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16. Abstract
The Psychological Constructs Related to Seat Belt Use (PCRSBU) survey was designed to "go beyond" demographic correlates of seat belt use (e.g., age, income, race) and identify psychological constructs that may help explain additional variance in seat belt use among the general U.S. population. The survey was administered in 2018 to a representative sample of U.S. residents 16 or older who reported driving or riding in a car in the past year. This volume, methodology, is the first of two describing the survey and its results. Volume 2 is the results report.

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This report is the first of two reports on the Psychological Constructs Related to Seat Belt Use (PCRSBU) survey. The other report is as follows:

Sheveland, A. C., Luchman, J. N., Xie, J., Bleiberg, M. A., Eby, D. W., Molnar, L. J., & Walton, B. R. (2020, December). *Psychological constructs related to seat belt use, volume 2: Results report* (Report No. DOT HS 813 029). National Highway Traffic Safety Administration.

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Executive Summary

The purpose of the *Psychological Constructs Related to Seat Belt Use (PCRSBU)* survey was to "go beyond" demographic correlates of seat belt use (e.g., race, income, age) and identify—through a nationally representative probability survey—psychological constructs that may help explain additional variance in seat belt use behavior among the general U.S. population. Insights gained could be leveraged to support future traffic safety initiatives and, ultimately, to save lives and prevent injuries through increased seat belt use.

Development of the *PCRSBU* survey began by conducting a needs analysis with key project stakeholders to identify topic areas of importance or interest. Following this analysis, we conducted an extensive literature review of potentially relevant health behavior research, with a focus on 12 protective and risky behaviors and 25 psychological constructs of interest. Then, we developed, tested, and refined the *PCRSBU* questionnaire based on the cumulative findings of the needs analysis, literature review, and nine cognitive interviews, as well as the subject matter expertise of the research team.

We received clearance from the Office of Management and Budget (OMB; Control Number: 2127-0729) on the final study design and materials in February 2018. The *PCRSBU* survey was launched on June 19, 2018, and closed on July 13, 2018. The survey was administered to a representative sample of U.S. residents 16 or older who reported driving or riding in a car in the past year. Participants were recruited through GfK's KnowledgePanel.[1] Adults (18 or older) and teens (16 and 17 years old) were sampled separately. Furthermore, sampling for each population segment was conducted independently for four geographic regions. Among the screened people, an additional sampling phase was applied to oversample "not-always" seat belt users. This ensured that enough of these people would be included in the final sample to conduct comparative analyses between the two user types (always and not-always seat belt users).

A random sample of 15,524 panel members (adults and parents of teens) was drawn. The median survey completion times for screened cases and qualified completes were 15 minutes and 23 minutes, respectively. In total, 6,038 valid cases (5,833 adults and 205 teens) were included in the final data set. Data quality checks assessing speed of completion, non-differentiation, and response inconsistencies were performed after data collection. The data were then weighted in several steps to account for the panel and study design, to mitigate the risks of nonresponse error and coverage error, and to ensure conformity with population benchmarks. The analysis plan outlines several research questions and associated hypotheses. The results of this study are published in a separate report, Sheveland, Luchman, Xie, Bleiberg, Eby, Molnar, and Walton's *Psychological Constructs Related to Seat Belt Use, Volume 2: Results report* (2020, Report No. DOT HS xxx xxx, National Highway Traffic Safety Administration).

[1] GfK was founded in 1934 by an association of university teachers as Gesellschaft für Konsumforschung ("Society for Consumer Research."). The market research company IPSOS acquired GfK in 2018 and now operates KnowledgePanel.

Introduction

As one of the most effective traffic safety interventions, seat belt use can reduce fatality of front-seat passenger car occupants in crashes by 45% and front seat occupants of light trucks, such as pickups and SUV, by 60% (Kahane, 2000). In the United States, nearly 15,000 lives were saved, and an additional 2,500 could have been saved, by seat belts in 2017 (National Center for Statistics and Analysis, 2019). Nearly half (47%) of passenger vehicle occupants fatally injured in motor vehicle crashes were not using a seat belt (NCSA, 2019). Although the national rate of seat belt use has increased since 2000 and was estimated to be 90.7% in 2019 (NCSA, 2019), gains have plateaued in recent years. Traffic safety researchers continue to seek a better understanding of why a non-negligible minority of the U.S. population do not consistently use seat belts.

Several demographic factors are correlated with seat belt use, including age, race/ethnicity, sex, and urban/rural dwelling status (Beck et al., 2017; Li & Pickrell, 2019). Situational factors, such as time of day, vehicle speed, and length of trip, also predict belt use (Boyle & Lampkin, 2008; Fhanér & Hane, 1973; NCSA, 2019, April; Richard et al., 2019). Yet, despite extensive research on how psychological factors predict other health behaviors (e.g., smoking, Coggins et al., 2009; sunscreen use, Craciun et al., 2012; and alcohol-impaired driving, González-Iglesias et al., 2015), the evidence base regarding the influence of such factors on seat belt use is relatively limited. The current study sought to add to the nascent body of literature in this domain by conducting a nationally-representative survey (the *Psychological Constructs Related to Seat Belt Use [PCRSBU]* survey) to examine associations between self-reported seat belt use and a set of psychological constructs.

This is the first of two reports. In this volume (the *Methodology Report*), we describe the survey's development and present the results of a literature review on seat belt use and range of health behaviors, which were used to identify the psychological constructs included in the survey. This *Methodology Report* also contains the details of the survey methodology, including information about respondents, sampling design, data collection, and weighting. Finally, the *Methodology Report* contains a description of the research questions the survey addresses, as well as the hypotheses associated with each question. In Volume 2, the *Results Report*, we present the results of analyses conducted to test the hypotheses.

Methods

Questionnaire Development

The formative steps in survey development included a needs analysis, a literature review, development and testing of a draft questionnaire, and development of a final questionnaire. First, we conducted a needs analysis with key project stakeholders to identify topic areas of importance or interest. Next, we performed an extensive literature review of potentially relevant health behavior research. Then, a regrouping meeting was held, during which the findings and recommendations of the letter report were discussed. Finally, building on the results of these foregoing activities, we developed, tested, and refined the *PCRSBU* questionnaire.

Needs analysis

We conducted a needs analysis to (1) gather input regarding the scope and aims of the survey and (2) identify topic areas of interest and/or practical value to likely end users of the resulting data. Hour-long stakeholder interviews were conducted with representatives from a NHTSA Regional Office, two State occupant protection programs, and the Centers for Disease Control and Prevention's National Center for Injury Prevention and Control. We also interviewed a former academic with expertise in special subpopulations. NHTSA strategically identified interviewees so that they differed from one another with respect to their professional backgrounds, subject matter expertise, and employment status vis-à-vis the Department of Transportation.

In each session, we provided interviewees with an overview of the project's aims and approach and asked for their input regarding:

1) Notable knowledge gaps in this research area (i.e., psychological and psychosocial constructs that might be important to consider);
2) Research questions and hypotheses;
3) Subpopulations of interest; and
4) How the collected data might be used downstream, either by the interviewees or others.

Common among the interviewees' responses were the following suggestions:

1) Examine seat belt use by seating position (e.g., driver, rear passenger), vehicle type (e.g., private vehicle, ride-sharing service, taxi), and time of day.
2) Include measures of social norms (descriptive, injunctive) and social-situational factors.
3) Solicit from respondents their explicit motivations or other reasons for using or not using seat belts.
4) Examine subgroup differences by dwelling status (urban versus rural), race/ethnicity, age, parental status, and geographic region.

Literature review

Literature search

We conducted an extensive search and review of the literature to identify and examine associations between psychological constructs and seat belt use or similar health behaviors. "Similar health behaviors" were defined within the context of a person engaging in a protective mechanism to prevent possible future personal harm (i.e., protective behaviors). Under this definition, unhealthy behaviors (e.g., self-harm) were generally excluded. However, recognizing that we might gain insights into part-time or non-use of seat belts by considering certain risky behaviors, we did include three in our search and review of the literature. The protective/risky health behaviors included in the literature search are presented in Table 1.

Table 1. Protective/Risky Behaviors Included in the Literature

Type	Behavior
Protective Behaviors	
	Bicycle helmet use
	Condom use
	Flu vaccination
	Life jacket/personal flotation device use
	Motorcycle helmet use
	Motorcycle protective clothing use
	Reflective clothing use
	Seat belt use
	Sunscreen use
Risky Behaviors	
	Alcohol-impaired driving
	Illicit substance (cocaine) use
	Smoking

Our preliminary search of the literature identified a large body of literature on more than a dozen specific illicit substances that fall under the "illicit substance use" risky behavior category. It was beyond the resources of this project to include research relating to all substances, so we conducted background research on the prevalence of illicit substance use in the United States to determine the substance with the widest relevance to the population. In 2013, marijuana, non-prescribed prescription drugs, and cocaine were the three most commonly used illicit substances (as self-reported) among people 12 and older (Substance Abuse and Mental Health Services Administration, 2014). Marijuana was excluded from consideration because (1) it is a legal recreational substance for certain age groups in some States, (2) it is legal for medicinal purposes in many States, (3) many States changed their marijuana laws during the time frame set for this review, which greatly complicated the findings, and (4) the body of literature was too large for the project's resources. We excluded prescription drug abuse due to the wide range of prescription medications that are abused—from pain relievers to tranquilizers to sedatives to stimulants. Each of these prescription groups had dedicated literature, and, in some cases, several medications within a class also had their own separate literature. Given the above considerations, we selected the third most commonly reported abused illicit substance, cocaine.

Next, the research team applied its subject matter expertise to construct a preliminary list of psychological constructs of interest. This list included major personality constructs (e.g., self-confidence, introversion/extroversion) and variables with known or theoretical links to one or more health/risky behaviors (e.g., risk assessment, sensation-seeking). After considering the relevance, application, and feasibility of these constructs in downstream belt-use countermeasures, we selected 25 constructs (or construct pairs, e.g., extraversion/introversion) to include in the literature review (see Table 2).

Table 2. Psychological Constructs Included in the Literature Search

Anger/hostility	Fatalism/destiny	Religiosity
Antisocial behavior spectrum	Hope/optimism	Risk assessment
Anxiety	Life satisfaction	Risk aversion
Confidence	Locus of control	Self-control/self-monitoring
Culture	Morality	Self-efficacy
Delay of gratification	Narcissism	Self-esteem
Emotional intelligence	Personality	Sensation-seeking
Empathy	Political leaning	Social connectedness
Extraversion/introversion		

All protective behaviors and one risky behavior—alcohol-impaired driving—were crossed with each psychological construct (e.g., "seat belt use" AND "culture") in searches using the following databases: PsycINFO, International Transport Research Documentation database, ProQuest, MEDLINE, ScienceDirect, and Google Scholar. We also searched for variations on the naming of the behaviors and psychological constructs (see Appendix A). Our searches returned no articles on reflective clothing use or empathy; therefore, neither were considered further.

Any article deemed by a research assistant to be potentially relevant based on the title was imported into a digital reference management system. A senior team member then reviewed each article to determine its suitability for inclusion in the annotated bibliography. The inclusion and exclusion criteria were the following:

1) The article must have a publication year of 2000 or more recent. (Note: This was relaxed for seat belt use, as 13 articles published from 1976 to 1999 were included.)
2) The article must be from a peer-reviewed journal, technical report, conference proceeding, etc. (i.e., not thesis or dissertation). (Note: This was relaxed for seat belt use, as one dissertation was included.)
3) The article must be a primary source document that presents original data (i.e., not a literature review or opinion article).
4) The study must have a protective or risky behavior of interest (see **Appendix A**) as a dependent variable.
5) The behavior under study must be the participant's own behavior and *not* his or her influence on the behaviors of others (e.g., a study directed at getting parents to encourage seat belt use among their children would be excluded).
6) The results must present the protective or risky behavior of interest independently (i.e., not as part of a composite variable).

7) The psychological construct of interest must serve as an independent variable (e.g., not a mediating variable explaining the relationship between some other variable and the behavior; not an outcome variable being used to evaluate an intervention).
8) The study sample must not represent such a specialized population that confounding factors are likely and/or the results would be unlikely to apply to the general U.S. population (e.g., an incarcerated population).
9) The outcome measure must be an actual behavior, not merely a behavioral intention.

These criteria were applied to studies investigating all the protective behaviors and one risky behavior—alcohol-impaired driving. We adjusted the methodology slightly for the two remaining risky behaviors, smoking and cocaine use. For smoking, we searched the literature using the same criteria outlined above, with the exception that only published literature reviews and systematic reviews were included. We made this decision because the research literature on smoking is quite large and could not be searched within the resources of the project. For cocaine, we used the same literature search procedures described above, with the exception that only the PsycINFO and MEDLINE databases were searched. We imposed this restriction because not every database could be searched within the resources of the project, and PsycINFO and MEDLINE were determined to be the most relevant.

Annotated bibliography

All articles that satisfied the inclusion criteria were imported into the reference manager, and an annotated bibliography was developed for each article. The format for the annotated bibliographies included the following:

1) The behaviors addressed in the article (many articles addressed more than one protective or risky behavior).
2) The psychological factors addressed in the article.
3) A description of the study, which included details on research methods and the study population.
4) A description of how each relevant behavior and construct was measured, including a description of the scales used, when possible.
5) A concise description of the relevant findings. This included, for seat belt use only, effect sizes as reported in the original articles.
6) A brief discussion of the strengths, weaknesses, and relevance to the project.

The annotated bibliography included 161 unique articles. The number of articles that addressed each behavior, construct, and behavior–construct combination is provided in Appendix B. The complete results of the literature review, including the annotated bibliography and suggestions for constructs to include in the survey, were provided to NHTSA in an interim report.

Questionnaire Design

Ultimately, 10 constructs examined in the literature review were included in the *PCRSBU* questionnaire. The research team also identified 11 additional constructs and factors to measure in the questionnaire based on areas of interest expressed by stakeholders as part of the needs analysis, as well as the team's collective subject matter expertise in the areas of traffic safety and psychology. Table 3 provides the rationale for including each variable identified.

Table 3. Constructs/Variables Included in the Questionnaire

Construct/Variable	Rationale for Inclusion
Identified through literature review	
Anger	Prior research has found an inverse association between seat belt use and driving anger (Sarma et al., 2013). This construct was included to explore whether seat belt use is associated with trait-based anger, more generally.
Delay of gratification	Future orientation and delay discounting both have strong and consistent associations with several protective and risky health behaviors (Coggins et al., 2009; Henson et al., 2006). Findings are mixed regarding seat belt use; however, the research team determined that there was utility in further investigating this construct in a non-college student population.
Fatalism	Previous research has found an association between fatalism and a variety of risky and protective health behaviors, including seat belt use (Daugherty & Brase, 2010; Shin et al., 1999).
Hostility	Hostility demonstrates a fairly consistent relationship with alcohol-impaired driving and illicit substance use among young men (Gerra et al., 2004; Patil et al., 2006). This construct was included to see if a similar association exists between hostility and seat belt use.
Impulsivity	Previous research has found impulsivity to be consistently related to a number of risky and protective health behaviors (Burris et al., 2009; Pasa et al., 2013; Wilson, 1990). Impulsivity was not formally included in our list of constructs of interest. However, it can be viewed as the converse of self-control. Impulsivity is consistently related to protective and risky behaviors of interest (although no studies had looked at seat belt use at the time of this publication). It was suggested that impulsivity be included in lieu of self-control, as self-control is closely related to other examined constructs (e.g., delay of gratification and sensation-seeking) and, therefore, may not provide much added value.
Life satisfaction	Previous studies have found that people who are more satisfied with their life circumstances may be more inclined to engage in protective health behaviors (Grant et al., 2009). If life satisfaction is linked to seat belt use, this might have implications for downstream interventions.
Loneliness	Studies have found a conflicting relationship between loneliness and risky behavior. To our knowledge, only one previous study (Ruangkanchanasetr et al., 2005) has compared loneliness to seat belt use and found no differences between the seat belt use of lonely and non-lonely participants.
Optimism	No studies have investigated the association between optimism and seat belt use. However, optimism has been linked to other health behaviors, including condom use and alcohol-impaired driving (González-Iglesias et al., 2015; Hendriksen et al., 2007).
Risk aversion	Although no studies have examined risk aversion and seat belt use, risk aversion has been linked to a number of risky and protective health behaviors, including alcohol-impaired driving, sunscreen use, and flu vaccination (Hatfield, & Fernandes, 2009; Massin et al., 2015). Paired with risk perception (see below), the inclusion of risk aversion could help provide a well-rounded picture of how comfort with and perceptions about risk together influence seat belt use.
Risk perception/perceived susceptibility	A preponderance of studies have found that engaging in protective and risky behaviors is generally influenced by assessments of risk (Craciun et al., 2012; Janssen et al., 2015; Meekers & Klein, 2002). There may be implications of this variable for downstream health messaging efforts.
Sensation-seeking	Existing evidence suggests that sensation-seeking influences seat belt use, as well as alcohol-impaired driving and illicit substance use (Curran et al., 2010; Pasa et al., 2013).

