perceptions of new healthcare products might help them have a less biased judgment, which is important in their profession. This study shows evidence that this would be the case for the HPV vaccine in particular.

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Appendix 1 Questionnaire Used in this Study

Questionnaire Part 1

Q1.1 If you want to take this survey in English, click on the upper right icon titled "English." You can switch at any time during this survey. Si vous voulez prendre ce questionnaire en Français, cliquez sur "Français" dans le coin haut à droite. Vous pouvez changer la langue à n'importe quel moment.

Q2.1 Check the appropriate box to indicate whether or not you agree with the consent form

- ☐ Yes, I agree (1)
- ☐ No, I don't agree (2)

Q2 Do you want to be entered for a chance to win an iTunes gift certificate of \$30?

- ☐ Yes (1)
- ☐ No (2)

Q3.1 If yes, re-enter your uottawa e-mail address. Note: this information will be kept separate from your other responses and will be deleted once the prizes are awarded.

Q4.1 Enter your username. NOTE: your username is your uottawa e-mail address

Q4.2 Create a password. NOTE: the password must have exactly 4 characters.

Q4.3 Retype the password. You will need it to access the second part of this study.

Q5.1 What is your age?

- ☐ 16-19 (1)
- ☐ 20-24 (2)
- ☐ 25+ (3)

Q5.2 What is your gender?

- ☐ Male (1)
- ☐ Female (2)

Q5.3 What is the degree you are currently enrolled in at the university of Ottawa?

Q5.4 What year are you currently in?

- ☐ 1st year (1)
- ☐ 2nd year (2)
- ☐ 3rd year (3)
- ☐ 4th year (4)
- ☐ other (5) _____

Q5.5 Are you familiar with the HPV vaccine and the issues surrounding its use?

- ☐ Yes (1)
- ☐ No (2)

Q5.6 Have you ever been vaccinated against HPV?

- ☐ Yes (1)
- ☐ No (2)

Q5.7 Would you be willing to take the vaccine?

- ☐ Yes (1)
- ☐ No (2)

Q5.8 Enter here any comments you may have:

Q6.1 People in our society often disagree about issues of equality and discrimination. How strongly you agree or disagree with each of these statements?

Q6.2 We have gone too far in pushing equal rights in this country.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q6.3 Our society would be better off if the distribution of wealth was more equal.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q6.4 We need to dramatically reduce inequalities between the rich and the poor, immigrants and Canadians, men and women.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q6.5 Discrimination against minorities is still a very serious problem in our society.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)

- ☐ strongly agree (6)

Q6.6 It seems like immigrants, blacks, women, homosexuals and other groups don't want equal rights, they want special rights just for them.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q6.7 Society as a whole has become too soft and feminine.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q6.8 Enter here any comments you may have:

Q7.1 People in our society often disagree about how far to let individuals go in making decisions for themselves. How strongly you agree or disagree with each of these statements?

Q7.2 The government interferes far too much in our everyday lives.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q7.3 Sometimes government needs to make laws that keep people from hurting themselves.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q7.4 It's not the government's business to try to protect people from themselves.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q7.5 The government should stop telling people how to live their lives.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q7.6 The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)

- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q7.7 Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.

- ☐ strongly disagree (1)
- ☐ moderately disagree (2)
- ☐ slightly disagree (3)
- ☐ slightly agree (4)
- ☐ moderately agree (5)
- ☐ strongly agree (6)

Q7.8 Enter here any comments you may have:

Questionnaire Part 2

Q1.1 If you want to take this survey in English, click on the upper right icon titled "English." You can switch at any time during this survey. Si vous voulez prendre ce questionnaire en Français, cliquez sur "Français" dans le coin haut à droite. Vous pouvez changer la langue à n'importe quel moment.

