ESTIMATING SUBSTANCE ABUSE TREATMENT NEEDS USING SOCIAL INDICATORS

Prepared by

Research Triangle Institute

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for

Ohio Department of Alcohol & Drug Addiction Services

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EXECUTIVE SUMMARY

This report presents findings from a study designed to estimate substance abuse treatment needs using social indicators from Alcohol and Drug Addiction Services Boards comprised of single counties or clusters of counties which are responsible for local planning within the State of Ohio. Social indicators are measures that described the social, health, demographic, or economic conditions of a community such as median income, number of alcohol-related traffic accidents, drug-related hospitalizations, or the proportion of the population with a communicable disease. These indicators are routinely collected by government agencies and are readily available for use in analyzing trends or community differences in social or health status. We used these indices in a statistical model to generate estimates of the percentage of the adult population in each Ohio Board expected to be using or abusing alcohol or illicit drugs and in need or treatment or intervention. The underlying premise of social indicator modeling is that these social, demographic, and economic characteristics are associated with substance abuse and that variation in these measures across Boards can be used to predict differences in communities in their need for substance abuse intervention or treatment. The present study investigated the associations among a variety of social indicators and six Board-level prevalence measures: heavy drinking, illicit drug use, need for alcohol treatment, need for alcohol intervention, need for drug treatment, and need for drug intervention.

Data were collected on 40 social indicators at the Board level across multiple years. This set of indicators was further reduced by grouping similar indicators together into independent factors, which were used to understand the underlying structure of the social indicators. The factors represented the following domains: Social Disorder/Social Consequences, Socioeconomic Deprivation, Community Mobility, Substance Abuse Treatment, and Alcohol-Related Problems.

A smaller subset of 6 indicators that represented the factors and correlated with the outcome variables was used in a series of logistic regression models. The purpose of the modeling was to predict the outcome measures of substance use and need for treatment or intervention using the social indicators. Three of the models yielded a good fit to the Board level data and three yielded a moderate fit. The three best fitting models were for heavy drinking, alcohol treatment need, and drug use treatment need. The most important social indicators in these models were

- the percentage of the population that moved within a county and
- the rate of child abuse and neglect referral.

Prevalence rates generated from the models were compared to the rates found in the Ohio household telephone survey. For the larger Boards, the predicted and actual rates were quite

close. The results of the social indicator models are very encouraging and highlight the potential application of this modeling technique for substance abuse treatment planning. Information from the modeling was also used to examine the degree to which changes in the indicator variables were linked with changes in the need for treatment and need for intervention. This information may be used by health planners to gauge differences in treatment needs across counties with different social indicator levels. Based upon the logistic regression analyses, a simple tool was presented so that Boards can estimate future values of the drug and alcohol use outcomes from future values of the social indicators.

Findings from this study suggest that social indicators may be useful for health service planning, because they are correlated with various measures of substance use and treatment needs. Furthermore, the results show that substance abuse treatment needs may be successfully modeled by a few easy-to-obtain and reliably measured variables describing the population characteristics of the Boards. The results of the models do not imply that the many indicators that were not selected for the final models are irrelevant but rather that their contribution in predicting levels of treatment needs may overlap with the contributions of the other variables. Overall, the findings suggest that in the absence of up-to-date comprehensive population surveys, social indicator studies may be very useful in estimating differences in substance abuse treatment and intervention needs both within and across counties in the State of Ohio. Social indicator studies may also be using for estimating future values of drug and alcohol outcomes at the Board level.

1. INTRODUCTION

This study represents one of a series of studies conducted to assess substance abuse treatment needs in Ohio. Although most of the other studies in the Ohio demand and needs assessment family of studies relied on direct methods for obtaining information about the need for substance abuse treatment, this study employed indirect methods to estimate the prevalence of substance abuse problems. Because the 88 counties in the State Of Ohio are organized into 50 Alcohol and Drug Addiction Services (ADAS) Boards which are responsible for local planning, substance abuse problems were estimated at the ADAS Board level. Specifically, this study utilized a social indicator approach to estimate the proportion of adults in Ohio counties at risk for abusing alcohol or drugs. Social indicator studies rely on existing social, economic, and population data available through State and Federal government agencies. The assumption behind social indicator studies is that many of these community characteristics reflect the degree to which problems such as substance abuse exist within a community (McAullife et al., 1993). This report

- summarizes the utility of, and current thinking behind, social indicator studies as an indirect approach to treatment needs assessment;
- develops and describes a methodology for generating indicator-based estimates;
- identifies a set of indicators for estimating treatment needs; and
- provides treatment planning and resource allocation agencies with ADAS Board-level indirect estimates of the number of adults who need substance abuse treatment or intervention or who are at high risk of needing intervention based on a model utilizing uniformly collected and readily available archival data.

This chapter introduces the concepts and objectives that characterize social indicator approaches to assessing treatment needs. Chapter 2 describes the data sources and statistical methods used in the study. Chapter 3 includes the results of the logistic regression models to predict treatment need and the estimated prevalence of intervention and treatment need by ADAS Boards. Chapter 4 summarizes the findings and discusses both the limitations of the methodology and its potential applications for treatment service planning and resource allocation.

1.1 Overview of the Social Indicator Study

This report presents findings from a study that estimates treatment needs for Boards (i.e., counties or clusters of counties) within Ohio based on social indicators obtained from archival sources. Although the majority of the State Needs Assessment studies for Ohio were designed to provide prevalence estimates based on samples of Ohio's general and high-risk populations, the purpose of this study was to develop estimates of treatment need based on already available data. This study is especially significant because it is the only study within the needs assessment project that generates estimates of treatment need for each ADAS Board in the State.

The underlying premise of this approach is that social, demographic, and economic characteristics of counties or local planning entities are associated with substance use and treatment need, and these characteristics (i.e., social indicators) are already available through existing sources. Examples of social indicator data available through Federal or State government agencies include median household income; the proportion of the population by age, gender, and ethnicity; the rate of alcohol or drug-related traffic accidents; and the violent crime rates.

Although surveying the population directly on the use of substances and the need for treatment services is probably the best approach for obtaining information, social indicator studies may provide an alternative to obtaining data when large-scale surveys are not possible. The benefits of social indicator studies include lower cost and less time commitment. Social indicator studies also may offer some alternatives to the methodological limitations associated with primary data collection. For example, social indicator studies are less likely to be affected by the potential underreporting of undesirable or illegal behaviors such as drug use. Moreover, social indicators can provide estimates of treatment need for small areas (such as counties or boards), which is often impractical in surveying due to the large sample sizes and the high costs needed to obtain reliable small area estimates.

Potential biases and inconsistencies in how social indicator data are collected remain a significant issue in the development of this approach. Challenges include validating the indicators by determining their relative strength of association with the level of need and developing procedures to combine indicator data into a useful composite for estimating treatment need. This report describes our efforts to address these challenges by developing an empirical model of the relationship between social indicators and measures of intervention need and treatment need. We expect that the ADAS Board-level, model-derived estimates of treatment need based on social indicators will be more accurate than estimates based purely on capitation strategies and also may be preferable to directly estimating need based on small sample household surveys. Thus, we believe that the estimates provided by this study are probably more precise at the ADAS Board level than others currently available to the State.