Table 3. Constructs/Variables Included in the Questionnaire

Construct/Variable	Rationale for Inclusion
Identified by research team	
Seat belt use decision rule use and frequency	This variable was included to explore whether there is an empirical association between having a rule about seat belt use and actual seat belt use.
Situational factors influencing seat belt use such as seating position, vehicle type, and time of day	These constructs have been previously hypothesized/investigated as potential influences on seat belt use (Boyle & Lampkin, 2008; Fhanér & Hane, 1973; Vivoda & Eby, 2011).
Presence of others in vehicle Presence of… (friend, child under 12, teen/adolescent, parent, adult child, family member)	Not-always-users of seat belts may be more or less likely to use their seat belts in the presence of another person, depending on who that person is.
Stated reasons for wearing/not wearing a seat belt	This question was included to investigate why people *say* they do or do not wear their seat belts and how these stated reasons are related to various psychological and psychosocial factors.
Descriptive norms regarding seat belt use by different groups (age group, friends, family)	Prior research has shown social norms to be associated with various risky and protective behaviors (Alarape et al., 2008; Coups et al., 2014).
Injunctive norms regarding seat belt use by different groups (age group, friends, family)	
Government intervention orientation	People who believe that an appropriate activity of the government is "making decisions that promote the quality of life and well-being of the people" are expected to be more inclined to follow seat belt laws.
Resistance to peer influence	Previous studies have found that people who are more susceptible to peer pressure are more likely to conform to the behavior of their peers than those who are more resistant to peer pressure (Fernandes et al., 2006).
Social norms espousal	The behavior of people who are higher on social norms espousal should be related to their perception of social norms regarding risky and protective health behaviors, such as seat belt use.
Social resistance orientation	Previous studies have found that people who are higher on social resistance orientation are generally less inclined to follow laws, including those regarding seat belt use (Factor et al., 2013).
Significant other's seat belt use behavior	Research has shown that in certain risky behavior domains, a couple's behaviors are correlated (Maron et al., 1986).
Age of car	Research has shown that enhanced seat belt reminder systems, a newer technology that is not in all cars, increase seat belt use (Freedman et al., 2007).
Crash history	Previous research has found a negative association between seat belt use and prior crash history (Hunter et al., 1993).

Next, we searched for and assessed existing scales for all constructs under consideration. To maximize the utility of the survey, we sought the shortest validated and publicly available scale for each construct (see Table 4). Shorter scales were selected over longer scales if the scale's reliability was deemed acceptable. Following the recommendation that was set forth by Nunnally (1978) and is widely adopted throughout the social and behavioral sciences, a Cronbach's alpha of 0.7 was set as the threshold for acceptable scale reliability.

Table 4. Validated Scales Included in the Final PCRSBU Questionnaire

Construct	Scale Name	# of Items	Source	Alphas	Survey Items
Fatalism	Traffic Locus of Control (T-LOC)—fate subscale	2	Özkan & Lajunen (2005)	.44[1]	Q20-Q21
Hostility/aggression	Brief Aggression Questionnaire (BAQ)	12	Webster et al. (2014)	.81	Q23_1-Q23_6
Impulsivity	Abbreviated Impulsiveness Scale (ABIS)	13	Coutlee et al., (2014)	.72–.77	Q22_1-Q22_13
Life satisfaction	Satisfaction With Life Scale (SWLS)	5	Diener et al., (1985)	.87	Q27_7-Q27_11
Loneliness	Social and Emotional Loneliness for Adults (SELSA), short-form social subscale	5	DiTommaso et al., (2004)	.9	Q27_12-Q27_16
Non-commitment to law	UNREST Questionnaire —non-commitment to law subscale	4	Factor et al., (2013)	.75	Q29_1- Q29_4
Optimism	Revised Life Orientation Test (LOT-R)	10	Scheier et al., (1994)	.78	Q27_1- Q27_6
Political ideology—government involvement	Government Intervention Scale	4	Wagaman & Segal (2014)	.79	Q28_1- Q28_4
Resistance to peer influence	Resistance to Peer Influence Scale (RPI)	10	Steinberg & Monahan (2007)	.70, .76, .74, and .73, for Lower Income, Detained, Community, and Serious Offender samples	Q26_1- Q26_10
Risk aversion	Risk Taking Inventory (RTI)	6	Nicholson et al., (2005)	.80 overall, .85 safety subscale	Q17_1-Q17_6
Risk perception	No scale name but perceived risk items taken from Stasson & Fishbein (1990)	3	Stasson & Fishbein (1990)	.64–.95	Q18-Q19
Sensation-seeking	Brief Sensation-Seeking Scale (BSSS)	8	Hoyle et al., (2002)	.76, .74	Q23_7-Q23_14
Social resistance	UNREST Questionnaire —social resistance subscale	4	Factor et al., (2013)	.87–.89	Q29_5-Q29_8
Social norms	Social-Norm Espousal Scale (SNES)	14	Bizer et al., (2014)	.87	Q25_1- Q25_14
Time perspective/ delay of gratification	Consideration of Future Consequences Scale (CFC)	12	Strathman et al., (1994)	.80–.86	Q24_1-Q24_12

[1]*Because the T-LOC "fate subscale" only contained two items, the authors calculated the Pearson correlation coefficient rather than Cronbach's alpha; .44 is considered a moderate correlation.*

Where needed (i.e., an appropriate item or scale did not exist), the research team developed new items following best practices in survey research (e.g., avoiding double-barreled items). This included the development of five screener items to assess respondents' frequency of driving and riding as a passenger and seat belt use behavior.

Cognitive interviews

We conducted nine cognitive interviews to test the comprehension and flow of the survey. Each interview lasted approximately 60 minutes. We recruited participants by email from a participant database and through community forums and posting boards. The emails and postings contained a description of the study and a web link to the screener. Qualifying potential participants were contacted and scheduled based on session availability, while taking care to obtain a sample that was (1) diverse with respect to demographic characteristics and (2) did not consist of solely drivers or solely riders.

Cognitive interview data collection consisted of two phases (Phase I: $n = 5$; Phase II: $n = 4$), with a one-day break in between to allow for ad-hoc revision of the survey. During each session, participants were directed to complete the survey and to share aloud their thoughts and decision-making process as they answered each question. The purpose of this "think aloud" protocol was to gain a deeper understanding of not just the "what" but also the "why" of participants' reactions and responses to the survey. Frequently, the moderator would ask follow-up questions to probe the specifics of the participant's evaluation process. For example, the moderator might have asked a participant to rephrase the information in their own words (e.g., "How would you define bad luck or fate?") or to provide an example that fits the definition of a concept (e.g., work vehicle) presented on the survey. There was also a set of standardized probes included in the moderator's guide. As time permitted, additional probes were supplied to the moderator from the observing team over a messenger/chat application that the moderator passively monitored.

Across both phases, the predetermined and ad-hoc probes were designed to (1) ensure that participants understood the survey items as intended, (2) assess the language and clarifying definitions included, (3) assess the appropriateness of the response options/anchors used for each survey item, and (4) assess the ordering of the survey items. Minor wording changes were made to improve respondents' comprehension of certain survey items.

Profile variables

In addition to the variables collected through the PCRSBU questionnaire, the use of the GfK KnowledgePanel allowed us to select a number of panelist profile variables of interest to append to the final dataset. These included standard demographic variables (e.g., age, gender, education, marital status), as well as questions regarding political leaning, political affiliation, religious affiliation, religiosity (as measured by the frequency of attendance at religious services), and parental status (Table 5)

Table 5. KnowledgePanel Profile Variables Included in the PCRSBU Survey (excluding standard demographic variables)

Construct/Variable	Rationale for Inclusion
Identified through literature review	
Political orientation	One study found an association between seat belt use and political leaning (Molnar et al., 2012). This variable could be considered an indicator of culture and/or the "live free or die" mentality and, therefore, might be useful for informing downstream programmatic efforts.
Political party affiliation	
Religiosity	Some research findings suggest that religiosity may be a barrier to seat belt use (Molnar et al., 2012). This variable might be useful for informing marketing campaigns.
Identified by research team	
Parental status	Parents may use their seat belts more consistently than non-parents out of a desire to "set a good example" for their children.

Sampling Approach

GfK KnowledgePanel

The GfK KnowledgePanel is an online probability panel that has been in existence since 1999. Panelists are recruited from U.S. households using a probability sample and complete surveys online.[2] The panel's probability sampling design achieves what is commonly referred to as a "nationally representative" sample. It also facilitates the calculation of unbiased survey estimates and their corresponding standard errors. GfK recruits its panelists using address-based sampling based on the U.S. Postal Service's computerized delivery sequence file. Before 2009, panelists were also recruited using random digit-dialing techniques. People who live in sampled addresses are invited to join the panel through a series of mailings. Follow-up invitations are conducted with non-respondents via phone (for addresses that can be matched to a phone number).

Study-specific recruitment

The target population for the PCRSBU survey was U.S. residents 16 and older who had driven or ridden in a car within the past year. The sampling approach to this survey was two-pronged, with adults (18 and older) and teens (16 and 17 years old) sampled separately. Participants were recruited for this survey via email. The teen sample was identified using household roster information. Their parents were then asked to provide consent for their child's participation in the study. Following parental consent, teens were presented with the informed consent shown to all participants and asked to complete the survey.

Sampling design

The total sample for this survey comprised two different components. The first component was a general population sample of adults 18 and older, and the second component was a teen sample (16 and 17). The two samples generally followed a similar design, except that special considerations were required for the teen sample, which entailed indirect sampling via the teens' parents.

[2] Panelists who do not have internet access are provided netbooks for the duration of their participation in the panel.

The adult sample was drawn in two steps:

1) A random probability sample of invitees was selected from eligible panelists.
2) Subsampling of screened adults was applied based on seat-belt-use information.

The teen sample was drawn in three steps:

1) A random probability sample of invitees was selected of panelists who are parents of teens.
2) For parents with more than one age-eligible teen in the household, rostering methods were applied to randomly select a single teen.
3) Subsampling of screened teens was applied based on seat-belt-use information.

Seat belt information consisted of whether the respondents were "always users" or "not-always users" of seat belts; people who had not driven or ridden in a car in the past year were screened out of the survey. Sampling procedures were based on GfK's typical procedures, with study-specific customizations that allowed for the oversampling of "not-always users" of seat belts and stratification by four geographic regions defined by NHTSA based on cultural and behavioral similarities (including seat belt use behavior) among States.

When obtaining samples from the GfK KnowledgePanel, modifications to the planned sampling procedures are sometimes necessary to account for certain characteristics of the panel, such as its finite size, procedures for limiting invitees to one per household (as to avoid reduction in precision due to clustering), panel management procedures for reducing respondent burden, and/or GfK's procedures for releasing sample in multiple batches (e.g., to ensure an appropriate number of invitees). Some of these modifications were applied to this study and are subsequently described. Although these modifications could introduce issues of non-representativeness in the sample, multiple steps were taken to mitigate such potential issues during the weighting procedures.

Adult sample

The starting point for the adult sample was the GfK KnowledgePanel, for which full-panel weights had been computed for all panelists, regardless of whether they were invited to any particular study. These weights reflect selection probabilities and incorporate a calibration adjustment to ensure that key demographic distributions align with the most recent data from the Current Population Survey, conducted by the U.S. Census Bureau and Bureau of Labor Statistics.[3]

Before selecting an initial sample of adult invitees, the target sample allocation of the invitees to sampling strata was determined to be proportional to the strata populations, as computed via

[3] More precisely, the weights for the adult sample were calculated as follows. Let w_i be the calibrated weight for panelist $i \in P$, where P represents the set of panelists. Then the calibration estimator is of the form $\widehat{\boldsymbol{X}}_{cal} = \sum_{i \in P} w_i \boldsymbol{X}_i = \boldsymbol{X}$, where $\sum_{i \in U} \boldsymbol{X}_i$ a vector of population totals used for calibration over the universe U; that is, the estimated vector of demographic totals $\widehat{\boldsymbol{X}}_{cal}$ is equal to the population totals used in calibration.

external benchmarks. The four strata comprised geographic regions[4], with $n_h \propto N_h$, where n_h is the target number of invitees in stratum h and N_h is the estimated population size in stratum h. N_h was determined based on the anticipated source of benchmarks for weighting rather than being estimated from panel weights, given that the panel weights are not adjusted by geographic region.

The next step in the sampling plan involved conducting sampling independently for each design stratum. GfK's standard sampling procedures involve oversampling people who have a lower probability of being in the panel so that each member of the population has the same chance of being sampled for NHTSA's survey before screening. The sampling plan entailed selecting a study-specific sample of invitees from the panel through a probability-proportional-to-size without replacement (PPSWOR) sampling procedure, using the full-panel weights as a measure of size to achieve an approximately EPSEM (i.e., equal probability of selection method) sample. This method generally results in a higher effective sample size and greater statistical power than would otherwise be obtained. PPSWOR sampling was to be conducted independently for each stratum, without replacement.

In practice, minor modifications were made to the planned sample design to deal with issues such as panel size restrictions, procedures for limiting invitees to one per household, and GfK's procedures for releasing sample in multiple batches. These modifications were generally reflective of GfK's standard procedures for handling such issues and were accounted for during the weighting process. The main modifications were:

1) *Modification due to panel size limitations*: Although the GfK KnowledgePanel has several tens of thousands of members, it is finite in size, and this study's sample requirements led to sampling a meaningfully large fraction of the panel. As such, for a given stratum, it was not possible to draw a PPSWOR sample with the measures of size (MOS) strictly proportional to the panel weights. Instead, a given stratum's PPSWOR sample was drawn in a manner that was equivalent to selecting with certainty the cases with the largest MOS, after which remaining units were sampled, without replacement, with probability proportional to the MOS. The practical impact of this modification is that groups sampled, recruited, and/or retained in the panel at lower rates may be underrepresented in the initial sample; however, the risk of bias from this modification is subsequently mitigated through calibration adjustments.

2) *Procedures for only selecting one invitee per household*: The initial PPS selection stage entailed selecting a sample of persons from eligible members of the KnowledgePanel. In some cases, this might have resulted in selecting multiple units for a given household, which might reduce precision due to clustering. Therefore, an additional within-

[4] Geographic Region 1 is comprised of the Pacific U.S. Census Division (AK, CA, HI, OR, WA). Geographic Region 2 is comprised of the Mountain (AZ, CO, ID, MT, NM, NV, UT, WY) and West North Central (IA, KS, MN, MO, ND, NE, SD) U.S. Census Divisions. Geographic Region 3 is comprised of the West South Central (AR, LA, OK, TX), East South Central (AL, KY, MS, TN), and South Atlantic (DC, DE, FL, GA, MD, NC, SC, VA, WV) U.S. Census Divisions. Geographic Region 4 is comprised of the East North Central (IL, IN, MI, OH, WI), Middle Atlantic (NJ, NY, PA) and New England (CT, MA, ME, NH, RH, VT) U.S. Census Divisions.

household selection phase was applied to ensure that no more than one person per household had been selected. Specifically, for a given household in which more than one person had been initially sampled, a subsequent selection phase entailed randomly selecting a single person from those initially sampled. The practical effect of this step is to reduce representation in the initial sample of households in which more adults are impaneled. Therefore, the weighting procedures sought to mitigate such issues by computing pseudo-base weights that take into account the number of adults in the household and by incorporating this characteristic into the calibration steps.

