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# Using the Timeline Followback to Identify Time Windows Representative of Annual Posttreatment Drinking

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**USING THE TIMELINE FOLLOWBACK TO IDENTIFY TIME WINDOWS  
REPRESENTATIVE OF ANNUAL POSTTREATMENT DRINKING**

By

**Christopher Gioia**

A Dissertation Presented to the School of Psychology  
of Nova Southeastern University  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy

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2011

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## **ABSTRACT**

Using 12-month posttreatment Timeline Followback drinking reports, data extrapolated from shorter time windows (e.g., 1 month, 6 months) were used to estimate total annual drinking. The objective was to determine whether data from a shorter time window would provide an estimate of annual drinking sufficiently consistent with the full year report such that it can be used in place of the full report. Data for this study were obtained from problem drinkers who voluntarily participated in a randomized controlled trial of a mail-based intervention. Complete follow-up data were obtained for 467 of the 825 participants who completed a 12-month Timeline Followback of their postintervention drinking. The results of this study suggest that 3 months is the necessary minimum time window to best represent annual posttreatment drinking with alcohol abusers. The major implication of this finding is that alcohol treatment outcome studies can use a shorter posttreatment time window, which is more time and resource efficient, over which to obtain follow-up data with little to no loss in the representativeness of that data.



## **CHAPTER I: STATEMENT OF THE PROBLEM AND REVIEW OF THE LITERATURE**

A key part of all treatment studies is follow-up, which is intended to collect treatment outcome data in order to evaluate the treatment's effectiveness. High follow-up rates are important because an unbiased representative sample that accurately reflects the sample's outcomes is needed. Several studies have shown that high follow-up rates provide an unbiased representation of treatment outcomes. However, high follow-up rates can be affected by many factors (e.g., amount of data to be collected, length of the follow-up interval, participant compliance, and attrition; Cottler, Compton, Ben-Abdallah, Horne, & Claverie, 1996; Hansten, Downey, Rosengren, & Donovan, 2000; Wutzke, Conigrave, Kogler, Saunders, & Hall, 2000).

Several research studies have shown that participants not found for follow-up show poorer treatment outcomes than those found for follow-up (Bamford, Booth, McGuire, & Salmon, 2004; Meyers, Webb, Frantz, & Randall, 2003; Nemes, Wish, Wraight, & Messina, 2002; Walton, Ramanathan, & Reischl, 1998). Moos and Bliss (1978) examined differences in treatment outcomes between alcohol abusers who were located and lost at follow-up. Using several outcome criteria, significant differences ( $p < .05$ ) were found between participants located and lost at follow-up on 7 of the 9 criteria. Moos and Bliss found that the greater the number of attempts to locate participants, the poorer their posttreatment outcomes. Similarly, Walton et al. (1998) found that contact difficulty with participants was associated with a significantly greater likelihood of relapsing at 3- and 6-month follow-up.

Of considerable methodological interest are the costs associated with extensive tracking efforts. This issue has been explored primarily through investigating differences between followed-up participants and non-followed-up participants for baseline variables (LaPorte,

McLellan, Erdlen, & Parente, 1981; Moos & Bliss, 1978; Nemes et al., 2002; Walton et al., 1998). If no baseline differences are found between the two groups, researchers can have increased confidence in the generalizability of their conclusions (Kosten et al., 1992; Toumbourou, Hamilton, & Fallon, 1998). However, doing so mistakenly implies similar treatment outcomes between those followed up and those not followed up. As previously noted, differences exist among those followed up and those not followed up which alter their outcomes posttreatment in unpredictable ways (Moos & Bliss, 1978). Furthermore, comparing the two groups is only useful “to the extent that the baseline variables examined actually have a strong relationship with the outcome of interest” (Diguisto, Panjari, Gibson, & Rea, 2006, p. 1202).

### **How Long Should Drinking Data Be Collected?**

Although the length of the time window over which drinking is measured has been recognized as an important factor for alcohol treatment outcome studies, it has not received much empirical study. In contrast to longer recall intervals, short recall periods tend to provide more accurate and unbiased estimates of drinking (Gmel & Rehm, 2004).

Interestingly, while a few studies have shown that some participants refuse to complete lengthy drinking questionnaires (Cunningham, Ansara, Wild, Toneatto, & Koski-Jännes, 1999; Miller & Del Boca, 1994; Sobell et al., 2002), they also have shown that many of these same participants when asked completed a shorter drinking measure (e.g., Quick Drinking Screen [QDS]; Sobell et al., 2003). These studies suggest that completing lengthy follow-up questionnaires place a time burden on some study participants and can lead to lower follow-up rates. In this regard, it would seem that shorter follow-up time windows over which drinking data are collected could minimize follow-up attrition.

Unfortunately, while a higher follow-up rate is achieved, shorter drinking measures can only provide limited data (i.e., quantity, frequency) compared to the daily drinking data obtained from the Timeline Followback (TLFB; see Appendix A) method. While past studies (reviewed in Sobell and Sobell, 2003) comparing Quantity-Frequency (QF) and daily estimation measures have found relatively similar reports for aggregate drinking variables, QF measures typically are not able to capture sporadic and atypical drinking patterns.

While short time windows (e.g., 7 to 30 days) typically require less time (Sobell & Sobell, 2003), one problem is that several studies have found that individual drinking patterns have considerable variability over shorter intervals (Alanko & Poikolainen, 1992). Further, although at the level of group data, random sampling and assignment will to some extent control for non-systematic individual variability, they cannot control for systematic temporal changes such as seasonal variations in drinking (e.g., summer vs. winter, or Christmas holidays; Alanko & Poikolainen, 1992; Cho, Johnson, & Fendrich, 2001; Fitzgerald & Mulford, 1987). Consequently, seasonal variations in drinking behavior could yield unrepresentative data for shorter vs. longer intervals (Lemmens & Knibbe, 1993). For example, Alanko & Poikolainen (1992) used a 1-week window to estimate annual drinking and found deviations around the true annual measure ranging from 50% to 185%, depending on the sample week.

Another limitation to short recall intervals is that they can distort the distribution of drinkers across a sample. Gmel and Rehm (2004) reported that short recall periods are particularly a problem if the focus of a research study is on abstaining from drinking. Others (Alanko & Duffy, 1996) have also noted that when short recall periods are used they typically overestimate the number of abstinent drinkers within a sample compared to longer intervals (e.g.,

12 months). On the other hand, some have argued that longer time windows could result in memory errors (Lemmens, Knibbe, & Tan, 1988).

### **Timeline Followback and Temporal Windows**

The length of the recall period and its influence on the acquisition of reliable and valid self-reports of drinking is particularly relevant to the TLFB where the recall of pre and posttreatment data ranges from 12 to 24 months from the interview date. One study (Searles, Helzer, Rose, & Badger, 2002) examined TLFB reports of drinking across three intervals (30, 90, and 366 days) and compared them to interactive voice recording reports. They found that even though the TLFB underestimated alcohol consumption in comparison to interactive voice recording, the level of underreporting did not differ across the three recall intervals. These results suggest that heavy drinking participants can provide reliable drinking information across a range of recall intervals. Other studies have also found the TLFB to have good stability over time with different populations (e.g., normal drinkers and college students; Sobell, Sobell, Klajner, Pavan, & Basian, 1986; Sobell, Sobell, Leo, & Cancilla, 1988).

One possible criticism of the TLFB is that participants might feel overwhelmed by its length, particularly longer time windows (e.g.,  $\geq 3$  months) and complete it quickly by writing in the same number of drinks for all or most days in the interval. In this regard, the TLFB was evaluated for a possible response set bias (i.e., respondents used the same pattern for all weeks to save time when completing the calendar). To investigate this, the percentage of 825 respondents who completed their TLFB using repetitive weekly patterns was evaluated (Sobell et al., 2003). Because respondents were asked to record their drinking on the calendar for 12 months back from the date of their interview, weekly drinking patterns could be calculated. A repetitive pattern was defined as reporting the same number of drinks consumed on the same days of the

week. The percentage of the 825 respondents who had no matching weekly patterns throughout the year-long interval was close to two-thirds of the entire sample, and over 75% of all respondents had relatively few matching weeks during the year. Furthermore, the percentage of the 825 respondents who had identical patterns ranged from 2% to 3% depending on the time interval being examined. Moreover, only 1.8% (15/823) of all respondents filled in the TLFB with the same number of drinks for each day on the 12-month calendar. These data suggest that the respondents did not complete the TLFB in a cursory manner by repeating the same pattern for each week.

What is of most interest to this study is how a 12-month TLFB recall period affects the collection of drinking data at the time of follow-up. Two studies (Cunningham et al., 1999; Sobell et al., 2002) highlight the effects of a 12-month interval on collecting posttreatment drinking data. In Cunningham et al. (1999), participants were randomly assigned to receive one of two versions of a mail survey investigating attempts to reduce drinking. In one group, participants were sent a graduated-frequency measure that reflected a shortened version of the TLFB, and in the second group, participants were sent a 365-day TLFB. The investigators found that 29% fewer respondents who were sent the 365-day TLFB returned baseline materials in comparison to those respondents who were sent the graduated-frequency measure.

Sobell et al. (2002) followed up alcohol abusers over 12 months as part of a mail intervention. At the 12-month follow-up date, participants were asked to complete a 360-day TLFB. Of the original 825 participants in the study, 657 (79.63%) were located for follow-up, a percentage equivalent to the “gold standard” of 80% (Hansten et al., 2000). However, only 467 (71.08%) of the 657 participants completed the 12-month follow-up TLFB. The remaining 358 participants (43.39%) who did not complete the 12-month TLFB were composed of two groups.

Participants in the first group (190 participants) were located for follow-up but were unwilling to complete the full 12-month TLFB. However, because the QDS and TLFB have been shown to provide similar drinking data on several major drinking variables (Sobell et al., 2003), the QDS was administered in an effort to collect some drinking data.

The second group (168 participants) was lost at follow-up. Sobell et al. (2002) examined whether these participants differed significantly from all participants who were located at follow-up (657). On only three of the 22 pretreatment variables were the two groups significantly different ( $p < .05$ ): participants lost at follow-up had higher scores on the Alcohol Use Disorders Identification Test (AUDIT), more alcohol-related consequences, and more drinks per week. This is consistent with past research (Edwards & Rollnick, 1997) which suggests that participants who are not followed up tend to have a more serious history of alcohol problems.