Although further refinements and validation of this approach will be necessary, we expect that social indicator modeling may ultimately prove useful as a systematic and cost-effective approach for estimating ADAS Board-level treatment needs in Ohio. In particular, this strategy allows for updating estimates of substance abuse treatment needs on a regular basis and at a lower cost as new archival data become available.

1.2 Rationale for Developing a Social Indicator Approach to Treatment Service Needs Assessment

The goal of needs assessment studies is to determine the types, numbers, and geographic distribution of people needing services. Needs assessments can employ both direct and indirect methods of gathering information. Direct methods include conducting field surveys to ascertain the number of people in the population who meet diagnostic or other designated criteria of need.

Two distinct yet related approaches for indirectly assessing treatment needs are recognized in the literature, synthetic estimation and social indicator modeling. Both approaches have been available for many years, although debate regarding their utility and refinements in their methodology and application continues. The first approach, *synthetic estimation*, has been used primarily to develop estimates of drug use prevalence in small areas, usually when area-specific population survey data are not available. Useful reviews of this method are provided by Levy (1979) and Rhodes (1993). In this approach, findings from drug use surveys conducted on larger populations (e.g., national or statewide surveys) are extrapolated to the target areas. Estimates are adjusted for population characteristics of the target areas (e.g., age, race/ethnicity, and gender), provided that estimates of the subgroup populations in each target area are available and prevalence estimates for these subgroups are provided by whatever benchmark survey is used.

As noted by Tweed and Ciarlo (1992), synthetic estimation techniques assume that area-specific prevalence rates are not significantly influenced by factors other than those demographic variables for which adjustments are explicitly made. McAuliffe et al. (1993) argue that there is substantial variation in levels of treatment need that cannot be explained by differences in age, race, and gender and that other characteristics of local areas may serve as useful proxies for estimating treatment need. This assumption underlies the second class of indirect estimation approaches, the use of social indicators.

Social indicator modeling has been used in mental health planning for a number of years (see Warheit, Bell, & Schwab, 1977; Cagle and Banks, 1986; Ciarlo, Tweed, Shern, Kilpatrick, & Sachs-Enesson, 1992). It became prominent in the 1920s at the University of Chicago as a way to investigate theories of "social disorganization." More recently, this methodology has been applied to substance abuse treatment needs assessment (McAuliffe et al., 1993; Simeone,

Frank, & Aryan, 1993; Flewelling et al., 1998; Herman-Stahl et al., 1999; 2001). The approach is based on the assumption that certain characteristics of subpopulations (e.g., as defined geographically by ADAS Board) are correlated with substance use. If reliable measures of these correlates are available, then they may be used as surrogate measures, or indicators, of the actual prevalence of use and need for treatment. A mathematical model useful for estimating the level of treatment need based on values of social indicators, and calibrated using survey-based estimates, can then be developed. Model-based estimation of treatment needs may serve as a resource allocation tool. The application of such approaches is based on principles of equitable distribution that contend that an area's share of the resources should be equivalent to its proportion of the problem (Simeone et al., 1993).

Several States have applied the social indicator approach to assessing substance use treatment and prevention needs. These efforts have produced compendiums of indicators, organized by ADAS Board or by some other relevant geographic unit (e.g., Zechmann, Flewelling, & van Eenwyk, 1995; Shukitt-Hale et al., 1994; Minnesota Department of Public Health, 1994; University of Maine, 1991). These documents provide extremely useful information to planners regarding their area's absolute and relative ranking on a number of measures believed to be either directly or indirectly related to substance abuse. Such data are useful for gauging the probable level of substance abuse problems in an area and for better understanding the populations being served and the social environmental context in which they live. The value of such data is enhanced if they are accompanied by information on the relative importance of each indicator with respect to predicting drug use and/or drug-related problems and treatment need.

Compendiums of indicators cannot, however, provide a single, overall assessment of the level of treatment needs in a particular area. In order to provide this, some method of weighting and combining the various indicators is required. One of the key challenges in the treatment needs assessment effort is constructing a meaningful composite of indicators. In a study conducted in Illinois, Sherman and colleagues (Sherman & Gillespie,1995; Sherman, Gillespie, & Diaz, 1996) reduced an initial set of 64 social indicators thought to be related to substance abuse to 8 statistically independent factors that accounted for more than 80% of the original variance. The researchers then used these factors in a statistical model to estimate treatment service needs. Unmet service needs were determined by subtracting the number of clients predicted by the model from the actual number of clients served.

Essential to accurate estimation is the operationalization of "need" in the predictive model. Some States have relied on treatment utilization as the criterion (or proxy) for need. The logic of using a treatment service <u>utilization</u> measure as a criterion for developing a model to predict treatment service <u>needs</u> is debatable. Of chief concern, the model does not take into account underutilization due to limited access or finances and may bias resource allocation in

favor of areas with high levels of current service use. Thus, those in need who have not utilized treatment are omitted from the "criterion" measure. To address this weakness, the State of Louisiana in conjunction with Research Triangle Institute (RTI) conducted a social indicator study to predict the number of persons in need of treatment. The model was designed to predict estimates of problem alcohol or drug use within the past year as derived from a telephone household survey measuring risk or need for treatment. Expanding the models to include all persons in need of treatment rather than only those who utilize services may lead to different conclusions regarding the relationships between social indicators and treatment need. This study found that social indicators are capable of explaining a significant proportion of the variance in models predicting levels of use and substance abuse treatment need (Flewelling et al., 1998). Subsequently, RTI has expanded on this methodology in working with other states (Herman-Stahl et al. 1999; 2001; Sanchez et al., 1999).

A critical challenge for developing useful social indicator models is to specify conceptually what the models should estimate and then to identify appropriate criterion measures with which to develop the models. One obvious criterion with which to develop a model to provide estimates of treatment need is the prevalence of substance abusers or substance dependent individuals in a ADAS Board. For this study, we use ADAS Board-level estimates of substance abuse problems provided by the Ohio household telephone survey. Although the precision of these estimates for most counties is not adequate to use them directly to assess the level of treatment needs, the survey-based estimates do provide a metric for calibrating social indicator models. Due to the relatively low prevalence of clinical levels of substance abuse and dependence, we have expanded the criterion variables to include other indicators of treatment needs including the proportion of individuals classified as being in "need of intervention," as well as the percentage of heavy drinkers and illicit drug users.

