Identifying Possible Sources of Bias Introduced in Traffic Safety Research: Comparison of Blind Linkage with Volunteer Clinical Samples.

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Abstract

In research on alcohol, drugs and traffic safety, and on road safety in general, investigators have employed a variety of measures to construct samples for research. Differing sample construction procedures may introduce bias into the resulting samples, but this possibility has rarely if ever been assessed empirically. In this research we compare two samples of individuals who obtained treatment for a substance abuse problem. One sample was obtained by blind linkage procedures, that is, groups were identified in the clinical records. A second sample was identified in the clinical records, and then tracked, contacted, and asked to consent to participate in a research study. Comparisons of the two samples on psychosocial and problem indicators derived from clinical records revealed a large number of significant differences between the samples. In all cases, the differences indicated that the group tracked and asked for consent had higher levels of functioning than the blind linkage group. The possible reasons for these differences, and their implications for research and research policy, are discussed.

Introduction

In research on drinking and drug using drivers, and other areas in the road safety field, a variety of research approaches have been used over the years. Two of these approaches can be broadly characterized as those which involve complete samples of individuals drawn from records (e.g., 1-3), and those which involve samples of individuals who have been asked to provide their consent to participate in research (e.g., 4-6). Increasing concerns with ethical issues in research, among other factors, have meant that researchers are increasingly following the latter route. An important concern that is highlighted where researchers must choose between procedures in which complete samples are used, versus those in which incomplete samples are used due to the inability to find or obtain consent from all eligible participants, is the introduction of potentially serious bias into the latter type of study. This bias may occur for a variety of reasons. For example, in studies involving driving records of clients in treatment for a substance abuse problem, it can be speculated that individuals with the characteristics of most interest (e.g., those who use drugs most frequently, or who have the highest levels of dependence) will be the individuals most likely not to volunteer to participate, or who will be least likely to be found in
order to seek agreement to participate. In assessing the effects of treatment for drug dependence on traffic safety measures, it is reasonable to suppose that individuals with the most serious drug problems, or the most serious driving problems, will also be those who are most likely not to agree to participate or those who are most likely not to be found when sought. However, while this is a general concern in the research community, virtually no studies have compared the characteristics of the two types of samples.

In a recent investigation of the collision experiences of individuals in treatment for alcohol, cannabis and/or cocaine problems (7,8), we had a unique opportunity to compare a complete samples of individuals with a sample that had to be tracked and from whom consent had to be obtained. We therefore compared the two groups on a variety of demographic and psychosocial measures, to test the hypothesis that the group from whom we had to obtain consent would be biased towards excluding individuals with more extreme characteristics and higher levels of dysfunction.

**Methods**

**Participants.** Two samples were drawn from clinical records, involving clients who sought help for an alcohol or drug problem in 1994, 1995, 1996 or 1997 from the Centre for Addiction and Mental Health (CAMH - formerly the Clinical Research and Treatment Institute of the Addiction Research Foundation). All clients selected were at least 20 years of age at the time treatment began and lived in the greater Toronto area, thus eliminating confounding influences associated with place of residence. About 75% of the clients seen at CAMH meet this criterion. The substance abuse groups were composed of 7 sub-groups: alcohol only; cannabis only; cocaine only; alcohol and cannabis; alcohol and cocaine; cannabis and cocaine; and alcohol, cannabis, and cocaine.

The first sample, for telephone interview purposes, was a random sample of 160 subjects in each of the seven sub-groups noted above, and was selected from patient records (projected N=1120). These people were targeted for a telephone interview. Patients must have been at least 20 years old at their assessment and have had addresses within the Greater Toronto area. It was found that many subjects did not have a valid address, phone number, lived in a group house, did not speak English, or did not provide a last name. These people also were excluded from the initial sampling frame. Patient records were first sampled from 1995. Sufficient numbers that met the selection criteria were obtained for the alcohol only and cocaine only groups. Subsequent random samples were taken from 1996 and 1997 to obtain the desired sample size of 160 patients per group. Insufficient numbers could not be obtained for the cannabis + cocaine and cannabis = cocaine + alcohol groups (i.e., 80 and 96 subject respectively were collected), and the final total number available for the telephone interview sample was 971.