Q2 Check the appropriate box to indicate whether or not you agree with the consent form

- ☐ Yes, I agree (1)
- ☐ No, I don't agree (2)

Q3 Do you want to be entered for a chance to win an iTunes gift certificate of \$30? If yes, re-enter your uottawa e-mail address. Note: this information will be kept separate from your other responses and will be deleted once the prizes are awarded.

E-mail address (1)

Re-enter your e-mail address (2)

Q4.1 This section is about healthcare attitudes. Different people have different opinions. Please rate, on a scale of 1 to 6, how strongly you agree or disagree with the following statements.

Q4.2 The best way to properly run a healthcare system is to think of it as a business with consumers, prices, and providers.

- ☐ Strongly disagree (1)
- ☐ Moderately disagree (2)
- ☐ Slightly disagree (3)
- ☐ Slightly agree (4)
- ☐ Moderately agree (5)
- ☐ Strongly Agree (6)

Q4.3 Drug coverage should be part of the universal healthcare insurance.

- ☐ Strongly disagree (1)
- ☐ Moderately disagree (2)
- ☐ Slightly disagree (3)
- ☐ Slightly agree (4)
- ☐ Moderately agree (5)
- ☐ Strongly agree (6)

Q4.4 An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those socially advantaged and disadvantaged.

- ☐ Strongly disagree (1)
- ☐ Moderately disagree (2)
- ☐ Slightly disagree (3)
- ☐ Slightly agree (4)
- ☐ Moderately agree (5)
- ☐ Strongly agree (6)

Q4.5 Policy decisions should be based more on the formal approaches of policy makers than on the values of the general population.

- ☐ Strongly disagree (1)
- ☐ Moderately disagree (2)
- ☐ Slightly disagree (3)
- ☐ Slightly agree (4)
- ☐ Moderately agree (5)
- ☐ Strongly agree (6)

Q4.6 Patients should be given more decision-making power when it comes to their own health and lifestyle.

- ☐ Strongly disagree (1)
- ☐ Moderately disagree (2)
- ☐ Slightly disagree (3)

- ☐ Slightly agree (4)
- ☐ Moderately agree (5)
- ☐ Strongly agree (6)

Q4.7 Enter here any comments you may have:

Q5.1 Some public health experts favor universal vaccination program for Canadian girls (at or before age 12) to protect them from being infected with human papillomavirus (HPV). Other public health experts oppose such a program. Please rate, on a scale of 1 to 4, how strongly you agree with the following items concerning the HPV vaccine. NOTE: the phrase "young women" shall be used throughout this section as a short form for the phrase "girls and young women"

Q5.2 It is important to devise public health policies to reduce the spread of HPV.

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Agree (3)
- ☐ Strongly agree (4)

Q5.3 The HPV vaccine is safe for use among young women.

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Agree (3)
- ☐ Strongly agree (4)

Q5.4 Universal HPV vaccination program for girls will likely endanger their health.

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Agree (3)
- ☐ Strongly agree (4)

Q5.5 Universal HPV vaccination program for girls will lead girls to become more sexually active.

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Agree (3)
- ☐ Strongly agree (4)

Q5.6 Young women vaccinated against HPV are more likely to engage in sex without a condom.

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Agree (3)
- ☐ Strongly agree (4)

Q5.7 How beneficial would you say universal HPV vaccination program for girls is likely to be?

- ☐ Not at all beneficial (1)
- ☐ Slightly beneficial (2)
- ☐ Moderately beneficial (3)
- ☐ Very beneficial (4)

Q5.8 How risky would you say universal HPV vaccination program for girls is likely to be?

- ☐ Not at all risky (1)
- ☐ Slightly risky (2)
- ☐ Moderately risky (3)
- ☐ Very risky (4)

Q5.9 Enter here any comments you may have:

Appendix 2 Reliability Analyses

Hierarchism Scale

Round 1

As can be seen below, the original cronbach's alpha is .71 . This was considered sufficient for the present study and no more revisions were performed on this scale. Moreover, if an item would have been deleted, the alpha would have gone up only to .720 (see item-total statistics table).