A recent study (Vakili, Sobell, Sobell, Simco, & Agrawal, 2008) using 12-month pretreatment data evaluated the representativeness of different time windows for describing aggregated reports from problem drinkers' annual drinking. Results indicated that for aggregated data and with large samples, time windows as short as one month provided good estimates of annual drinking rates. However, the authors recommended that pretreatment drinking data be collected for a minimum of 3 months when small samples or where more precision is needed. Because this study only examined pretreatment drinking data, this conclusion does not apply to posttreatment data. The present study examined whether alcohol consumption data from shorter posttreatment follow-up intervals is sufficiently representative of longer intervals to warrant their use in alcohol treatment outcome studies.

## **Self-Reports**

Self-report measures are an important source of information about drinking behavior whether at assessment, throughout treatment, or at posttreatment follow-up. Over the past three decades many studies have examined the validity and reliability of the self-reports of different drinker groups, including alcohol abusers. Almost all these studies have found that in most cases self-reports typically reflect more consumption and consequences (i.e., a more negative picture is provided by the respondent) than other data sources (e.g., biochemical measures, official records, and collateral informants; Babor, Steinberg, Anton, & Del Boca, 2000; Connors & Maisto, 2003; Del Boca & Darkes, 2003; Sobell & Sobell, 2003). Such a finding led Babor and his colleagues (2000) to conclude that retrospective self-reports are the “gold” standard for collecting drinking data over biological and collateral data sources. Lastly, to insure the accuracy of self-reports of alcohol consumption they need to be obtained under the following conditions: (a) when participants are alcohol-free; (b) when they are given assurances of confidentiality; (c) when interviewed by a researcher or clinician; and (d) when participants are voluntary (Babor et al., 2000; Sobell & Sobell, 2003).

## **Timeline Followback and Quantity-Frequency Measures**

Forty years ago, drinking behavior was primarily assessed using QF measures (Agrawal, Sobell, & Sobell, 2009; Sobell & Sobell, 1992, 2003). Such measures asked respondents to report the average number of days per week they drank, and the average number of alcoholic drinks they consumed on such days. Thus, QF measures involve two primary drinking variables: (a) average number of drinks consumed per drinking day (i.e., quantity); and (b) average number of days during which alcohol consumption occurred within a specified time period (frequency). Comparisons of the TLFB and QF measures generally have shown that they have good

agreement on the two primary variables (Dum et al., 2009; Roy et al., 2008; Sobell et al., 2003). When assessing the effectiveness of treatment outcome studies, however, QF methods have a serious drawback in that they cannot capture sporadic heavy drinking days and are not sensitive to infrequent drinkers who consume large amounts when drinking. Although methodological refinements have been made to some QF methods to better capture more detailed drinking data (Sobell & Sobell, 2003), such refinements have required additional questions, and thus lose the advantage of being quick and easy to administer.

Because of these limitations one recommended alternative measure to QF measures is the TLFB (Sobell & Sobell, 2003, 2008). Close to 100 ( $n = 99$ ) studies have been conducted examining the psychometric properties of the TLFB with both clinical and nonclinical populations, including individuals with alcohol problems (reviewed in Sobell, Voluse, Dum, Wacha, & Sobell, in preparation). Based on this review and other reviews (Agrawal et al., 2009; Sobell & Sobell, 2003) it is very clear that the TLFB is a psychometrically sound retrospective estimation measure of daily alcohol consumption. In addition, over the course of its development three decades ago over 250 treatment outcome studies have reported using the TLFB to monitor changes in a variety of behaviors.

The TLFB asks respondents to recall their past alcohol consumption over a designated time period using a calendar format that includes holidays and other special events as memory aids. The TLFB can be self-administered in person or by mail or other administered in person or over the phone and uses either a pencil-and-paper or computer format. The goal of the TLFB with individuals with alcohol problems is to provide a detailed picture of their day-by-day drinking over a specified interval using standard drinks as a common metric (Agrawal et al., 2009; Sobell & Sobell, 1992, 2003).



Three key features of the TLFB deserve mention. First, when reporting alcohol consumption, respondents are required to include not only days during which they drank a certain number of alcoholic beverages, but also days during which they did not drink any alcohol. Second, the TLFB presents cues to aid the recall of daily drinking behavior. This is particularly important as retrieval failure is one of four major classes of memory problems identified by Tourangeau (2000). Finally, the TLFB can generate a variety of variables (e.g., percent of days drinking at various levels, mean number of drinks per drinking day, maximum number of drinks consumed on any one day) compared to many other drinking assessment measures.

#### **Are Partial Follow-up Windows Representative of Long-Term Posttreatment Functioning?**

In addition to evaluating the representativeness of short follow-up time windows for predicting longer term drinking, this study will also address an issue of great importance in evaluating the treatment outcome literature. As noted in two different methodological reviews of the alcohol treatment outcome literature (i.e., 1989-1993 and 1980-1984; Breslin & Sobell, 1999; Sobell, Brochu, Sobell, Roy, & Stevens, 1987), a sizeable percentage of studies presenting long-term follow-up data (i.e., one year or longer) reported data for only a short time period prior to the end of the follow-up interval. The following represent examples of this practice: (a) Oei and Jackson (1982) only presented data relating to the week prior to a 1-year follow-up interview; (b) Miller and Baca (1983) only presented the 2- to 6-month period prior to the 2<sup>nd</sup> year follow-up anniversary; (c) Wiens and Menustik (1983), in a three to four year follow-up study, only presented data for a 12-month period prior to 3- to 4-year follow-up; (d) Edwards, Duckitt, Oppenheimer, Sheehan, and Taylor (1983) followed up subjects for 10 to 12 years but only reported drinking behavior for the 1-year prior to the follow-up interview; (e) Glenn and Parsons

(1991) only presented data for 6 of the 14 months of the follow-up interval; and (f) in Project MATCH (1998) at a 3-year follow-up drinking data were only reported for the last three months of follow-up. These examples reflect a tendency for investigators to present only partial follow-up data in what are ostensibly reported as long-term follow-up studies. It is possible that partial follow-up windows could seriously limit the value of long-term follow-up studies because alcohol problems tend to be highly recurrent (Marlatt & Donovan, 2005; Marlatt & Gordon, 1985). Consequently, results based on partial intervals may not be an accurate reflection of how subjects actually fared over the entire course of follow-up.

## **CHAPTER II: METHOD**

The current study will use data gathered by Sobell et al. (2002) that evaluated the utility of a mail intervention for problem drinkers in Toronto, Canada. The following information describes the participants and the measures. For more detail readers are referred to the original article (Sobell et al., 2003).

### **Participants**

Participants were recruited via various media advertisements (e.g., newspapers, cable television, postal flyers) whose title read, “Thinking about changing your drinking?” Those who responded to the ad were first screened with the QDS (Roy et al., 2008; Sobell et al., 2003). Study inclusion criteria were as follows: (a) participants must have been of legal drinking age, which was 19 years old in Ontario, Canada; (b) participants must have reported consumption of, on average, more than 12 drinks (one drink = 13.6 grams of absolute alcohol [in Canada]) per week or consumption of 5 or more drinks on 5 or more days in the past year; and (c) participants could not have been in formal treatment or sought self-help previously for an alcohol problem. Participants who met the above criteria were sent via mail screening materials and an informed

consent form that were to be returned to the researchers using a self-addressed stamped envelope. Initially, 2,434 respondents replied to the advertisement. After excluding those who did not meet the inclusion criteria and those who did not return the initial screening materials and informed consents, there were 825 eligible participants.

Participants were randomly assigned to one of two groups: Motivational enhancement/Personalized feedback (414 participants) or Bibliotherapy/Drinking guidelines (411 participants). There were no significant differences between the two groups across several variables prior to the start of treatment ( $p > 0.05$ ). Depending upon their group assignment, participants were sent personalized feedback related to their drinking behavior (Motivational enhancement/Personalized feedback group) or two informational pamphlets on drinking guidelines (Bibliotherapy/Drinking guidelines group).

One year after receiving the intervention materials participants were scheduled to complete a 12-month mailed follow-up questionnaire. Participants were sent questionnaires about their postintervention drinking and related behaviors, including a TLFB that covered the time period from their initial screening to the 12-month follow-up date. In addition, 10% ( $n = 70$ ) of the full sample ( $N = 657$ ) were selected to complete an in-person follow-up interview with a breath-test and allow a collateral to be interviewed to confirm their self-reports. Of the original 825 participants, the 467 who completed all follow-up materials including the 12-month posttreatment TLFB will be used for the primary data analyses.

The mean (SD) age of the original 825 study participants was 47.46 (11.82) years and 66.91% were male, 60.61% were married, 30.67% had completed university, 60.36% were employed full-time, and 62.33% ( $N = 823$ ) worked in white-collar jobs. Participants reported having had a drinking problem for a mean (SD) of 11.38 (9.18) years, with a mean (SD) of 0.47

(1.48) alcohol-related arrests and 0.11 (1.26) hospitalizations. Participants' mean (SD) score on the AUDIT was 20.24 (6.18). Participants reported drinking on a mean (SD) of 5.29 (1.80) days per week and consuming a mean (SD) of 6.17 (3.15) drinks on days when they drank in the year preceding the intervention. Although none of the participants had ever been in treatment, they reported significant alcohol problems similar to participants in studies of brief interventions (Bien, Miller, & Tonigan, 1993; Heather, 1995; Sobell, Sobell, & Gavin, 1995; Sobell, Sobell, & Leo, 2000).

### **Psychometric Characteristics of Participants' Self-Reports**

As reported elsewhere, the reliability and validity of participants' self-reports were examined and found to have good psychometric characteristics. The first study (Sobell et al., 2003) compared results from two drinking measures covering the same time interval that were administered on two different occasions approximately 2.5 weeks apart. Both measures, the QDS (a QF summary measure that collected data by telephone) and the TLFB (a self-administered daily estimation measure), collected drinking data for the year prior to the interview. Results indicated that remarkably similar aggregate drinking data across several drinking variables supported the reliability of the participants' self-reports. The second study (Sobell et al., 2002) compared a random sample of collaterals' and participants' posttreatment reports of the participants' drinking over the 12-month follow-up interval and found no significant differences ( $p > 0.05$ ) between the two data sources. These results support the validity of the participants' posttreatment reports of drinking. In addition, all participants were alcohol free when interviewed.