2. METHODOLOGICAL APPROACH

The primary goal of this study was to estimate the need for substance abuse treatment and intervention at the Alcohol and Addiction Services (ADAS) Boards. To do this, we examined the relation between social indicators that characterize each ADAS Board and a set of ADAS Board-level measures of treatment need. Before developing the social indicator models, we conducted factor analysis on the large number of social indicators to identify a reduced number of predictors. Then, using multivariate logistic regression techniques, we developed models for estimating heavy drinking, illicit drug use, substance abuse intervention needs and substance abuse treatment needs based on this smaller set of social indicators.[1] We next derived estimates from the models to generate the proportions of adults in each ADAS Board needing substance abuse treatment and intervention. Finally, we demonstrated how parameters obtained from the regression models may be used to predict future levels of substance abuse and treatment need.

2.1 Data and Sample Weights

The data on alcohol and illicit drug use and the need for substance abuse treatment that serve as our criterion variables (or dependent variables) in developing the social indicator models were obtained from the Winter 1994-1995 telephone survey of Ohio's adult household population. The survey included a random sample of 3,656 adults. The procedure recommended by the National Technical Center (NTC) for selecting a respondent within a randomly selected household was followed. That is, the adult (18 years or older) with the most recent birthday before the interview date was chosen as the selected respondent. The survey design and methods are described in more detail in the final report for the statewide adult telephone study (Cochran et al., 1997).

Observations were weighted to reduce bias in the estimates. The sample first was weighted by household size to account for probability of selection. Then post-stratification weighting was carried out to adjust the sample to the demographic composition of the State for the variables age, gender, racial/ethnic identification, and region of residence (urban or rural). These steps provided the closest possible approximations to the actual State population counts at the time of the survey.

[1]Logistic regression was used because the response variables represent proportions of the population. This method builds a linear model for the logit [$\log(p/(1-p))$] of the response probability p.

2.2 Selection of Criterion Measures for the Models

Ideally, the criterion measure to use in calibrating a social indicator model for estimating treatment needs would be the prevalence of persons in each ADAS Board in need of treatment. A distinction would be made between the need for alcohol abuse treatment and the need for drug abuse treatment. In the Ohio household telephone survey of adults, a determination was made for each respondent with respect to their treatment need status. The following outcome measures were selected from the household survey data:

- past 18 months heavy alcohol use
- past 18 months illicit drug use
- need for alcohol abuse treatment
- need for drug abuse treatment
- need for alcohol abuse intervention
- need for drug abuse intervention

Heavy alcohol use was defined as persons consuming on average 5 or more drinks (4 or more drinks for women) in a 24-hour period at least once a week in the past 18 months. Illicit drug use was defined as the percentage of persons using marijuana, hallucinogens, cocaine, heroin, or stimulants in the past 18 months.

Treatment need was defined according to whether a person had experienced serious adverse effects of alcohol or drug use or reported a pattern of substance use that strongly suggested the existence of a problem.

For alcohol abuse individuals were determined to be in need of treatment if:

(1) they met lifetime DSM III-R criteria for alcohol abuse or dependence as described in the third, revised edition of the American Psychiatric Association (APA, 1987) Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R);

(2) used alcohol within the past 18 months; and

(3) had one or more symptoms of dependence or abuse in the past 18 months.

Or

(4) had a lifetime diagnosis for alcohol abuse or dependence and

(5) engaged in past 18 months or past month heavy drinking (5 or more drinks [4 or more drinks for women] in a 24-hour period on 4 or more days in the past month).

For illicit drug use, individuals were determined to be in need of treatment if:

(1) they met lifetime DSM III-R criteria for drug abuse or dependence as described in the third, revised edition of the American Psychiatric Association (APA, 1987),

(2) used illicit drugs within the past 18 months; and

(3) had one or more symptoms of dependence or abuse in the past 18 months.

Or

(4) had a lifetime diagnosis for drug abuse or dependence and a problem pattern of drug use defined as using marijuana, hallucinogens, or stimulants at least once a month; or using cocaine or heroin in the past 18 months.

Need for drug or alcohol abuse intervention was defined as a less restrictive criteria for determining problem levels of use. Alcohol use need for intervention was defined as persons who (a) had no lifetime diagnosis of alcohol abuse or dependence; (b) reported symptoms of alcohol abuse or heavy drinking in the past 18 months or past month; and (c) used alcohol in the past 18 months. Illicit drug use need for intervention was defined as persons who (a) had no lifetime diagnosis of drug abuse or dependence; (b) reported symptoms of drug abuse or a problem pattern of drug use; and (c) used drugs in the past 18 months.

The prevalence rates were defined simply as the estimated percentage of adult respondents aged 18 years and older in each ADAS Board or ADAS Board cluster who met the criteria for each measure. Additional details of the outcome measures are provided in the Ohio household survey report (Cochran et al., 1997).

Table 2.1 presents the estimates of treatment need and intervention need from the household telephone survey and the rates of illicit drug use and heavy alcohol use. As shown, the statewide prevalence rates for treatment need are relatively low. As a result, ADAS Board-level estimates tend to be based on small numbers of respondents who meet the criteria. Therefore, we also included risk indicators of substance abuse, namely heavy drinking and past year illicit drug use as criterion variables in the model. These variables are correlated with need for intervention and treatment and have a higher prevalence in the population; thus, they may generate more stable models.

2.3 Selection of Social Indicators to Use as Predictors

The research literature on area-based attributes that could be used to indicate the level of substance use treatment need is still sparse and largely exploratory. Therefore, in order to identify a comprehensive list of potential indicators, the selection of indicators used for this study was based primarily on an extensive review of the literature on social and psychosocial predictors of substance use among adolescents (Hawkins, Catalano, & Miller, 1992). In their review, Hawkins and colleagues identified 17 “risk and protective factor” constructs as predicting substance use in longitudinal design studies. Most of these constructs are conceptually and/or empirically associated with adult substance abuse.

Table 2.1 Adults in Ohio in Need of Treatment or Intervention and Rates of Substance Use

Treatment Need Measure	Percentage of Adults
In Need of Treatment	
Alcohol	2.1
Any illicit drug[a]	1.5
In Need of Intervention	
Alcohol	9.4
Any illicit drug	3.8
Use in 18 months	
Any illicit drug	8.9
Heavy drinking	3.8

[a]Marijuana or hashish, hallucinogens, cocaine (including crack), heroin/opiates, or nonmedical use of sedatives or tranquilizers.

Source: Ohio household survey report (Cochran et al., 1997).

For this study, we revised the list of measures and reorganized them into eight broad and conceptually meaningful categories. Although most of these variables were identified based on their association with use rather than dependency or need for treatment, it is assumed that many of them may exhibit an association with dependency and more problematic forms of use. The categories, and the measures used for each, are displayed in Table 2.2.

The indicator data that were obtained from a variety of State and Federal agencies are described in detail in Appendix A. The indicators selected for this study generally are standard types of measures generated by the source agencies; therefore, they are expected to be based on valid and reliable data collection procedures. They were drawn from a larger set of candidate measures in a process that eliminated measures that appeared to be inconsistently or poorly operationalized. The frequency distribution of each indicator was examined, and indicators with unusual distributions or extreme values were noted. Questions concerning data collection procedures and definitions were clarified with the source agencies before the data were used; remaining concerns and limitations of the indicator data are included in Appendix A. Some indicators, however, still may contain significant sources of bias or error that could not be readily discerned.

