Using the unmatched count technique to improve base rate estimates of risky driving behaviours among veterans of the wars in Iraq and Afghanistan

Sean C Sheppard,[1,2] Mitch Earleywine[1]

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ABSTRACT

Background Few studies have investigated base rate estimates of risky driving behaviours among veterans of the wars in Afghanistan and Iraq despite evidence suggesting such behaviours result in increased death rates. In addition, published estimates of driving behaviours may be subject to a significant response bias via the impact of perceived mental health stigma on honest self-reporting.

Aim The present study compared the unmatched count technique, a form of randomised response technique used to mitigate biased responding, with traditional anonymous self-report to gain information about base rates of risky driving behaviours among combat veterans.

Methods Cross-sectional data gathered as part of a study of attitudes and behaviours related to military service provided estimates of target activities. Six facets of risky driving (horn honking, carrying firearms in the vehicle, drinking and driving, screaming at other drivers, following other drivers to complain, and tailgating) were assessed.

Results In our sample of 1351 combat veterans, the unmatched count technique revealed significantly higher rates relative to traditional anonymous assessment specifically for horn honking in anger (22.1% vs 13.6%), carrying firearms (51.1% vs 32.2%), and drinking and driving (77.8% vs 54.0%). There were no significant differences for the remaining three items.

Conclusions The high level of morbidity associated with risky driving and motor vehicle crashes is a significant concern in the combat veteran population. These data suggest the presence of a strong response bias associated with endorsing certain risky driving behaviours, potentially leading to serious underestimation of these problem behaviours in standard anonymous questionnaires.

The wars in Afghanistan (Operation Enduring Freedom; OEF) and Iraq (Operation Iraqi Freedom; OIF) have stimulated significant interest in understanding the impact of combat deployment on a range of health-related outcomes. Recent work includes attempts to estimate the prevalence of a range of behavioural health concerns associated with deployment including post-traumatic stress disorder (PTSD),[1] depression,[2] alcohol misuse,[3] aggression,[4] and facets of marital and family functioning.[5] Risky driving, however, has received dramatically less attention.[6] This oversight is striking given the compelling link between risky driving and motor vehicle crashes (MVCs).[7] [8] MVCs have consistently accounted for increased injury-related death rates in combat veterans

relative to non-deployed veterans (for a recent review see Knapik et al[9]). Given the link among risky driving, MVCs and increased death rates in combat veterans, deriving good estimates of risky driving seem imperative.

Despite significant variability in operational definitions, risky driving can best be conceptualised as intentional acts of aggression to cause physical or mental harm, negative emotions occurring while driving, or risk-taking behaviours.[10] [11] Thus, risky driving includes a wide range of behaviours with varying prevalence and varying degrees of morbidity/mortality. Despite the importance of understanding various aspects of risky driving, few empirical assessments of risky driving base rates in military veteran populations exist. Available data suggest that problems with risky driving are likely common.

In a sample of OEF/OIF veterans from the UK, Fear et al[6] found that 19% of veterans met established definitions of risky drivers. Kuhn et al[12] found lifetime prevalence rates of approximately 66% and current rates of 33% in a sample of veterans enrolled in a residential PTSD treatment programme. Sayer et al[4] assessed risky driving with a single item and found that 35% of a sample of OEF/OIF veterans receiving treatment at a Veterans Affairs facility had learned from someone else that they drove dangerously. Strom et al[13] assessed rates of several types of risky driving as part of a broader study of risk-taking behaviour in treatment-seeking OEF/OIF veterans; they found rates of risky driving that ranged from 14.8% to 72.2%. The handful of studies conducted to date yield a wide range of base rate estimates on a variety of risky driving behaviours.[4 6 12 13]

With respect to studies of risky driving, assessment strategies have varied markedly in previous papers, making comparisons across studies challenging. Other limitations include uncertain generalisability,[14 15] an overreliance on self-report screening measures[15] and low response rates.[14] Of further concern is the relative paucity of studies using anonymous assessment methods: a potential source of bias given mental health stigma in the military.[16] Furthermore, there are two additional, related concerns that have received relatively less attention but may have important implications for ascertaining accurate base rates: stigma and anonymity.[17]