Table 14. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.71	0.71	6

Table 15. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
We have gone too far in pushing equal rights in this country.	13.67	25.94	0.39	0.30	0.69
Our society would be better off if the distribution of	12.79	21.49	0.55	0.48	0.64

wealth was more equal.					
We need to dramatically reduce inequalities between the rich and the poor, immigrants and Canadians, men and women.	13.21	22.10	0.54	0.53	0.65
Discrimination against minorities is still a very / serious problem in our society.	13.03	23.97	.39	.27	.69
It seems like immigrants, blacks, women, homosexuals / and other groups don't want equal rights, they want special rights just for / them.	13.14	21.25	0.53	0.32	0.65
Society as a whole has become too soft and feminine.	13.21	26.33	0.29	0.30	0.72

Individualism Scale

Round 1

For the individualism scale, the initial Chronbach's alpha was .47 . Since the deletion of item 3 would have increased this to .556, it was decided that item 3 will be deleted to increase Chronbach's alpha.

Table 16. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.47	0.48	6

Table 17. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
The government interferes far too much in our everyday lives.	17.35	11.62	0.25	0.17	0.42
Sometimes government needs to make laws that keep people from hurting themselves.	17.81	11.99	0.12	0.10	0.45
It's not the government's business to try to protect people from	17.37	13.17	-0.01	0.07	0.56

themselves.					
The government should stop telling people how to live their lives.	16.87	9.11	0.59	0.38	0.22
The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.	15.84	11.39	0.24	0.29	0.42
Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.	16.11	10.52	0.31	0.31	0.38

Round 2

With the deletion of item 3 from the individualism scale, Chronbach's alpha increased to .56. Since the .70 cut-off had not been reached and, since the deletion of item 2 would have increased the alpha coefficient to .65, item 2 was deleted.

Table 18. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.56	0.56	5

Table 19. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
The government interferes far too much in our everyday lives.	14.44	9.99	0.28	0.16	0.52
Sometimes government needs to make laws that keep people from hurting themselves.	14.90	11.02	0.06	0.08	0.65
The government should stop telling people how to live their lives.	13.97	7.81	0.59	0.39	0.33
The government should do more to	12.94	9.35	0.33	0.28	0.49

advance society's goals, even if that means limiting the freedom and choices of individuals.					
Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.	13.21	8.65	0.39	0.31	0.46

Round 3

After item 2 and 3 were deleted, the new alpha coefficient became .65 . The deletion of item 1 would have increased the coefficient to .69 . However, since the scale had now only 4 items (thus decreasing the range of the composite score) and since the deletion of this item would have only increased the reliability coefficient by .39 , item 1 was kept.

Table 20. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.65	0.64	4

Table 21. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
The government interferes far too much in our everyday lives.	11.98	8.18	0.25	0.16	0.69
The government should stop telling people how to live their lives.	11.51	6.29	0.56	0.33	0.48
The government should do more to advance society's goals, even if that means limiting the	10.48	6.96	0.42	0.27	0.58

freedom and choices of individuals.					
Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.	10.75	6.29	0.49	0.30	0.53

HPV Vaccine Risk Perceptions Scale

Round 1

The same process was used with the HPV vaccine risk perceptions scale. In the first round, the alpha coefficient for this scale was 0.44. However, the deletion of item 1 from this scale would have increased this coefficient to 0.69. Therefore, item 1 was deleted and the analysis was rerun.