The second sample, drawn for blind linkage purposes, of 527 patients was randomly selected from each of the seven drug groups from 1994. We attempted to retrieve 80 patients in each of the 7 groups selected at random from the list of all clients seen initially for a substance abuse problem in 1994, for a projected total sample of 560. However, only 47 patients met the criteria of having a drug problem with all 3 substances. No interviews were conducted with this group.
Data sources and measurement. The data described here were obtained from clinical intake forms, patient records, and supplementary telephone interviews. When clients first arrive at CAMH they are all asked routine questions (i.e., name, address, birth date, marital status and other demographic characteristics) and given a standardized drug use assessment interview from which their substance problems are identified.

Over the course of a client's contact with CAMH, detailed clinical files are maintained. These files covered the following topic areas: presenting problem, alcohol and drug use history, family alcohol and drug use, social relationships, accommodation, educational attainment, financial, leisure, legal, physical, emotional concerns, previous treatment of any kind, crisis issues and treatment recommendations. Progress notes were also available and described each visit by the client, types of treatment received and information on the therapist's impression of the client's progress. In order to develop the coding scheme for the study, 40 patient files were reviewed and a coding form, the Detailed Client Coding Form, was developed and used for coding the information in the files. Following the development of the Detailed Client Coding Form, the sample files were reviewed and relevant information extracted onto the coding forms for data entry.

Measures of severity of the substance abuse problem were drawn from the alcohol and drug use history chart, which was also useful for assessing whether other drugs were being used in addition to those reported in the face sheets. An interval level variable was constructed measuring intensity of treatment based on the number of hours in contact with the Clinical Institute. Type of program attended was treated as a nominal variable and could include: a youth program, an adult abstinent lifestyle program, individual counseling, group counseling, family counseling, guided self change, an Employee Assistance Program, low intensity outpatient program (i.e., one hour per week), and a high intensity day patient and residential program (i.e., 7 hours per day for 14 to 28 days). Since at least 5 years of follow-up data were available for each client, indicators of subsequent treatment and relapse were recorded. Additional variables extracted included suicide attempts, depression, anger, social supports and other emotional problems.

Telephone interviews. Tracking of individuals in the telephone interview sample began in the fall of 1999. The initial task was to obtain the telephone numbers of 971 patients, based on the first and last names of each subject as well as their phone number and address at the time they were initially assessed.

Direct or likely telephone matches were made for 396 subjects (i.e., 40.8% of the initial sample) and these people, termed the telephone match sample, were telephoned for an interview. At least 20 phone call attempts were made for each telephone number in order to resolve their status. We were unable to make a positive identification in the telephone interview for 80 of these people and 3 were clearly the wrong person. For those where positive identification could be made 63 people were ineligible for the study because they did not have a drivers license (31), had died (8) or moved away from the Greater Toronto area (24). Another 13 people were identified by someone at the residence as being the correct person but were never able to be contacted. Finally, 63 people were successfully contacted but refused to participate in the study. The final response rate, comparing the participants with whom interviews were successfully completed
to the total participants and refusals among the positively identified group, was 64%, or 28% of the telephone match sample.

Results
We compared the telephone interview group (TI) with the blind linkage group (BL) on 58 demographic, substance use, and psychosocial problem measures derived from the Detailed Client Coding Form. Variables on which significant differences between groups were found are summarized in Table 1. It is clear that the samples differed substantially on a large number of variables. It is also clear that in every instance, the differences revealed that the TI group had lower levels of problems, or fewer difficulties, than the BI group.

Discussion
This study provides one of the first empirical assessments of the types of bias introduced by differing procedures used to obtain samples for road safety research. The differences in procedures were substantial, and it is important to note that not all comparisons between groups were significant. However, there is clear support for the general hypothesis that the way in which research samples are constructed can have a very large impact on the nature of the eventual sample obtained. All the significant differences observed support the specific hypothesis that sampling procedures requiring contact and consent to participate will act to exclude individuals who have more serious problems, or whose levels of dysfunction are higher that those who are eventually contacted and provide consent.