The first issue stems from research suggesting perceived mental health stigma negatively impacts veterans' willingness to report mental health concerns (see Hoge et al[1]). For example, combat veterans are concerned that admitting a mental health problem would harm their career and lead others

to view them as weak or 'crazy.'[1] [15] [16] Researchers have also found that stigma is higher in those with combat deployment history than in those without.[18] Research linking mental health problems and risky driving suggests that perceived mental health stigma may have a detrimental and enduring impact on veterans' willingness to report both types of concerns.[4] [6] [12]

The second issue relates to the use of traditional anonymous self-report measures. This approach is problematic because even anonymous questionnaires frequently appear to underestimate the frequency of sensitive or controversial behaviours.[19] [20] Specifically, people frequently provide inaccurate or untruthful responses because of social desirability or perceived stigma.[21] These effects have appeared even when respondents are assured that their responses are completely anonymous. For example, researchers have found that assurances of anonymity did not significantly decrease distortions on computer-based surveys of personal information.[22]

Given the significant stigma associated with reporting behavioural health problems, combat veterans may be inclined to underreport mental health concerns, as well as risky driving behaviours. This, coupled with reliance on traditional anonymous self-report measures, has potentially resulted in a significant source of self-report bias and an underestimation of base rates of risky driving in studies of OEF/OIF veterans.

To address this issue of biased responding with respect to sensitive behaviours, investigators have developed an assessment methodology called the unmatched count technique (UCT).[20] The UCT is a variant of a set of approaches called random response techniques. These techniques provide complete anonymity at the individual level while allowing the estimation of the prevalence of controversial behaviours at the group level.[23] By conferring absolute anonymity for participants' responses, the methodology employed in the UCT mitigates the confounding effects of perceived stigma and results in more accurate endorsement of sensitive behaviours.

THE CURRENT STUDY

Although a handful of studies have investigated base rate estimates of risky driving behaviours among OEF/OIF veterans, none to date have used anonymous assessment methods or otherwise attempted to mitigate the impact of biased responding. In addition, none have used a non-treatment-seeking sample which significantly limits generalisability to the broader veteran population. Combat veterans have also never served as participants in an UCT investigation. Therefore, the current study used the UCT to gain information about the accuracy of base rate estimates of self-reported risky driving behaviours among OEF/OIF veterans by comparing two different assessment methodologies. Given potential stigma associated with admitting to these driving behaviours, it was hypothesised that the UCT would yield higher estimates of risky driving relative to traditional anonymous self-report.

METHOD
The unmatched count technique

Unlike standard anonymous questionnaires, the UCT does not require that a specific individual endorse a controversial behaviour. Participants receive a set of statements and simply indicate the number of these that are true for them, but not which ones are true. One portion of the sample receives five innocuous statements (eg, 'I wish I had more energy,' 'I am handy around the house'). They do not report which individual statements are true for them, but respond with the total number, from zero to five, that are true. Another set of participants receives these

same five innocuous statements as well as an additional item of interest. This additional item is usually the sensitive one, such as engaging in a socially unacceptable behaviour (eg, binge eating or unsafe sex). These participants also do not report which individual statements are true for them, but respond with a total number, from zero to six, that are true.

With large samples and random assignment, it is possible to estimate the frequency of the sensitive behaviour by subtracting the responses of the second group from the first. If the group who responded to six statements reported that 3.0 were true on average while the group who responded to five statements reported an average of 2.5 statements, the difference must arise from the endorsement of the sixth sensitive behaviour. In this case, 50% of the participants must have engaged in the sensitive behaviour $(3.0-2.5=0.50)$. Comparing this estimate with one from a group who receives a traditional anonymous self-report measure can reveal the extent of biased responding. Thus, if this 50% estimate differs significantly from the one obtained with a traditional anonymous questionnaire, a self-report bias likely serves as the source of the difference. Relative to traditional anonymous assessment, the UCT has revealed higher estimates of a number of sensitive behaviours, including symptoms of eating disorders,[24] unsafe sexual behaviour,[25] hate crime victimisation[26] and theft.[27]

Participants

Data collected as part of an ongoing online study of attitudes and behaviours related to military service were analysed in the current study. Participants were selected for inclusion in the current analyses if they reported history of at least one OEF/OIF combat deployment. This research was approved by the appropriate local institutional review board.