## Measures

### *Pretreatment Measures*

Participants completed the following assessment measures:

1. 360-day TLFB covering drinking data one year prior to entry into the study.
2. The QDS during the telephone screening: (a) on average, in the last 12 months, how many days per week did you drink?; (b) when you did drink, how many standard drinks would you have in a day?; (c) how many times in the past 12 months have you had five or more standard drinks in one day?; and (d) in the past 12 months, what was the greatest number of standard drinks you consumed in one day? A fifth variable (average number of standard drinks per week) was obtained by multiplying responses from (a) and (b).
3. The AUDIT (see Appendix B), a self-report measure that contains 10 questions that examine the severity of an individual's alcohol use. Scores range from 0 to 40; scores of 8 or higher are suggestive of a possible alcohol problem (Allen, Litten, Fertig, & Babor, 1997; Conigrave, Hall, & Saunders, 1995).
4. A demographic and alcohol history questionnaire (see Appendix C).
5. Four questions measuring participants' motivation to change their drinking: (a) would you like to reduce or quit drinking if you could do so easily?; (b) how seriously would you like to reduce or quit drinking if you could do so easily?; (c) do you intend to reduce or quit drinking in the next two weeks?; and (d) what is the possibility that 12 months from now you will not have a problem with alcohol?

6. Participants' subjective evaluation of their drinking rated on a 5-point, Likert scale (1 = not a problem at all; 2 = very minor problem; 3 = minor problem; 4 = major problem; and 5 = very major problem).

### ***Posttreatment Measures***

At 12-months postintervention, participants were mailed a TLFB and a follow-up questionnaire that covered the time period from the intervention to the 12-month follow-up date. Of the 825 participants, 79.64% ( $n = 657$ ) were located at follow-up. Of the 657, 190 did not complete the full TLFB. The 190, however, agreed to complete a shorter drinking measure, the Quick Drinking Screen (QDS; Sobell et al., 2003), which contained several short questions about the participants' postintervention drinking behaviors.

### **Analytic Strategies**

Annual drinking estimates using the TLFB will be calculated using monthly time windows (one month = 30 days; one year = 360 days), up to an 11-month time window. The 12-month follow-up or postintervention window will start from the day the intervention was delivered. For purposes of this study this will be referred to as Day 1. The 12-month (or 360-day) timeframe for this study will extend to the last recorded day on the TLFB, which will be labeled as Day 360. Thus, the first month (or 30 days) from the time of the intervention delivery will be labeled as Days 1 through 30 and will be calculated using the total number of drinks consumed for the first 30 days reported on the 360-day TLFB postintervention (i.e., days 1-30), and then multiplied by 12 to obtain an annual drinking estimate.

For the reasons noted earlier, the same process will occur for all other time windows up to eleven months, yielding a total of 11 annual drinking estimates (i.e., one-, two-, three, four-, five-, six-, seven-, eight-, nine-, ten-, and eleven-month windows).

An additional comparison will be made (i.e., Days 271-360 postintervention, a 90-day time window) comparing annualized drinking extrapolated from the 90-day interval to drinking actually reported for Days 1-360. As discussed earlier, outcome studies sometimes base their evaluation of treatment outcome on data for the 90 days prior to the end of the follow-up interval. This analysis will investigate whether such generalization is warranted.

As in the Vakili et al. (2008) study that looked at the representativeness of pretreatment windows, the actual annual drinking rate will then be calculated by adding up all drinking occasions during the 360 days after the delivery of the intervention using the TLFB. The extent of representativeness will then be examined by calculating Pearson correlation coefficients ( $r$ ) and effect sizes ( $r^2$ ) between participants' reported total alcohol consumption on the 360-day TLFB (considered the gold standard for these analyses) and their extrapolated total consumption for the 360-day interval derived using the 11 shorter time windows. Correlations between participants' reported and extrapolated total alcohol consumption for each of the 11 time windows will be subjected to a .01 level of significance.

A set of analyses for the 13 demographic and pretreatment drinking variables will be performed to explore whether there are any significant differences between those who have no posttreatment drinking data ( $n = 168$ , NPT), participants for whom full posttreatment drinking data are available as part of the TLFB ( $n = 467$ , FPT), and those for whom brief posttreatment drinking data are available as part of the QDS ( $n = 190$ , BPT).

For categorical variables (e.g., gender, employment status), a series of 2-by-3  $\chi^2$  comparisons will be performed ( $\alpha = .01$ ). If the initial tests are significant, pairwise 2-by-2  $\chi^2$  comparisons will be subsequently carried out to determine which group pairings are significantly different.

For continuous variables (e.g., age, AUDIT score), a one-factor analysis of variance (ANOVA) with 3 levels will be performed ( $\alpha = .01$ ). Before comparing the means of the continuous variables among the three groups, assumptions of the ANOVA (independence, normality, and homogeneity of variance) will be examined using the Kolmogorov-Smirnov test for normality and Levene's test for homogeneity of variance. If any of the assumptions are not met ( $p < .05$ ), alternative tests will be used (e.g., the Brown-Forsythe test will be used if heterogeneity of variance is found). Any significant omnibus  $F$  statistics on any of the continuous variables will be subsequently inspected using posthoc pairwise comparisons and the Tukey Honestly Significant Difference test ( $\alpha = .01$ ).

### **CHAPTER III: RESULTS**

All participants were scheduled to be followed up one year after they received the mail intervention. The follow-up included a 360-day TLFB calendar, and a follow-up questionnaire that covered events over the 12 months from the date of the intervention. Of the original 825 participants, (a) 79.64% (657) were located for follow-up, a rate similar to that of other large brief intervention and clinical trials (reviewed in Sobell et al., 2002); (b) 0.61% were reported as deceased ( $n = 4$ ) or incapacitated ( $n = 1$ ); (c) 12.36% ( $n = 102$ ) refused or withdrew from the follow-up; (d) 7.15% ( $n = 59$ ) were lost to follow-up; and (e) 0.24% ( $n = 2$ ) were excluded from the study as they reported having never received the study materials. Across the two intervention groups, there was no significant (Fisher's exact test;  $p = .20$ ) differential attrition/dropout as a function of the intervention group assignment.

Of the 79.64% ( $n = 657/825$ ) of participants located for the 12-month follow-up interview, 467 (71.08%; 467/657) returned their entire follow-up questionnaire, including the 360-day TLFB calendar. Of the 358 participants who did not complete a 360-day TLFB



calendar, as noted earlier, 190 completed the QDS, a brief drinking behavior measure that has been shown to collect summary aggregate drinking data for several drinking variables that parallel drinking data obtained using the TLFB (Dum et al., 2009; Roy et al., 2008; Sobell et al., 2003). No follow-up data were available for the remaining 168 participants.

A set of analyses was performed on 13 demographic and pretreatment drinking variables shown in Table 1 between participants who completed the full TLFB posttreatment drinking calendar ( $n = 467$ , FPT; Sobell & Sobell, 1992) with those who only had posttreatment drinking data obtained using the QDS ( $n = 190$ , BPT; Sobell et al., 2003) and those with no posttreatment drinking data ( $n = 168$ , NPT). A series of 2-by-3  $\chi^2$  comparisons and one-factor ANOVAs with 3 levels were conducted on categorical and continuous variables, respectively. No significant differences were found among the three groups on any of the 13 demographic and pretreatment drinking variables.

Assumptions of the ANOVA (independence, normality, and homogeneity of variance) were examined first before comparing the means of the continuous variables among the three groups. Only the normality assumption was not met ( $p < .05$ ). As a result, each group was examined individually for each continuous variable to determine the presence of extreme cases (outliers) and their influence on the shape of the sampling distribution. Certain statistical plots (e.g., stem-and-leaf, box) and descriptive statistics (e.g., skewness, kurtosis) were inspected to assist in these analyses. After examination, no cases were removed. Even though some cases within each group could have been classified as outliers, such cases were more likely to reflect unusual, but valid, drinking patterns and were important to include in the data analyses.

To control for inflation of the type I error rate, all statistical analyses and significance tests used a .01 level of significance. Table 2 shows the total number of drinks for each time

window as reported by participants on the one-year posttreatment TLFB and total number of drinks for the same time windows estimated by extrapolating from shorter time windows. Pearson product-moment correlations between the actual and extrapolated variables are presented in Table 3. All correlations in Table 3 were significant ( $p < .01$ ) and there was a minimum of 74% shared variance between extrapolated and reported annual number of drinks. As the length of time windows decreases, the correlations with the 1-year window generally decrease (see Table 4).

To assess the degree of error that could be expected when extrapolating the yearly number of drinks from shorter time windows, a series of bivariate regression analyses were performed. Table 5 summarizes the regression analyses and shows that the standard error of the estimate decreased substantially as time windows got longer. For example, the standard error of the estimate decreased 91% (i.e.,  $[399.64 - 34.19] / 399.64$ ) from 399.64 with a 1-month time window to 34.19 with an 11-month time window. Although the present results suggest that short time windows (e.g., 1-month) provide a reasonable estimate of annual drinking when using aggregated data, they also show that the incremental gains in error reduction are much less for windows greater than 3 months.

In reliability studies, it is common to look for cases (i.e., outliers) of unusually large differences between the two reports and to determine how the results would be affected with the outliers removed from the data set. The reason relates to the fact that outliers can either reflect measurement error or if there are a large number of systematically disparate cases they can reflect underlying distributions that violate assumptions of normality and homoscedasticity (Kleinbaum, Kupper, Nizam, & Muller, 2008; Stevens, 2002). In the present study, an alternative explanation for outliers is that they accurately reflect patterns in the data (e.g., if drinking for the

first three months of the follow-up interval actually was much greater than the subsequent nine months, the data points extracted from the three month window would differ substantially from those for the aggregated twelve months, but in this case the discrepancy would reflect a true difference rather than a measurement error). While there is no way to identify whether cases with large discrepancies reflect true differences or are spurious, analyses corrected for outliers are reported, but readers should use caution in interpreting such findings.

For the variable, total number of drinks, all cases with studentized deleted residuals  $\geq \pm 3.3$  were identified as outliers (Tabachnick & Fidell, 1996) and the regression analyses were recalculated without these cases. As expected, deleting the outliers improved the degree of shared variance between the dependent and independent variables and reduced the standard error of the estimate. For example,  $r^2$  for extrapolated annual number of drinks for the 1-month time window increased from .74 ( $N = 467$ ) to .82 ( $N = 459$ ), while the standard error of the estimate decreased from 399.64 to 331.85.