The most recent five years of available data were collected, going back to 1990. Some indicators were available for only a limited number of years and some for only a single year (e.g., 1990 U.S. Census Bureau decennial census data). To address the potential instability of measures collected over a number of years, we have averaged them to form a single rate or proportion.

Table 2.2 Social Indicators Available in Ohio

		Years
A.	**Alcohol and Drug Abuse Indicators**	
1.	Juvenile arrest rate for alcohol law violations	1994-1997
2.	Juvenile arrest rate for drug use or possession	1994-1997
3.	Adult arrest rate for alcohol law violations (except driving under the influence [DUI]	1994-1997
4.	Adult arrest rate for drug use or possession	1994-1997
5.	Adult DUI arrest rate	1995-1999
6.	Percent motor vehicle accidents in which alcohol was a factor	1994-1998
7.	Adult admission rate to publicly funded treatment programs	1995-1999
8.	Juvenile admission rate to publicly funded treatment programs	1995-1999
9.	Alcohol-related death rate	1994-1998
10.	Drug-related death rate	1994-1998
B.	**Community Disorganization and Transition**	
1.	Percent of residential properties that are renter-occupied	1990
2.	Percent of residential properties that are unoccupied	1990
3.	Divorce rate	1994-1998
4.	Percent of adult population registered to vote	1995-2000
5.	Percent of adults voting in last presidential election	1992, 1996
6.	Percent of population that moved from outside county	1990
7.	Percent of population that moved within county	1990
C.	**Levels of Community Crime and Violence**	
1.	Adult arrest rate for violent index crimes	1994-1997
2.	Adult arrest rate for property index crimes	1994-1997
3.	Adult arrest rate for other nonalcohol or other drug (AOD) crimes	1994-1997
4.	Juvenile arrest rate for violent index crimes	1994-1997
5.	Juvenile arrest rate for property index crimes	1994-1997
6.	Juvenile arrest rate for other non-AOD crimes	1994-1997
D.	**Demographic Characteristics**	
1.	Percent of population that is male aged 15 to 34	1994-1998
2.	Percent of population that is White	1994-1998
3.	Percent of population that is Black	1994-1998
4.	Percent of population that is Native American	1994-1998
5.	Percent of population that is Asian	1994-1998
6.	Percent of population that is Other/Unknown	1994-1998
7.	Population density	1990
8.	Percent of population living in urban areas	1990
E.	**Socioeconomic Deprivation**	
1.	Percent of persons living below poverty level	1989, 1993, 1995
2.	Percent of children living below poverty level	1999, 1993, 1995
3.	Percent of adults who are unemployed	1995-1999
4.	Percent of households receiving Aid to Families with Dependent Children (AFDC)	1995-1999
5.	Percent of households headed by single parent	1990
6.	Median household income	1989, 1993, 1995
7.	Percent of adults without high school education	1990
F.	**Alcohol and Drug Availability**	
1.	Arrest rate for drug sales or manufacturing	1994-1997
G.	**Problems Indirectly Associated with Substance Use**	
1.	Rate of births to teenage mothers	1994-1998
2.	Sexually transmitted disease rate	1996-1998

2.4 Reduction of Social Indicators into Discrete Constructs

Given the large number of social indicators relative to the number of ADAS Boards (50) and the expected high degree of correlation among many of the social indicators, we chose to reduce the number of variables to be used in each model through factor analysis. Factor analysis is a data analytic procedure used to assess the underlying structure of a data set. Factor analysis

identifies items which share common variance and groups them together into a factor. It is useful for determining the number of distinct constructs that emerge from a large set of items, and it provides information on the degree to which variables overlap or represent a common structure.

2.5 Modeling Procedures

A logistic regression model was specified and estimated for each of the 6 drug and alcohol measures: past 18 months heavy drinking, past 18 months illicit drug use, need for alcohol treatment, need for drug treatment, need for alcohol intervention, and need for drug intervention. The social indicators which were the independent variables for each of the outcome variables were selected on the basis of the following considerations: previous social indicator research; findings from previous social indicator studies that RTI has conducted for various states; the results of the factor analysis of the social indicator variables; the bivariate correlations of the social indicators with the 6 outcome measures; and some preliminary stepwise logistic regression models. For each of the drug and alcohol outcomes, we wanted the social indicators in the final logistic regression models presented here to represent as many of the factors as possible, be strongly related to the outcomes, and be conceptually appealing.

Logistic regression is a statistical method for examining the relationship between a set of predictor variables (i.e., social indicator variables), and a dependent variable that is a proportion or probability (e.g., the proportion of individuals residing in a Board who are heavy drinkers, drug users, etc.). The key output of a logistic regression analysis is a set of regression coefficients that summarize the strength of the relationships between the predictors, in our case social indicator variables, and the outcome or dependent variable, which in our case is the proportion of heavy drinkers, etc., at the Board level. We will use the words proportion and probability interchangeably since the proportion of heavy drinkers in a Board can be thought of as the probability of a randomly selected resident from that Board being a heavy drinker. The unit of analysis is the Ohio Boards. There are 50 Boards and all were used in the logistic models with one exception. The Union Board was dropped from the logistic regression model for predicting heavy drinking because there was a missing value for the social indicator predictor variable, drug related death rate. However, the Union Board contributed only 7 survey respondents to the analysis, so omitting them had little effect on the model results..

The logistic regression model uses the information from the Boards to make the best estimate (prediction) about the actual prevalence in the Boards. For example, for some of the smaller Boards there were no cases of drug treatment need among those who participated in the survey. This does not mean, however, that there is actually no treatment need for those Boards. Rather it means that for the small Boards with small samples, no survey respondents turned out to need drug use treatment. The logistic regression model gives a predicted probability of drug

use treatment need that is greater than zero for those Boards which is more logical. The regression acts as a “smoother” of surveyed prevalence and also can be used a tool for predicting prevalence after some social indicators change.

When the logistic regression parameter associated with a social indicator variable is exponentiated, i.e., exp(B), the exponentiated parameter indicates the change in the odds of prevalence for the Board level outcome (e.g., heavy drinking) due to a one unit increase in the associated social indicator variable. Odds is defined as the ratio of the probability of the outcome (e.g., heavy drinking) occurring to the probability of the outcome not occurring. Since a one unit increase in a social indicator is in most cases a trivial change, we decided to transform the expontiated parameter to represent the effect of a standard deviation increase in the associated social indicator variable on the odds of, say, heavy drinking. (The standard deviation is a measure of the variability of the social indicator among the Boards). If the expontiated parameter is greater than 1, then a standard deviation increase in the associated social indicator increases the odds of, say, heavy drinking. If it is less than 1, then an increase in the indicator decreases the odds of heavy drinking. For example, the adjusted odds ratio for rate of child abuse and neglect in the logistic regression model predicting the probability of drug use treatment need is 1.949. This indicates that a one standard deviation increase in the rate of child abuse increases the odds of drug use treatment need by a factor of 1.949 or 94.9%.