Measures

We adapted six risky driving items from a variety of empirically validated instruments to measure facets of risky driving that included negative and under-controlled affect, intentional aggressive behaviours and risky behaviours with high potential for catastrophic outcomes. Two items ('I have driven a car after drinking quite a bit of alcohol' and 'I have followed another car to its destination to complain to the driver') were adapted from the Driving Behaviour Questionnaire.[28] Two items ('I have screamed at other drivers on the road' and 'I sometimes drive right on the rear bumper of another car to make the driver move out of the way') were adapted from the Driving Anger Expression Inventory.[29] Despite the potential implications for public safety, there is a paucity of research examining the impact of carrying a weapon while driving on risky driving behaviour. The research that does exist suggests that carrying a firearm while driving is strongly associated with illegal and aggressive behaviour behind the wheel[30] and that even the presence of a firearm in the vehicle increases aggressive behaviour.[31] To asses this driving behaviour, one item ('I have carried a gun with me in the car while driving') was adapted from an ongoing project evaluating perceptions of road rage.[32] In addition, another item ('I often honk my horn in anger at other drivers on the road') was adapted from this same project. The six target items adapted for the current study were used to create the following three self-report measures.

UCT Driving Form A is a traditional anonymous true/false self-report measure comprised of the six risky driving items adapted for this study (online supplementary appendix A). UCT Driving Form B is comprised of six sets of items (three sets of five innocuous items and three sets of five innocuous items plus three of the risky driving items from UCT Driving Form A).

UCT Driving Form C is comprised of six sets of items (three sets comprised of five innocuous items plus the remaining three driving items from UCT Driving Form A and three sets of five innocuous items) (online supplementary appendix B).

Procedure

Participants were initially recruited via multiple postings on a popular listserv that focused on a broad array of health topics, legal concerns and veterans' issues. Listserv members were encouraged to re-post recruitment materials and study link on social networking and other veteran-relevant websites. Prospective participants followed the link to a webpage that provided information about the study and a copy of the informed consent form. Recruitment materials, the study webpage and the informed consent all prominently featured the anonymous nature of the study. After providing electronic informed consent, participants completed a brief demographic survey before being randomly assigned to complete either the traditional anonymous self-report measure (UCT Driving Form A) or one of the UCT forms (UCT Driving Form B or C) via an online data collection engine.

Statistical analyses

Primary analyses were χ^2 tests of independence across the three groups. Specifically, bases rate of risky driving behaviours derived from the UCT conditions (UCT Driving Forms B and C) were compared with estimates obtained from standard anonymous self-report (UCT Driving Form A) and considered different if p<0.05. Bonferonni corrections were made to control for inflated Type I error. Factor scores were calculated for each item by dividing the proportion of individuals endorsing the item in the UCT condition by the proportion of those endorsing the item in standard anonymous condition. This measure of effect size can be interpreted similar to an OR. For example, a factor score of 1.31 for a driving item means that participants in the UCT condition were 1.31 times more likely to endorse this item than participants in the traditional anonymous condition.

RESULTS

Data from 1351 OEF/OIF veterans (M age=31.9 years, SD=14.1 years) were analysed in the current study. Table 1 presents demographic data for the anonymous and UCT conditions. Preliminary analyses revealed no significant between group differences on any demographic variable. The Department of Defense[33] reports the military is comprised primarily of male (85%) service members with the following ethnic breakdown: Caucasian (70%), African American (17), Latino (11%), Asian (4%) and other (5%). The majority of service members serve in the Army (39%), followed by Navy (23%), Air Force (22%), Marine Corps (14%) and Coast Guard (3%). As can be seen, our sample closely approximates current military veteran population with respect to age, gender, branch of service and rank.[33] Our sample differed somewhat from the veteran population with respect to gender (slightly greater percentage of men) and ethnicity (more Caucasian, fewer African American participants).