Table 20. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.44	0.51	7

Table 21. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
It is important to devise public health policies to reduce the spread of HPV.	14.89	7.08	-0.43	0.39	0.69
The HPV vaccine is safe for use among young women.	14.39	4.19	0.57	0.59	0.25
Universal HPV vaccination program for girls will likely endanger their health.	16.52	4.63	0.37	0.64	0.34

Universal HPV vaccination program for girls will lead girls to become more sexually active.	16.45	4.72	0.16	0.50	0.43
Young women vaccinated against HPV are more likely to engage in sex without a condom.	16.48	3.88	0.47	0.57	0.25
How beneficial would you say universal HPV vaccination program for girls is likely to be?	14.55	4.11	0.39	0.60	0.30
How risky would you say universal HPV vaccination program for girls is likely to be?	16.36	4.42	0.29	0.35	0.36

Round 2

In Round 2, it was noticed that Chronbach's alpha had now reached a more or less satisfactory level. However, the deletion of item 4 would have increased this coefficient to 0.75 (a .58 difference). Therefore item 4 was deleted from the analysis also.

Table 22. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.69	0.72	6

Table 23. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
The HPV vaccine is safe for use among young women.	11.00	5.02	0.66	0.59	0.59
Universal HPV vaccination program for girls will likely endanger their health.	13.14	5.33	0.534	0.63	0.63
Universal HPV vaccination program for girls will lead girls to become more sexually active.	13.07	5.88	0.15	0.46	0.75
Young women	13.09	5.20	0.37	0.52	0.67

vaccinated against HPV are more likely to engage in sex without a condom.					
How beneficial would you say universal HPV vaccination program for girls is likely to be?	11.16	4.70	0.55	0.57	0.61
How risky would you say universal HPV vaccination program for girls is likely to be?	12.98	5.19	0.40	0.32	0.66

Round 3

In round 3, it is noticed that the deletion of item 5 (i.e. Young women vaccinated against HPV are more likely to engage in sex without a condom) would have increased the reliability to .83 . However, the range of the HPV vaccine risk perception scale was only from 10 to 15 within the present sample. The deletion of item 5 would have reduced this range even more, making it more difficult to conduct analysis. Since the criterion of .70 had been reached and that the range of this variable would have been compromised for the present sample, item 5 was kept.

Table 24. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.75	0.77	5

Table 25. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
The HPV vaccine is safe for use among young women.	9.18	3.87	0.73	0.59	0.63
Universal HPV vaccination program for girls will likely endanger their health.	11.32	4.08	0.63	0.62	0.67
Young women vaccinated against HPV are more likely	11.27	4.76	0.16	0.15	0.83

to engage in sex without a condom.					
How beneficial would you say universal HPV vaccination program for girls is likely to be?	9.34	3.44	0.66	0.56	0.64
How risky would you say universal HPV vaccination program for girls is likely to be?	11.16	3.86	0.51	0.29	0.70

Healthcare Questions Scale

Round 1

The same process was used with the Healthcare Questions scale. In the first round, the alpha coefficient for this scale was 0.37. However, the deletion of item 1 from this scale would have increased this coefficient to 0.57. Therefore, item 1 was deleted and the analysis was rerun.

Table 26. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.37	0.38	5

Table 27. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
The best way to properly run a healthcare system is to think of it as a business with consumers, prices, and providers.	16.80	11.93	-0.14	0.22	0.57
Drug coverage should be part of the universal healthcare insurance.	14.11	9.87	0.16	0.26	0.34
An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those socially advantaged and	14.52	7.70	0.31	0.41	0.200

disadvantaged.					
Policy decisions should be based more on the formal approaches of policy makers than on the values of the general population.	16.55	9.42	0.20	0.14	0.31
Patients should be given more decision-making power when it comes to their own health and lifestyle.	14.75	7.63	0.49	0.48	0.06

Round 2

In Round 2, the coefficient alpha was 0.57. The deletion of item 4 would have increased the reliability to 0.70. Therefore, item 4 was deleted also.