Since the proportions or probabilities associated for all 6 drug and alcohol outcome measure are below 0.10 and in most cases below 0.05, we can also interpret these adjusted odds ratios as approximately the ratios of the proportions or probabilities themselves. That is, in this example, the factor by which the probability of drug use treatment need is increased by a standard deviation increase in the rate of child abuse. This is because the odds ratio which is p/1-p is approximately equal to p if p is small. For example, if p equals .05, then the odds ratio equals .05/1-.05 or .053 which is approximately equal to .05, the probability itself.

Chapter 3 presents the results of these modeling efforts.

3. MODELING SUBSTANCE USE AND NEED FOR TREATMENT

This chapter presents results from modeling activities of the social indicator study, that include the following:

- the factor analysis used to reduce the full set of social indicators to a manageable number of variables for modeling;
- the best fitting models for predicting heavy drinking, illicit drug use, need for alcohol treatment and intervention, and need for drug treatment and intervention;
- the estimated proportion of adults in each board determined to be heavy drinkers, illicit drug users, or in need of treatment and intervention for alcohol use or drug use based on findings from the logistic regressions; and
- the standardized effects of indicator variables (adjusted odds ratios) used to estimate change in drug and alcohol use and their intervention or treatment need.

3.1 Factor Analysis

The first step in our analyses was to estimate the number of distinct dimensions contained in the full set of social indicator variables. The number of dimensions that emerges dictates the maximum number of variables to be selected for modeling. Because variables that have a high association with the same factor may be highly correlated, they may fail to achieve significance in the final model due to item redundancy. We performed a factor analysis with a varimax rotation employing all 40 social indicators. Five- and six- factor solutions were tested. The five-factor solution appeared to have the most conceptually distinct factors and was considered optimal. Table 3.1 shows the five factors (Social Disorder, Socioeconomic Deprivation, Community Mobility, Substance Abuse Treatment, Alcohol-Related Problems) and the variables that have the highest associations with each.

The five-factor solution accounts for about 70% of the total variation in the analysis. Thus, the dimensions that emerge from the factor analysis are able to represent the full social indicator set reasonably well. Factors were named based on the predominant theme that emerged.

Table 3.1 Items and Factor Loadings Forming the Five Factors

Social Disorder/ Social Consequences	Socioeconomic Deprivation	Community Mobility	Substance Abuse Treatment	Alcohol-Related Problems
Percent of Population that is White (-.96)	Percent of Persons Living Below Poverty Level (.90)	Percent of Population that Moved from Outside County (.91)	Adult Admission Rate to Publicly-Funded Treatment Programs (.68)	Juvenile Alcohol-Related Arrest Rate (.78)
Percent of Population that is Black (.95)	Percent of Children Living Below Poverty Level (.84)	Percent of Population that Moved Out of the County (.82)	Juvenile Admission Rate to Publicly-Funded Treatment Programs (.67)	Percent Residential Properties that are Unoccupied (.64)
HIV Rate (.94)	Percent of Adults without High School Education (.80)	Percent of Population that is Male Aged 15-34 (.67)	Percent of Adult Population Registered to Vote (-.56)	Retail Liquor Outlets per Capita (.53)
Population Density (.92)	Distance to Nearest Interstate (.74)	Unemployment Claims Rate (-.60)	Divorce Rate (.47)	Adult Alcohol-Related Arrest Rate (.52)
Sexually Transmitted Disease Rate (.90)	Percent of Households Receiving Temporary Assistance to Needy Families (TANF) (.68)	Percent Motor Vehicle Accidents in which Alcohol Impairment was a Factor (-.44)		Alcohol-Related Hospital Admission Rate (.43)
Percent Population Living in Urban Areas (.88)	Percent of Adults Who are Unemployed (.63)			
Percent Residential Properties that are Renter Occupied (.84)	Rate of Births to Teenage Mothers (.62)			
Percent of Households Headed by a Single Parent (.82)	Percent of Adults Voting in Last Presidential Election (-.61)			
Adult Arrest Rate for Drug-Related Crimes (.81)	Rate of Child Abuse/ Neglect Referrals (.55)			
Juvenile Arrest Rate for Drug-Related Crimes (.78)	Percent of Population that is Native American (.52)			
Alcohol Sales Per Capita (.77)				
Percent of Population that is Asian (.76)				
Drug-Related Death Rate (.75)				
Percent of Population that Moved Within the County (.72)				
Alcohol-Related Death Rate (.67)				
Drug-Related Hospital Admissions (.65)				

Source: Ohio Social Indicator Study, 2001.

3.1.1 The Social Disorder/Social Consequences Factor

The Social Disorder/Social Consequences factor accounted for 32% of the total variance. Two somewhat distinct conceptual factors seem to be captured here. The first is social disorder, as reflected in the high loadings for the variables representing urbanicity, residential instability, and the proportion of the population that is part of a minority group. The majority of variables loading on this factor appear to reflect a common structure that may be thought of as "social disorder." Social disorder theory has a long history dating back to the early 20th century at the University of Chicago and posits that social problems vary systematically based on the characteristics of a neighborhood.

The second somewhat distinct concept captured by this factor represents the social consequences of an individual's substance abuse, including the prevalence rates of HIV and sexually transmitted disease, and health or legal problems related to drugs and alcohol.

3.1.2 Socioeconomic Deprivation

Ten variables have their highest associations with the second factor, which accounted for 15% of the overall variance. This factor can be most strongly characterized as Socioeconomic Deprivation, as five of the variables reflect indices of low social economic status, including the total poverty rate, the child poverty rate, the percentage of the adult population without a high school degree, the proportion of unemployed adults, and involvement in the public welfare system through Temporary Assistance to Needy Families (TANF). The other indicators associated with this factor are less directly linked to socioeconomic deprivation. Three of these variables may be classified as indicators of social responsibility: the rate of births to teen mothers, the rate of child abuse or neglect, and a negative loading for the percent of adults who voted in the last presidential election. Distance to the nearest interstate (indicating the extent to which a community is isolated) and the percent of the population that is Native American also loaded on this factor.

3.1.3 Community Mobility

The indicators with the highest loadings on third factor are ones of Community Mobility: the percentage of the population that had moved either into or out of the county. Also loading high on this factor were the percentage of young males in the population (a group that is likely to be relatively mobile), the percentage of motor vehicle accidents in which alcohol was a factor, and (negatively loaded) the unemployment rate. This factor appears less conceptually distinct than the first two, and accounted for 12% of the total variance.

3.1.4 Substance Abuse Treatment

The fourth factor, Substance Abuse Treatment, accounted for 7% of the total variance, and consists of two measures of receipt of substance abuse treatment (for adults and for children), the divorce rate in the county, and (negatively loaded) the percentage of the population who are registered voters.