3) *Procedures for selecting the sample in multiple batches*: In conducting the study, certain quantities affecting the necessary initial sample size were not known upfront, such as incidence rates for seat belt use (which affected subsampling rates, as is subsequently described). Consequently, the start of the field period was staggered to allow for mid-field modifications to the sampling plan (if necessary). This entailed drawing an initial stratified PPSWOR sample, of which 17.5% was randomly assigned to the earlier field start. Given that the incidence rate for "not-always" users, as assessed by the screener, was higher than expected, any cases not assigned to the earlier field start were treated as not having initially been sampled. A new stratified PPSWOR sample was drawn for remaining cases, using the same MOS as before. The practical effect of these steps is to introduce some minor deviations in the unconditional selection probabilities in comparison to a single-stage PPSWOR design with the original MOS. However, a post-hoc analysis indicated that the effect on selection probabilities can be assumed to be minor, and calibration weighting adjustments may further mitigate the risk of bias from this approximation.

Following the sampling by stratum, responding panelists were screened to ensure that they were in the target population and to classify them as always users versus not-always users of seat belts. This classification was also used to oversample not-always users relative to always users to improve the precision for domain estimates of "not-always users." After classifying panelists, a subsampling rate was applied based on seat belt usage. The subsampling rates, which were held constant throughout the entirety of the study, were 100% for not-always users and 59.77% for always users of seat belts. These subsampling rates had been determined in a manner aimed at improving precision for domain estimates of not-always users of seat belts without having much effect on precision overall nor overly taxing the GfK KnowledgePanel.[5] Subsampling was conducted independently for each individual.

Teen sample

The sampling plan for teens paralleled the sampling plan for adults, with modifications to reflect special considerations since teens were to be sampled indirectly (i.e., through their parents). This indirect sampling approach was necessary due to the panel design, since KnowledgePanel

[5] These sampling rates had been determined based on a conservative assumption of 13% population incidence for not-always users of seat belts; at this incidence, these sampling rates would result in approximately 1,200 interviews with not-always users of seat belts (assuming seat belt use was not related to panel or survey nonresponse). A sensitivity analysis conducted at the sample design stage suggested that these sampling rates would only have a minor impact on overall precision even if the rate of not-always users turned out to be substantially higher (e.g., 20%, 25%, or even 30%).

panelists are adults 18 and older. As a starting point, a probability sample was selected of parents who have at least one 15-, 16-, or 17-year-old in their household, based on panel demographic characteristics. Note that this initial sample included parents of a broader age range of teens (i.e., 15 to 17) than was used ultimately for population eligibility (i.e., 16 and 17), since the age information from the panel may have been up to one year old. However, the screener was subsequently used to obtain up-to-date information on the age of teens and to confirm eligibility within the narrower age range. The modifications to the stratified PPSWOR method were roughly analogous to those described earlier for the adult sample modifications were roughly analogous to those described earlier for the adult sample.[6]

Next, for parents with multiple age-eligible teens in their household, random selection (with equal probability) was applied to select a single teen to be interviewed, using a rostering method. This selection of a single teen to be interviewed was applied as to avoid introducing design effects from clustering. The rostering method entailed asking parents how many 16- or 17-year-old children they had within their household, after which the age and sex was asked for each child. For parents of more than one age-eligible teen, a random teen was selected and invited to participate in the survey. As with the adult sample, teens were classified based on their self-reported seat belt usage and subsampling rates of 100% and 59.77% (for not-always users and always-users, respectively) were applied.

Data Collection

We received clearance from the Office of Management and Budget (OMB) to conduct the information collection (Control Number: 2127-0729; Expiration: February 28, 2021).

Survey programming, beta testing, and pilot testing

Upon receipt of OMB clearance for data collection, separate versions of the final questionnaire were programmed for the adult and teen samples (see Appendix D). The teen-specific questionnaire was identical to the adult version with the exception that additional demographic questions were asked of the teens, as GfK did not have profile variables for the teen sample members. Multiple team members tested both links to ensure the questionnaires were designed and functioning as intended.

We then piloted the survey with 30 adults (18 and older) and 15 teens (16 and 17 years old) to assess survey completion time, skip logic accuracy, and data set quality and clarity. FMG personnel worked closely with GfK to ensure all typographical errors were corrected and that the contents and format of the final data set would meet the needs of the project. The only substantive issue encountered during piloting was a longer-than-expected median completion time (23 minutes for adults, 25 minutes for teens, and 23 minutes for the entire sample).

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[6] The modifications for the teen sample were similar to those for the adult sample, with the main difference being that the finite panel size posed added challenges for sampling parents of teens. For the parent PPS samples, in addition to needing to select large units with certainty, the limited number of parents of teens meant that all parents of teens needed to be sampled in two geographic regions. For similar reasons, it was not possible to exactly follow the initially planned sample allocation by region. With respect to weighting, the limited sample size of parents of teens prevented the ability to account for number of adults in household in computing base weights for teens, although this household characteristic was subsequently accounted for during the weight calibration steps.

Survey fielding

The *PCRSBU* survey launched on June 19, 2018 and closed on July 13, 2018. As a precaution, the release of the full sample was staggered, with 10% of the sample released on June 19, 2018, another 10% released on June 22, and the remainder of the sample released on June 27. This gradual release allowed for the opportunity to adjust the subsampling rate for always users (originally set at 59.77%) if the observed incidence rate of not-always users in the sample (as assessed through the screener) was substantially lower than what was estimated (13%). Such an adjustment proved to not be necessary, as not-always users exceeded 13% in both the adult and teen samples.

Surveys were self-administered and accessible at any time during the fielding period. Participants could complete the survey only once. Responses to the screener items served two purposes:

1) Respondents who reported neither driving nor riding as a passenger in a motor vehicle within the past year and those who were younger than 16 (i.e., people who are not members of the target population) were screened out.
2) The selection of participants into the full survey was informed by their self-reported status as an always versus a not-always user. Respondents were first classified into one of the two groups based on their response to Q3. If a self-reported always user then reported not wearing a seat belt within the past year in Q4 and/or Q5, he or she was reclassified as a not-always user for oversampling purposes.

Participants selected to complete the full survey based on their responses to the screener were immediately redirected to the full survey to reduce the likelihood of attrition as compared to a two-phase administration approach. Email reminders to non-responders were sent on the third day following initial contact. Additional reminders were emailed on July 2, 5, 9, and 11.

Outcome rates

A random sample of 15,524 panel members (adults and parents of teens) was drawn from GfK's panel. Of these, 9,893 (excluding break-offs) completed the screener (screener completion rate of 63.7%), from which 6,455 qualified members were subsampled; of those, 6,111 completed the survey (survey completion rate of 94.7%). This resulted in a cumulative response rate of 4.7%, which also accounts for the panel nonresponse—namely, the rate at which households were initially recruited to the KnowledgePanel (12.2%) and the rate at which recruited households were profiled (64.2%). Table 6 summarizes key outcome rates. The computations are based on formulas from Callegaro and DiSogra (2008) for outcome rates for probability web panels, which are incorporated into American Association for Public Opinion Research (AAPOR) Standard Definitions (2016; pp. 48–49). Note that the definition of completion rate below differs from the typical definition, given that the use of screener-based subsampling necessitated separately breaking out the rate at which invitees completed the screener from the rate at which screened and subsampled people completed the full survey.

Table 6. Outcome Rate Summary Metrics

Metric	Value
Study-Specific Average Panel Recruitment Rate (RECR)	12.2%
Study-Specific Average Household Profile Rate (PROR)	64.2%
Study-Specific Average Household Retention Rate (RETR)	29.8%
Screener Rate (S_COMP)[7]	63.7%
Completion Rate (COMR)[8]	94.7%
Cumulative Response Rate[9]	4.7%

Final sample characteristics and dispositions

After removing people who answered fewer than two-thirds of the questions, the final number of participants was 6,038 (5,833 adults, 205 teens). The median completion time for all qualified completes was 23 minutes. Table 7 provides a summary of participant demographics.

Table 7. Sample Demographics

	Adults		Teens		Combined	
Variable	N	%	N	%	N	%
Age						
Under 18	-	-	205	100.00%	205	3.40%
18–29	696	11.93%	-	-	696	11.53%
30–44	1,257	21.55%	-	-	1,257	20.82%
45–59	1,667	28.58%	-	-	1,667	27.61%
60+	2,213	37.94%	-	-	2,213	36.65%
Race/Ethnicity						
White, Non-Hispanic	4,302	73.75%	134	65.37%	4,436	73.47%
Black, Non-Hispanic	542	9.29%	15	7.32%	557	9.22%
Other, Non-Hispanic	227	3.89%	15	7.32%	242	4.01%
Two or more races, Non-Hispanic	176	3.02%	11	5.37%	187	3.10%
Any race, Hispanic	586	10.05%	30	14.63%	616	10.20%
Gender						
Male	2,756	47.25%	103	50.24%	2,859	47.35%
Female	3,077	52.75%	102	49.76%	3,179	52.65%
Household Income						
Less than $25,000	791	13.56%	28	13.66%	819	13.56%
$25,000 to $49,999	1,149	19.70%	30	14.63%	1,179	19.53%
$50,000 to $74,999	1,050	18.00%	36	17.56%	1,086	17.99%
$75,000 to $99,999	860	14.74%	50	24.39%	910	15.07%
$100,000 to $149,000	1,053	18.05%	41	20.00%	1,094	18.12%
$150,000 or more	930	15.94%	20	9.76%	950	15.73%
Education						
Teen sample (question not asked)	-	-	205	100.00%	205	100.00%
Less than high school	305	5.23%	-	-	305	5.23%
High school	1,448	24.82%	-	-	1,448	24.82%
Some college	1,800	30.86%	-	-	1,800	30.86%

[7] Computed as Number completing screener/Number of invitees.
[8] Computed as Completes/Number of screener completes who had been subsampled.
[9] Computed as RECR*PROR*S_COMP*COMR.

Table 7. Sample Demographics

	Adults		Teens		Combined	
Variable	N	%	N	%	N	%
Bachelor's degree or higher	2,280	39.09%	-	-	2,280	39.09%
Total	5,833		205		6,038	

Sampled cases were categorized in accordance with the AAPOR standardized classification system for final disposition codes (see Table 8). While 6,111 sampled cases were considered "complete," this number includes 73 respondents who answered less than two-thirds of the questions and were not included in the final sample.

Table 8. Final Disposition Codes of Sample

Disposition Code	Adults	Teens	Total	Percent
1.10 Complete	5,905	206	6,111	39.36%
1.20 Partial or break-off with sufficient information	338	6	344	2.22%
2.11 Refusal	142	13	155	1.00%
2.12 Break-off or partial with insufficient information	14	52	66	0.43%
3.00 Unknown eligibility, non-interview	5,048	362	5,410	34.85%
4.10 Selected Respondent Screened Out of Sample	3,010	428	3,438	22.15%
Total sampled	*14,457*	*1,067*	*15,524*	*100.00%*

Participant consent and incentives

Before beginning the survey, prospective participants were presented with informed consent text (approved by Chesapeake IRB, now Advarra, IRB) that briefly explained the study's purpose and the fact that participation was voluntary. No personally identifiable information (PII) was collected during this study. Existing PII that GfK possessed for each KnowledgePanel member was kept secured by GfK (in Palo Alto, CA). At no time did the research team have access to these data. GfK operates an incentive program to encourage participation in its surveys. Adult participants earned 1,000 loyalty points (roughly equivalent to $1) and an entry into a sweepstakes for completing this survey. Teen participants each received a cash equivalent of $5 for their participation.

Data Set Preparation

Data quality checks and cleaning

Data quality checks were performed after data collection. This process involved evaluating several parameters, including speed of completion, non-differentiation, and frequent skipping. Respondents who exhibited suboptimal behavior on several indicators were flagged. A total of 6,111 completes were deemed qualified. However, we excluded 73 respondents who answered less than two-thirds of the questions. In total, 6,038 cases (5,833 adults, 205 teens) were determined to be valid cases to be included in the final analysis.

Two survey questions allowed open-ended text responses for "other" response options. These questions (Q10 and Q11) asked participants about their personal reasons for using (Q10) or not using (Q11) a seat belt. After all obscenities, proper names, and PII were removed, two team members independently reviewed all open-ended responses and identified responses that could reasonably be back-coded into an existing response option. A senior team member reviewed and resolved any disagreements.

Weighting

We developed full-sample weights to mitigate the risks of nonresponse error and coverage error. Because the two samples (adults, teens) were selected separately, several of the weighting steps were applied independently for each sample before combining the two sets of weights.

Special considerations were applied to account for differences between the target population (i.e., U.S. residents 16 and older who have driven or ridden in a car in the past year) and the available benchmarks (i.e., U.S. residents 16 and older), given that people who had not driven or ridden in a car in the past year were screened out. To account for the difference between these populations, an initial set of weights was computed for people who completed the screener (regardless of car usage); these were adjusted to external benchmarks, allowing for generalizations to the population of U.S. residents 16 and older. These weights were then used to generate benchmarks for the target population. The latter set of benchmarks was used in the last step of the weighting process, which was applied independently for always users and not-always users of seat belts.

The process of adjusting weights to control totals, known as calibration, can reduce nonresponse and coverage biases. Raking was the type of calibration that was used (i.e., iterative proportional fitting), which allows for adjustment on multiple variables when post-stratification to the full cross-classification of all adjustment variables would result in small cell sizes.

The weights were computed in several steps, using a series of multiplicative weighting adjustments, as summarized below.

1) *Initial base weights*: For each population (i.e., teens and adults), initial sample invitees were divided into mutually exclusive groups in which the selection probabilities were assumed to be roughly constant. The groups were determined in a manner aimed at approximating key features of the sample design. Within a given group, initial base weights were computed for initial sample invitees as the population size in that group divided by the number of invitees in that group. These base weights reflect the design for obtaining the initial sample of invitees, in which all members of a group had equal probability of selection (EPSEM).

2) *Final base weights*: For adults, the initial base weights from the previous step were the final base weights. For teens, the initial base weights from the above step were modified to account for within-household selection of teens.

3) *Screener weights*: For each population, a raking adjustment was applied to adjust the final base weights of people completing the screener (regardless of car usage and regardless of subsampling based on seat belt behavior) to external population benchmarks from the CPS. Each population (i.e., teens and adults) entailed adjustment on the number of adults in household, age by gender, race/ethnicity, geographic region, metropolitan status, and household income; the weights of adults were also adjusted by level of educational attainment. The set of people receiving screener weights included all people providing usable and complete screener data, regardless of car usage and regardless of whether the individual ultimately was subsampled and/or completed the full survey. These raked weights for each group (i.e., teens and adults) summed to the total number of people in

that group, and the two groups were mutually exclusive; therefore, the two sets of weights were combined into a single variable.

4) *Subsample weights*: Next, an adjustment was applied to the screener weights from the previous step to account for subsampling of screened people based on seat belt usage. This entailed dividing the screener weights by the probability of subsampling for the individual (conditional upon having completed the screener) and removing the weights of people who were not subsampled.

5) *Raked weights*: As a final step, the subsample weights of eligible respondents with complete data[10] were raked to population benchmarks. These benchmarks were obtained as subpopulation estimates from the screener weights computed in Step 3, reflecting the subpopulation of U.S. residents 16 and older who have driven or ridden in a car in the past year. Each raking dimension incorporated a cross-classification with the dichotomous seat-belt-use variable (i.e., always versus not-always users of seat belts). For each of the two seat-belt-use categories, the weights were adjusted by number of adults in household, age and gender, race/ethnicity, geographic region, educational attainment, and household income.

Detailed descriptions of the weighting procedures are provided in Appendix D. Note that inherent in the design of some weighting steps are tradeoffs between systematic errors (i.e., bias) and variable errors (i.e., variance). For instance, a weighting strategy that better reflects the panel design can result in increased weight variability, which typically increases the variance of point estimates; on the other hand, simplifying the weighting procedures to approximate the panel design may reduce the variance at the cost of introducing bias. The procedures that were taken generally aimed to minimize the mean square error, which reflects both types of error.