Table 28. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.57	0.56	4

Table 29. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Drug coverage should be part of the universal healthcare insurance.	11.73	8.11	0.34	0.17	0.50
An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those	12.14	6.35	0.43	0.41	0.41

socially advantaged and disadvantaged.					
Policy decisions should be based more on the formal approaches of policy makers than on the values of the general population.	14.16	9.86	0.06	0.02	0.70
Patients should be given more decision-making power when it comes to their own health and lifestyle.	12.36	6.42	0.63	0.48	0.26

Round 3

In round 3, it is noticed that the deletion of item 2 would have increased the reliability to 0.77. However, since the main purpose of combining the healthcare questions was so that a continuous variable with a bigger range would be formed, and given that the current alpha approximated 0.70, item 2 was kept.

Table 30. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.70	0.70	3

Table 31. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Drug coverage should be part of the universal healthcare insurance.	9.09	6.22	0.36	0.17	0.77
An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those	9.50	4.26	0.53	0.41	0.58

socially advantaged and disadvantaged.					
Patients should be given more decision-making power when it comes to their own health and lifestyle.	9.73	4.67	0.68	0.47	0.40

Appendix 3 Description of Continuous Variables

Table 32. Descriptives for the Continuous Variables Used in this Study

Variable	N	Mean	SD	Possible Range	Actual Range	Reliability Coefficient
Hierarchism Scale (Only Reliable Items)	63	0.81	5.66	-9 to 22	-9 to 12	0.71
Individualism Scale (Only Reliable Items)	63	0.90	3.32	-10 to 10	-6 to 8	0.65
HPV Vaccine Risk Perceptions Scale (Only Reliable Items)	44	11.84	1.08	4-20	10-15	0.75
Healthcare Items Scale (Individualism)	63	8.70	1.61	3-18	6-13	0.70
Healthcare Items Scale (Hierarchism)	63	6.84	3.14	3-18	3-18	0.70

Appendix 4 Description of Categorical Variables

Table 33. Demographics (gender, age, degree, year of study)

Characteristics	N	%
<i>Gender (N=63)</i>		
Male	15	23.8%
Female	48	76.2%
<i>Age (N=63)</i>		
16-19	31	49.2%
20-24	31	49.2%
25+	1	1.6%
<i>Degree (N=63)</i>		
Missing	3	4.8%
Business Degree	45	71.4%
Health Sciences Degree	14	22.2%
Other	1	1.6%
<i>Year of Study (N=63)</i>		
1 st	3	4.8%
2 nd	42	66.7%
3 rd	10	15.9%
4 th	7	11.1%
5 th and other	1	1.6%

Table 34. Gender and Degree Variables

Characteristics	N	%
<i>Males versus Females in Business (N=45)</i>		
Male	15	33.3%
Female	30	66.7%
<i>Males in Business versus Females in Health Sciences (N=30)</i>		
Male	15	50.0%
Female	15	50.0%
<i>Females in Business versus Females in Health Sciences (N=44)</i>		
Male	29	65.9%
Female	15	34.1%

Table 35. Familiarity, Willingness to Vaccinate and Previous Vaccination

Characteristics	N	%
<i>Familiarity with HPV Vaccine and Issues Surrounding this Vaccine (N=63)</i>		
Yes	46	73.0%
No	17	27.0%
<i>Willingness to Take the HPV Vaccine (N=62)</i>		
Yes	42	66.7%
No	20	31.7%
<i>Previous Vaccination with HPV (N=63)</i>		
Yes	27	42.9%
No	36	57.1%

Table 36. Healthcare Items and Agreement (N=63)

Item	Strongly disagree %	Moderately disagree %	Slightly disagree %	Slightly agree %	Moderately agree %	Strongly agree %
The best way to properly run a healthcare system is to think of it as a business with consumers, prices, and providers.	34.1%	27.3%	18.2%	9.1%	9.1%	2.3%
Drug coverage should be part of the universal healthcare insurance.	34.1%	27.3%	18.2%	9.1%	9.1%	2.3%
An important test of the success of the Canadian health care system is whether it has managed to close the gap in health between those socially advantaged and disadvantaged.	9.1%	2.3%	2.3%	22.7 %	27.3%	36.4%
Policy decisions should be based more on the formal approaches of policy makers than on the values of the general population.	18.2%	36.4%	20.5%	13.6%	11.4%	0.0%
Patients should be given more decision-making power when it comes to their own health and lifestyle.	2.3%	4.5%	13.6%	29.5%	27.3%	22.7%