Figure 1 presents scatterplots with fitted regression lines and 95% confidence interval bands and prediction interval bands of reported total number of drinks in the past 12 months compared with estimated total number of drinks in the past 12 months calculated by extrapolating from shorter time windows. Unlike confidence interval bands that predict the distribution of a parameter of interest in the population (e.g., true population mean), prediction interval bands predict the distribution of future individual data points. With increasing time windows, there was a large reduction in the number of individual cases outside of the confidence interval. This coupled with the data in Table 3 shows that the correlations between reported and extrapolated annual number of drinks were relatively stable and high ( $> .94$ ) for intervals three months or longer.

For the variable mean drinks per drinking day, Pearson product-moment correlations between reported annual mean drinks per drinking day and mean drinks per drinking day extrapolated from shorter time windows are shown in Table 6. Regardless of the time window, mean drinks per drinking day were highly similar. All correlations were significant ( $p < .01$ ) and the lowest correlation ( $r = .90$ ) which was for 1-month accounted for a minimum of 81% shared variance between the dependent and independent variables. Compared with total number of drinks reported consumed, the results for mean number of drinks per drinking day suggest that the main difference between shorter and longer time intervals is in frequency rather than intensity of reported drinking. Scatterplots of mean drinks per drinking day (see Figure 2) are similar to the scatterplots for annual number of drinks. As time windows increased, the scatter of cases from the regression line notably decreased.

A series of bivariate regression analyses were performed with reported annual mean drinks per drinking day as the dependent variable and mean drinks per drinking day extrapolated from shorter time windows as independent variables. The regression findings are summarized in Table 7. The standard errors of the estimate were small (1.05) and decreased as the time window increased in length, indicating that mean drinks per drinking day in the past month is a reasonable indication of mean drinks per drinking day during the past year, although the agreement increased substantially for windows longer than 3 months. Removing outliers ( $n = 7$ ) identified via studentized deleted residual values  $\leq \pm 3.3$ ) resulted in an improvement in shared variance ( $r^2$  [435] = .81;  $r^2$  [428] = .89) and a reduction in the standard error of the estimate ( $SEE$  [435] = 1.05;  $SEE$  [428] = 0.76) between extrapolated drinks per drinking day from the 1-month time window and the reported annual value.

Table 8 summarizes descriptive statistics for the variable percent days drinking from different time windows and Pearson product-moment correlations between reported annual percent days drinking and percent days drinking extrapolated from shorter time windows. All correlations were  $> .80$  and significant ( $p < .01$ ), with a minimum of 65% shared variance between percent days drinking from shorter time windows and annual percent days drinking. Figure 3 shows the scatterplots with fitted regression lines and 95% confidence interval bands and prediction interval bands between percent days drinking in the past year and percent days drinking from shorter time windows. The scatterplots show a greater degree of scatter and departure from the regression line when shorter time windows of percent days drinking are compared to the reported annual value.

A series of bivariate regression analyses were performed with percent days drinking in the past 12 months as the dependent variable and percent days drinking extrapolated from shorter time windows as independent variables. The regression findings are shown in Table 9. The standard errors of the estimate ranged from 18.11 (1-month time window) to 1.53 (11-month time window). Removing outliers ( $n = 11$ ) identified by studentized deleted residual values  $\geq \pm 3.3$ ) improved the shared variance ( $r^2 [467] = .65$ ;  $r^2 [456] = .76$ ) and reduced the standard error of the estimate ( $SEE [467] = 18.11$ ;  $SEE [456] = 15.07$ ) between percent days drinking at the 1-month time window and the reported annual value. Results for percent days drinking suggest 3 months is a necessary minimum time window to represent frequency of annual drinking.

To determine whether shorter follow-up windows (e.g., past 90 days) are representative of annual posttreatment outcomes, a series of bivariate regression analyses were performed using the most distal 90-day interval (i.e., days 271-360 postintervention) to predict total number of drinks, mean drinks per drinking day, and percent days drinking for the entire year. Descriptive

statistics and regression findings are presented in Table 10. Extrapolated values for the shortened follow-up window for the three drinking variables were highly correlated with the annual reported values, and accounted for a minimum of 86% shared variance between the extrapolated and annual values. Significant differences were found between the two time windows for number of drinks,  $t(466) = -3.47, p = .001$ , and percent days drinking,  $t(466) = -3.28, p = .001$ ; no significant difference was found between the two time windows for mean drinks per drinking day,  $t(436) = -1.45, p = .15$ . The actual differences between annual values and estimated annual values extrapolated from the distal window were 47.36 drinks (annual = 1090.99; partial = 1043.63), 0.05 drinks per drinking day (annual = 4.71; partial = 4.66), and 1.92 percent days drinking (annual = 64.41; partial = 62.49). Although the differences between number of drinks and percent days drinking were statistically significant, in absolute terms the differences are unlikely to be clinically meaningful (Meehl, 1978). Therefore, these results indicate that the values for total number of drinks, mean drinks per drinking day, and percent days drinking extrapolated from the most distal 90-day interval are adequate representations of the reported annual values.

#### **CHAPTER IV: DISCUSSION**

Alcohol abusers' self-reported annual drinking derived from their posttreatment TLFB calendars were used to evaluate the representativeness of different time windows for estimating annual posttreatment drinking behavior. Results indicated that a 3-month time window is the necessary minimum time window that was representative of annual reports of drinking. There were also incremental gains in agreement for windows longer than 3 months. These results were consistent across all three drinking variables (i.e., total number of drinks consumed, mean drinks per drinking day, and percent days drinking). In addition, all correlations and shared variances

between any two time windows (e.g., the 1-month time window predicting the 12-month time window) were above .86 and .74, respectively. These relationships were also evident in the scatterplots comparing reported with annual drinking extrapolated from shorter time windows. The current study's findings were consistent with Vakili et al. (2008) who used a similar strategy to examine pretreatment drinking data.

These findings are consistent with past research (Lemmens & Knibbe, 1993), suggesting that short time windows to estimate annual drinking runs the risk of yielding lower annual drinking estimates (Alanko & Poikolainen, 1992; Vakili et al., 2008). In this regard, a 3-month time window is recommended as the shortest window to have for acceptable balance among the variance accounted for in the dependent variable by the independent variable (88%) and the amount of scatter of individual cases from the regression line.

The present results are strengthened by a comparison of a random sample of participants' and collaterals' reports of the participants' postintervention drinking over the 12-months following the intervention. No significant differences ( $p > .05$ ) were found across any of the drinking variables (Sobell et al., 2002).

Another analysis in the present study investigated how well the most distal 90-day follow-up interval (days 271-360 postintervention; a 90-day time window) predicted the total number of drinks, mean drinks per drinking day, and percent days drinking for the entire year. Extrapolations for all three drinking variables were relatively accurate reflections of the actual annual values. These findings are consistent with previous studies that support the use of a short time window to represent longer-term posttreatment functioning (Edwards et al., 1983; Duckitt, Oppenheimer, Sheehan, & Taylor, 1983; Glenn & Parsons, 1991; Miller & Baca, 1983; Oei & Jackson, 1982; Project MATCH, 1998; Wiens & Menustik, 1983).

The advantage of using a shorter follow-up (e.g., 3 months vs. 12 months) window for alcohol treatment outcome studies is that it is more efficient in terms of resources and time. In the present study, which asked participants to complete a 12-month TLFB, if the QDS had not been available follow-up data for an additional 23% ( $n = 190/825$ ) of all participants would have been lost. Although the QDS provided summary drinking outcome data for those participants, it would have been more useful to have collected data for a 90-day follow-up window since the TLFB provides far more information than the QDS. Other researchers who have encountered problems with data collection over lengthy follow-up intervals have similarly turned to using short summary measures to obtain data for a greater percentage of study participants (Cunningham et al., 1999; Miller & Del Boca, 1994). Having follow-up data on as complete a sample as possible is critical as several studies have shown that participants lost to follow-up often are functioning worse than those found (Hansten et al., 2000; LaPorte et al., 1981; Sobell, Sobell, & Maisto, 1984). Further, in randomized clinical trials participants lost to follow-up often are entered into intent to treat analyses as functioning poorly.

An important advantage of using shorter follow-up windows which have been shown to be representative of longer posttreatment drinking intervals is that it will yield higher follow-up rates, because data collection over a shorter recall interval takes less time. For example, in a recent mail intervention study similar to the one in the present study a 3-month follow-up time window resulted in a 96.64% follow-up rate (Sobell, Sobell, Gioia, Montgomery, & Marker, 2010). Although follow-up rates of 70 to 80% are considered acceptable (reviewed in Hansten et al., 2000), the follow-up rate achieved by Sobell et al. (2010) is very high and provides more confidence when estimating population parameters (Hansten et al., 2000).



In view of the small differences in the scatter of individual cases from the regression line beyond the 3-month time window, the present results support Vakili et al.'s (2008) statement that "the added value in variance explained in going beyond 3 months in data collection is small and usually would not be sufficient to justify the use of longer time windows" (p. 1129). However, it is also recognized that on occasion it may be necessary to collect longer posttreatment drinking data (e.g., when examining seasonal or temporal variations in drinking). Likewise, it is important to keep in mind that the present conclusions apply to aggregated data. Thus, longer windows might be needed when evaluating individual case trajectories over time.

Future research is needed to determine whether the results from this study will generalize to alcohol abusers with more severe drinking problems as well as those that have been in treatment before. While still providing reliable and valid drinking data, alcohol abusers with more severe drinking problems typically display more variability in their drinking, which may affect the necessary minimum time window to represent annual reports of drinking. Finally, because this study was conducted in Canada, generalization to other countries awaits further test.