Computation of variance estimates

Taylor series linearization methods were used to estimate variances in this survey. Taylor series linearization generally relies on the simplicity associated with estimating the variance for a linear statistic even with a complex sample design and is valid in large samples. In this formulation, the variance strata, primary sampling units (PSUs), and survey weights must be defined. For this survey, the variance strata were defined based on the initial stratification that had been used in selecting the samples of invitees from eligible panelists (before any subsampling based on seat belt use). This initial sampling stage entailed conducting sampling separately for the teen[11] and adult samples; for each of the two population segments (i.e., teens and adults), sampling was conducted independently by geographic region. Therefore, the variance strata reflect the cross-classification of the age group used in sampling (teen, adult) by geographic region (Geographic Region 1 – 4), for a total of eight variance strata.

[10] In this context, *complete data* refers to the subset of eligible respondents with complete interviews (i.e., disposition code of 1.1) who answered at least two-thirds of survey questions.

[11] In this context, *teen sample* refers to the sample of invitees that was drawn for purposes of obtaining interviews with teens. Therefore, this initial sample of invitees reflects parents of teens rather than teens, but is described here as a *teen sample* for simplicity in reporting.

Analysis Approach

Measures of seat belt use

Our analysis approach included three different seat-belt-use variables. With few exceptions, each analysis was conducted three times, once with each variable. The seat-belt-use variable that was calculated from respondents' answers to Q3 (seat belt use frequency), Q4 (past year seat belt use when driver), and Q5 (past year seat belt use when passenger) and used for subsampling purposes served as our first seat-belt-use variable. Respondents who responded "all of the time" or "always" to each of these three questions were classified as always users. We refer to this variable as the primary binary seat-belt-use metric.

Both the second and third seat-belt-use variables adjusted the primary seat-belt-use variable based on the answers that the respondents provided to Q8, which asked about seat belt use in a variety of situations, specifically the following:

1) When driving (Q8_1)
2) When a front-seat passenger (Q8_2)
3) When a back-seat passenger (Q8_3)
4) When riding in a taxi/cab (Q8_4)
5) When using a rideshare service (Q8_5)
6) When riding as a passenger in a work vehicle (Q8_6)
7) During the daytime (Q8_7)
8) During the nighttime (Q8_8)
9) When others are present in the vehicle (Q8_9)
10) When others are not present in the vehicle (Q8_10)

Any respondent who was previously categorized as an "always user," yet selected any answer other than "all of the time" or "not applicable" for any subpart of Q8, was recategorized as a "not-always user" vis-à-vis our second seat-belt-use variable, referred to as the adjusted binary seat-belt-use metric.

Finally, we calculated a third seat-belt-use variable that differed from the first two, as it permitted gradations of seat belt use. Specifically, all the seat-belt-use questions (Q3, Q4, Q5, and Q8) were used to construct a semi-continuous scale of seat belt use, combining all responses into a single dimension reflecting seat belt use across situations. The scale was constructed based on linear combinations of responses to the 13 seat-belt-use questions using multiple components analysis, a data reduction procedure. We refer to this variable as the semi-continuous seat-belt-use.

Our sample size of 6,038 was expected to result in stable estimates of the group proportions with the sample split of seat belt users. Additionally, two seat-belt-use groups permitted more stable estimates of both subpopulation proportions (e.g., geographic regions) and statistical model estimates compared with more groups of seat belt use (e.g., four or five). With a fixed sample size and sampling design, having a greater number of parameters estimated by any statistical model tends to reduce statistical power, although it can also increase the explanatory usefulness of the model. In addition, the use of a semi-continuous metric shares advantages with the two-group seat-belt-use indicators in that the combination of 13 different seat-belt-use indicators

increases the psychometric internal consistency reliability of the seat-belt-use questions and, consequently, increases their statistical power and reduces response error, increasing the scale's explanatory usefulness, as well. Overall, we sought to balance both the statistical power along with the explanatory use of the model throughout the modeling process to obtain as much information as possible from each model for inferences related to seat-belt-use patterns.

Imputation of missing data

We imputed missing data on a case-by-case basis, depending on the analysis. More specifically, for analyses with high "missingness" (10% or greater of the sample[12]) due to refused and "not applicable" responses or valid skips, we employed a full information maximum likelihood augmentation approach (Enders, 2001). This approach is simpler to implement than alternatives, such as multiple imputation, and has shown equally favorable results in simulation studies (e.g., Schafer & Graham, 2002).

Computation of scale scores

We created a composite variable (i.e., scale score) for each validated scale included in the questionnaire (see Table 4). Scale items were reverse-coded as appropriate.

Research Questions and Planned Analyses

The survey, sampling approach, and analysis plan were designed to address several research questions. The research team developed these questions and associated hypotheses based on the initial project aims, the findings of the needs analysis, the results of the literature review, and the content of the final questionnaire. Below, we present each research question and the accompanying planned analysis approach. We also present more specific, directional hypotheses pertaining to some of the research questions.

Research Question 1: What is the breakdown of the U.S. population 16 and older by not-always and always seat belt users?

We calculated descriptive statistics to estimate survey-weighted proportions of the population metrics, as well as their levels of design-adjusted precision (i.e., standard errors and confidence intervals). Our standard errors assumed that all observations, conditional on their group membership and weights, were statistically independent and that the proportions were approximately normally distributed. The complex sample design also affected the assumptions, as discussed in the weighting section. The incorporation of the complex sampling design features and robust standard errors reduces concern about observation independence and the size of the sample, allowing the proportions to approximate a normal distribution.

Research Question 2: What reasons for wearing their seat belts are people most likely to endorse?

To address Research Question 2, we estimated weighted proportions for each seat-belt-use reason. The considerations for estimating the proportions endorsing each variable followed the same logic as in Research Question 1.

[12] This is the point at which bias tends to increase (Bennett, 2001).

Research Question 3: What reasons for seat-belt-non-use are people most likely to endorse?

To address Research Question 3, we estimated weighted proportions for each seat belt non-use reason. The considerations for estimating the proportions endorsing each variable followed the same logic as in Research Question 1.

Research Question 4: How does seat belt use differ by demographic and personal history characteristics?

We examined the association between seat belt use and the following demographic and personal history factors:

1) Age;
2) Gender;
3) Race/ethnicity;
4) Marital status;
5) Socioeconomic status;
6) Urban/rural dwelling status;
7) Parental status;
8) Prior crash history; and
9) Age of the car most often drives/rides in.

We estimated three statistical models predicting each of the three measures of seat belt use using the demographic variables listed above. The demographic variables' coefficients and standard errors were design-adjusted, and the computed *p*-values were based on Wald tests, with model selection uncertainty incorporated using Akaike information criterion fit (Lumley & Scott, 2015) in a multimodel inference framework (e.g., Burnham & Anderson, 2004). Multimodel inference is a method in which one or more estimated models' coefficients and standard errors are averaged together, usually weighting the contribution of each individual model based on a fit metric such as the Akaike information criterion. Our use of a multimodel approach reduces concern about parameter estimate bias by averaging estimates across different estimated models. The incorporation of the complex sampling design features and robust standard errors reduces concern about observation independence.

We assessed whether our hypotheses were supported based on the pattern of probability values obtained across all three models/seat-belt-use metrics. Specifically, a hypothesis was deemed supported if the corresponding variable was found (1) to have statistically significant non-null coefficients, (2) in the same direction as stated in the hypothesis, and (3) in at least two of the three models.

Hypotheses

H1. Younger people will report wearing their seat belts less frequently than older people.
H2. Males will report wearing their seat belts less frequently than females.
H3. Non-Hispanic Whites will report wearing their seat belts more frequently than non-Whites and Hispanics (any race).
H4. Single people will report wearing their seat belts less frequently than married people.

H5. Higher socioeconomic status (SES) people will report wearing their seat belts more frequently than lower SES people.
H6. People living in rural areas will report wearing their seat belts less frequently than people living in urban areas.
H7. Parents will report wearing their seat belts more frequently than non-parents.
H8. People with a prior crash history will report wearing their seat belts less frequently than people who have not experienced a crash.
H9. People who drive/ride in older cars on a regular basis will report wearing their seat belts less frequently than people who drive/ride in newer cars on a regular basis.

Research Question 5: Which psychological constructs are predictive of full-time seat belt use?

We examined the association between seat belt use and the following psychological constructs:

1) Adoption/use of a seat belt decision rule;
2) Anger;
3) Delay of gratification;
4) Fatalism;
5) Government intervention orientation;
6) Hostility;
7) Impulsivity;
8) Life satisfaction;
9) Loneliness;
10) Optimism;
11) Political leaning;
12) Religiosity;
13) Resistance to peer influence;
14) Risk aversion;
15) Risk perception;
16) Sensation-seeking;
17) Social norms espousal; and
18) Social resistance orientation.

For Research Question 5, as for Research Question 4, we estimated three statistical models predicting each of the three measures of seat belt use using all available psychological variables listed above. The estimation of these models followed the same set of procedures as outlined for Research Question 4. Before analysis, all multi-item scales were aggregated based on their arithmetic average. For each multi-item scale, the correlation between the scale's arithmetic average and the first extracted factor from an exploratory factor analysis was computed. For all scales, the correlation was high enough (i.e., the lowest observed correlation was .97) to justify using the conceptually and computationally simpler arithmetic average.

Hypotheses

H10. People with a seat-belt-use rule will report wearing their seat belts more frequently than people without a rule.
H11. People higher on anger will report wearing their seat belts less frequently than people lower on anger.
H12. People higher on delay of gratification will report wearing their seat belts more frequently than people lower on delay of gratification.
H13. People higher on fatalism will report wearing their seat belts less frequently than people lower on fatalism.
H14. People higher on government intervention orientation will report wearing their seat belts more frequently than people lower on government intervention orientation.
H15. People higher on hostility will report wearing their seat belts less frequently than people lower on hostility.
H16. People higher on impulsivity will report wearing their seat belts less frequently than people lower on impulsivity.
H17. People higher on life satisfaction will report wearing their seat belts more frequently than people lower on life satisfaction.
H18. People higher on loneliness will report wearing their seat belts less frequently than people lower on loneliness.
H19. People higher on optimism will report wearing their seat belts more frequently than people lower on optimism.
H20. People who self-report as more liberal will report wearing their seat belts more frequently than people who self-report as more conservative.
H21. People who attend religious services more often will report wearing their seat belts less frequently than people who attend religious services less often.
H22. People higher on risk aversion will report wearing their seat belts more frequently than people lower on risk aversion.
H23. People who view not wearing seat belts as risky will report wearing their seat belts more frequently than people who view not wearing seat belts as not risky.
H24. People higher on sensation-seeking will report wearing their seat belts less frequently than people lower on sensation-seeking.
H25. People higher on social norms espousal will report wearing their seat belts more frequently than people lower on social norms espousal.
H26. People higher on social resistance orientation will report wearing their seat belts less frequently than people lower on social resistance orientation.

Research Question 6: Do any of the psychological or psychosocial variables measured explain observed demographic or regional differences in seat belt use?

Research Question 6's modeling followed from the results of Research Question 5. The focus of Research Question 6 was to explain demographic (including regional) differences observed in seat belt use using psychological and psychosocial factors.

The statistical model we used was a mediated generalized structural equation model in which, at the first stage, a given demographic variable predicted seat-belt-use group membership (as in Research Question 4), as well as each psychological and psychosocial variable. The second stage used all the psychological and psychosocial variables to predict seat-belt-use group membership.

This model allowed us to assess indirect effects or the extent to which psychological and psychosocial variables explain or account for observed differences in seat belt use by demographic variables. Given the potential size of the model in terms of the number of parameters likely to be estimated, we elected to model a single demographic variable at a time, as opposed to modeling all demographic factors simultaneously. Additionally, we only modeled the primary binary seat-belt-use indicator, as it was the broadest, most general seat-belt-use metric, and modeling more than one seat-belt-use indicator would have yielded an impractically large volume of results. We also focused only on the demographic and personal history characteristics that were significantly associated with the primary binary seat-belt-use indicator in Research Question 4.

Research Question 7: Which nonsocial-situational factors appear to influence seat belt use?

We examined the association between seat belt use and the following nonsocial-situational factors:

a. Vehicle type (taxi/cab, ride-sharing service vehicle, work vehicle);
b. Time of day (day, night); and
c. Seating position (driver, front-seat passenger, back-seat passenger).

We estimated a statistical model predicting seat-belt-use group membership using the non-social-situational variables listed above. The analysis approach was structured as a within-person analysis, attempting to determine trends in each variable controlling for a respondents' tendency to wear or not wear his or her seat belt overall. In addition to the above nonsocial-situational predictors above, this analysis incorporated the demographic variables from Research Question 4, the psychological constructs from Research Question 5, and two additional psychosocial variables (descriptive norms and injunctive norms) to control for the effect of each associated construct on a respondent's tendency to wear seat belts overall, as well as in each nonsocial situation examined. The evaluation of the fit of the two seat-belt-use groups' model and the semi-continuous scale followed the same set of procedures as outlined in Research Question 4. Before analysis, all multi-item scales were aggregated based on their arithmetic average.

Hypotheses

H27. People will report being less likely to wear their seat belts when riding in a taxi/cab (than in a ride-sharing or work vehicle).
H28. People will report being less likely to wear their seat belts when using a ride-sharing service (than when in a work vehicle).
H29. People will report being less likely to wear their seat belts at night than during the daytime.
H30. People will report being less likely to wear their seat belts when riding as a backseat passenger than when driving.
H31. People will report being less likely to wear their seat belts when riding as a front seat passenger than when driving.

Supplemental Research Questions

Research Question S1: How does seat belt use differ by geographic region?

Research Question S1 closely follows Research Question 1, with the additional subpopulation inference by geographic region. We compared weighted geographic subpopulation proportions to one another to assess their similarity in profiles across seat-belt-use group membership, using sampling design-adjusted Wald tests. As with Research Question 1, for Research Question S1, we assumed that all observations, conditional on their group membership and weights, were statistically independent and that the proportions were approximately normally distributed. The incorporation of the complex sampling design features and robust standard errors reduces concern about observation independence and the size of the sample, allowing the proportions to approximate a normal distribution.

Research Question S2 and S3: How do personal reasons for seat belt use differ by geographic region and between certain demographic subgroups? How are reasons for wearing a seat belt associated with psychological constructs and psychosocial factors?

We investigated patterns of endorsement of different seat-belt-use reasons by demographic variables (Research Question S2) and psychological and psychosocial factors (Research Question S3). To do so, we used survey design-weighted, generalized structural equation models adjusted for complex sampling design. Because the questions involved in this analysis were "mark all that apply" batteries, all potential reasons for wearing a seat belt were modeled simultaneously as a set of correlated, binary logistic regressions. Given the large model size and exploratory nature of these research questions, we did not view the application of model averaging and multimodel inference as necessary.

Research Question S4 and S5: How do personal reasons for seat belt non-use differ by geographic region and between certain demographic subgroups? How are reasons for seat belt non-use associated with psychological constructs and psychosocial factors?

Similar to Research Questions S2 and S3, we sought to determine the demographic, or psychological and psychosocial, predictors of endorsement of reasons for seat belt *non*-use. To do so, we used survey design-weighted, generalized structural equation models adjusted for complex sampling design. Because the questions involved in this analysis were "mark all that apply" batteries, all potential reasons for wearing a seat belt were modeled simultaneously as a set of correlated, binary logistic regressions. Given the large model size and exploratory nature of these research questions, we did not view the application of model averaging and multimodel inference as necessary.

Conclusion

Traffic safety researchers continue to seek a deeper understanding of the determinants of seat belt use that can inform the development of effective programmatic work in occupant protection. The *PCRSBU* survey is unique in that it assesses seat belt use and non-use in relation to an array of psychological constructs, situational factors, and demographic characteristics. Insights gleaned from this research may help inform future traffic safety initiatives in innovative ways. Findings are presented in the accompanying results report.

References

Alarape, A. I., Olapegba, P. O., & Chovwen, C. O. (2008). Condom use among students: The influence of condom self-efficacy, social norms and affective attitude towards condom. *Journal of Social Sciences*, *17*(3), 237–241.

American Association for Public Opinion Research. (2016). *Standard definitions: Final dispositions of case codes and outcome rates for surveys* (9th ed.).

Beck, L. F., Downs, J., Stevens, M. R., & Sauber-Schatz, E. K. (2017). Rural and urban differences in passenger-vehicle-occupant deaths and seat belt use among adults - United States, 2014. *MMWR Surveillance Summaries, 66*(17), 1–13. https://doi.org/10.15585/mmwr.ss6617a1.