The factors influencing or responsible for this biasing process cannot be identified specifically, but several could be operating. First, a substantial proportion of the potential TI sample was unable to be located for telephone calls. This could reflect a higher level of mobility over the follow-up interval, or insufficient resources to maintain residential stability or a telephone, among other factors. Additionally, although the participation rate among individuals who were successfully contacted (64%) is considered very good (9), it is possible that biasing factors were operating here as well. For example, individuals with higher levels of dysfunction may have been less likely to agree to the interview. Higher levels of substance abuse could be the direct or underlying cause for the various sources of bias identified here. Thus, since the interest of the research was in the impact of substance abuse on collisions and injuries, in addition to there being an indirect bias introduced by the TI interview procedures, the bias could be more direct in screening out individuals with the highest levels of exactly those characteristics or qualities we are interested in. However, although the factors mentioned here are all associated with higher levels of dysfunction or substance abuse, that need not necessarily be the case and additional work is needed to understand this biasing process.

The likely impact of this bias on collisions and convictions can easily be hypothesized. We have observed, in general, that individuals with a substance abuse problem have increased collision risk (4-9). Thus, in a sample which is biased to exclude those who may have the highest levels of substance abuse problems, we would seem to be excluding those with the highest collision risk (analyses to assess this hypothesis are underway). If this is the case, it would seem to underscore the significance of differences found in studies using such biasing procedures. That is, the biasing procedures would make the comparisons between groups more conservative, and thus any significant differences that are found would likely be smaller than those that really
Table 1: Significant comparisons between Telephone Interview (TI) and Blind Linkage (BL) groups on measures derived from the Detailed Patient Coding Form.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Test of Significance</th>
<th>Direction of Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems with family members</td>
<td>$\chi^2 = 3.90, p&lt;.05$</td>
<td>BL group had higher levels of family problems</td>
</tr>
<tr>
<td>Likelihood of seeking help at another agency</td>
<td>$\chi^2 = 6.79, p&lt;.01$</td>
<td>BL group were more likely to seek help at other agencies</td>
</tr>
<tr>
<td>Alcohol consumption level</td>
<td>$t = 4.41, p&lt;.001$</td>
<td>BL group had higher alcohol consumption levels</td>
</tr>
<tr>
<td>Emotional health concerns</td>
<td>$\chi^2 = 5.57, p&lt;.05$</td>
<td>BL group had more emotional health concerns</td>
</tr>
<tr>
<td>Likelihood of receiving outpatient counseling</td>
<td>$\chi^2 = 4.82, p&lt;.05$</td>
<td>BL group was less likely to receive outpatient counseling, and more likely to be assigned to an inpatient program</td>
</tr>
<tr>
<td>Likelihood of having legally imposed treatment</td>
<td>$\chi^2 = 5.96, p&lt;.05$</td>
<td>BL group was more likely to have legally imposed treatment</td>
</tr>
<tr>
<td>Likelihood of having injected drugs</td>
<td>$\chi^2 = 8.81, p&lt;.05$</td>
<td>BL group was more likely to have used injection drugs</td>
</tr>
<tr>
<td>Likelihood of having used cocaine in the past year</td>
<td>$\chi^2 = 15.35, p&lt;.05$</td>
<td>BL group was more likely to have used cocaine in the past year</td>
</tr>
<tr>
<td>Likelihood of having used other drugs in the past year</td>
<td>$\chi^2 = 3.90, p&lt;.05$</td>
<td>BL group was more likely to have used other drugs in the past year</td>
</tr>
<tr>
<td>Total opioid use</td>
<td>$t = 2.62, p&lt;.05$</td>
<td>BL opioid users had higher total levels of opioid use</td>
</tr>
<tr>
<td>Total other drug use</td>
<td>$t = 3.80, p&lt;.01$</td>
<td>BL other drug users had higher total levels of other drug use</td>
</tr>
</tbody>
</table>

exist. Thus, while our results highlight the bias that might be implemented by procedures which require tracking and obtaining consent, they do not necessarily imply that results from such studies are invalid. Instead, the results may be conservative and underestimate differences that really exist. However, this hypothesis requires more work to confirm.

Our results also underscore the value of blind linkage procedures in research on this and related questions. Ethical issues in conducting research are never simple, and problems of consent and confidentiality in dealing with government, transportation and health datasets are particularly complex. One trend in recent years has been to deny access to these databanks for research purposes, or to introduce a blanket consent policy where any access requires individual consent. Our data demonstrate that such procedures can result in significant bias in the resulting sample. Thus, the solution to the consent and confidentiality problem of requiring individual consent in
all instances will result in biased and inaccurate results. This may create problems that are worse than those a blanket consent policy is meant to solve.

Acknowledgement

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References