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Table 1

*Characteristics of 825 Participants at Assessment and Nonparametric Tests by Whether Participants had Provided Full Posttreatment Drinking Data, Brief Posttreatment Drinking Data, or No Posttreatment Drinking Data*

Variable	Follow-up group			$\chi^2$	$F(2, 822)$
	FPT ( $n = 467$ )	BPT ( $n = 190$ )	NPT ( $n = 168$ )		
Sex (female; %)	35.33	33.16	26.79	4.08	-
Employed (self-employed or full-time; %)	57.39	67.37	60.71	5.63	-
White collar (%) <sup>a,b</sup>	64.45	55.03	64.67	5.58	-
Married (%)	58.89	65.26	60.12	2.32	-
Completed university (%)	33.19	22.63	32.74	7.51	-
Ethnicity (white; %)	95.07	93.68	93.45	0.88	-
Described alcohol problem as major/very major (%)	45.18	52.11	53.57	4.78	-
$M(SD)$ age (years)	47.91 (12.06)	47.53 (11.36)	46.13 (11.60)	-	1.41
$M(SD)$ AUDIT score <sup>c</sup>	19.80 (6.04)	20.45 (6.08)	21.21 (6.57)	-	3.38
$M(SD)$ years with a drinking problem	11.27 (9.28)	11.37 (9.58)	11.70 (8.46)	-	0.14
$M(SD)$ days drinking/week/past year	5.26 (1.79)	5.44 (1.75)	5.21 (1.90)	-	0.90
$M(SD)$ drinks/drinking day/past year <sup>d</sup>	6.07 (3.13)	6.15 (3.13)	6.47 (3.19)	-	1.01
$M(SD)$ days drinking 5 or more drinks in the past year <sup>d</sup>	172.07 (134.56)	182.14 (142.18)	182.23 (134.17)	-	0.56

*Note.* FPT = full posttreatment drinking data obtained from the TLFB; BPT = brief posttreatment drinking data obtained from the QDS; NPT = no posttreatment drinking data; AUDIT = Alcohol Use Disorders Identification Test.

<sup>a</sup>Hollingshead scale (Hollingshead & Redlich, 1958). <sup>b</sup> $N = 823$ . <sup>c</sup>AUDIT scores range from 0 to 40. <sup>d</sup>One drink = 13.6 g of absolute alcohol (in Canada).

Table 2

*Mean Reported and Extrapolated Total Number of Drinks per Time Window (N = 467)*

	TLFB reported total number of drinks per month											
	1	2	3	4	5	6	7	8	9	10	11	12
Time window <sup>a</sup>	(94.0)	(187.0)	(279.9)	(372.2)	(467.7)	(560.2)	(650.9)	(740.5)	(830.1)	(918.9)	(1004.3)	(1091.0)
1 month	-	188.0	282.0	376.0	470.0	564.0	658.0	752.0	846.0	940.0	1034.0	1128.0
2 months		-	280.5	374.1	467.6	561.1	654.6	748.1	841.6	935.1	1028.7	1122.2
3 months			-	372.2	467.4	559.7	652.1	747.3	839.6	932.0	1027.1	1119.5
4 months				-	465.2	558.2	651.3	744.3	837.4	930.4	1023.5	1116.5
5 months					-	561.3	654.8	748.4	841.9	935.4	1029.0	1122.5
6 months						-	655.4	745.0	840.2	935.5	1025.1	1120.3
7 months							-	742.1	839.7	930.9	1022.0	1113.1
8 months								-	836.8	925.7	1021.9	1110.8
9 months									-	921.4	1012.7	1104.0
10 months										-	1010.8	1102.7
11 months											-	1094.7
12 months												-

*Note.* TLFB = Timeline Followback.

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval. For example, the 1-month time window is the month closest to the intervention date (i.e., days 1 through 30 postintervention).

Table 3

*Pearson Product-Moment Correlations between Reported Total Number of Drinks per Time Window and Total Number of Drinks Extrapolated from Shorter Time Windows for the Same Period (N = 467)*

Time window <sup>a</sup>	TLFB reported total number of drinks per month											
	1	2	3	4	5	6	7	8	9	10	11	12
1 month	-	.97*	.95*	.94*	.92*	.91*	.90*	.89*	.88*	.87*	.87*	.86*
2 months		-	.99*	.98*	.97*	.96*	.95*	.94*	.93*	.92*	.92*	.91*
3 months			-	.99*	.99*	.98*	.97*	.97*	.96*	.95*	.94*	.94*
4 months				-	.99*	.99*	.98*	.98*	.97*	.97*	.96*	.95*
5 months					-	1.00*	.99*	.99*	.98*	.98*	.97*	.97*
6 months						-	1.00*	.99*	.99*	.98*	.98*	.97*
7 months							-	1.00*	1.00*	.99*	.99*	.98*
8 months								-	1.00*	1.00*	.99*	.99*
9 months									-	1.00*	1.00*	.99*
10 months										-	1.00*	1.00*
11 months											-	1.00*
12 months												-

*Note.* TLFB = Timeline Followback.

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval.

\* $p < .01$ , two-tailed.

Table 4

*Total Number of Drinks for Different Time Windows (N = 467)*

Time window <sup>a</sup>	<i>M</i>	<i>SD</i>	<i>r</i> <sup>b</sup>
1 month	1128.01	851.67	.86*
2 months	1122.18	827.79	.91*
3 months	1119.48	820.93	.94*
4 months	1116.49	822.49	.95*
5 months	1122.53	823.19	.97*
6 months	1120.33	818.42	.97*
7 months	1115.91	811.58	.98*
8 months	1110.79	807.27	.99*
9 months	1106.77	804.18	.99*
10 months	1102.73	799.70	1.00*
11 months	1095.58	793.36	1.00*
12 months	1090.99	789.41	-

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval. <sup>b</sup>Correlation between annual and extrapolated total number of drinks for different time windows.

\* $p < .01$ , two-tailed.

Table 5

*Bivariate Regression Analyses for Predicting Annual Number of Drinks from Shorter Time Windows (N = 467)*

Time window <sup>a</sup>	<i>B</i>	95% CI		<i>SEE</i>	<i>r</i> <sup>2</sup>
		<i>LL</i>	<i>UL</i>		
1 month	.80*	.76	.84	399.64	.74
2 months	.87*	.83	.90	328.31	.83
3 months	.90*	.87	.93	275.32	.88
4 months	.92*	.89	.94	239.78	.91
5 months	.93*	.90	.95	205.89	.93
6 months	.94*	.92	.96	178.91	.95
7 months	.96*	.94	.97	149.18	.96
8 months	.97*	.95	.98	120.34	.98
9 months	.97*	.96	.99	96.09	.99
10 months	.98*	.98	.99	66.12	.99
11 months	.99*	.99	1.00	34.19	1.00

*Note.* SEE = Standard error of the estimate. Each line represents a separate regression analysis.

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval.

\* $p < .01$ .

Table 6

*Mean Drinks per Drinking Day for Different Time Windows*

Time window <sup>a</sup>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>r</i> <sup>b</sup>
1 month	435	4.77	2.41	.90*
2 months	443	4.85	2.48	.94*
3 months	447	4.86	2.51	.94*
4 months	451	4.80	2.46	.97*
5 months	452	4.80	2.51	.97*
6 months	452	4.78	2.47	.98*
7 months	454	4.78	2.47	.99*
8 months	456	4.78	2.45	.99*
9 months	456	4.77	2.43	1.00*
10 months	456	4.77	2.43	1.00*
11 months	456	4.77	2.42	1.00*
12 months	456	4.77	2.42	-

*Note.* All *Ns* are smaller than 467 because not all participants had a drinking day in the selected time window. One drink = 13.6 g of absolute alcohol (in Canada).

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval. <sup>b</sup>Correlation between annual and extrapolated mean drinks per drinking day for different time windows.

\* $p < .01$ , two-tailed.

Table 7

*Bivariate Regression Analyses for Predicting Annual Mean Drinks per Drinking Day from Shorter Time Windows*

Time window <sup>a</sup>	<i>B</i>	95% CI		<i>SEE</i>	<i>r</i> <sup>2</sup>
		<i>LL</i>	<i>UL</i>		
1 month <sup>b</sup>	.90*	.86	.94	1.05	.81
2 months <sup>c</sup>	.91*	.88	.94	0.80	.89
3 months <sup>d</sup>	.90*	.87	.93	0.83	.88
4 months <sup>e</sup>	.95*	.92	.97	0.63	.93
5 months <sup>f</sup>	.93*	.91	.95	0.61	.94
6 months <sup>f</sup>	.96*	.94	.97	0.47	.96
7 months <sup>g</sup>	.96*	.95	.98	0.41	.97
8 months <sup>h</sup>	.98*	.97	.99	0.33	.98
9 months <sup>h</sup>	.99*	.98	1.00	0.25	.99
10 months <sup>h</sup>	.99*	.99	1.00	0.17	1.00
11 months <sup>h</sup>	1.00*	.99	1.00	0.09	1.00

*Note.* *SEE* = Standard error of the estimate. Each line represents a separate regression analysis. All *N*s are smaller than 467 because not all participants had a drinking day in the selected time window.

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval. <sup>b</sup>*N* = 435. <sup>c</sup>*N* = 443. <sup>d</sup>*N* = 447. <sup>e</sup>*N* = 451. <sup>f</sup>*N* = 452. <sup>g</sup>*N* = 454. <sup>h</sup>*N* = 456.

\**p* < .01.



Table 8

*Percent Days Drinking for Different Time Windows (N = 467)*

Time window <sup>a</sup>	<i>M</i>	<i>SD</i>	<i>r</i> <sup>b</sup>
1 month	65.66	33.60	.81*
2 months	65.22	32.88	.86*
3 months	65.26	32.29	.90*
4 months	65.31	31.86	.93*
5 months	65.45	31.42	.95*
6 months	65.47	31.16	.96*
7 months	65.37	30.89	.97*
8 months	65.20	30.81	.99*
9 months	65.06	30.82	.99*
10 months	64.87	30.80	1.00*
11 months	64.59	30.73	1.00*
12 months	64.41	30.67	-

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval. <sup>b</sup>Correlation between annual and extrapolated percent days drinking for different time windows.

\* $p < .01$ , two-tailed.

Table 9

*Bivariate Regression Analyses for Predicting Annual Percent Days Drinking from Shorter Time Windows (N = 467)*

Time window <sup>a</sup>	<i>B</i>	95% CI		<i>SEE</i>	<i>r</i> <sup>2</sup>
		<i>LL</i>	<i>UL</i>		
1 month	.74*	.69	.79	18.11	.65
2 months	.80*	.76	.85	15.70	.74
3 months	.85*	.82	.89	13.50	.81
4 months	.89*	.86	.93	11.56	.86
5 months	.92*	.90	.95	9.92	.90
6 months	.95*	.92	.97	8.52	.92
7 months	.97*	.95	.99	6.92	.95
8 months	.98*	.96	1.00	5.38	.97
9 months	.99*	.97	1.00	4.20	.98
10 months	.99*	.98	1.00	2.99	.99
11 months	1.00*	.99	1.00	1.53	1.00

*Note.* SEE = Standard error of the estimate. Each line represents a separate regression analysis.