Table 37. Hierarchism Items and Agreement (N=63)

Item	Strongly disagree %	Moderately disagree %	Slightly disagree %	Slightly agree %	Moderately agree %	Strongly agree %
We have gone too far in pushing equal rights in this country	38.1%	30.2%	15.9%	11.1%	4.8%	0.0%
Our society would be better off if the distribution / of wealth was more equal.	19.0%	23.8%	25.4%	7.9%	15.9%	7.9%
We need to dramatically reduce inequalities between the rich and the poor, immigrants and Canadians, men and women.	30.2%	23.8%	22.2%	7.9%	11.1%	4.8%
Discrimination against minorities is still a very serious problem in our society.	25.4%	22.2%	25.4%	7.9%	14.3%	4.8%
It seems like immigrants, blacks, women, homosexuals and other groups don't want equal rights, they want special rights just for them.	38.1%	15.9%	7.9%	22.2%	11.1%	4.8%
Society as a whole has become too soft and feminine.	25.4%	28.6%	15.9%	22.2%	6.3%	1.6%

Table 38. Individualism Items (N=63)

Item	Strongly disagree %	Moderately disagree %	Slightly disagree %	Slightly agree %	Moderately agree %	Strongly agree %
The government interferes far too much in our everyday lives.	3.2%	34.9%	33.3%	15.9%	11.1%	0.0%
Sometimes government needs to make laws that keep people from hurting themselves.	4.8%	3.2%	7.9%	23.8%	38.1%	22.2%
It's not the government's business to try to protect people from themselves.	11.1%	31.7%	28.6%	17.5%	6.3%	4.8%
The government should stop telling people how to live their lives.	4.8%	17.5%	33.3%	25.4%	15.9%	3.2%
The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.	1.6%	1.6%	23.8%	17.5%	36.5%	19.0%
Government should put limits on the choices individuals can make so they don't get in the way of what's good for society.	1.6%	11.1%	17.5%	22.2%	34.9%	12.7%

Table 39. HPV vaccine risk perception items (1 through 12) (N=44)

Item	Strongly disagree %	Disagree %	Agree %	Strongly agree %
It is important to devise public health policies to reduce the spread of HPV.	4.5%	6.8%	34.1%	54.5%
The HPV vaccine is safe for use among young women.	2.3%	4.5%	72.7%	20.5%
Universal HPV vaccination program for girls will likely endanger their health.	29.5%	68.2%	0.0%	2.3%
Universal HPV vaccination program for girls will lead girls to become more sexually active.	36.4 %	50.0%	9.1%	4.5%
Young women vaccinated against HPV are more likely to engage in sex without a condom.	40.9 %	38.6%	20.5%	0.0%
How beneficial would you say universal HPV vaccination program for girls is likely to be?	2.3%	11.4%	43.2%	43.2%
How risky would you say universal HPV vaccination program for girls is likely to be?	29.5 %	52.3%	15.9%	2.3%

Table 40. Individualism Categorical Variable

Characteristics	N	%
Individualism Categories (<i>N</i> =63)		
Communitarian	21	33.3%
Between Communitarian and Individualistic	13	20.6%
Individualistic	29	46.0%

Table 41. Individualism Extreme Groups

Characteristics	N	%
Individualism Categories (<i>N</i> =50)		
Communitarian	21	42.0%
Individualist	29	58.0%

Table 42. Hierarchism Categorical Variable

Characteristics	N	%
Hierarchism Categories (<i>N</i> =63)		
Egalitarian	25	39.7%

Between Egalitarian and Hierarchical	9	14.3%
Hierarchical	29	46.0%

Table 43. Hierarchism Extreme Groups

Characteristics	N	%
Hierarchism Categories (<i>N</i> =53)		
Egalitarian	25	46.3%
Hierarchical	29	53.7%