Bennett, D. A. (2001). How can I deal with missing data in my study? *Australian and New Zealand Journal of Public Health, 25*(5), 464–469.

Bizer, G. Y., Magin, R. A., & Levine, M. R. (2014). The social-norm espousal scale. *Personality and Individual Differences, 58*, 106–111.

Boyle, J. M., & Lampkin, C. (2008, August). *2007 Motor Vehicle Occupant Safety Survey: Volume 2, seat belt report* (Report No. DOT HS 810 975). National Highway Traffic Safety Administration. www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/810975.pdf.

Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Methods & Research, 33*(2), 261–304.

Burris, J. L., Smith, G. T., & Carlson, C. R. (2009). Relations among religiousness, spirituality, and sexual practices. *Journal of Sex Research*, *46*(4), 282–289.

Callegaro, M., & DiSogra, C. (2008). Computing response metrics for online panels. *Public Opinion Quarterly, 72*(5), 1008–1032.

Coggins, C. R. E., Murrelle, E. L., Carchman, R. A., & Heidbreder, C. (2009). Light and intermittent cigarette smokers: A review (1989–2009). *Psychopharmacology*, *207*(3), 343–363.

Coups, E. J., Stapleton, J. L., Manne, S. L., Hudson, S. V., Medina-Forrester, A., Rosenberg, S. A., Gordon, M., Tatum, K. S., Robinson, J. K., Natale-Pereira, A., & Goydos, J. S. (2014). Psychosocial correlates of sun protection behaviors among U.S. Hispanic adults. *Journal of Behavioral Medicine*, *37*(6), 1082–1090.

Coutlee, C. G., Politzer, C. S., Hoyle, R. H., & Huettel, S. A. (2014). An Abbreviated Impulsiveness Scale constructed through confirmatory factor analysis of the Barratt Impulsiveness Scale Version 11. *Archives of Scientific Psychology, 2*(1), 1–12.

Craciun, C., Schüz, N., Lippke, S., & Schwarzer, R. (2012). A mediator model of sunscreen use: A longitudinal analysis of social-cognitive predictors and mediators. *International Journal of Behavioral Medicine, 19*(1), 65–72.

Curran, M. F., Fuertes, J. N., Alfonso, V. C., & Hennessy, J. J. (2010). The association of sensation seeking and impulsivity to driving while under the influence of alcohol. *Journal of Addictions & Offender Counseling*, *30*(2), 84–98.

Daugherty, J. R., & Brase, G. L. (2010). Taking time to be healthy: predicting health behaviors with delay discounting and time perspective. *Personality and Individual Differences*, *48*(2), 202–207.

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*(1), 71–75.

Ditommaso, E., Brannen, C., & Best, L. A. (2004). Measurement and validity characteristics of the short version of the social and emotional loneliness scale for adults. *Educational and Psychological Measurement, 64*(1), 99–119.

Enders, C. K. (2001). A primer on maximum likelihood algorithms available for use with missing data. *Structural Equation Modeling, 8*(1), 128–141.

Factor, R., Kawachi, I., & Williams, D. R. (2013). Evaluation of the UNREST questionnaire for testing the social resistance framework. *Journal of Epidemiology and Community Health, 67*(7), 618–624.

Fernandes, R., Hatfield, J., & Job, S. (2006, October 25-27). *Factors associated with speeding, drink-driving, driving while fatigued and seat belt use in a sample of metropolitan Sydney drivers.* Paper presented at the Australasian Road Safety Research Policing Education Conference, Surfers Paradise, Queensland, Australia.

Fhanér, G., & Hane, M. (1973). Seat belts: Factors influencing their use. A literature review. *Accident Analysis and Prevention*, *5*, 27–-43.

Freedman, M., Levi, S., Zador, P., Lopdell, J., & Bergeron, E. (2007). *The effectiveness of enhanced seat belt reminder systems–Observational field data collection methodology and findings* (Report No. DOT HS 810 844). National Highway Traffic Safety Administration. www.nhtsa.gov/sites/nhtsa.dot.gov/files/810844.pdf.

Gerra, G., Angioni, L., Zaimovic, A., Moi, G., Bussandri, M., Bertacca, S., Santoro, G., Gardini, S., Caccavari, R., & Nicoli, M. A. (2004). Substance use among high-school students: relationships with temperament, personality traits, and parental care perception. *Substance Use & Misuse*, *39*(2), 345–367.

González-Iglesias, B., Gómez-Fraguela, J. A., & Sobral, J. (2015). Potential determinants of drink-driving in young adults. *Traffic Injury Prevention*, *16*(4), 345–352.

Grant, N., Wardle, J., & Steptoe, A. (2009). The relationship between life satisfaction and health behavior: A cross-cultural analysis of young adults. *International Journal of Behavioral Medicine, 16*(3), 259–268.

Hatfield, J., & Fernandes, R. (2009). The role of risk-propensity in the risky driving of younger and older drivers. *Accident Analysis and Prevention, 41*(1), 25–35.

Hendriksen, E. S., Pettifor, A., Lee, S.-J., Coates, T. J., & Rees, H. V. (2007). Predictors of condom use among young adults in South Africa: The Reproductive Health and HIV Research Unit National Youth Survey. *American Journal of Public Health*, *97*(7), 1241–1248.

Henson, J. M., Carey, M. P., Carey, K. B., & Maisto, S. A. (2006). Associations among health behaviors and time perspective in young adults: Model testing with boot-strapping replication. *Journal of Behavioral Medicine*, *29*(2), 127–137.

Hoyle, R. H., Stephenson, M. T., Palmgreen, P., Lorch, E. P., & Donohew, R. L. (2002). Reliability and validity of a brief measure of sensation seeking. *Personality and Individual Differences, 32*(3), 401–414.

Hunter, W. W., Stewart, J. R., Stutts, J. C., & Rodgman, E. A. (1993). Observed and self-reported seat belt wearing as related to prior traffic accidents and convictions. *Accident Analysis and Prevention*, *25*(5), 545–554.

Janssen, E., van Kann, D., de Vries, H., Lechner, L., & van Osch, L. (2015). Sun protection during snow sports: An analysis of behavior and psychosocial determinants. *Health Education Research, 30*(3), 380–387.

Kahane, C. J. (2000, December). *Fatality reduction by safety belts for front-seat occupants of cars and light trucks: Updated and expanded estimates based on 1986-99 FARS data* (Report No. DOT HS 809 199). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/809199.

Kish, L. (1992). Weighting for unequal P_i. *Journal of Official Statistics*, *8*(2), 183–200.

Li, R., & Pickrell, T. M. (2018, April, revised). *Seat belt use in 2017—overall results* (Traffic Safety Facts Research Note. Report No. DOT HS 812 465). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812465.

Li, R., & Pickrell, T. M. (2019, February). *Occupant restraint use in 2017: Results from the NOPUS controlled intersection study* (Report No. DOT HS 812 594). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812594.pdf.

Lumley, T., & Scott, A. (2015). AIC and BIC for modeling with complex survey data. *Journal of Survey Statistics and Methodology*, *3*(1), 1–18.

Maron, D. J., Telch, M. J., Killen, J. D., Vranizan, K. M., Saylor, K. E., & Robinson, T. N. (1986). Correlates of seat-belt use by adolescents: implications for health promotion. *Preventive Medicine*, *15*(6), 614–623.

Massin, S., Ventelou, B., Nebout, A., Verger, P., & Pulcini, C. (2015). Cross-sectional survey: Risk-averse French general practitioners are more favorable toward influenza vaccination. *Vaccine*, *33*(5), 610–614.

Meekers, D., & Klein, M. (2002). Determinants of condom use among young people in urban Cameroon. *Studies in Family Planning*, *33*(4), 335–346.

Molnar, L. J., Eby, D. W., Dasgupta, K., Yang, Y., Nair, V. N., & Pollock, S. M. (2012). Explaining state-to-state differences in seat belt use: a multivariate analysis of cultural variables. *Accident Analysis and Prevention*, *47*, 78–86.

National Center for Statistics and Analysis. (2018, April). *Rural/ urban comparison of traffic fatalities: 2015 data* (Traffic Safety Facts. Report No. DOT HS 812 521). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/Publication/812521.

National Center for Statistics and Analysis. (2018, February). *Occupant protection in passenger vehicles: 2016 data* (Traffic Safety Facts. Report No. DOT HS 812 494). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812494.

National Center for Statistics and Analysis. (2018, June, revised). *Seat belt use in 2017—Use rates in the states and territories* (Traffic Safety Facts Crash•Stats. Report No. DOT HS 812 546). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812546.

National Center for Statistics and Analysis. (2019, April). *Occupant protection in passenger vehicles: 2017 data* (Traffic Safety Facts. Report No. DOT HS 812 691). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812691.

National Center for Statistics and Analysis. (2019, March). *Lives saved in 2017 by restraint use and minimum-drinking-age laws* (Traffic Safety Facts Crash•Stats. Report No. DOT HS 812 683). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812683.

National Center for Statistics and Analysis. (2019, December). *Seat belt use in 2019 – Overall Results* (Traffic Safety Facts Research Note. Report No. DOT HS 812 875). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812875.

National Highway Traffic Safety Administration. (2001, November). *Fifth/sixth report to Congress: effectiveness of occupant protection systems and their use* (Report No. DOT HS 809 442). https://crashstats.nhtsa.dot.gov/Api/Public/Publication/809442.

Nicholson, N., Soane, E., Fenton-O'Creevy, M., & Willman, P. (2005). Personality and domain-specific risk taking. *Journal of Risk Research, 8*(2), 157–176.

Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). McGraw-Hill.

Özkan, T., & Lajunen, T. (2005). Multidimensional Traffic Locus of Control Scale (T-LOC): Factor structure and relationship to risky driving. *Personality and Individual Differences, 38*(3), 533-545.

Pasa, G. G., Sousa, T., Guimaraes, L., & Pechansky, F. (2013, August 25-28). *Risk behavior, sensation seeking and impulsivity: study comparing drunk drivers with sober drivers.* Presented at the 20th International Conference on Alcohol, Drugs and Traffic Safety (T2013), Brisbane, Queensland, Australia.

Patil, S. M., Shope, J. T., Raghunathan, T. E., & Bingham, C. R. (2006). The role of personality characteristics in young adult driving. *Traffic Injury Prevention*, *7*(4), 328–334.

Potter, F. J. (1993). The effect of weight trimming on nonlinear survey estimates. *Proceedings of the American Statistical Association, Survey Research Methods Section*, 88(424), 758–763.

Richard, C. R., Thomas, F. D., Blomberg, R. D., Brown, J. L., Wright, T., Graham, L., Lee, J., & Landgraf, A. (2019, November). *Characteristics and predictors of occasional seat belt use using Strategic Highway Research Program 2 data* (Report No. DOT HS 812 840).

National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/43936.

Ruangkanchanasetr, S., Plitponkarnpim, A., Hetrakul, P., & Kongsakon, R. (2005). Youth risk behavior survey: Bangkok, Thailand. *Journal of Adolescent Health*, *36*(3), 227–235.

Sarma, K. M., Carey, R. N., Kervick, A. A., & Bimpeh, Y. (2013). Psychological factors associated with indices of risky, reckless and cautious driving in a national sample of drivers in the Republic of Ireland. *Accident Analysis and Prevention*, *50*, 1226–1235.

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology, 67*(6), 1063–1078.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7*(2), 147–177.

Shin, D., Hong, L., & Waldron, I. (1999). Possible causes of socioeconomic and ethnic differences in seat belt use among high school students. *Accident Analysis and Prevention*, *31*(5), 485–496.

Spencer, B. D. (2000). An approximate design effect for unequal weighting when measurements may correlate with selection probabilities. *Survey Methodology*, *26*(2), 137–138.

Stasson, M., & Fishbein, M. (1990). The relation between perceived risk and preventive action: A within-subject analysis of perceived driving risk and intentions to wear seatbelts. *Journal of Applied Social Psychology, 20*(19), 1541–1557.

Steinberg, L., & Monahan, K. C. (2007). Age differences in resistance to peer influence. *Developmental Psychology, 43*(6), 1531–1543.

Strathman, A., Gleicher, F., Boninger, D. S., & Edwards, C. S. (1994). The consideration of future consequences: Weighing immediate and distant outcomes of behavior. *Journal of Personality and Social Psychology, 66*(4), 742–752.

Substance Abuse and Mental Health Services Administration (2014). *Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings* (NSDUH Series H-48, HHS Publication No. SMA 14-4863).

Vivoda, J. M. & Eby, D. W. (2011). Factors influencing safety seat belt use. In B. Porter (Ed.). *The Handbook of Traffic Psychology* (pp. 215-229). Elsevier.

Wagaman, M. A., & Segal, E. A. (2014). The relationship between empathy and attitudes toward government intervention. *Journal of Sociology and Social Welfare, 41*, 91–112.

Webster, G. D., DeWall, C. N., Pond Jr, R. S., Deckman, T., Jonason, P. K., Le, B. M., Nichols, A. L., Orozco Schember, T., Crysel, L. C., Crosier, B. C., Smith, C. V., Paddock, E. L., Nezlek, J. B., Kirkpatrick, L. A., Bryan, A. D., & Smith, C. V. (2014). The brief aggression questionnaire: Psychometric and behavioral evidence for an efficient measure of trait aggression. *Aggressive Behavior, 40*(2), 120–139.

Wilson, R. J. (1990). The relationship of seat belt non-use to personality, lifestyle and driving record. *Health Education Research*, *5*(2), 175–185.

APPENDIX A: Variations of Search Terms for Literature Review

Table A1. Variations of Search Terms (Literature Review)

Primary Term	Related Alternate Terms
Seat belt use	Safety belt, part-time belt user, occupant restraint use, occupant protection device, use, full-time belt use
Motorcycle helmet use	None
Motorcycle protective clothing use	None
Sunscreen use	SPF, suntan lotion
Condom use	None
Bicycle helmet use	None
Reflective clothing use	None
Life jacket/personal flotation device use	Life vest, PFD
Flu shot	Influenza vaccination, flu vaccination
Cocaine use	None
Smoking	Tobacco use, cigarette use
Alcohol-impaired driving	Drunk driving, drink driving
Anger/hostility	Anger, hostility
Antisocial behavior spectrum	None
Anxiety	None
Confidence	None
Culture	None
Delay of gratification	Delay discounting, future orientation
Emotional intelligence	None
Empathy	None
Extroversion/introversion	Extroversion, introversion
Fatalism/destiny	Fatalism, destiny
Hope/optimism	Hope, optimism
Life satisfaction	None
Locus of control	None
Morality	None
Narcissism	None
Personality	Big 5
Political leaning	Politics, political party
Religiosity	Religion, spirituality
Risk assessment	None
Risk aversion	None
Self-esteem	None
Self-control/self-monitoring	Self-control, self-monitoring
Self-efficacy	None
Sensation-seeking	None
Social connectedness	None

APPENDIX B: Number of Articles From Literature Review

Table B1. Number of Articles Addressing the Cross Between Each Behavior and Psychological Construct (Literature Review)

	Seat belt	Motorcycle helmet	Protective clothing	Sunscreen	Condom	Bicycle helmet	Life jacket/PFD	Flu shot	Alcohol-impaired driving	Smoking	Illicit substance	Total
Anger/hostility	3	0	0	0	0	0	0	0	8	0	1	12
Antisocial behavior spectrum	1	0	0	1	0	0	0	0	0	0	0	2
Anxiety	1	0	0	3	5	0	0	1	1	0	1	12
Confidence	1	2	1	0	0	0	1	0	0	0	0	5
Culture	7	0	0	1	0	0	0	1	1	2	0	12
Delay of gratification	2	1	0	1	1	0	0	0	0	2	2	9
Emotional intelligence	0	0	0	0	1	0	0	0	0	1	1	3
Extroversion/ introversion	0	0	0	0	1	0	0	0	0	0	0	1
Fatalism/destiny	5	1	1	1	0	0	0	0	0	0	0	8
Hope/optimism	0	0	0	1	2	0	0	0	1	0	0	4
Life satisfaction	0	0	0	1	1	0	0	0	0	1	1	4
Locus of control	5	1	1	0	2	1	0	0	3	0	0	13
Morality	0	0	0	0	0	0	0	0	1	0	0	1
Narcissism	0	0	0	1	0	0	0	0	0	0	0	1
Personality	7	1	0	0	2	0	1	1	4	4	2	22
Political leaning	1	0	0	0	0	0	0	0	0	1	1	3
Religiosity	2	0	0	0	14	0	0	2	0	4	5	27
Risk assessment	4	1	1	5	4	2	2	2	4	0	0	25
Risk aversion	0	0	0	1	0	0	0	1	1	0	0	3
Self-esteem	3	2	0	1	11	1	0	0	1	1	0	20
Self-control/self-monitoring	0	0	0	0	3	0	0	0	3	1	1	8
Self-efficacy	0	2	2	7	33	2	3	3	2	0	0	54
Sensation-seeking	7	3	0	0	9	1	0	0	12	1	2	35
Social connectedness	0	0	0	0	2	0	0	0	0	0	0	2
Total	49	14	6	24	91	7	7	11	42	18	17	

APPENDIX C: Final Annotated Web-Based Questionnaire

(With Branching for Adult, Teen Samples)

I. SAMPLE VARIABLES

- *KP standard demographics*
- xseat: 1=gen pop; 2=parent of teens

II. QUOTA CHECK BASED ON SAMPLE VARIABLES

No quotas based on sample variables.