<sup>a</sup>Time windows start from the first postintervention TLFB date (the most proximal date to the intervention date) and extend to the most distal date in the selected time interval.

\* $p < .01$ .

Table 10

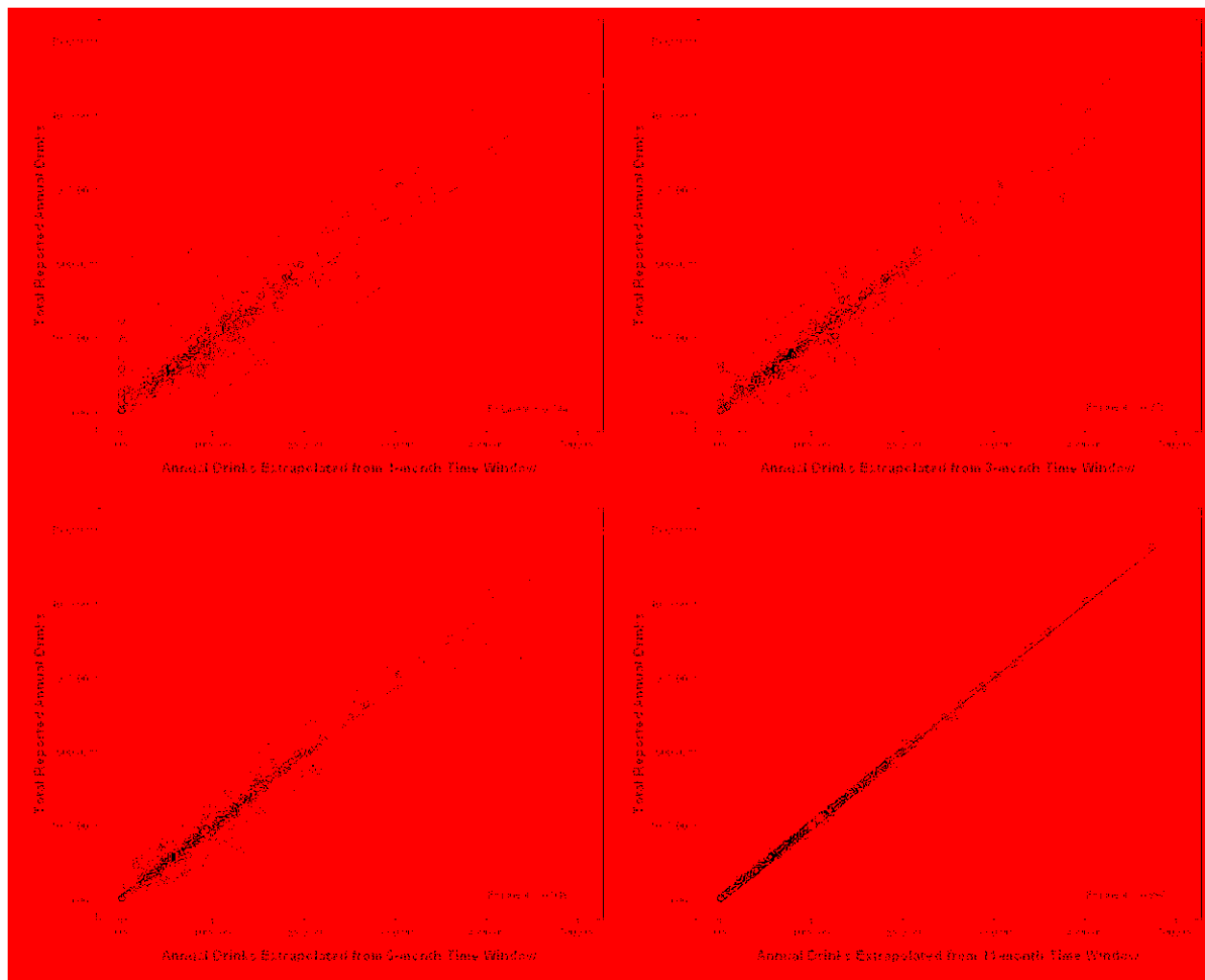
*Bivariate Regression Analyses for Predicting Annual Drinking Variables from the Most Distal 90-Day Time Window*

Variable	<i>M</i>	<i>SD</i>	<i>r</i> <sup>a</sup>	<i>B</i>	95% CI		<i>SEE</i>	<i>r</i> <sup>2</sup>
					<i>LL</i>	<i>UL</i>		
Total number of drinks <sup>b</sup>	1043.63	817.46	.93*	.90 <sup>†</sup>	.87	.93	283.59	.87
Drinks per drinking day <sup>c,d</sup>	4.66	2.51	.96*	.92 <sup>†</sup>	.89	.95	0.68	.92
Percent days drinking <sup>b</sup>	62.49	33.57	.93*	.85 <sup>†</sup>	.82	.88	11.58	.86

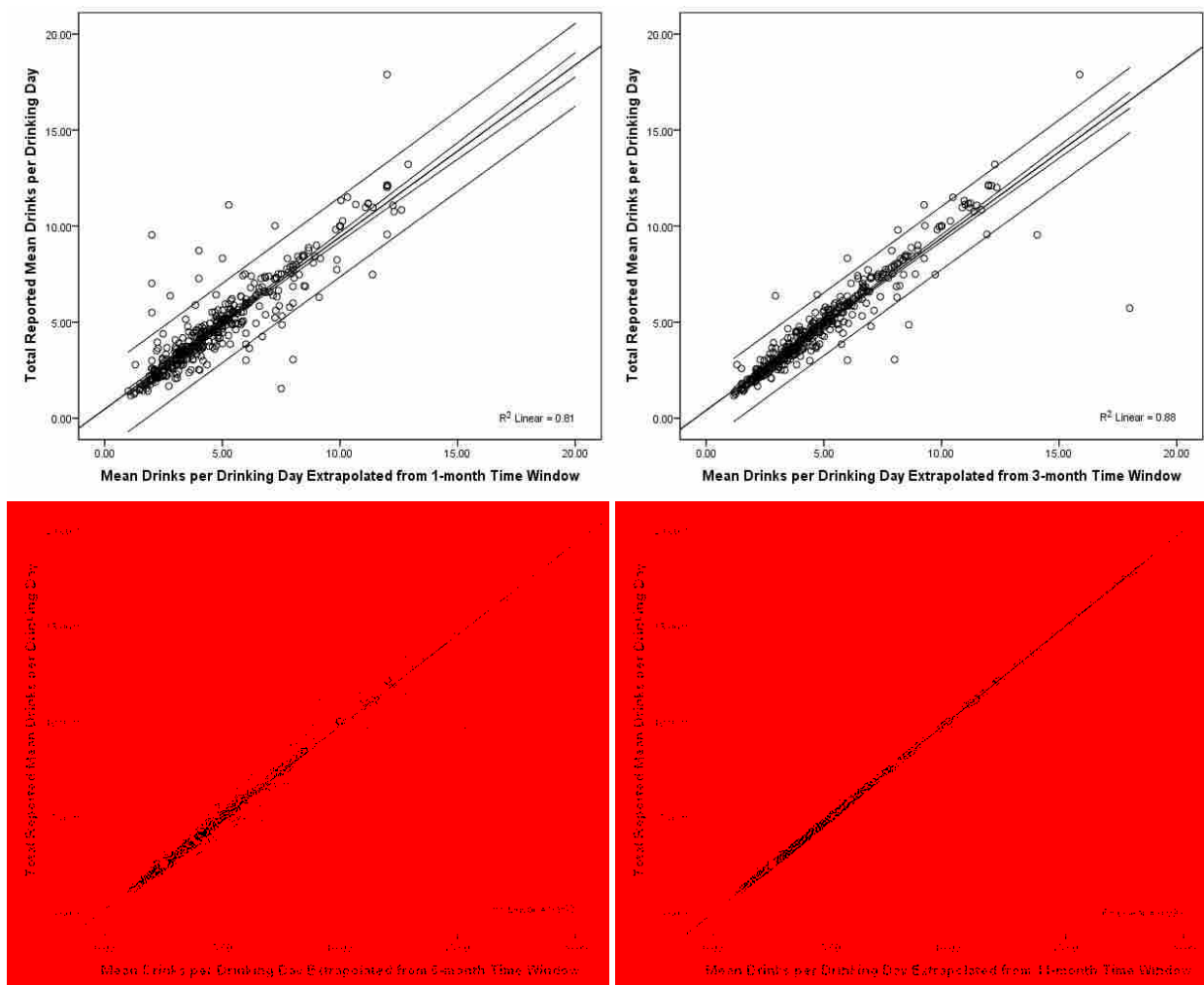
*Note.* SEE = Standard error of the estimate. Reported *M*(*SD*) values for the 360-day time window: 1090.99 (789.41) drinks, *N* = 467; 4.71 (2.40) drinks per drinking day, *N* = 437; and 64.41 (30.67) percent days drinking, *N* = 467. Each line represents a separate regression analysis. Drinks per drinking day in the past year has a smaller *N* than 467 because not all participants had a drinking day in the selected time window.

<sup>a</sup>Correlations between annual drinking variables and drinking variables extrapolated from the most distal 90-day time window. <sup>b</sup>*N* = 467. <sup>c</sup>*N* = 437. <sup>d</sup>One drink = 13.6 g of absolute alcohol (in Canada).

\**p* < .01, two-tailed. <sup>†</sup>*p* < .01.



*Figure 1.* Reported vs. extrapolated annual number of drinks from shorter time windows scatterplots with fitted regression lines and 95% confidence interval bands and prediction interval bands. Bands closest to the regression line are the confidence interval bands; bands farthest away from the regression line are the prediction interval bands.



*Figure 2.* Reported vs. extrapolated annual mean drinks per drinking day from shorter time windows scatterplots with fitted regression lines and 95% confidence interval bands and prediction interval bands. Bands closest to the regression line are the confidence interval bands; bands farthest away from the regression line are the prediction interval bands.

