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The Value of Statistical Life for College Students in the Context of Death by Homicide

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Abstract
The Value of Statistical Life (VSL) is used in policy analysis to calculate the benefit of risk-reducing policy initiatives. College students are currently overlooked in the literature, for no college student-specific VSL estimate exists. In this study, I discuss why VSL estimates for the general population cannot be applied to college students. I also derive a college student-specific VSL using a willingness-to-pay survey. I found that payment vehicle has a large impact on students' willingness-to-pay for risk reduction, and college student VSLs are substantially lower than those of the general population.

Introduction

The United States' increase in mass shootings has hit home particularly hard on college campuses (Kaminski 2010). In 2015 alone, college campuses in the United States experienced 23 shootings (Sanburn 2015), reflecting a growing number of these incidents on college campuses.

A study by the New York Crime Commission states, "When students and parents consider criteria for choosing a college, campus safety is typically not at the top of the list. But most students and parents probably don't realize that gun violence at colleges has exploded over the past five school years, increasing from just 12 incidents during the 2010-2011 school year to nearly 30 during the 2015-2016 school." (Cannon 2016). The increasing number of incidents and media coverage has fueled conversation regarding improved campus safety initiatives.

The increased conversation can be seen in Google search analytics. The number of people worried about campus safety conditions has increased. According to Google Trends, Google searches for "college campus safety" have increased 50% since 2011, with searches for "campus safety [phone] number" increasing 200% over that same time period. Given that legislation tends to be the fruit of public worry, the increased concern for keeping students safe means that accurate data on students will be more important than ever for evaluating related policy proposals.

The current literature surrounding the Value of Statistical Life, a method for valuing human life in policy analysis, is missing representation from the unique, but crucial demographic: college students. Value of Statistical Life estimates have been found to vary based on both demographic characteristics and the cause of death being studied. Due to college students' distinct living and financial situations, simply applying an existing estimate to college students is not adequate. Not having a college student-specific Value of Statistical Life estimate could result in policy analysts basing cost-benefit analyses of life-saving regulations on inaccurate information, especially those heavily impacting college students.

In this study, I use a willingness-to-pay survey to answer the question: "What are college students' VSLs in the context of death by homicide?" My paper begins with a review of the existing literature. I explain the role of VSL in the policy analysis arena, the causes of the wide range of VSL estimates, and why college students are distinct

from members of the general population, and thus, require a separate VSL estimate. Next, I outline the development and administration of my survey, including how I worked to mitigate hypothetical bias. Lastly, I outline and interpret my results.

Literature Review

I begin the literature review by explaining the role of the Value of Statistical Life in policy analysis. Next, since there are currently no studies examining college students' Value of Statistical Life, I focus on estimates of the Value of Statistical Life for the overall population, examining what variables impact a person's willingness-to-pay for safety enhancing measures. After highlighting why these existing studies cannot be adjusted to form a student-specific VSL estimate, I hypothesize how the effects of these variables on the overall population might apply to the VSL for college students.

Value of Statistical Life in Policy Analysis

The guiding principle of Microeconomics is that an activity should be continued until the reward of an additional unit of that activity (marginal benefit) equals the cost of an additional unit of that activity (marginal cost). These are calculated and compared through a cost-benefit analysis. Cost-benefit analysis is a tool that is the foundation of many types of policy analysis, including crime (Streff et. al. 1992), and its use has grown in OECD countries (Lindhjem et. al. 2004).

It is fairly easy for economists to calculate the marginal cost of a government regulation. To give an example, the cost of a regulation requiring factories to install filters would be the monetary value of purchasing and installing the filters. While the benefit of installing these filters could be the number of human lives saved, a conversion is needed to compare the number of human lives saved to the dollar cost of the filters. To be able to compare these two numbers, economists developed the Value of Statistical Life (VSL) (Banzhaf et. al. 2004).

The Value of Statistical Life is based on the dollar amount "which [a person] is willing to pay for small reductions in mortality risk" (Viscusi 2009, 105). For example, if an individual were willing to pay $10,000 to eliminate a risk that has a 1/200 chance of killing him or her, that individual's VSL would be $2,000,000 or $10,000/[1/200].