3.1.5 Alcohol-Related Problems

The final factor that emerged in the model, alcohol-related problems, accounted for 6% of the total variance. The items that loaded on this factor include the juvenile and adult alcohol-related arrest rates, the number of retail liquor outlets per capita, the rate of hospital admissions for alcohol-related problems, and the percent of residential properties that were unoccupied. Most of these variables indicate alcohol-related problems.

3.1.6 Summary of Factor Analysis

The factor analysis described above was performed to produce a reduced number of social indicators useful for modeling. The majority of variance in the full social indicator set was accounted for by five factors representing the following constructs: Social Disorder/Social Consequences; Socioeconomic Deprivation; Community Mobility; Substance Abuse Treatment; and Alcohol-Related Problems.

Results from this analysis helped guide the model building by indicating the variables best representing the social indicator set as well as the maximum number of variables useful for modeling. Because the goal was to arrive at the most parsimonious set of indicators accounting for the variance in the measures of treatment need, use of highly related (or collinear) variables in the model would reduce its utility while adding nothing to its predictive ability. Thus, the factor analysis helped to demonstrate which variables may contribute little, given that a redundant set of variables was already in the model.

3.2 Results of Logistic Regression Social Indicator Models

A logistic regression model was specified and estimated for each of the 6 drug and alcohol measures: past 18 months heavy drinking, past 18 months illicit drug use, need for alcohol intervention, need for drug intervention, need for alcohol treatment, and need for drug treatment. The social indicators (i.e., the independent variables) for each of the outcome variables were selected on the basis of the following considerations: previous social indicator research; findings from previous social indicator studies that RTI has conducted for various states; the results of the factor analysis of the social indicator variables; the bivariate correlations of the social indicators with the 6 outcome measures; and some preliminary stepwise logistic

regression models. For each of the drug and alcohol outcomes, we wanted the social indicators in the final logistic regression models to represent as many of the factors as possible, be strongly related to the outcomes, and be conceptually appealing.

Six out of the 40 indicators were selected as predictors for the final 6 logistic regression models. These were:

- the percentage of residential properties within a Board that were renter occupied,
- the percentage of the population that moved within the counties comprising a Board,
- the rate of child abuse and neglect referrals,
- drug related death rate,
- percentage of the population comprised of males aged 15 to 34, and
- percentage of adults in a Board that were admitted to a publicly funded treatment program.

The first three indicators above each turned out to be highly statistically significant in two of the logistic regression models. The percentage of residential properties that were renter occupied was predictive of both the proportion of Board residents that used drugs within the past 18 months and the proportion of Board residents that were in need of drug use intervention. Within county mobility was predictive of both the proportion of Board residents that were heavy drinkers and the proportion of Board residents that needed treatment for drug use. The rate of child abuse and neglect was predictive of both Board level need for drug use treatment and Board level need for alcohol use treatment.

The remaining 3 social indicators (drug related death rate, percentage of the population comprised of males aged 15 to 34, and percentage of adults in a Board that were admitted to a publicly funded treatment program) each appeared in one of the six models. Thus, altogether, these six indicators accounted for 9 significant logistic regression parameters across the 6 models.

Three of the indicators (percentage of residential properties that were renter occupied, drug related death rate, percentage of the population that moved within the county) correlated highly with factor 1 (Social Disorganization). One indicator (rate of child abuse and neglect referrals) was highly correlated with factor 2 (Socioeconomic Deprivation). One indicator (percentage of the population that is male aged 15-34) was highly correlated with factor 3 (Community Mobility). Finally, one indicator (adult admissions rate to publicly funded treatment programs) was highly correlated with factor 4 (Substance Abuse Treatment). There were no social indicators in any of the 6 logistic regression models that represented the last and fifth factor, Alcohol Related Problems. However, this factor explained the least amount of variation in the 40 social indicators and, hence, was the least important of the five factors.

It should be noted that other models could be just about as predictive as the ones presented here. This is because the social indicators that are highly correlated with a particular factor are also, by definition, highly correlated with each other. Thus, indicators that are highly correlated with those in the models presented here could be identified and used as predictors in alternative models.

The results of the six logistic regression models are presented below. The estimated parameters that are presented in the tables are called adjusted odds ratios which, as discussed above, indicate the increase or decrease in the odds of say, drug use, at the Board level for a one standard deviation increase in the associated social indicator.

For each logistic regression model, the correlation between the observed Board level drug or alcohol use proportion and the corresponding proportion predicted by the logistic regression model is presented in the tables below. The correlations are measures of how well the model fits the observed data. The correlations range from .361 for predicting alcohol intervention need to .525 for predicting alcohol treatment need. These correlations indicate that the model fits ranged from moderate to good. The best fitting models were for heavy drinking, alcohol use treatment need, and drug use treatment need. The correlations, representing goodness of fit were, .477, .525, and .487, respectively. Each of these models had 2 statistically significant social indicator predictors. The remaining 3 moderate fit models each had only one significant predictor.

The percentage of the population that moved within a county was a strong predictor in two of the best fitting models. It had an adjusted odds ratio of 1.76 for heavy drinking and 1.462 for drug use treatment need. The odds ratio of 1.76 for heavy drinking means that a one standard deviation increase in within county mobility increases the odds of heavy drinking by 76 percent. A similar interpretation can be applied to the second odds ratio. Within county mobility had a correlation of .72 with the first and most important factor, Social Disorganization.

Rate of child abuse and neglect referrals was also a strong predictor in two of the best fitting models. It had an odds ratio of 1.949 for drug use treatment need indicating that a one standard deviation increase in the rate of child abuse and neglect for a Board almost doubled the odds of drug use treatment need for a Board. The corresponding odds ratio for alcohol treatment need for this indicator was 1.69. Rate of child abuse and neglect referrals had a correlation of .55 with the second most important factor, Socioeconomic deprivation.

These two social indicators, within county mobility and rate of child abuse and neglect had the strongest effects of all social indicators on drug and alcohol prevalence outcomes. These were the two most important indicators and should be given priority by the Boards with respect

to tracking them through time. Major changes in either one of these indicators could indicate major changes in drug use or alcohol problems in the Board's population.

Factor 1 accounted for 32% of the total variation in the social indicator variables and Factor 2 accounted for 15%. Thus, together they accounted for almost half (47%) of the total variation in the 40 social indicators. These results suggest that underlying dimensions of social disorganization and poverty may be related to drug and alcohol problems at the Board level.

3.2.1 Modeling Drug Use

Only one social indicator (the percentage of residential properties that were renter occupied) emerged as a significant predictor in the logistic regression model predicting the proportion of drug users in a Board (see Table 3-2). A standard deviation increase of 5.18% in the percentage of residential properties that were renter occupied increased the odds of Board level drug use by a factor of 1.32, or by 32%. This is a modest effect. The correlation of the observed proportion of drug users with that predicted by the model was .40 and also indicated a modest fit of the model to the observed Board level proportions of drug users. Percentage of residential properties that are renter occupied is an indicator of the most important underlying factor, Social Disorganization. The indicator's correlation with the underlying factor was .84.