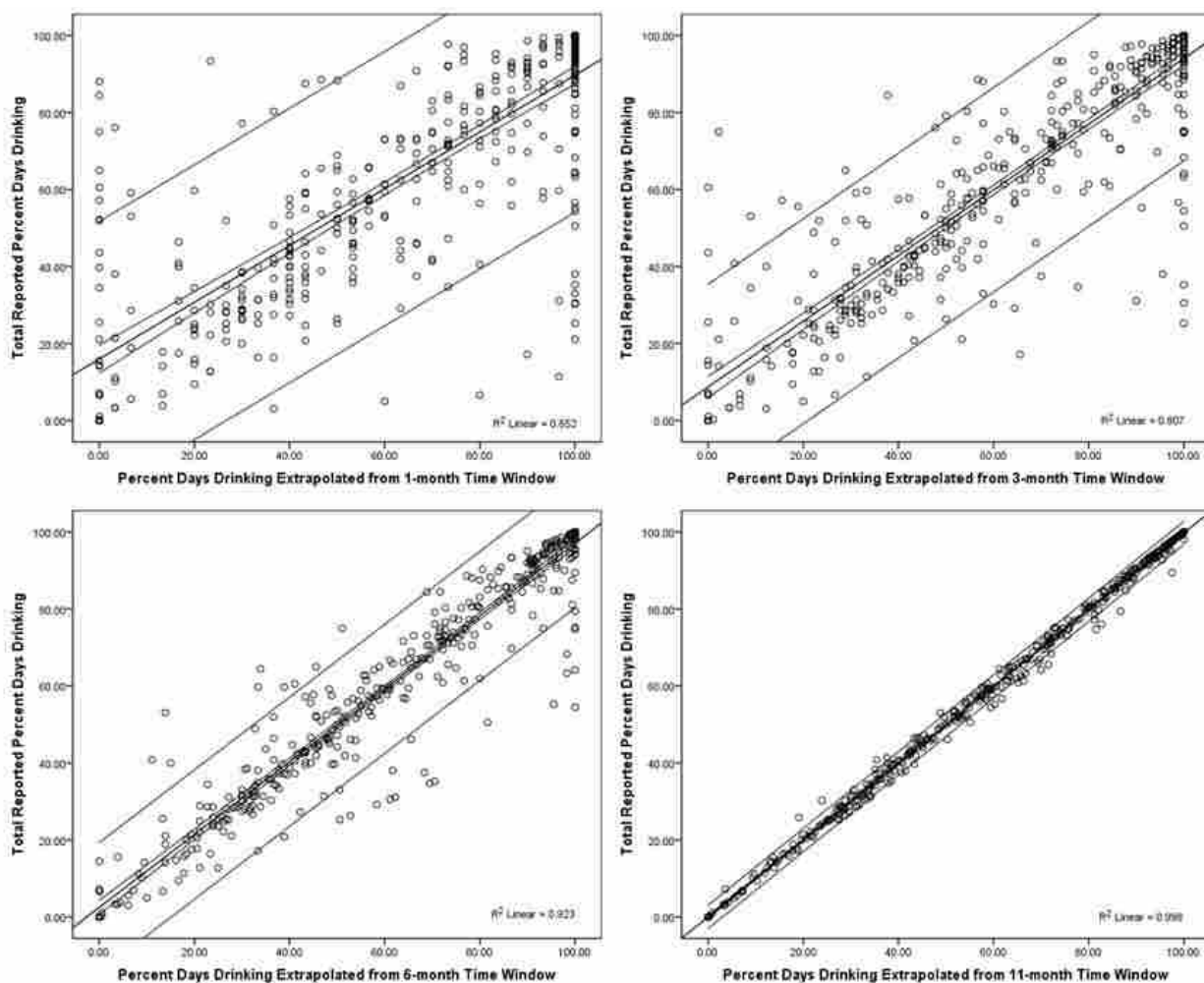


Figure 3. Reported vs. extrapolated annual percent days drinking from shorter time windows scatterplots with fitted regression lines and 95% confidence interval bands and prediction interval bands. Bands closest to the regression line are the confidence interval bands; bands farthest away from the regression line are the prediction interval bands.

**APPENDIX A**

**Timeline Followback**

### Instructions for Filling Out the Timeline Alcohol Use Calendar

To help us evaluate your drinking, we need to get an idea of what your alcohol use was like in the past \_\_\_\_ days. To do this, we would like you to fill out the attached calendar.

- ✓ Filling out the calendar is not hard!
- ✓ Try to be as accurate as possible.
- ✓ We recognize you won't have perfect recall. That's OKAY.

#### ✓ **WHAT TO FILL IN**

- The idea is to put a number in for **each day** on the calendar.
- On days when you did not drink, you should write a "0".
- On days when you did drink, you should write in the total number of drinks you had.
- We want you to record your drinking on the calendar using Standard Drinks. *For example*, if you had 6 beers, write the number 6 for that day. If you drank two or more different kinds of alcoholic beverages in a day such as 2 beers and 3 glasses of wine, you would write the number 5 for that day.

**It's important that something is written for every day, even if it is a "0".**

#### ✓ **YOUR BEST ESTIMATE**

- We realize it isn't easy to recall things with 100% accuracy.
- If you are not sure whether you drank 7 or 11 drinks or whether you drank on a Thursday or a Friday, **give it your best guess!** What is important is that 7 or 11 drinks is very different from 1 or 2 drinks or 25 drinks. The goal is to get a sense of how frequently you drank, how much you drank, and your patterns of drinking.

#### ✓ **HELPFUL HINTS**

- If you have an appointment book you can use it to help you recall your drinking.
- Holidays such as Thanksgiving and Christmas are marked on the calendar to help you better recall your drinking. Also, think about how much you drank on personal holidays & events such as birthdays, vacations, or parties.
- If you have regular drinking patterns you can use these to help you recall your drinking. For example, you may have a daily or weekend/weekday pattern, or drink more in the summer or on trips, or you may drink on Wednesdays after playing sports.

#### ✓ **COMPLETING THE CALENDAR**

- A blank calendar is attached. Write in the number of Standard Drinks that you had each day.



- The time period we are talking about on the calendar is  
from \_\_\_\_\_ to \_\_\_\_\_.
- In estimating your drinking, be as accurate as possible.
- **DOUBLE CHECK THAT ALL DAYS ARE FILLED IN BEFORE RETURNING THE CALENDAR.**
- Before you start look at the **SAMPLE CALENDAR AND STANDARD DRINK CHART** on the next page.

<b>Instructions for Filling Out the Timeline Alcohol Use Calendar</b>
---

✓ **SAMPLE CALENDAR**

	SUN	MON	TUES	WED	THURS	FRI	SAT
2000						1 8	2 0
S	3 7	4 Labor Day 0	5 3	6 8	7 1	8 0	9 11
E	10 2	11 2	12 0	13 3	14 5	15 14	16 4
P	17 2	18 0	19 0	20 0	21 0	22 2	23 13
T	24 0	25 0	26 6	27 0	28 0	29 0	30 2

---

### U. S. STANDARD DRINK CONVERSION CHART

#### One Standard Drink Is Equal To

◆ 12 oz of BEER (5%)

◆ 5 oz of WINE (10% – 12%)

◆ 3 oz of FORTIFIED WINE (16% – 18%)

◆ 1.5 oz of HARD LIQUOR (86 proof – 100 proof; 43% – 50%)

◆ WINE: 1 Bottle

25 oz/750 ml	=	5 standard drinks
40 oz/1.5 liter	=	8 standard drinks
25 oz fortified	=	8 1/3 standard drinks

◆ HARD LIQUOR: 1 Bottle

12 oz (mickey)	=	8 standard drinks
26 oz	=	17 1/3 standard drinks
40 oz	=	26 2/3 standard drinks



2010	SUN	MON	TUES	WED	THURS	FRI	SAT
			1	2	3	4	5
J	6	7	8	9	10	11	12
U	13	14	15	16	17	18	19
N	20 Father's Day	21	22	23	24	25	26
	27	28	29	30	1	2	3
J	4 Independence Day	5	6	7	8	9	10
U	11	12	13	14	15	16	17
L	18	19	20	21	22	23	24
	25	26	27	28	29	30	31
A	1	2	3	4	5	6	7
U	8	9	10	11	12	13	14
G	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
S	5	6 Labor Day	7	8	9	10	11 Rosh Hashanah
E	12	13	14	15	16	17	18
P	19	20 Yom Kippur	21	22	23	24	25
	26	27	28	29	30	1	2
O	3	4	5	6	7	8	9
C	10	11 Columbus Day	12	13	14	15	16
T	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
	31 Halloween	1	2 Election Day	3	4	5	6
N	7	8	9	10	1 Veterans' Day	12	13
O	14	15	16	17	18	19	20
V	21	22	23	24	25 Thanksgiving	26	27
	28	29	30	1	2	3	4 Hanukkah
D	5	6	7	8	9	10	11
E	12	13	14	15	16	17	18
C	19	20	21	22	23	24	25 Christmas
	26	27	28	29	30	31	





**APPENDIX B**

**Alcohol Use Disorders Identification Test**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**AUDIT QUESTIONNAIRE**

	<b>One 12 oz can/bottle of beer</b>		<b>One 5 oz glass of regular (12%) wine</b>		<b>1 ½ oz of hard liquor (e.g. rum, vodka, whiskey)</b>		<b>1 mixed or straight drink with 1 ½ oz hard liquor</b>
---	---	---	---	---	---	---	--

These questions refer to your use of alcohol. Please circle the answer that is correct for you.

1. How often do you have a drink containing alcohol?  

0	1	2	3	4
never	monthly or less	2 to 4 times/month	2 to 3 times/week	4 or more times/week
2. How many drinks containing alcohol do you have on a typical day when you are drinking?  

0	0	1	2	3	4
none	1 or 2	3 or 4	5 or 6	7 to 9	10 or more
3. How often do you have six or more drinks on one occasion?  

0	1	2	3	4
never	less than monthly	monthly	weekly	daily or almost daily
4. How often during the last year have you found that you were not able to stop drinking once you had started?  

0	1	2	3	4
never	less than monthly	monthly	weekly	daily or almost daily
5. How often during the last year have you failed to do what was normally expected from you because of drinking?  

0	1	2	3	4
never	less than monthly	monthly	weekly	daily or almost daily
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?  