By converting human lives saved to a monetary value, economists can compare the marginal cost and marginal benefit of a life-saving initiative. Stemming from the VSL is a measure called the Value of Statistical Life Year (VSLY). The VSLY is the VSL on a per-year basis with an applied discount rate, and can be used as a substitute for VSL (Hammitt 2008, 37). As will be further discussed later, the Value of Statistical Life Year, used in combination with the standard VSL, presents an important substitute of what can be derived from a VSL estimate.

The VSLY is especially helpful when accounting for the difference in VSLs for people of different ages. The effect of age on VSL is ambiguous, with some estimates showing large differences and others showing that age has no effect. Shepard and Zeckhauser (1984) finds an inverted U-shape when it comes to the relationship between age and VSL estimates, with the VSL peaking for one's life at around age 40. Johansson (2002) finds no real relationship between age and VSL. Viscuci and Aldy (2007) uses revealed preference to find VSL varies with age, and states, "Whether the VSL should vary by age is not a matter of equity or political expediency. Rather it should be grounded on estimates of how people's willingness-to-pay for risk reduction varies with age. As we age, our life expectancy shortens, but our economic resources vary as well...it is clear that VSL does vary with age." (Aldy and Viscuci 2007). O'Brien (2014) agreed with the statement by Aldy and Viscuci, finding a strong inverted-U relationship between age and VSL estimates. Despite the inconsistent conclusions in the literature regarding VSL variation with age, WTP estimates are partially driven by the economic resources available to the respondent, which generally vary with age. Deriving a VSLY estimate in addition to the VSL provides an additional measure to compare students to the overall population (Sunstein 2003).

Recently, the most common method for VSL calculation has been stated preference (OECD 2011). However, there are differences depending on where the research is being conducted. One report states, "The main difference between the US and Europe is the reliance of Revealed Preference (RP) methods in terms of wage risk

studies in the US (where most such studies have been conducted), while Europe relies on Stated Preference methods." Stated preference is a method of VSL estimation that involves directly or indirectly asking people how much money they would pay to reduce, or accept to increase, a certain risk of ending their life. Another way of evaluating VSL is revealed preference, in which researchers look at data such as averting costs (i.e. money spent on vaccines to prevent a fatal illness) and hedonic wage (i.e. looking at a labor market where wages are affected by risk of death). Given that revealed preference estimates are largely found in hedonic wage studies (OECD 2011), students' financial situations make a stated preference estimate more fitting for this study.

Both stated preference and revealed preference methods can be used to estimate two types of Value of Statistical Life estimates. The first is Willingness-to-Pay (WTP). This involves finding out how much a participant is willing to pay to reduce their risk of a certain harmful event. The second is Willingness-to-Accept (WTA). WTA estimates find how much money participants are willing to accept to take on additional risk. In the context of asking students what they would pay for additional safety initiatives, WTP is in line with the question this study seeks to answer.

Regardless of the method used to acquire the data, current Value of Statistical Life estimates are very inconsistent and often times depend heavily on the method used to acquire data. For example, one meta-analysis showed that while many of the VSL estimates are below $7,000,000, there are estimates leading all the way up to and

over $30,000,000 (Lindhjem et. al. 2010). Although regulatory agencies take an average of estimates for their policy analyses, with such a wide range of respected estimates, it is difficult to argue that it makes sense to have a one-size-fits-all VSL estimate.

In addition, these estimates vary widely based on the cause of death affiliated with the estimate. For example, in a study comparing how people valued the risks of death due to terrorism attacks and natural disasters, researchers found that, "Those who have average terrorism risk beliefs value terrorism deaths almost twice as highly as natural disaster deaths" (Viscusi 2009). In a study comparing VSL estimates in road safety and air pollution, researchers found estimates in the context of air pollution to be 1.8 times higher than those in the context of road safety (Dekker 2011). In addition, there is a large difference between WTA and WTP estimates. One meta-analysis found that while the average median for WTA estimates was just below $40,000,000, the average median for WTP estimates was under $10,000,000 (Lindhjem 2010). Due to the large difference between estimates, estimates should not be treated as the same and simply averaged for use with any policy proposal. Rather than having a single, all-inclusive VSL estimate for every proposed policy initiative, it is clear that VSL estimates should be calculated based on the context of a specific policy proposal.

This type of cause of death-based inconsistency in VSL estimates underscores the need for VSL estimates specific to the context of different policy proposals, not one-size-fits-all estimates.