Table 44. HPV vaccine risk perceptions Categorical Variable

Characteristics	N	%
HPV Vaccine Risk Perceptions Categories (<i>N</i> =44)		
Low risk-benefit ratio	17	38.6%
Moderate risk-benefit ratio	25	56.8%
High risk-benefit ratio	2	4.5%

Table 45. HPV vaccine risk perceptions Dichotomous Variable

Characteristics	N	%
HPV Vaccine Risk Perceptions Categories (<i>N</i> =19)		
Low risk-benefit ratio	17	89.5%
High risk-benefit ratio	2	10.5%

Appendix 5 Assumptions and Explanations for Multiple Regression

Table 46. Assumptions and Explanation for Multiple Regression

	Description	Detection	How To Deal With It
Correct Specification of the Form of the Relationship Between IVs and DVs	The relationship between all independent variables and the dependent variable should be linear. In other words, linearity between each pair of any variables used in the regression model is assumed.	Create scatterplots for all pairs of variables	Transformations (e.g. log or exponential)
Correct Specification of the Independent Variables in the Regression Model	All the variables that were supposed to be included were included. Moreover, they were included in the way that they are supposed to, which means that they were 1) valid and 2) there are linear relationships between all pairs of variables.	Create scatterplots by following the procedure below: 1. Conduct the regression analysis and save the residuals 2. Use the residuals on the y axis and, on the x axis, put a variable that	Add the independent variable that is missing

		would be a candidate for the regression The omitted variable should be considered in subsequent analysis if the graph (or lowess line fitted to the data) suggests a systematic relationship (either linear or curvilinear)	
No Measurement Error in the Independent Variable (Perfect Reliability)	• each IV in the regression equation is assumed to be measured without error • reliability is defined as the correlation between the measure as measured in this context with another equivalent measure	Reliability measures should be used	Include variables that are properly measured
Constant Variance	• for any value of	Statistical tests such	Use weighted least

of Residuals (Homoscedasticity)	the IV, the conditional variance of the residuals around the regression line is assumed to be constant • when there is heteroscedasticity, the regression coefficients are correctly estimated, but their standard errors, CIs and significance tests may be incorrect ○ in practice, the nonconstant variance will not be a problem unless the violation is big	as Levene's can be used. In the Levene test, the desired outcome is to have a NONsignificant result (i.e. to fail to reject the null hypothesis) Scatterplots in which the residuals are on the x axis and the predicted variable is on the y axis can be used as well. There should be no relationship (linear or curvilinear) in this graph	regression
Independence of Residuals	• if data are clustered or temporally linked, the residuals may not be independent	Index plots (i.e. casewise plots) can be used. No relationship should be discerned in these graphs.	If it is due to clustering, use dichotomous variables to identify group membership and

	• in the multiple IV case, the variance of the residuals should not be related to any of the IVs or predicted Y • clustering ○ occurs when data are collected from groups • temporally linked ○ occurs when the same measures are collected over a period of time	Scatterplots where the residuals are on the y axis and the x axis is occupied by any of the other variables in the model should show no pattern.	use that new variable in the regression. If it is due to time series dependency (e.g. measures taken at different points in time), then a Lag 1 autocorrelation should be used.
Normality of Residuals	• for any value of the IV X, the residuals around the regression line are assumed to have a normal distribution • violation of this assumption does not bias the estimate of the regression	Histograms of the residuals and/or normal q-q plots can be used	Nonnormality of residuals may indicate errors in the specification of the regression model.

	coefficients, though it does have an effect on the standard errors, CIs, and significance tests; the effect of this bias depends on the sample size • nonnormality of residuals usually signals other problems (e.g. misspecification of the regression model)		
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