III. INTRODUCTION

IV. SCREENER

III. Screening

Base: if XSEAT=2
Prompt once
****programming note: this item can be copied from s20233 S1****
Script: Please terminate if S1_roster=2 or -1 (Refused)

QS1 [S]
Are you the parent, step-parent, foster parent or legal guardian of a child 16-17 years of age living in your household?

1. Yes
2. No

Base: IF QS1 =1
****programming note: this item can be copied from s20233 Q3****
Script: Please prompt once if skipped, terminate if refused, terminate if Q3=0

QS2 [Q]
How many children are in your household (include all children age 16-17) for which you are the parent, step-parent, foster parent, or guardian?

[INSERT NUMERIC BOX, RANGE 0-12]

Base: IF QS2 > =1
****programming note: this item can be copied from s20233 Q4****
SHOW NUMBER OF ROWS FOR NUMBER SELECTED IN Q3_ROSTER
Script: Prompt once; if respondent skips age cell, terminate

QS7 [GRID, S PER ROW]

Please provide information on each child age 16-17 in your household for which you are the parent, step-parent, foster parent or guardian:
Begin with oldest age child.

3a. Child	3b. Age (begin with oldest child)	3c. Gender
1.	☐ **[RANGE 16 TO 17]**	❑ M ❑ F

If there is only one child's age is 16-17, please select that child, record dov_select=1; if more than one child's age is 16-17, please randomly select one; record this child as dov_select=1, please also record selected child's age as dov_teen_age, and selected child's gender as dov_teen_gender

Base: if dov_select=1
Prompt once, if parent_consent=2 or refuse please terminate

Parent_consent [S]

Your **dov_teen_age-year-old [if dov_teen_gender=1: son/if dov_teen_gender=2: daughter/if dov_teen_gender=refused: child]** is invited to complete a survey sponsored by the National Highway Safety Administration (NHTSA). The survey asks about attitudes, beliefs, and behaviors in a variety of domains that may help to inform future traffic safety initiatives. It will take about 20 minutes for **[if dov_teen_gender=1:** him**/if dov_teen_gender=2:** her**/if dov_teen_gender=refused:** him/her**]** to complete. The **Traffic Safety and Behavior Survey** poses minimal potential risk to respondents completing the survey. Some questions might make **[if dov_teen_gender=1:** him**/if dov_teen_gender=2:** her**/if dov_teen_gender=refused:** him/her**]** feel uncomfortable, but **[if dov_teen_gender=1:** he**/if dov_teen_gender=2:** she**/if dov_teen_gender=refused:** he/she**]** has the right to skip any questions **[if dov_teen_gender=1:** he**/if dov_teen_gender=2:** she**/if dov_teen_gender=refused:** he/she**]**'doesn't want to answer. Participation is completely voluntary. We will provide **5,000 incentive points** to your child for completing the survey.

We will protect the privacy of your child with the same high standards we apply to all our members. **[if dov_teen_gender=1:** His**/if dov_teen_gender=2:** Her**/if dov_teen_gender=refused:** His/Her**]** identity will be unknown in all data resulting from the study. The researchers will not have access to any of your child's identifying information (such as **[if dov_teen_gender=1:** his**/if dov_teen_gender=2:** her**/if dov_teen_gender=refused:** his/her**]** name). All of the conditions and terms described in the "GfK's Privacy & Terms of Use Policy" document that you received when you got your recruitment packet are in effect for this study. If you have questions about your child's rights as a participant in this study, or are dissatisfied at any time with any aspect of the Traffic Safety and Behavior Survey, you may contact GfK at [redacted].

We sent you a copy of the survey that your teenager would be invited to participate in. If you already reviewed the survey or do not wish to review it, please answer the question below now. If you would like to review the survey, please come back to this survey to answer the question below.

Do you give your consent to GfK for your child to complete this survey?

1. Yes
2. No

Base: if parent_consent=1
****programming note: this item can be copied from s18755 QS8A****
Prompt once
[SP; PROMPT]
QS8a. Is your [**dov_teen_age-year-old] [if dov_teen_gender=1: son/if dov_teen_gender=2: daughter/if dov_teen_gender=refused: child]** currently available to take the survey?

Yes 1
No, but available at a later time 2

Base: if QS8A=1
****programming note: this item can be copied from s18755 DISPLAY****
QS8B [DISPLAY]
At this time, please have your [**dov_teen_age-year-old] [if dov_teen_gender=1: son/if dov_teen_gender=2: daughter/if dov_teen_gender=refused: child]** come to the computer to begin the survey.

Base: if QS8A=2 OR REFUSED
****programming note: this item can be copied from s18755 DISPLAY****
Code as drop-off and resume at QS8A
QS8C [DISPLAY]
It is important that your [**dov_teen_age-year-old] [if dov_teen_gender=1: son/if dov_teen_gender=2: daughter/if dov_teen_gender=refused: child]** completes this survey as soon as possible and within the next 48 hours.

When your [**dov_teen_age-year-old] [if dov_teen_gender=1: son/if dov_teen_gender=2: daughter/if dov_teen_gender=refused: child]** is ready to begin, please access the survey for your child through your Member Page or via your invitation email.

Base: all respondents
INTRO[DISPLAY]
This survey asks questions about your attitudes, beliefs, and behaviors in a variety of domains. Your responses will assist the survey's sponsor, the National Highway Traffic Safety Administration, by helping to inform future road safety initiatives.

Under the Paperwork Reduction Act, a federal agency may not conduct or sponsor, and a person is not required to respond to collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a current valid OMB Control number. The OMB Control Number for this information collection is 2127-0729 (expiration date: February 28, 2021). The average amount of time to complete this survey is 19 minutes. All responses to this collection of information are voluntary. If you have comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, send them to Information Collection Clearance Officer, National Highway Traffic Safety Administration, 1200 New Jersey Ave, SE, Washington, DC, 20590.

Protecting your privacy is important. We use confidentiality standards set by the Council of American Survey Research Organizations. We never give your identity or contact information to anyone without your permission. You can read our Panel Member privacy statement **here [HYPER LINK FOR PRIVACY STATEMENT]**.

Thank you for participating!

Base: XSEAT=2
Prompt once, if refuse please terminate

[PPAGE_teen]
AGECONS [Q]
How old are you?

[PROMPT]
Your answer will help represent the entire U.S. population and will be kept confidential. Thank you!

Type in your age.

SCRIPTER: min.=0, max.=120. Show label to right of box: years old. Prompt following nonresponse.

Terminate if ppage_teen ne 16 or 17

Base: if XSEAT=2
Prompt once, if refuse please terminate

[PPGENDER_teen]
QGENDER [S]
Are you…?

[PROMPT]
Your answer will help represent the entire U.S. population and will be kept confidential. Thank you!

Select one answer only.

1. Male
2. Female

Base: Base: if XSEAT=2
Prompt once, if refuse please terminate

[PPHISPAN_teen]
QRACE1 [M]
Are you Spanish, Hispanic, or Latino?

[PROMPT]
Your answer will help represent the entire U.S. population and will be kept confidential. Thank you!

Select all answers that apply.

1. No, I am not [S]
2. Yes, Mexican, Mexican-American, Chicano
3. Yes, Puerto Rican
4. Yes, Cuban, Cuban American
8. Yes, other Spanish, Hispanic, or Latino group (Please specify, for example Argentinean, Colombian, Dominican, Nicaraguan, Salvadoran, Spaniard, and so on) … [O]

Base: respondents who indicated multiple countries of origin (more than one response selected for QRACE1 _2 to QRACE1_8)
Prompt once, if refuse please terminate

QRACE1a [S]
Which group do you identify with most closely?

[PROMPT]
Your answer will help represent the entire U.S. population and will be kept confidential. Thank you!

Select one answer only.

Show only response options selected in QRACE1_teen:
2. Mexican, Mexican-American, Chicano
3. Puerto Rican
4. Cuban, Cuban American
5. Other Spanish, Hispanic, or Latino group

SCRIPTER: Prompt following nonresponse.

SCRIPTER: Create Data-only variable PPHISPAN by using the below logic involving responses to QRACE1 and QRACE1a.
Variable name: PPHISPAN [S]
Variable Text: Census Hispanicity
Response list:
1. Non-Hispanic
2. Mexican, Mexican American, Chicano
3. Puerto Rican
4. Cuban, Cuban American
5. Other Spanish, Hispanic, or Latino group

Count numhispan=QRACE1_2 QRACE1_3 QRACE1_4 QRACE1_5 (1).

QRACE1	NUMHISPAN	QRACE1a	PPHISPAN
1	-	-	1
2	1	-	2
3	1	-	3
4	1	-	4
5	1	-	5
Any value	>1	2	2
Any value	>1	3	3
Any value	>1	4	4
Any value	>1	5	5
Any value	>1	Refused	Randomly assign to one of the values chosen in QRACE1

Base: XSEAT=2
QRACE2INTRO
Please indicate what you consider your race to be. We appreciate your effort to describe your background using these U.S. Census Bureau categories.

SCRIPTER: Show on same screen as CPSRACE_teen.

Base: XSEAT=2
Prompt once, if refuse please terminate
CPSRACE [M]
Please choose one or more **races** that you consider yourself to be.

[PROMPT]
Your answer will help represent the entire U.S. population and will be kept confidential. Thank you!

Select all answers that apply.

1. White
2. Black or African American
3. American Indian or Alaska Native
4. Asian
5. Native Hawaiian or other Pacific Islander
6. Some other race … [O]

Base: respondents who are Asian (CPSRACE=4)
Prompt once, if refuse please terminate

CPSASIAN [M]
Which of the following Asian groups are you?

Select all answers that apply.

1. Asian Indian
2. Chinese
3. Filipino
4. Japanese
5. Korean
6. Vietnamese
7. Other Asian (Please specify, for example Hmong, Laotian, Thai, Pakistani, Cambodian, and so on) … [O]

Base: respondents who are Native Hawaiian/Pacific Islander (CPSRACE=5)
Prompt once, if refuse please terminate

CPSNHPI [M]
Which of the following Native Hawaiian or Other Pacific Islander groups are you?

Select all answers that apply.

1. Native Hawaiian
2. Guamanian or Chamorro
3. Samoan
4. Other Pacific Islander (Please specify, for example Fijian, Tongan, and so on) … [O]

SCRIPTER: Create Data-only variable PPETHM_teen by using the below logic involving responses to QRACE1, CPSRACE, CPSASIAN and CPSNHPI.

Variable name: PPETHM_teen [S]
Variable Text: Census Ethnicity demographic

Response list:

1. White, Non-Hispanic
2. Black, Non-Hispanic
3. Other, Non-Hispanic
4. Hispanic
5. 2+ Races, Non-Hispanic

Compute Asian=0.
Compute nhopi=0.
If CPSASIAN_1=1 or CPSASIAN _2=1 or CPSASIAN _3=1 or CPSASIAN _4=1 or CPSASIAN _5=1 or CPSASIAN _6=1 or CPSASIAN _7=1 asian=1.
If CPSNHPI _1=1 or CPSNHPI_2=1 or CPSNHPI_3=1 or CPSNHPI_4=1 nhopi=1.
Count numraces=CPSRACE_1 CPSRACE_2 CPSRACE_3 asian nhopi CPSRACE_6 (1).

RACE1	**CPSRACE/CPSASIAN/ CPSNHPI**	**PPETHM_TEEN**
1	CPSRACE_1=1 and numraces=1	1
1	CPSRACE_2=1 and numraces=1	2
1	(CPSRACE_3=1 OR CPSASIAN_1=1 OR CPSASIAN_2=1 OR CPSASIAN_3=1 OR CPSASIAN_4=1 OR CPSASIAN_5=1 OR CPSASIAN_6=1 OR CPSASIAN_7=1 OR CPSNHPI_1=1 OR CPSNHPI_2=1 OR CPSNHPI_3=1 OR CPSNHPI_4=1 OR CPSRACE_6=1) and numraces=1	3
1	numraces > 1	5
2 OR 3 OR 4 OR 8	(numraces=1 or numraces>1)	4

REFUSED	Any value	MISSING
Any value	REFUSED	MISSING
2 OR 3 OR 4 OR 8	REFUSED	4

BASE: Show all qualified respondents
Please prompt once if refused, terminate if still refused after prompt

Q1. [S]

How often do you DRIVE a motor vehicle (car, van, truck, taxi or ridesharing service)?

1 Never
2 A few days a year
3 A few days a month
4 A few days a week
5 Almost every day

BASE: all respondents
Please prompt once if refused, terminate if still refused after prompt

Q2. [S]

How often do you RIDE AS A PASSENGER in a motor vehicle (car, van, truck, taxi or ridesharing service)?

1 Never
2 A few days a year
3 A few days a month
4 A few days a week
5 Almost every day

if Q1=1 and Q2=1, please terminate, and set qflag=2 (not qualified)

BASE: all qualified respondents
Please prompt once if refused, terminate if still refused after prompt

Q3. [S]

When DRIVING OR RIDING AS A PASSENGER in a motor vehicle (car, van, truck, taxi or ridesharing service), how often do you wear your seat belt?

1 Never
2 Rarely
3 Some of the time
4 Most of the time
5 All of the time

BASE: if Q3=2-5
Please prompt once if refused, terminate if still refused after prompt

Q4. [S]

When was the last time you did NOT wear your seat belt when DRIVING a motor vehicle (car, van, truck, taxi or ridesharing service)?

1 Today
2 Within the past week
3 Within the past month
4 Within the past 12 months
5 A year or more ago/I always wear it

BASE: if Q3=2-5
Please prompt once if refused, terminate if still refused after prompt

Q5. [S]

When was the last time you did NOT wear your seat belt when RIDING AS A PASSENGER in a motor vehicle (car, van, truck, taxi or ridesharing service)?

1 Today
2 Within the past week
3 Within the past month
4 Within the past 12 months
5 A year or more ago/I always wear it

BASE: all respondents

Quota table:

Termination logic	Group	Quota	
Q3=5 and Q4=5 and Q5=5 and xseat=1	Adult always users	4650	If quota met please terminate
(Q3=1-4 or Q4=1-4 or Q5=1-4) and (xseat=1)	Adult not-always users	1170	If quota met please terminate
Q3=5 and Q4=5 and Q5=5 and xseat=2	Teen always users	170	If quota met please terminate

(Q3=1-4 or Q4=1-4 or Q5=1-4) and (xseat=2)	Teen not-always users	50	If quota met please terminate

DOV_ELIGIBLE[S]
DOV_ELIGIBLE=1: IF Q3=5 and Q4=5 and Q5=5 and xseat=1
DOV_ELIGIBLE=2: IF (Q3=1-4 or Q4=1-4 or Q5=1-4) and (xseat=1)
DOV_ELIGIBLE=3: IF Q3=5 and Q4=5 and Q5=5 and xseat=2
DOV_ELIGIBLE=4: IF (Q3=1-4 or Q4=1-4 or Q5=1-4) and (xseat=2)
DOV_ELIGIBLE=5: IF ELSE.