While VSL estimates have been found to vary depending on the context of the risk being assessed, age, and a variety of other factors, a number of the explanatory variables that have been studied to explain VSL estimate differentiation hold little or different meaning in the lives of college students. For example, rather than examining variables such as household size and income for college students, perhaps living situation (on- or off-campus) and percent of tuition paid by parents are more relevant indicators. With this in mind, my study fills the important hole in the literature of deriving a VSL and VSLY estimate for college students.

Prior Studies of VSLs for Young Adults

No research has been done to determine a Value of Statistical Life for college students. The study most closely resembling a college student VSL was conducted on college students willingness-to-pay for violent crime reduction in Portugal (Teixeira and Soeiro, 2013). This study found that being male and having a greater fear of crime positively influenced willingness-to-pay, whereas income had no statistically significant effect. The study did not include a comparison of the student estimate to the WTP of the general population in Portugal.

With this being said, it would be difficult to apply one estimate to both Portugal and the United States. As mentioned above, exposure to violent crime is shown to have an effect on the willingness-to-pay for violent crime reduction. According to the World Bank, Portugal had a homicide rate of 1 for every 100,000 people in 2012. In the United States, the homicide rate was 5 for every 100,000 people. Other differences between the countries, such as tuition rates, do not allow us to use this data to estimate a VSL that would apply to students in the US.

Factors that May Impact Student Value of Statistical Life

The existing body of VSL research has focused on the general population. While many studies have looked at how certain demographic attributes affect Value of Statistical Life estimates, many of these variables are irrelevant or have an entirely different meaning in the life of a college student versus that of a non-college student. As a result, we cannot take a VSL estimate 'off-the-shelf' and adjust it for college students. However, looking at the effect of these variables on the overall population, we can hypothesize how the college student-VSL would compare to that of the overall population.

For one, students may have a higher VSL than the overall population due to the tuition payment vehicle. Members of the general population would pay for crime reduction through increased taxes, for that is the general revenue stream for the governing bodies that fund law enforcement agencies. However, students generally pay for crime reduction through tuition. According to the Bureau of Justice Statistics

(2015), 75% of college campuses used armed officers in the 2011-2012 school year. This is a rising trend among colleges, for armed officers were only present on 68% of college campuses in the 2004-2005 school year. Since the college funds campus law enforcement, it is important to note that the payment vehicle for student safety initiatives would likely be tuition, not taxes.

What previous research does show us is that the payment vehicle used for contingent valuation does have an impact on the result. Ivehammar (2009) conducted three separate contingent valuation studies on reducing environmental encroachment. The researchers used one main payment vehicle, an increase in local taxes for ten years, and compared the results to three alternative payment vehicles. The alternate vehicles were the redistribution of existing tax revenue, a voluntary contribution, and an obligatory earmarked charge. All alternatives were set on a per-year basis for ten years. The researchers found, "Redistribution of already collected tax money can give higher WTP than raised taxes or a new fee, while donations as a vehicle payment results in lower (or the same) WTP" (Ivehammar, 2009).

It is unclear how an increase in tuition would fit into this specific model. It could be considered similar to a new fee, or given that many students' tuition is paid for by their parents without much mind for the specific breakdown of expenses, it could have an effect similar to a redistribution of already collected tax money. Regardless of its effect, Ivehammar demonstrated that the payment vehicle does matter, and

with a vehicle as unique as tuition increases, it is another reason that college students require a separate VSL estimate.

In regards to tuition overall, Hemelt and Marcotte (2008) found price elasticity for college was relatively inelastic, for a 1% increase in price resulted in only a -0.1% decrease in enrollment. This goes to show students are not extremely responsive to tuition increases, and therefore, would likely be willing to pay more for a safety initiative funded by a tuition increase.

On the other hand, students may have a lower VSL estimate than the general population due to having lower incomes. Ludwig and Cook (2001) found that willingness-to-pay for violent crime reduction increases with household income. Evans and Viscuci (1993) attribute the income effect to avoiding loss in utility. In effect, the higher the income, the greater utility that could be lost from injury or death. With these effects in mind, we would expect college students' VSLs to be lower than the overall population, for their incomes are generally smaller, and in most cases, they are not living in large households.

This leads to two hypotheses for how the college student-specific estimate will relate to that of the general population. The first hypothesis is that student VSLs will be greater than that of the general population due to the tuition payment vehicle. The second hypothesis is that student VSLs will be lower than the general population due to students having lower income.