Table 3.2 Social Indicators Related to Drug Use

Indicator	Odds Ratio	*p*-Value	Standard Deviation
Percentage of Residential Properties that are Renter Occupied	1.32	.0001	5.18

Correlation Between Observed and Predicted Values = .40

In discussing the remaining 5 logistic regression models we will talk in terms of odds but the reader can keep in mind that the interpretation also holds approximately for the probabilities themselves.

3.2.2 Modeling Heavy Drinking

The percentage of the population that moved within the county and drug related death rate were the two strong predictors of heavy drinking (see Table 3.3). They had adjusted odds ratios of 1.716 and .742, respectively. The second odds ratio associated with drug related death rate had an odds ratio less than 1 indicating a negative relationship between the death rate and heavy drinking. That is, as the drug related death rate increases, the incidence of heavy drinking decreases. The adjusted odds ratio was .742 indicating that a one standard deviation (1.3) increase in the drug related death rate decreases the odds of heavy drinking by a factor of 1 minus .742 or 25.8%. This finding is counterintuitive and one can only speculate about the

causal mechanism underlying it. This is the only model that produced a counterintuitive adjusted odds ratio. The .477 correlation of the observed proportions of Board residents that were heavy drinkers with the corresponding proportion predicted by the logistic model indicates a good fitting model.

Table 3.3 Social Indicators Related to Heavy Drinking

Indicator	Odds Ratio	*p*-Value	Standard Deviation
Mobility Within County	1.716	.0001	3.64
Drug Related Death Rate	.742	.005	1.30

Correlation Between Observed and Predicted Values = .477

It should be noted, however, that the effect of drug related death rate, though highly statistically significant, was much weaker than the effect of percent of the population that moved within the county. A standard deviation increase in within county mobility increased the odds of Board level heavy drinking by 71.6 percent while a standard deviation increase in the drug related death rate decreased the odds of heavy drinking by 25.8 percent. So the effect of mobility was almost three times the size of the effect for the death rate. Both of these indicators had substantial correlations with the underlying Social Disorganization factor. The correlations were .72 and .75, respectively.

3.2.3 Modeling Drug Use Treatment Need

The percent age of the population that moved within the county and the rate of child abuse and neglect had adjusted odds ratios of 1.462 and 1.949, respectively (see Table 3.4). The effect of rate of child abuse and neglect on drug use treatment need was about twice as strong as the effect of within county mobility. A one standard deviation (10.76) increase in rate of child abuse almost doubled the odds on Board level drug use treatment need while a one standard deviation (3.64) increase in mobility only increased the odds by 46 percent. Rate of child abuse and neglect correlated .55 with the second most important underlying factor, Socioeconomic Deprivation. The .487 correlation of the observed proportions of Board residents needing drug use treatment with the corresponding proportion predicted by the logistic regression model indicates a strong and good fitting model.

Table 3.4 Social Indicators Related to Drug Use Treatment Need

Indicator	Odds Ratio	*p*-Value	Standard Deviation
Mobility Within County	1.462	.02	3.64
Rate of Child Abuse and Neglect	1.949	.0001	10.76

Correlation Between Observed and Predicted Values = .487

3.2.4 Modeling Alcohol Use Treatment Need

A standard deviation (10.76) increase in the rate of child abuse and neglect increased the odds of Board level alcohol use treatment need by 69 percent while a standard deviation (2.16) increase in the admission rate to publicly funded treatment programs decreased the need for alcohol treatment need by 1 minus .744 or 25.6 percent (see Table 3.5). Note that since there is a negative relationship between treatment rate and alcohol treatment need that a decrease in treatment will lead to an increase in alcohol treatment need. The rate of child abuse and neglect was the strongest predictor. This was the best fitting model with a correlation between observe and predicted Board proportions of .525. Admission rate to treatment correlated .68 with the underlying factor, Substance Abuse Treatment.

Table 3.5 Social Indicators Related to Alcohol Use Treatment Need

Indicator	Odds Ratio	*p*-Value	Standard Deviation
Rate of Child Abuse and Neglect	1.690	.0003	10.76
Admission Rate to Treatment Programs	.744	.03	2.16

Correlation Between Observed and Predicted Values = .525

3.2.5 Modeling Drug Use Intervention Need

A standard deviation (5.18) increase in the percent of residential properties that were renter occupied increased the odds of the Board level proportion of residents who need drug use intervention by 31.3% (see Table 3.6). This is a modest effect size and the correlation between the observed and predicted proportions was .37, a modest value for goodness of fit. As mentioned previously, percentage of residential properties that were renter occupied had a correlation of .84 with the underlying factor, Social Disorganization.

Table 3.6 Social Indicators Related to Drug Use Intervention Need

Indicator	Odds Ratio	*p*-Value	Standard Deviation
Percentage of Residential Properties that are Renter Occupied	1.313	.0001	5.18

Correlation Between Observed and Predicted Values = .4370

3.2.6 Modeling Alcohol Use Intervention Need

The percentage of the population that is male aged 15-34 had a modest effect on alcohol use intervention need (see Table 3.7). A standard deviation (1.30) increase in this

indicator was associated with a 22 % increase in alcohol intervention need. This is a modest effect and the correlation between the observed Board level proportions and the proportions predicted by the model correlated was .36. The young male indicator correlated .67 with the underlying factor, Community Mobility. This was the weakest logistic regression model.

Table 3.7 Social Indicators Related to Alcohol Intervention Need

Indicator	Odds Ratio	*p*-Value	Standard Deviation
Percentage of Population that were Young Males	1.222	.0001	1.30

Correlation Between Observed and Predicted Values = .361

3.3 Values of Social Indicators and Predicted Outcome Values

Table 3.8 presents, for all 50 Boards, the values of the 6 social indicator variables that were used in the 6 logistic regression models. We can see that there is wide range of values for all 6 social indicators. Table 3.9 presents the predicted and observed proportions for the 6 outcome variables for all 50 Boards. We can see that the observed and predicted proportions are quite close for the Boards with the larger sample sizes.