0	1	2	3	4
never	less than monthly	monthly	weekly	daily or almost daily
7. How often during the last year have you had a feeling of guilt or remorse after drinking?  

0	1	2	3	4
never	less than monthly	monthly	weekly	daily or almost daily
8. How often during the last year have you been unable to remember what happened the night before because you had been drinking?  

0	1	2	3	4
never	less than monthly	monthly	weekly	daily or almost daily
9. Have you or someone else been injured as a result of your drinking?  

0	2	4
no	yes, but not in the last year	yes, during the last year
10. Has a relative or friend or a doctor or other health worker been concerned about your drinking or suggested you cut down?  

0	2	4
no	yes, but not in the last year	yes, during the last year

<b>AUDIT Score:</b> _____
---------------------------

**APPENDIX C**

**Demographic and Alcohol History Questionnaire**

--	--	--	--	--

ID No.

--	--	--	--	--	--

DAY MONTH YEAR  
Date Sent

## Fostering Self-Change Program

### Background Questionnaire

1. How old are you? (Age in years): \_\_\_\_\_ years
2. Gender:    Male    Female
3. What level of education have you completed?   **CHECK HIGHEST LEVEL ATTAINED**

<input type="checkbox"/> a. Grade completed: _____ <input type="checkbox"/> b. Completed High School (Ontario Grade 13/OAC same as Grade 12) <input type="checkbox"/> c. Completed Community College <input type="checkbox"/> d. Completed University Degree B.A./B.Sc. (3 or 4 yrs)	<input type="checkbox"/> e. Completed Master's Degree or Law Degree <input type="checkbox"/> f. Completed Ph.D. or MD <input type="checkbox"/> g. Other (Please describe): _____ _____ _____
--	--
4. What is your Current Relationship Status:   **CHECK ONLY ONE**

<input type="checkbox"/> a. Married/common-law/same sex partner	<input type="checkbox"/> c. Separated	<input type="checkbox"/> e. Widowed
<input type="checkbox"/> b. Single	<input type="checkbox"/> d. Divorced	
5. What is your Current Employment Status:   **CHECK ONLY ONE**

<input type="checkbox"/> a. Full-time/Self-employed	<input type="checkbox"/> d. Not Employed	<input type="checkbox"/> g. Homemaker
<input type="checkbox"/> b. Part-time/Self-employed	<input type="checkbox"/> e. Student	
<input type="checkbox"/> c. Disabled	<input type="checkbox"/> f. Retired	
6. Please describe current (or last) occupation: \_\_\_\_\_
7. What is your ethnic origin?   **CHECK ONLY ONE**

<input type="checkbox"/> a. Asian or Pacific Islander (includes persons of Chinese, Philipino, Japanese, Korean, Samoan, East Indian etc. ancestry or descent)
<input type="checkbox"/> b. Black (not Hispanic)
<input type="checkbox"/> c. Hispanic (includes persons of Chicano, Cuban, Mexican, Puerto Rican, South or Central American or other Spanish ancestry or descent)
<input type="checkbox"/> d. Native Indian or Inuit
<input type="checkbox"/> e. White (not Hispanic)
<input type="checkbox"/> f. Other (Please describe): _____



**ALCOHOL USE:**

8. Have you ever received any type of treatment or help for alcohol problems? **CHECK ALL THAT APPLY**

- | NO                       | YES                      | Type of Treatment/Help   |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | a. Detox only  |
| <input type="checkbox"/> | <input type="checkbox"/> | b. Outpatient treatment  |
| <input type="checkbox"/> | <input type="checkbox"/> | c. Inpatient/Residential/Day treatment   |
| <input type="checkbox"/> | <input type="checkbox"/> | d. Counseling by a professional (e.g., physician, psychiatrist, psychologist, social worker, etc.) |
| <input type="checkbox"/> | <input type="checkbox"/> | e. Alcoholics Anonymous or other similar self-help group   |
| <input type="checkbox"/> | <input type="checkbox"/> | f. Anti-alcohol medications (Antabuse, temposil)   |
| <input type="checkbox"/> | <input type="checkbox"/> | g. Other — Please describe: _____  |

9. Please check the box below that best describes your **drinking** during the past year:

**CHECK ONLY ONE**

- a. Not a Problem at All
- b. A Very Minor Problem (I worry about it, but I have not experienced any negative consequences from it)
- c. A Minor Problem (I've experienced some negative consequences from it, but none that I consider to be serious)
- d. A Major Problem (I have experienced some negative consequences from it, one of which I consider to be serious)
- e. A Very Major Problem (I have experienced some negative consequences from it, at least 2 considered serious)
10. In the past year, were there any days that you would drink in the morning upon waking, **to specifically avoid withdrawals** from the previous night's drinking? (Please note: For shift workers this refers to drinking immediately upon waking, e.g., relief drinking.)

Yes  No

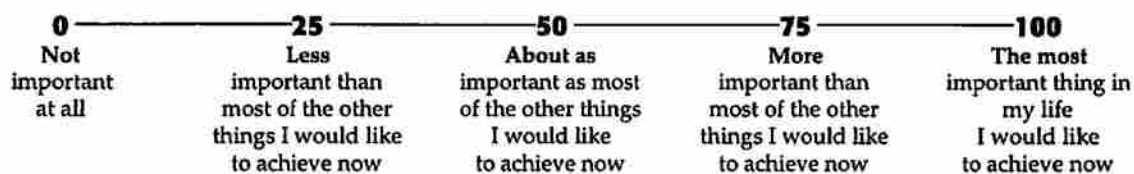
11. How many total times, have you ever been **hospitalized** for **alcohol-related reasons**: \_\_\_\_\_times  
(includes detox, general and private hospitals)
12. How many total times, have you ever been **arrested** for **alcohol-related offenses**: \_\_\_\_\_times
13. How many years do you feel you have had a **problem with alcohol**? \_\_\_\_\_years
14. Since the time when your **drinking first became a problem**, how many times have you **seriously** attempted to **quit or reduce** your drinking? Please be specific, avoid phrases like lots or many, if you have trouble with a specific number then put a range such as 50-70 times. \_\_\_\_\_times

Questions 15-22 deals with possible consequences that may have occurred in the **past 12 months**.

15. Have you experienced any **Physical Health Impairment (including overdose but not neurological problems unless neurological damage has been diagnosed)** in the past 12 months relating to your alcohol use?
- a. None
- b. Self-identified/other person concerned
- c. Health care professional's health warning
- d. Medical treatment for physical problem (illness or accident) related to alcohol use

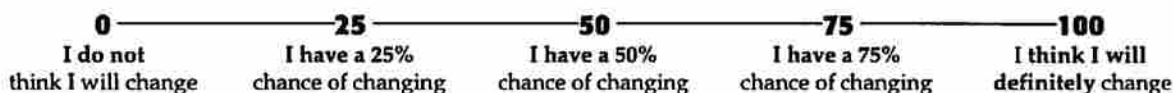
16. Have you experienced any **Cognitive Impairment (blackouts or memory problems, forgetting, confusion, difficulty thinking)** in the past 12 months relating to your alcohol use?
- a. None
  - b. 5 or fewer occasions
  - c. More than 5 occasions
17. Have you experienced any **Affective Impairment (mood changes, personality changes, substance-related psychoses, flashbacks when using)** in the past 12 months relating to your alcohol use?
- a. None
  - b. Minor (impairment had no serious consequences on daily functioning)
  - c. Major (impairment had adverse consequences on daily functioning)
18. Have you experienced any **Interpersonal Problems** in the past 12 months relating to your alcohol use?
- a. None
  - b. Minor (arguments or strained relationships only)
  - c. Major (relationships lost or about to be broken due to alcohol use)
19. Have you experienced any **Aggression** in the past 12 months relating to your alcohol use?
- a. None
  - b. Verbally abusive when using
  - c. Physically violent when using
20. Have you experienced any **Vocational/Educational Problems** in the past 12 months relating to your alcohol use?
- a. None
  - b. Performance affected (loss of time from work or school, or reduced work/school capacity or supervisor complained)
  - c. Loss of job threatened, or actual loss of job
21. Have you experienced any **Legal Problems** in the past 12 months relating to your alcohol use?
- a. None
  - b. Charged only (case pending or dropped)
  - c. Convicted
22. Have you experienced any **Financial Problems** in the past 12 months relating to your alcohol use?
- a. None
  - b. Minor (spending too much)
  - c. Major (associated with significant loss of income, etc.)

23. Would you like to reduce or quit drinking if you could do so easily?  Yes  No
24. How seriously would you like to reduce or quit drinking altogether?  
 Not at all seriously  Not very seriously  Fairly seriously  Very seriously
25. Do you intend to reduce or quit drinking in the next two weeks?  
 Definitely No  Probably No  Probably Yes  Definitely Yes
26. What is the possibility that 12 months from now you will not have a problem with alcohol?  
 Definitely No  Probably Will Not  Probably Will  Definitely Will
27. At this moment, how important is it that you change your current drinking? (Using the following scale, answer this question by writing a number from 0 to 100 in the designated area below.)



**Importance rating (from 0 to 100%):** \_\_\_\_\_

28. At this moment, how confident are you that you will change you current drinking? (Using the following scale, answer this question by writing a number from 0 to 100 in the designated area below.)



**Confidence rating (from 0 to 100%):** \_\_\_\_\_

### **CIGARETTE USE:**

29. What is your current smoking status: **CHECK ONLY ONE**
- a. Never Smoked Cigarettes **STOP, GO ON TO THE NEXT QUESTIONNAIRE.**
- b. Current Cigarette Smoker **Complete Questions 30-33**
- c. No longer smokes Cigarettes **Complete Questions 30-33 with respect to your past cigarette use only**

**For Ex-smokers, Questions 30-33 should be answered with respect to past tobacco use.**

30. How many years have (or did) you smoke(d) cigarettes regularly? \_\_\_\_\_ Years
31. How many cigarettes do (or did) you smoke per day? \_\_\_\_\_ Cigarettes
32. How many minutes (1 hr. = 60 min.) upon waking in the morning would (or did) you wait before smoking your first cigarette? \_\_\_\_\_ Minutes
33. **What percentage** of the time from **0% to 100%** when you drink (drank) alcohol do (or did) you also smoke cigarettes? \_\_\_\_\_%

**THANK YOU, This is the end of this questionnaire. PLEASE GO ON TO THE NEXT QUESTIONNAIRE.**