Methodology

To find a college student Value of Statistical Life and test my two hypotheses, I developed a questionnaire to determine what students would be willing to pay for homicide-reducing safety initiatives.

Survey Development

Just as WTP surveys for the overall population are designed to determine what factors influence individual's WTP estimates, my survey was designed to determine the impact of those factors for college students.

I begin my survey by asking the participant their age and the number of full semesters remaining in their undergraduate career, for the safety initiatives would only reduce risk during their time as an undergraduate student. To determine the effect of income on VSL, the survey then asks for their household and personal incomes, respectively.

To determine the full effect of payment vehicle on VSL, it is important to see the breakdown of how a student pays for his or her tuition. The survey asks students what percentage of their tuition is funded by himself or herself, their parents, and merit/need-based aid. Controlling for these factors will help determine how much payment vehicle plays a role in WTP for risk reduction initiatives.

The survey asks students what age they expect to live until. As will be discussed later, this number is used to help calculate the Value of Statistical Life Year.

The student is then told that according to Census data, about 12 in 10,000 people ages 15-24 will die by homicide in the next year. Based on that number, the student is asked what they believe their probability is of death by homicide over the next year. This information is used to provide a more full picture of how William & Mary students perceive their risk compared to the overall population.

Finally, the student is asked two WTP questions. Both questions begin as follows: *Suppose that the William & Mary Police Department and Williamsburg Police Department are considering an initiative that will lower your risk of death by homicide 25% for the rest of your time as a college student (even when you are not physically at the College). In other words, if your stated risk of homicide were 20 in 10,000 before the initiative, it would now be 15 in 10,000.*

The first question asks how much money the student would be willing to pay for such an initiative through a tuition increase. The second question asks how much money the student would be willing to pay out-of-pocket. The risk reduction in each question is kept consistent in order to isolate the effect of the payment vehicle on each student's willingness-to-pay. Additionally, both questions specify that the cost will not be covered by merit/need-based aid.

Mitigating Biases from Willingness-to-Pay Estimates

With stated preference willingness-to-pay estimates, it is important that the number that the respondents record be as close to the actual number he or she would choose to pay in the real life situation. To find a realistic willingness-to-pay estimate, we must work to eliminate hypothetical bias. Loomis (2013) defines hypothetical bias as, "the difference between what a person indicates they would pay in the survey or interview and what a person would actually pay." A meta-analysis of stated preference WTP estimates by Murphy et. al. (2005) found an average overstatement of 1.35; in other words, the willingness-to-pay a respondent lists on a survey, on average, is 35% higher than the amount he or she would be willing to pay in the actual situation. To have results that reflect a respondent's actual willingness-to-pay, it is important to take steps to mitigate the effect of hypothetical bias in my questionnaire.

Considering that this is an ex ante survey, or a survey that asks about an event in advance of an event happening, I turned to Loomis (2013) to incorporate strategies for reducing hypothetical bias in ex ante willingness-to-pay surveys. Loomis states, "There are four primary ex ante survey design approaches: (1) emphasize consequentiality of the survey and respondents' choices; (2) urge respondents to be honest and to act as though they really had to pay here and now; (3) use cheap talk approaches, which explicitly communicate the problem of hypothetical bias to respondents; (4) reduce social desirability bias, the tendency to give answers that

the respondent considers to be socially acceptable or what they think the interviewer wants to hear" (Loomis 2013).

Within the first point, the author highlights that there must be some effect on the future utility of the subject. To address this point, Loomis states, "One way to do this is to cast the referenda as an 'advisory one' to public officials who will be making a decision on the issue" (Loomis 2013). My questionnaire addresses utility changes by informing participants, in both the written and oral instructions, that the results will be shared with College of William & Mary Police Chief Deb Cheeseboro. Sharing the results with a key decision maker mitigates hypothetical bias, for participants believe their answers can make a difference. The second point is that "the payment mechanism must be compulsory (such as a tax paid by all) if the referendum passes." This is addressed through the questionnaire using across-the-board fees and tuition increases as funding mechanisms for the safety initiatives.

Loomis' second point involves requesting the respondents' honesty to avoid hypothetical bias. Stevens et. al. (2013) was successfully able to eliminate hypothetical bias in a willingness-to-pay survey for college students by including a simple oath. The oath reads, "I undersigned swear upon my honor that, during the whole survey I will tell the truth and always provide honest answers" and is followed by a signature line for the respondent. I included this in my survey.