Table 1 presents target item endorsement rates of risky driving behaviour for the anonymous and UCT conditions. Significant differences were found between groups on the items measuring honking at other drivers in anger, driving with a gun in the vehicle, and drinking and driving. For example, 54% of participants receiving the traditional survey reported drinking and driving, while the UCT condition revealed that 77.8% endorsed the same behaviour. Thus, the UCT revealed rates of drinking and driving nearly 50% higher than those found in the traditional anonymous condition. Similarly, rates of carrying a

Table 1 Demographic data by study condition

	Total (%) (N=1351)	UCT (%) (n=751)	Anonymous (%) (n=600)
Male	95	94.8	95
Ethnicity			
Caucasian	85	84.4	84.8
Mixed race	5	6	4.7
Asian/Pacific Islander	3	3.2	3.5
African/Caribbean	3.7	3.3	4.1
Native American	<1.0	<1.0	<1.0
Other	2.4	2.4	2.5
Married	51	50.6	51.5
Branch			
Army	42	43.1	40.6
Navy	24.6	25.2	23.8
Air force	14	14.2	13.7
Marines	1	1	1
Coast guard	1	1	1
Unlisted	17.4	15.5	19.9
Rank			
Junior enlisted	50	50.3	49.7
Non-commissioned	43	42.8	44
Warrant officer	1.6	1.6	1.8
Officer	5	4.9	5.2

There were no significant differences between conditions.
Anonymous, traditional anonymous condition; UCT, unmatched count technique.

gun were higher in the UCT condition (51.1% vs 32.2%) as were rates of honking in anger (22.1% vs 13.6%). No differences were found between conditions for items measuring screaming at other drivers, following to destination to complain, or tailgating other drivers (table 2).

DISCUSSION

The purpose of the present study was to gain information about base rate estimates of risky driving behaviours among OEF/OIF veterans. Consistent with expectations, the UCT revealed significantly higher rates of honking in anger, having carried a gun in

Table 2 Comparisons of anonymous and unmatched count estimates of risky driving behaviours

	Anonymous (%) (n=600)	UCT (%) (n=751)	χ^2	Factor
Honk	13.6	22.1	16.65*	1.63
Gun	32.2	51.1	50.69*	1.59
Drink and drive	54.0	77.8	89.49*	1.44
Scream	54.9	50.0	2.89	0.91
Follow	9.3	9.0	0.04	0.97
Tailgate	20.3	19.2	0.36	0.95

N=1351.
Factor score, UCT%/anonymous%.
Drink and drive, I have driven a car after drinking quite a bit of alcohol.
Follow, I have followed another car to its destination to complain to the driver.
Gun, I have carried a gun with me in the car while driving.
Honk, I often honk my horn in anger at other drivers on the road.
Scream, I have screamed at other drivers on the road.
Tailgate, I sometimes drive right on the rear bumper of another car to make the driver move out of the way.
*p<.001.
Anonymous, traditional anonymous condition.

the vehicle, and drinking and driving relative to traditional anonymous assessment. To our knowledge, this represents the first published estimates of the base rate in combat veterans for carrying a gun while driving.

Although carrying a gun in the car while driving may not, by itself, represent risky behaviour, the strong association between the presence of firearms and violent behaviour suggests it does confer some degree of risk.[34] With respect to drinking and driving, the rates found via traditional anonymous assessment in our sample approximate those found by Kuhn et al[12] and Strom et al[13] whereas the rates revealed by the UCT were nearly 50% higher. Given the high-risk nature of carrying firearms and driving under the influence, it was concerning to find that these were the two of the most common risky behaviours in this sample. Considering these three items as a group (honking, carrying firearms and driving under the influence), it seems that the UCT provided an opportunity for veterans to respond more honestly about sensitive risky driving behaviours. Nevertheless, there were no differences between traditional assessment and the UCT for the three remaining risky driving behaviours, and it seems prudent to consider potential reasons for this outcome.

One potential interpretation for the pattern of null findings is that veterans found it less stigmatising to report screaming at, following to complain to and tailgating other drivers. While it seems plausible that these behaviours may have been perceived as more socially appropriate than driving with a weapon or driving under the influence (and thus more likely to be equally reported in both groups), it is challenging to see how they differ from honking a horn in anger, at least with respect to degree of stigmatisation. Alternatively, residual concerns about anonymity or how the UCT truly affords complete anonymity may have contributed to the observed pattern of findings. Ideally, future research will shed light on this seemingly incongruent finding.

Strengths and limitations

To our knowledge, this study provides the first published estimates of a range of risky driving behaviours in a non-treatment seeking sample of OEF/OIF veterans. Importantly, this is also the first study to use both an anonymous assessment method and an unmatched count approach developed to mitigate the impact of social desirability, perceived mental health stigma and related responses biases on accurate responding. Along similar lines, this study confirms the supposition noted by Fear et al[6] that stigma is associated with endorsing some risky driving behaviours and that estimates are in fact subject to a significant response bias. These strengths notwithstanding, these findings must be interpreted in the context of several important limitations.