DOV_ASSIGN [S]

DOV_ELIGIBLE=1: IF DOV_ELIGIBLE=1 AND QUOTA NOT MET
DOV_ELIGIBLE=2: IF DOV_ELIGIBLE=2 AND QUOTA NOT MET
DOV_ELIGIBLE=3: IF DOV_ELIGIBLE=3 AND QUOTA NOT MET
DOV_ELIGIBLE=4: IF DOV_ELIGIBLE=4 AND QUOTA NOT MET
DOV_ELIGIBLE=5: IF ELSE.

V. MAIN QUESTIONNAIRE

PROGRAMMING NOTE: DO NOT SHOW OPTION FOR -99 DO NOT WISH TO ANSWER.
PROGRAMMING NOTE: PLEASE REPEAT COLUMN HEADERS IN THE MIDDILE OF THE GRID FOR Q8, Q10, Q11, 22, 23, 24, 25, 26, 27, 29, REMOVE HEADER AT THE BOTTOM

Section 1

BASE: all qualified respondents

Q6 [S]

A ***decision rule*** is a rule you follow that determines or otherwise informs your behavior in certain situations. For example, you may have a decision rule about the weather and sunscreen use, such as: "If it is sunny outside, I will put on sunscreen." Do you have a rule like this that you follow about when to use your seat belt when you are driving or riding as a passenger in a motor vehicle?

1	Yes
2	No
-99	Do not wish to answer

BASE: if Q6=1 (Yes)

Q7 [S]

How often would you say that you follow this rule?

1	Never
2	Rarely
3	Some of the time
4	Most of the time
5	All of the time
-99	Do not wish to answer

BASE: all qualified respondents

Q8 [Grids, SP]

Some people's use of a seat belt differs depending on the situation. We'd like to know how often you use a seat belt in certain situations. How often do you wear your seat belt when…

Statements in row:

Q8_1	You are DRIVING a motor vehicle?
Q8_2	You are riding as a FRONT SEAT PASSENGER in a motor vehicle?
Q8_3	You are riding as a BACK SEAT PASSENGER in a motor vehicle?
Q8_4	You are riding as a passenger in a TAXI/CAB?
Q8_5	You are riding as a passenger while using a RIDE SHARING SERVICE, such as Uber or Lyft?
Q8_6	You are driving or riding as a passenger in a WORK VEHICLE (e.g., a mail carrier driving a mail van)?
Q8_7	You are driving or riding as a passenger DURING THE DAY?
Q8_8	You are driving or riding as a passenger AT NIGHT?
Q8_9	OTHERS ARE PRESENT in the motor vehicle?
Q8_10	Others are NOT present in the motor vehicle?

Responses in column:

1	Never
2	Rarely
3	Some of the time
4	Most of the time
5	All of the time

98	Not applicable
-99	Do not wish to answer

BASE: all qualified respondents

Q9 [Grid, SP]

Next, please tell us how the presence of SPECIFIC people in a vehicle with you is likely to alter your seat belt use, if at all.

Statements in row:

Q9_1	A friend?
Q9_2	A child under the age of 12?
Q9_3	A teenager or adolescent?
Q9_4	A parent?
Q9_5	An adult child of yours?
Q9_6	A family member that is not a parent or child of yours?

Responses in column:

1	Less likely to wear my seat belt
2	More likely to wear my seat belt
3	Does not affect the likelihood I will wear my seat belt
98	Not applicable
-99	Do not wish to answer

BASE: all qualified respondents
Please randomize statement 1-13, and record the order; stickyHeaders on the mobile device

Q10 [Grid, SP]

Below is a list of reasons why you might wear your seat belt. Please indicate whether each reason applies to you.

Statements in row:

Q10_1	It's a habit.
Q10_2	I don't want to get a ticket.
Q10_3	I'm uncomfortable without it.
Q10_4	Others want me to wear it.
Q10_5	It's the law.
Q10_6	I want to avoid serious injury or death.
Q10_7	The people I'm with are wearing seat belts.

Q10_8	My car, truck, or van has a bell, buzzer, or light that reminds me.
Q10_9	I was brought up to wear it.
Q10_10	The seat belt is automatic.
Q10_11	Road, traffic, or weather conditions.
Q10_12	I'm going to be driving/riding for a long distance.
Q10_13	I'm going to be driving/riding on the highway.
Q10_14	Other (please specify): **[O]**

Responses in column:

1	Yes
2	No
-99	Do not wish to answer

BASE: all qualified respondents
Please randomize statement 1-13, and record the order, please anchor the last one "other"
stickyHeaders on the mobile device

Q11 [Grid, SP]

Below is a list of reasons why you might NOT wear your seat belt. Please indicate whether each reason applies to you.

Statements in row:

Q11_1	I'm only driving a short distance.
Q11_2	I'm driving in light traffic.
Q11_3	I'm in a rush.
Q11_4	I forget to put it on.
Q11_5	It's a hassle to put on.
Q11_6	I don't want my clothes to get wrinkled.
Q11_7	The seat belt is uncomfortable.
Q11_8	The probability of being in a crash is too low.
Q11_9	The people I am with are not wearing seat belts.
Q11_10	I don't like being told what to do.

Q11_11	It may cause injury or trap me if I'm in an accident.
Q11_12	I or someone I know was previously in an accident where the seat belt caused an injury.
Q11_13	I don't need to wear one.
Q11_14	Other (please specify):

Responses in column:

1	Yes
2	No
-99	Do not wish to answer

BASE: all qualified respondents

Q12 [Grid, SP]

Below is a list of different groups of people. Please tell us whether you believe the TYPICAL MEMBER of each group WEARS THEIR SEAT BELT *never, rarely, some of the time, most of the time*, or *all of the time*.

Statements in row:

Q12_1	People your age
Q12_2	Your friends
Q12_3	Your family members

Responses in column:

1	Never
2	Rarely
3	Some of the time
4	Most of the time
5	All of the time
-99	Do not wish to answer

BASE: all qualified respondents

Q13 [Grid, SP]

Now, tell us whether you believe the TYPICAL MEMBER of each group THINKS OTHERS SHOULD WEAR THEIR SEAT BELTS *never, rarely, some of the time, most of the time*, or *all of the time*.

Statements in row:

Q13_1	People your age
Q13_2	Your friends
Q13_3	Your family members

Responses in column:

1	Never
2	Rarely
3	Some of the time
4	Most of the time
5	All of the time
-99	Do not wish to answer

BASE: all qualified respondents

Q14 [S]

When driving or riding as a passenger in a motor vehicle, how often does your SIGNIFICANT OTHER (i.e., wife/husband, boyfriend/girlfriend, partner) wear their seat belt?

1	Never
2	Rarely
3	Some of the time
4	Most of the time
5	All of the time
6	Do not have a significant other or (s)he never rides in a motor vehicle with me (N/A)
-99	Do not wish to answer

BASE: all qualified respondents

Q15 [Drop down menu]

What's the year of the motor vehicle you ride in most often?

1	2019
2	2018
3	2017
…	…
27	1993 or older
98	Don't know
-99	Do not wish to answer

BASE: all qualified respondents

Q16 [S]

Have you ever been in a motor vehicle crash?

1	Yes
2	No
-99	Do not wish to answer

BASE: Section 2

BASE: all qualified respondents
Show display2 and q17 on the same screen

Display2 [Display]

People differ in the ways they act and think in certain situations. The next few questions ask about your own risk taking behaviors and perceptions.

BASE: all qualified respondents

Q17 [Grids, SP]

How often do you engage in the following types of risks?

Statements in row:

Q17_1	Recreational risks (e.g., rock-climbing, scuba diving)
Q17_2	Health risks (e.g., smoking, poor diet, high alcohol consumption)
Q17_3	Career risks (e.g., quitting a job without another to go to)
Q17_4	Financial risks (e.g., gambling, risky investments)
Q17_5	Safety risks (e.g., fast driving, city cycling without a helmet)
Q17_6	Social risks (e.g., standing for election, publicly challenging a rule or decision)

Responses in column:

1	Never
2	Rarely
3	Occasionally
4	Often
5	Very often
-99	Do not wish to answer

BASE: all qualified respondents

Q18 [SP]
Please choose the number that most closely reflects your opinion.

Not wearing a seat belt is…

Responses in column:

1	1—Safe
2	2
3	3
4	4
5	5—Dangerous
-99	Do not wish to answer

BASE: all qualified respondents

Q19 [SP]
Please choose the number that most closely reflects your opinion.

Not wearing a seat belt is…

Responses in column:

1	1—Not risky
2	2
3	3
4	4
5	5—Risky
-99	Do not wish to answer

BASE: all qualified respondents

Q20 [SP]
Please choose the number that most closely reflects your opinion.

How possible do you think it is that BAD LUCK has caused an accident you've been involved in, or one that you will be involved in at some point in the future?

Responses in column:

1	1—Not at all possible
2	2
3	3
4	4
5	5—Highly possible
-99	Do not wish to answer

BASE: all qualified respondents

Q21 [SP]

Please choose the number that most closely reflects your opinion.

How possible do you think it is that FATE has caused an accident you've been involved in, or one that you will be involved in at some point in the future?

Responses in column:

1	1—Not at all possible
2	2
3	3
4	4
5	5—Highly possible
-99	Do not wish to answer

BASE: all qualified respondents

Q22 [GRID, SP]

People differ in the ways they act and think in different situations. The following items ask about how often you act and think in certain ways.

Statements in row:

Q22_1	I am a careful thinker.
Q22_2	I plan trips well ahead of time.
Q22_3	I do things without thinking.
Q22_4	I concentrate easily.
Q22_5	I plan for job security.
Q22_6	I act on impulse.
Q22_7	I am self-controlled.
Q22_8	I say things without thinking.
Q22_9	I don't pay attention.
Q22_10	I act on the spur of the moment.
Q22_11	I plan tasks carefully.
Q22_12	I am a steady thinker.
Q22_13	I am future oriented.

Responses in column:

1	Never
2	Rarely
3	Often
4	Almost always
5	Always
-99	Do not wish to answer

BASE: all qualified respondents

Q23 [GRIDs, SP]

To what extent do you agree with the following statements?

Statements in row:

Q23_1	I am an even-tempered person.
Q23_2	Sometimes I fly off the handle for no good reason.
Q23_3	I have trouble controlling my temper.
Q23_4	Other people always seem to get the breaks.
Q23_5	I sometimes feel that people are laughing at me behind my back.
Q23_6	When people are especially nice, I wonder what they want.
Q23_7	I would like to explore strange places.
Q23_8	I would like to take off on a trip with no pre-planned routes or timetables.
Q23_9	I get restless when I spend too much time at home.
Q23_10	I prefer friends who are excitingly unpredictable.
Q23_11	I like to do frightening things.
Q23_12	I would like to try bungee jumping.
Q23_13	I like wild parties.
Q23_14	I would love to have new and exciting experiences, even if they are illegal.

Responses in column:

1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree
5	Strongly agree
-99	Do not wish to answer

BASE: all qualified respondents

Q24 [GRIDs, SP]

To what extent would you say the following statements are characteristic of you?

Statements in row:

Q24_1	I consider how things might be in the future, and try to influence those things with my day to day behavior.
Q24_2	I often engage in particular behavior in order to achieve outcomes that may not result for many years.
Q24_3	I only act to satisfy immediate concerns, figuring the future will take care of itself.

Q24_4	My behavior is only influenced by the immediate (i.e., a matter of day or weeks) outcomes of my actions
Q24_5	My convenience is a big factor in the decisions I make or actions I take.
Q24_6	I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.
Q24_7	I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.
Q24_8	I think it is more important to perform a behavior with important distant consequences than a behavior with less important immediate consequences.
Q24_9	I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.
Q24_10	I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.
Q24_11	I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.
Q24_12	Since my day to day work has specific outcomes, it is more important to me than behavior that has distant outcomes.

Responses in column:

1	Extremely uncharacteristic
2	Somewhat uncharacteristic
3	Uncertain
4	Somewhat characteristic
5	Extremely characteristic
-99	Do not wish to answer

BASE: all qualified respondents

Q25 [GRIDs, SP]

How much do you agree with the statements below?

Statements in row:

Q25_1	I go out of my way to follow social norms.
Q25_2	We shouldn't always have to follow a set of social rules.
Q25_3	People should always be able to behave as they wish rather than trying to fit the norm.

Q25_4	There is a correct way to behave in every situation.
Q25_5	If more people followed society's rules, the world would be a better place.
Q25_6	People need to follow life's unwritten rules every bit as strictly as they follow the written rules.
Q25_7	There are lots of vital customs that people should follow as members of society.
Q25_8	The standards that society expects us to meet are far too restrictive.
Q25_9	People who do what society expects of them lead happier lives.
Q25_10	Our society is built on unwritten rules that members need to follow.
Q25_11	I am at ease only when everyone around me is adhering to society's norms.
Q25_12	We would be happier if we didn't try to follow society's norms.
Q25_13	My idea of a perfect world would be one with few social expectations.
Q25_14	I always do my best to follow society's rules.

Responses in column:

1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree
5	Strongly agree
-99	Do not wish to answer

BASE: all qualified respondents

Q26 [GRID, SP]

For each of the following questions, decide which sort of person you are most like—the one described on the left OR the one described on the right. Then, decide if the statement is "sort of true" or "really true" for you, and mark that choice. You should mark only ONE CHOICE for EACH ROW.

		Really true for me	Sort of true for me	Sort of true for me	Really true for me	
Q26_1	Some people go along with their friends just to keep their friends happy.					Other people refuse to go along with what their friends want to do, even though they know it will make their friends unhappy.

Q26_2	Some people think it's more important to be an individual than to fit in with the crowd.					Other people think it is more important to fit in with the crowd than to stand out as an individual.
Q26_3	For some people, it's pretty easy for their friends to get them to change their mind.					For other people, it's pretty hard for their friends to get them to change their mind.
Q26_4	Some people would do something that they knew was wrong just to stay on their friends' good side.					Other people would not do something they knew was wrong just to stay on their friends' good side.
Q26_5	Some people hide their true opinion from their friends if they think their friends will make fun of them because of it.					Other people will say their true opinion in front of their friends, even if they know their friends will make fun of them because of it.
Q26_6	Some people will not break the law just because their friends say that they would.					Other people would break the law if their friends said that they would break it.
Q26_7	Some people change the way they act so much when they are with their friends that they wonder who they "really are."					Other people act the same way when they are alone as they do when they are with their friends.
Q26_8	Some people take more risks when they are with their friends than they do when they are alone.					Other people act just as risky when they are alone as when they are with their friends.

Q26_9	Some people say things they don't really believe because they think it will make their friends respect them more.					Other people would not say things they didn't really believe just to get their friends to respect them more.
Q26_10	Some people think it's better to be an individual even if people will be angry at you for going against the crowd.					Other people think it's better to go along with the crowd than to make people angry at you.

BASE: all qualified respondents

Q27 [GRIDs, SP]

Please indicate how much you agree or disagree with each of the following statements.

Statements in row:

Q27_1	In uncertain times, I usually expect the best.
Q27_2	If something can go wrong for me, it will.
Q27_3	I'm always optimistic about the future.
Q27_4	I hardly ever expect things to go my way.
Q27_5	I rarely count on good things happening to me.
Q27_6	Overall, I expect more good things to happen to me than bad.
Q27_7	In most ways my life is close to my ideal.
Q27_8	The conditions of my life are excellent.
Q27_9	I am satisfied with my life.
Q27_10	So far I have gotten the important things I want in life.
Q27_11	If I could live my life over, I would change almost nothing.
Q27_12	I feel part of a group of friends.
Q27_13	My friends understand my motives and reasoning.
Q27_14	I don't have any friends who share my views, but I wish I did.
Q27_15	I am able to depend on my friends for help.
Q27_16	I do not have any friends who understand me, but I wish I did.

Responses in column:

1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree

5	Strongly agree
-99	Do not wish to answer

Section 3
BASE: all qualified respondents
Display3 [Display]

These **[if xeat=1:** final**; if xseat=2:** next**]** two questions ask about your opinions on certain political and social issues.

BASE: all qualified respondents
Q28 [grids, SP]

Please respond to each of the following statements using the scale provided.

Statements in row:

Q28_1	I think the government needs to be a part of leveling the playing field for people from different racial groups.
Q28_2	I believe government should protect the rights of minorities.
Q28_3	I think it is the right of all citizens to have their basic needs met.
Q28_4	I believe the role of government is to act as a referee, making decisions that promote the quality of life and well-being of the people.