In Loomis' third point, another method for mitigating bias, called "cheap talk," is outlined. This involves telling the respondents before they take the survey that WTP estimates are known to produce inflated results. As is described in Loomis (2013), out of the eight estimates Loomis examined that used "cheap talk" to mitigate hypothetical bias, three successfully mitigated hypothetical bias (Cummings and Taylor, 2009; Morrison and Brown, 2009; Landry and List, 2007), three reduced hypothetical bias (Aadland and Caplan, 2003; Brown, Ajzen, and Hrubes, 2003; Champ, Moore, and Bishop, 2009), one had no effect on hypothetical bias (Blumenschein et al., 2008), one overcorrected hypothetical bias (Morrison and Brown, 2009). Since only one out of eight estimates found that cheap talk overcorrected the issue of hypothetical bias, I chose to include a sentence stating, "surveys of this format are known to result in respondents stating values higher than what they would actually pay, so please keep that in mind when filling out your survey," in my pre-survey script as a method for reducing hypothetical bias.

Loomis' last point touches on reducing social desirability bias. This issue is two-fold. For one, he warns of respondents giving an answer that the researcher wants to hear. Two, he discusses a certain "cognitive dissonance" or discomfort that comes from one revealing the actual value that they would pay for something. To mitigate these effects, I phrased my questionnaire asking what students "think" they would pay, rather than what they would actually pay. Lusk and Norwood (2009) and Norwood and Lusk (2011) found this method mitigated hypothetical bias by

separating respondent's answers from their social desirability and habit of self-judgment.

Gathering the Data and Calculation

Once I collected the data, I converted the data so that it could be used in Stata. For example, I took my income data and turned it into dummy group variables. I also calculated my VSL estimates.

The formula for VSL is essentially a substitution function between income and risk. Thus, the equation is:

$$\text{VSL} \equiv \frac{dw}{dp}$$

Where *dw* represents change in wealth and *dp* represents change in risk. For both of my risk questions, the new safety initiative reduced the risk from 20 in 10,000 to 15 in 10,000. Therefore, an individual's VSL would be how much he or she is willing to pay divided by 5/10,000.

Results

My results show that the VSL estimate for college students is less than the estimates for the general population. I begin this section by giving an overview of my sample. I then discuss my regression analyses in the context of my two hypotheses.

Summary Statistics

	Mean	**Median**
Age	19.5	19
Semesters Remaining	4	4
Family Income	-	$100,000-$150,000
Personal Income	-	$1,000-$2,000
Family Contribution to Tuition (%)	75.6%	95%
Aid Contribution to Tuition (%)	18.2%	0%
Personal Contribution to Tuition (%)	6.2%	0%

I collected 200 surveys from undergraduate students at the College of William & Mary. However, due to 29 people not reporting their family income, I only included 171 observations in the regressions. The median age was 19 years old and the median semesters remaining at the College of William & Mary was four. In other words, the median student represented in my survey is a second semester sophomore.

In terms of risk perception, students at the College of William & Mary see themselves at a lower risk of violent crime relative to the general population. The survey tells students that, according to the census, the odds of a 15-24 year old experiencing death by homicide in the next year is about 12 in 10,000. The survey then asks students, given this statistic, to rate their risk level. The median risk level was 4 in 10,000.

On average, students who took the survey receive most of their college tuition funding from their family. The mean family contribution to tuition was 76%, while

the average personal contribution was 6%. The other 18% was made up by merit and need-based aid.

Student VSL in the Context of General Population Estimates

To calculate the individual student VSLs, I took their willingness-to-pay and set it as the numerator for the VSL formula above. Given that the proposed initiative would decrease risk from 20 in 10,000 to 15 in 10,000, the change in risk was 5 in 10,000. This was the denominator. After calculating each student's individual VSL, I took the average to estimate overall student VSL.

The average VSL for the tuition payment vehicle was $1,373,525. The average VSL for the out-of-pocket payment vehicle was $783,765.

For comparison purposes, a VSL estimate used by the Department of Homeland Security in 2007 was between $3.1 million and $6.2 million. A VSL estimate used by the Environmental Protection Agency in 2008 was $6.8 million (Viscuci, 2009).