First, this study used a convenience sample of OEF/OIF veterans, and thus these findings may not generalise to the broader veteran population. We were also not able to compare rates with the general civilian population. Second, the nature of this anonymous internet research project did not allow us to confirm veteran status or fully screen for multiple submissions.[35] Furthermore, the recruitment methodology may have resulted in a selection bias. Third, there is limited information about deployment history or mental health status. Given data that suggest combat deployment and PTSD are both uniquely associated with increased rates of risky driving,[6 12] the current study cannot inform discussions about potential aetiological or complicating factors associated with driving behaviours. Fourth, all but two items used to assess driving behaviour in this study were worded so as to functionally measure lifetime prevalence.

While this may have provided valuable information, an assessment of current prevalence would have been more useful in the context of informing prevention or treatment policy. Fifth, we opted to limit the number of risky behaviours given the increased complexity of the UCT item sets relative to traditional dichotomous self-report items. This approach left several facets of risky driving unassessed. Finally as Lavender and Anderson[36] noted, the UCT only allows for dichotomous responding, which potentially precludes making inferences about the degree or magnitude of assessed behaviour.

Implications

This study highlights risky driving among OEF/OIF veterans as a prevalent and concerning problem worthy of increased attention. In particular, the high rates of driving under the influence and driving with firearms, two arguably high-risk behaviours, suggest that the current cohort of veterans is at increased risk for heightened death rates similar to previous generations of combat veterans. Given the significant increase in death rates of combat veterans due to MVCs (relative to non-combat veterans) seen after Vietnam and Operation Desert Shield/Storm,[8 9] it may be expected that risky driving behaviours and associated negative outcomes will only increase. Risky driving might be particularly relevant for those veterans deployed recently. The nature of battle (eg, significant convoy operations with high threat of roadside bombs) led to explicit training and engagement in risky driving behaviours. Although these driving behaviours might have kept these people alive in combat, comparable behaviours can be quite dangerous when back home. This risk suggests that more effort be expended in attempting to understand the factors that contribute to aggressive and risky driving. Prevention efforts might be expanded by encouraging commanders to emphasise the importance of safe driving at mandatory safety briefs required before holiday weekends. Additionally, treatment programmes for a range of mental health problems within the Veterans Affairs system might incorporate psychoeducation or other interventions to minimise risky driving.

This study further suggests that researchers be mindful of the potentially significant response bias associated with assessing prevalence of sensitive behaviours in veteran populations. As the findings from this study suggest, response biases can dramatically skew base rate estimates, which in turn may have broad implications for resource allocation, prevention and treatment initiatives, and public policy, to name but a few. In addition, random response-style techniques, including the UCT, clearly have a helpful place in the methods employed for gathering data on controversial behaviours. At a minimum, it seems important to at least remain cognizant of this potential source of bias when attempting to assess base rates of potentially sensitive behaviours.

What is already known on the subject

▶ Few studies have investigated base rate estimates of risky driving behaviours among veterans of the wars in Afghanistan and Iraq despite evidence suggesting such behaviours result in increased death rates.

▶ Published estimates of driving behaviours among veterans of the wars in Afghanistan and Iraq may be subject to a significant response bias via the impact of perceived mental health stigma and social desirability on honest self-reporting.

Original article

What this study adds

▶ This study provides the first published estimates of a range of risky driving behaviours in a non-treatment seeking sample of veterans of the wars in Afghanistan and Iraq.

▶ This is the first study with veterans of the wars in Afghanistan and Iraq to use an assessment methodology specifically developed to mitigate the impact of social desirability and perceived mental health stigma on accurate responding.

Competing interests None.

Ethics approval SUNY Albany IRB.

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Firearm violence research priorities

In 2010, more than 105 000 people were injured or killed in the USA as the result of a firearm-related incident. As reported previously, part of the problem is the curtailment of funds for research into firearm-related violence. To counter this, President Obama issued 23 executive orders directing federal agencies to improve knowledge of the causes of this type of violence and how it might be prevented. One of these orders directed the CDC to immediately begin identifying the most pressing research problems in this domain. A committee was convened whose agenda will include the characteristics of firearm violence, risk and protective factors, intervention strategies, gun safety technology, and the influence of video games and other media.