Responses in column:

1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree
5	Strongly agree
-99	Do not wish to answer

BASE: all qualified respondents
Q29 [grids, SP]

How much do you agree or disagree with the following statements?

Statements in row:

Q29_1	There is no need to obey laws that seem unreasonable to me.
Q29_2	It is okay to disobey a law if I'm not causing any harm to anybody.
Q29_3	Sometimes it is okay to ignore unimportant laws.
Q29_4	If a law is unjust, I don't have to obey it.
Q29_5	Often I find myself objecting to the symbols of the country (e.g., the flag, the national anthem).

Q29_6	I disagree with the values that the USA represents.
Q29_7	It is okay for people who are in a difficult situation to occasionally disobey the law.
Q29_8	Sometimes I get so frustrated I feel like damaging public property.

Responses in column:

1	Strongly disagree
2	Disagree
3	Neither agree nor disagree
4	Agree
5	Strongly agree
-99	Do not wish to answer

Base: xseat=2

Q30 [S]

What is your religion?

1. Catholic
2. Evangelical or Protestant Christian (Baptist, Lutheran, Methodist, Presbyterian, Episcopalian, Pentecostal, Church of Christ, etc.)
3. Jehovah's Witness
4. Mormon
5. Jewish
6. Islam/Muslim
7. Greek or Russian Orthodox
8. Hindu
9. Buddhist
10. Unitarian (Universalist)
11. Other Christian religion
12. Other non-Christian religion
13. No religion

Base: xseat=2

Q31 [S]

How often do you attend religious services?

1. More than once a week
2. Once a week
3. Once or twice a month
4. A few times a year
5. Once a year or less
6. Never

Base: xseat=2

Q32 [S]

In general, do you think of yourself as…

1. Extremely liberal
2. Liberal
3. Slightly liberal
4. Moderate, middle of the road
5. Slightly conservative
6. Conservative
7. Extremely conservative

VII. STANDARD SCREENED OUT TEXT FOR PANEL SAMPLE:

Use KP standard termination text.

END OF QUESTIONNAIRE

APPENDIX D: Calculation of Weights

Weights were calculated as follows:

Teen Base Weights

First, teen base weights were computed in two steps to approximate the panel and study design:

1) Initial teen base weights (*teen_bw1*). As a starting point, initial base weights for invited parents of teens in geographic region h were computed as the estimated region population size (i.e., estimated number of parents of 15-, 16- or 17-year-olds in the given region), $\hat{N}_h$, divided by the number of parents in region h invited to complete the screener, n_h. These estimated quantities were based on CPS benchmarks and incorporated 15-year-olds to reflect their inclusion in the initial sampling step (prior to screening). Then, for invited parent i in region h, we have that the initial base weight is $teen\_bw1_{hi} = \hat{N}_h/n_h$. If the initial sampling plan had been exactly implemented and the panel weights had been calibrated to CPS benchmarks by region, then this step would be equivalent to computing base weights in two steps to reflect the panel design and study-specific selection probabilities.[13] In practice, the modifications to the initial sampling plan result in these base weights reflecting an approximation to the study design.[14]

2) Final teen base weights (*teen_bw2*). The above weights were restricted to parents of 16- or 17-year-olds and were adjusted for within-household selection of teens. For sample member i, let T_i refer to the number of 16- to 17-year-olds in the teen's household in the GfK panel. Then we compute $teen\_bw2_i = teen\_bw1_i T_i$. Note that to limit weight variability, we limited the adjustment factor of T_i to a maximum adjustment factor of 2. Given that T_i was obtained via screening information, rather than having been available for all invited units, the final teen base weights were computed only for units that completed the screener.

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[13] More specifically, let $parent\_panel\_wt_{hi}$ denote the panel weight for parent i, where P_h refers to the set of active empaneled parents of 15-, 16-, or 17-year-olds in stratum h. This panel weight had been computed to reflect GfK's study design and has been raked to population benchmarks as per GfK's standard methods to mitigate the risks of nonresponse and/or coverage error. Let π_{hi} denote the planned probability-proportional-to-size (PPS) selection probability for unit i in stratum h (conditional upon being an active panelist), and which is proportional to $parent\_panel\_wt_{hi}$, such that $\pi_{hi} = n_h \frac{parent\_panel\_wt_{hi}}{\sum_{i \in P_h} parent\_panel\_wt_{hi}}$. Note that we can estimate the population size in stratum h as $\hat{N}_h^P = \sum_{i \in P_h} parent\_panel\_wt_{hi}$, that is, by summing the panel weights for all active empaneled parents of teens, and where the superscript of P is intended to connote that the population total is estimated via the panel. Then if the initial base weights were computed for invitees as the panel weights divided by the (conditional) selection probability, this would result in $teen\_bw1_{hi} = \frac{parent\_panel\_wt_{hi}}{\pi_{hi}} = \frac{\hat{N}_h^P}{n_h}$. If the panel-estimated stratum population sizes, $\{\hat{N}_h^P\}$, were calibrated to the external benchmarks, $\{\hat{N}_h\}$, then both sets of base weight computations would produce equivalent results.

[14] Such an approximation can be expected to reduce the variance of point estimates (by virtue of reducing weight variability), at the cost of possibly introducing bias. However, such possible bias is likely to be mitigated by the subsequent calibration weighting steps, which entail adjustment to population benchmarks.

Note that although the above steps do not account for the number of adults and/or parents associated with a given teen in the GfK panel, the subsequent calibration steps, which include adjustment to relevant external benchmarks, should mitigate the risk of any selection bias due to this factor.[15]

Adult Base Weights

Next, adult base weights were computed in one step to approximate key features of the panel and study design: namely, stratification by geographic region, as well as procedures for ensuring that no more than one adult per household could be sampled. This step entailed dividing the population into mutually exclusive groups (in which the selection probabilities were assumed to be roughly constant), after which a base weight was computed as the population size in that group divided by the number of invitees within that group. This step was computed in a fashion analogous to the initial teen base weights, with two differences: first, the group population sizes and sample sizes were for adults, rather than being for parents of teens; second, the grouping used for adults incorporated a cross-classification with number of adults in household, as to better approximate the sample design.

More specifically, the adult sample had been stratified by geographic region; within each geographic region, as previously described, the design was approximately equivalent to a two-phase design in which the first phase entailed an equal selection of probability method sample of adults, and the second phase entailed random selection of a single adult from households in which multiple adults had been sampled. Hence, the design was assumed to be approximately equivalent to one in which the selection probability was constant for a given cross-classification of geographic region and number of adults in household.

Thus, base weights for invited adults in group h were computed as the estimated group population size (i.e., estimated number of U.S. residents 18 and older in the given group), $\widehat{N}_h$, divided by the number of adults in group h invited to complete the screener, n_h, where the groups $h = 1,2,\dots,12$ reflected the cross-classification of geographic region and number of adults in household (1 adult; 2 adults; 3+ adults). Then, for invited adult i in group h, we have that the initial base weight is $adult\_bw_{hi} = \widehat{N}_h/n_h$. If the initial sampling plan had been exactly implemented and the panel weights had been calibrated to CPS benchmarks by group, then this step would be identical to computing base weights in two steps to reflect the panel design and

[15] There are two ways in which this can affect selection probabilities (with the effects differing in direction): first, the modification for ensuring only one invitee per household can reduce the representation of households with more impaneled adults in the initial sample; on the other hand, holding all else constant, teens with two impaneled parents have a larger chance of being sampled than teens with only a single impaneled parent (among non-certainty units). Although the exact unconditional selection probabilities from the sampling process were not retained, risk of bias from these issues is mitigated in the calibration stage by adjusting based on the number of adults in the household.

study-specific selection probabilities.[16] In practice, the modifications to the initial sampling plan result in these base weights reflecting an approximation to the study design.[17]

Screener Weights

For each population, a raking adjustment was applied to adjust the final base weights of people completing the screener to external population benchmarks from the CPS. The adjustment of the weights to CPS benchmarks allowed for the mitigation of coverage and/or nonresponse error, and for the generation of valid population benchmarks for a subsequent weighting step.

This adjustment stage applied to all people who had completed the screener and had usable data for weighting purposes (e.g., excluding people who broke off during the screener and/or had missing information on key weighting variables), regardless of car use and regardless of whether they ultimately were subsampled and/or completed the full survey. Note that it was necessary to include in this step people who had not driven or ridden in a car in a past year, due to their inclusion in external benchmarks, although they were not reflected in the final survey weights, as will be described for a subsequent weighting step. Note that by computing screener weights for all people completing the screener, it was possible to leverage information from people who were not subsampled or who broke off in computing more precise population benchmarks for the final weighting step.

The computation of screener weights was applied separately for the two populations: teens (i.e., 16- and 17-year-olds) and adults (18 and older). For each population, benchmarks of key sociodemographic characteristics were obtained from the 2018 March Supplement of the CPS. Each population entailed adjustment on number of adults in household, age by gender, race/ethnicity, geographic region, metropolitan status, and household income; the weights of adults were also adjusted by level of educational attainment.

Specifically, the final base weights of teens were raked using the following dimensions:

1) Number of adults in household (1; 2; 3+);
2) Age (16-year-olds; 17-year olds) cross-classified by gender (males; females);

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[16] More specifically, let $adult\_panel\_wt_{hi}$ denote the panel weight for adult i, where P_h refers to the set of active empaneled adults age 18+ in group h. This panel weight had been computed to reflect GfK's study design and has been raked to population benchmarks as per GfK's standard methods to mitigate the risks of nonresponse and/or coverage error. Let π_{hi} denote the probability-proportional-to-size (PPS) selection probability for unit i in stratum h (conditional upon being an active panelist), and which is proportional to $adult\_panel\_wt_{hi}$, such that $\pi_{hi} = n_h \frac{adult\_panel\_wt_{hi}}{\sum_{i \in P_h} adult\_panel\_wt_{hi}}$. Note that we can estimate the population size in group h as $\widehat{N}_h^P = \sum_{i \in P_h} adult\_panel\_wt_{hi}$, that is, by summing the panel weights for all active empaneled adults, and where the superscript of P is intended to connote that the population total is estimated via the panel. Then if the initial base weights were computed for invitees as the panel weights divided by the (conditional) selection probability, this would result in $adult\_bw_{hi} = \frac{adult\_panel\_wt_{hi}}{\pi_{hi}} = \frac{\widehat{N}_h^P}{n_h}$. If the panel-estimated group population sizes, $\{\widehat{N}_h^P\}$, were equivalent to the external benchmarks, $\{\widehat{N}_h\}$, then both sets of base weight computations would produce equivalent results.

[17] Such an approximation can be expected to reduce the variance of point estimates (by virtue of reducing weight variability), at the cost of possibly introducing bias. However, such possible bias is likely to be mitigated by the subsequent calibration weighting steps, which entail adjustment to population benchmarks.

3) Race/ethnicity (White, non-Hispanic; Black, non-Hispanic; Other, non-Hispanic; Hispanic; or two or more races, non-Hispanic);
4) Geographic region (Geographic Region 1; 2; 3; 4);
5) Metropolitan status (yes; no); and
6) Household income (under $25,000; $25,000–$49,999; $50,000–$74,999; $75,000–$99,999; $100,000–$149,999; $150,000+).

The base weights of adults were raked using the following dimensions:

1) Number of adults in household (1; 2; 3+);
2) Age (18–29; 30–44; 45–59; 60+) cross-classified by gender (males; females);
3) Race/ethnicity (White, non-Hispanic; Black, non-Hispanic; Other, non-Hispanic; Hispanic; or two or more races, non-Hispanic);
4) Geographic region (Geographic Regions 1; 2; 3; 4)
5) Metropolitan status (yes; no);
6) Educational attainment (less than high school; high school; some college; bachelor's degree or higher); and
7) Household income (under $25,000; $25,000–$49,999; $50,000–$74,999; $75,000–$99,999; $100,000–$149,999, $150,000+).

In computing these adjustments, the weights for each population (teens, adults) summed to the total number of people in that group. Given that the two groups were mutually exclusive and were computed as population weights, the two sets of screener weights were combined into a single variable (*screen_wt*). At the conclusion of this weighting step, only people who had completed the screener still had weights, and these weights conformed to external CPS benchmarks.

Subsample Weights

Next, the two sets of weights were adjusted to account for study-specific subsampling based on seat belt use, to reflect the oversampling of not-always users of seat belts. This entailed multiplying the screener weights by the multiplicative inverse of the probability of being subsampled (conditional upon having completed the screener).

More specifically, let r_i refer to the subsampling rate that was applied to individual i who completed the screener. This rate depended on seat belt usage and was equal to .5977 for always users and 1 for not-always users; these rates were held constant throughout the duration of fielding. Let SS refer to the set of units that had been subsampled. The subsampling-adjusted weight for subsampled unit $i \in SS$ was computed as $subsample\_wt_i = \frac{screen\_wt_i}{r_i}$, whereas the weights for units that were not subsampled (i.e., $i \notin SS$) were removed.

Note that subsampling was only applied to people who had driven or ridden in a car in the past year. People who had done neither were outside of the target population and were therefore screened out and their weights were dropped during this step.

Raked Weights

As a final step, the subsampling-adjusted weights (*subsample_wt*) for all qualified respondents[18] were raked to the sociodemographic distributions of the population of people 16 and older who have driven or ridden in a car in the past year, as estimated by the screener weights (*screen_wt*).

The raking dimensions used for adjustment generally followed from those used in computing the screener weights, with three exceptions. First, adults and teens were adjusted together, rather than being adjusted independently, as to improve the efficiency of the weights. Second, adults and teens who had not driven or ridden in a car in the past year were excluded from the benchmarks, given that they had been screened out. Third, all adjustment categories included a cross-classification with seat belt use (i.e., not always users versus always users). This cross-classification had not been available in CPS, and therefore could not be used in adjusting the subsample weights, however, its inclusion in the screener allowed for its use in generating the final benchmarks. This allowed for the weighting process to leverage the screening information on a key survey measure.

As noted previously, the control totals were estimated via *screen_wt*. More specifically, let SCR refer to the set of units receiving screening weights, and let I_{di} be an indicator variable that is equal to 1 if screened unit $i \in SCR$ is in domain (i.e., subgroup) d and 0 otherwise. Then the population estimate for the number of people in domain d can be computed via the screener weights as $\widehat{D} = \sum_{i \in SCR} screen\_wt_i I_{di} = \sum_{i \in (SCR \cap d)} screen\_wt_i$, that is, by summing the screener weights for the people in that domain. Note that the domains used in the final raking dimensions all incorporated a cross-classification with seat belt use and, therefore, people who had not driven or ridden in a car in the past year are implicitly excluded from the raking process.

The raking dimensions were as follows:

1) Seat belt use (always user; not always user) cross-classified by number of adults in household (1 adult in household; 2 adults in household; 3 or more adults in household);
2) Seat belt use (always user; not always user) cross-classified by age (16–17; 18–29; 30–44; 45–59; 60+) and gender (males; females);
3) Seat belt use (always user; not always user) cross-classified by race/ethnicity (White, non-Hispanic; Black, non-Hispanic; Other, non-Hispanic; Hispanic; or two or more races, non-Hispanic);
4) Seat belt use (always user; not always user) cross-classified by geographic region (Geographic Regions 1; 2; 3; 4);
5) Seat belt use (always user; not always user) cross-classified by Metropolitan status (yes; no);
6) Seat belt use (always user; not always user) cross-classified by educational attainment (16- or 17-year-old; 18+, less than high school; 18+, high school; 18+, some college; 18+, bachelor's degree or higher); and

[18] "Qualified respondents" refers to people in the target population who also had complete data. More specifically, this refers to the subset of eligible respondents with complete interviews (disposition code of 1.1) who answered at least two thirds of survey questions. Note that people completing the screener who had not driven or ridden in a car in the past year received a disposition code of 4.1 and were therefore excluded from this group.

7) Seat belt use (always user; not always user) cross-classified by household income (under $25K, $25K–$49,999, $50K–$74,999, $75K–$99,999, $100K–$149,999, $150K+).

This raking adjustment resulted in the final set of weights. As a result of this adjustment, the weights of completed interviews with qualified respondents (n = 6,038) summed to the estimated population size and are consistent with population benchmarks estimated from the screener weights, which had incorporated an adjustment to CPS benchmarks.

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