The students' lower VSL estimates are a direct results of the students being willing to pay less for risk reduction than the overall population. To determine the factors that affect student VSL, I run regressions in the framework of my two hypotheses.

Hypothesis One: Students Have Above Average VSLs Due to Tuition Payment Vehicle

Based solely on the averages of each payment vehicle's VSL, it is clear that payment vehicle makes a large impact on willingness-to-pay. Tuition VSL was about $589,760, or 75%, greater than out-of-pocket VSL.

I ran a regression to isolate the effect of payment vehicle on student VSL. Each student was represented twice, once with his or her out-of-pocket VSL and once with his or her tuition VSL. I created a dummy variable, vehicle, to measure the effect of the payment vehicle on the Value of Statistical Life. To isolate the effect of the payment vehicle, I controlled for personal income and family income, as well as the students' sources for funding tuition (percentage paid by their family, aid, and themselves). I also controlled for undergraduate semesters remaining since the safety initiative only applies to their time as an undergraduate student. My dependent variable was Log(VSL). Since the distribution of VSLs were right skewed, taking the log of this number provided a more normal distribution.

Table One: Payment Vehicle Effect On Student Value of Statistical Life

	Log(VSL)
Tuition Payment Vehicle (Relative to Out-of-Pocket Payment Vehicle)	.395**
Personal Income >$1,000 (Relative to Personal Income <$1,000)	.398
Family Income >$100,000 (Relative to Family Income <$100,000)	.761**
Family Contribution to Tuition (%) (Relative to Aid Contribution)	.000
Personal Contribution to Tuition (%) (Relative to Aid Contribution)	.001
Undergraduate Semesters Remaining	-.024

342 Observations, SE Clustered at Ind. Level **= 10% Significance Level **=5% Significance Level*

The payment vehicle does have a statistically significant impact on college students' WTP. In other words, college students' VSLs for risk reduction are lower than those of the general population when paid through tuition increases, but are even lower when paid out-of-pocket. My regression shows that paying for risk reduction through tuition results in a 39.5% higher VSL than paying out-of-pocket, all else equal.

While there is no research specifically looking at students' WTP through tuition, Hemelt and Marcotte (2008) discussed how students are largely insensitive to tuition increases. This could play a factor in the student's willingness-to-pay more through tuition.

There is a statistically significant relationship between student VSLs and payment vehicle. It is important to note that while the tuition payment vehicle results in greater WTP than students' paying out of pocket, the estimate is still much lower than that of the general population.

Hypothesis Two: Students Have Below Average VSLs Due to Lower Income

Income is found to have an effect on VSL estimates. Students have less personal income than members of the general population. By having less income, Evans and Viscuci (1993) states that adults will have less utility lost by dying.

I ran two regressions to isolate the effect of family and personal income on student VSL. First, due to my five family income groups and eight student income groups having skewed numbers, I consolidated all family income groups and all student income groups into two groups, respectively. To isolate the effect of income, I controlled for the students' sources for funding tuition (percentage paid by their family, aid, and themselves). I also controlled for undergraduate semesters remaining since the safety initiative only applies to their time as an undergraduate student. In my two regressions, my dependent variables were Log(VSL Tution Payment Vehicle) and Log(VSL Out-of-Pocket), respectively. I took the log of each dependent variable to better account for outliers in my sample.

Table Two: Student and Family Income Effect On Student Value of Statistical Life

	Log(VSL Tuition Payment Vehicle)	Log(VSL Out-of-Pocket)
Personal Income >$1,000 (Relative to Personal Income <$1,000)	.353	.512*
Family Income >$100,000 (Relative to Family Income <$100,000)	.934**	.629*
Family Contribution to Tuition (%) (Relative to Personal Contribution)	.009	.005
Aid Contribution to Tuition (%) (Relative to Personal Contribution)	.011	.005
Undergraduate Semesters Remaining	-.025	-.022

171 Observations **= 10% Significance Level* ***=5% Significance Level*

Based on the results of my regressions, it is clear that income is a factor of student WTP being so much lower than that of the general population. This is best illustrated by the change in the effect of income depending on the payment vehicle.

When a student is paying for the risk reduction out-of-pocket, the student's personal income is a statistically significant explanatory variable. A student making over $1,000 a year has a VSL 51.5% higher than that of a student who makes less than $1,000 a year. Family income also has a statistically significant impact on the out-of-pocket VSL.

When a student is paying for the risk reduction through tuition, family income is a statistically significant explanatory variable. Students from families making

$100,000-$150,000 and more than $150,000 have VSLs 99.9% and 87.3% higher than students from families making less than $100,000 a year, respectively.

The impact of income seems to depend heavily on the payment vehicle. We know that, on average, the students' families pay over three-fourths of tuition, so it makes sense that family income would have a greater impact when WTP is measured through fees added to tuition. Additionally, student income doesn't make an impact until measuring WTP for an out-pocket-fee. This also makes sense, as the student's income would most likely pay for the fee.

This goes to show that when formulating an answer for a WTP question, the students think about the income source that will be paying for the fee. Therefore, we can conclude that the size of that income is a factor that, at least partially, drives the difference between students VSLs and those of the general population.

Discussion

As the first study to determine a college student-specific Value of Statistical Life estimate, it is clear that the VSL for college students is much less than that of the general population. Income seems to be the driving cause for this difference. In addition, whether the fee is paid out-of-pocket or through tuition makes a large difference in students' willingness-to-pay.

Policy Implications

This study can be applied to policy analysis in a couple ways. For one, the specific estimate found can be used in cost-benefit analyses of initiatives reducing the risk of violent crimes on college campuses. As stated in the introduction, there is a good deal of discussion for such initiatives, and it is important to have an estimate that is applicable to those directly affected.

This study can be used to understand the relationship between college student VSLs and VSLs of the general population. It is important to note that my exact estimate should not be used for other causes of death, such as environmental factors or traffic accidents. As was discussed in the literature review, these different contexts cause a great deal of variation in VSL estimates. However, my study can be a start to understanding the relationship between student VSLs and VSLs of the overall population in other policy contexts.

I used my student VSL estimate to form a VSLY estimate. As I discussed in the literature review, the VSLY makes my estimate useful in other policy contexts, such as initiatives that involve a large number of college students in addition to others in the general population. For example, a crime reduction initiative in the Williamsburg area would affect a large number of college students and people of other ages. My estimated VSLY could be used along with the VSLY estimates for the general population to better account for the large student population.

Overall, several government agencies have been using VSLY estimates in addition to VSL estimates in the policy cost-benefit analysis arena (Graham 2003). Sunstein (2003) states

In the last two decades, numerous regulatory agencies have conducted cost- benefit analysis (CBA) of proposed rules. To undertake this analysis, they have had to quantify the value of a statistical life (VSL)... But there is a conspicuous difficulty with the use of a uniform VSL. Some regulatory programs benefit people who are relatively young; others benefit people who relatively old…At the very least, VSLY is a more precise measure of what is at stake. (Sunstein 2003)

To calculate VSLY, I took the students' respective answers for what age he or she expected to live until. I subtracted the student's current age from this number to determine the expected number of years left in life. I applied a discount rate of 7%, for that is the preferred discount rate of the Office of Management and Budget (Aldy and Viscuci, 2008).

The formula for VSLY is as follows:

$$VSLY = \frac{rVSL}{1 - (1 + r)^{-L}}.$$

In the equation, *r* represents the discount rate, and *L* represents the number of years remaining in life.

In my study, the average VSLY for the tuition payment vehicle was $98,072. The average VSLY for the out-of-pocket payment vehicle was $55,683. For context, a VSLY estimate for a person of average health and 20-29 years old is $208,284 (Jones-Lee et. al., 1993).

To go back to our previous example, a crime reduction initiative affecting the entire Williamsburg area, having a VSLY estimate for college students would be useful. Given that the VSLY better captures the difference in VSL estimates for different ages, this estimate will allow for a more accurate calculation of the benefits of such an initiative.

Conclusion

Through a WTP questionnaire, I estimated the first college student-specific Value of Statistical Life. I found that college students have much lower VSLs than those of the general population. Additionally, I found that payment vehicle makes a large difference in college student's WTP for crime reduction initiatives.

While it is clear income plays a role in students' lower VSLs, more research must be conducted to understand what other factors cause the difference between student VSLs and VSLs of the general population. My research shows that students think about income when it comes to determining their willingness-to-pay for risk reduction. Family income has a statistically significant positive effect for both

payment vehicles, and student VSL has a statistically significant positive effect when the fee is out-of-pocket. Although my study shows the difference between student-VSLs and those of the general population, future studies could more thoroughly explore what factors drive this difference.

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