Table 3.8 Board Size and Values of Independent Variables for Each Board

Board Name	Board Size	Adult Admission Rate to Drug Treatment	Drug Related Death Rate	Percent Residential Property Renter Occupied	Percent Population Moved Within County	Percent Population Young Males	Rate of Child Abuse
Allen/Auglaize/Hardin	47	5.48	1.18	25.18	24.81	14.71	31.22
Ashland	20	5.93	1.17	24.48	23.93	14.31	37.72
Ashtabula	22	9.20	3.91	25.07	26.66	12.73	7.15
Athens/Hocking/Vinton	24	3.77	2.35	28.92	20.08	18.47	42.67
Belmont/Harrison/Monroe	39	5.46	2.17	22.56	19.16	11.86	27.53
Brown	12	5.83	4.02	21.68	20.30	13.83	27.51
Butler	111	2.88	4.67	29.15	25.47	14.99	22.54
Eastern Miami Valley	113	4.23	4.01	29.18	23.55	14.73	25.26
Clermont	60	7.94	3.19	26.57	23.76	14.73	38.07
Columbiana	49	9.01	2.69	23.17	24.41	12.51	15.31
Cuyahoga	401	6.66	5.36	35.43	29.26	13.32	44.36
Four	46	8.85	0.67	20.81	23.35	13.76	26.05
Delaware/Morrow	25	2.74	2.08	19.90	16.56	13.32	23.29
Erie/Ottawa	36	5.02	3.02	20.63	22.42	12.45	19.65
Fairfield	41	4.87	1.34	23.89	21.92	14.51	20.11
Franklin	347	6.84	4.21	42.15	33.32	16.89	34.53
Gallia/Jackson/Meigs	31	3.74	0.89	22.49	24.61	13.29	38.84

Table 3.8 (Continued)

Board Name	Board Size	Adult Admission Rate to Drug Treatment	Drug Related Death Rate	Percent Residential Property Renter Occupied	Percent Population Moved Within County	Percent Population Young Males	Rate of Child Abuse
Geauga	25	1.60	2.56	13.75	14.32	11.94	11.61
Hamilton	296	4.87	4.79	39.10	31.44	14.16	37.80
Hancock	17	6.90	2.05	24.39	27.01	14.19	22.85
Huron	17	7.71	0.68	26.85	23.58	13.70	18.86
Jefferson	31	4.85	1.32	24.42	21.78	11.69	10.16
Lake	77	3.75	3.32	23.43	23.08	13.56	16.72
Licking/Knox	55	8.65	1.72	26.30	24.09	13.75	31.10
Logan/Champaign	30	6.74	2.64	23.05	24.91	13.47	28.46
Lorain	84	7.92	1.57	27.03	25.73	14.06	14.83
Lucas	142	6.02	4.20	32.47	30.82	14.46	31.49
Mahoning	76	6.52	4.02	26.52	24.06	12.23	19.14
Marion/Crawford	55	8.48	2.31	27.17	26.52	13.94	42.33
Medina	53	2.83	1.72	19.99	19.34	13.17	13.59
Tri-Co. (Mercer)	40	6.80	0.88	17.49	22.97	13.42	25.86
Tri-Co. (Miami)	74	6.11	1.91	24.77	25.31	13.41	19.76
Montgomery	221	5.81	6.34	34.81	30.52	14.18	28.76
Muskingum Area	78	5.18	2.17	22.49	24.84	13.05	39.58
Portage	51	3.72	1.48	28.15	22.24	16.28	29.03
Preble	9	3.90	1.39	21.61	22.78	13.09	19.88
Putnam	14	4.33	2.28	14.97	20.90	14.18	8.36
Richland	30	6.79	1.72	27.58	28.61	14.60	28.34
Paint Valley	78	7.90	2.43	27.52	24.16	15.71	33.89
Adams/Lawrence/Scioto	58	2.67	2.89	26.47	26.96	13.15	44.18
Seneca/Sandusky/Wyandot	49	6.86	0.96	24.19	22.75	13.70	38.75
Summit	188	11.44	2.66	29.58	27.54	13.73	52.99
Stark	143	8.39	2.62	28.39	27.06	13.01	35.40
Trumbull	65	5.70	3.09	25.58	24.46	12.55	8.13
Tuscarawas/Carroll	45	3.68	1.38	22.11	22.81	12.52	28.60
Union	7	4.48		24.39	22.99	13.52	20.94
Warren/Clinton	54	5.28	1.59	25.95	20.98	14.93	23.80
Washington	28	1.71	1.89	23.38	22.63	13.15	37.25
Wayne/Holmes	13	4.83	1.10	26.34	24.10	13.99	28.84
Wood	29	2.20	2.72	28.56	17.72	16.53	14.67

Table 3.9 Observed Probabilities vs. Predicted Probabilities for All The Outcome Variables

	Drug Use		Heavy Drinking		Drug Treatment Need		Alcohol Treatment Need		Drug Intervention Need		Alcohol Intervention Need	
Board Name	**observed**	**predicted**	**observed**	**predicted**	**observed**	**predicted**	**observed**	**predicted**	**observed**	**predicted**	**observed**	**predicted**
Allen/Auglaize/Hardin	9.51%	6.68%	7.69%	4.28%	0.00%	0.85%	2.90%	1.99%	1.74%	2.77%	5.67%	10.07%
Ashland	4.02%	6.46%	4.02%	3.78%	4.02%	1.15%	4.02%	2.55%	0.00%	2.67%	4.02%	9.51%
Ashtabula	9.75%	6.65%	0.00%	3.04%	0.00%	0.23%	0.00%	0.38%	5.85%	2.76%	0.00%	7.60%
Athens/Hocking/Vinton	1.60%	8.03%	1.75%	1.67%	0.00%	1.05%	0.00%	4.28%	1.60%	3.35%	25.10%	16.68%
Belmont/Harrison/ Monroe	0.00%	5.87%	0.00%	1.52%	0.00%	0.38%	0.00%	1.68%	0.00%	2.43%	12.33%	6.71%
Brown	13.41%	5.61%	0.00%	1.18%	6.71%	0.42%	6.71%	1.59%	6.71%	2.32%	0.00%	8.89%
Butler	4.67%	8.13%	2.15%	2.16%	0.40%	0.53%	0.56%	1.87%	2.23%	3.39%	10.73%	10.47%
Eastern Miami Valley	8.00%	8.14%	0.76%	1.90%	0.76%	0.52%	0.00%	1.78%	3.77%	3.39%	11.26%	10.09%
Clermont	7.01%	7.16%	0.00%	2.35%	0.00%	1.16%	0.00%	1.98%	2.24%	2.97%	5.59%	10.08%
Columbiana	7.27%	6.05%	1.71%	2.89%	0.00%	0.31%	0.00%	0.58%	2.57%	2.50%	7.64%	7.37%
Cuyahoga	11.08%	10.99%	3.22%	3.20%	3.40%	2.97%	3.03%	3.16%	4.50%	4.64%	6.99%	8.28%
Four	1.24%	5.38%	2.49%	3.88%	0.00%	0.53%	0.00%	0.99%	0.00%	2.22%	2.49%	8.81%
Delaware/Morrow	0.00%	5.13%	0.00%	1.06%	0.00%	0.22%	0.00%	1.98%	0.00%	2.12%	5.35%	8.28%
Erie/Ottawa	2.58%	5.32%	6.04%	2.01%	0.00%	0.33%	0.00%	1.22%	0.00%	2.20%	10.23%	7.31%
Fairfield	16.08%	6.27%	0.00%	2.73%	0.00%	0.32%	2.47%	1.28%	1.95%	2.60%	7.87%	9.78%
Franklin	14.84%	14.99%	6.77%	7.28%	2.74%	2.49%	4.24%	1.94%	6.72%	6.46%	12.96%	13.55%
Gallia/Jackson/Meigs	4.10%	5.85%	4.10%	4.42%	0.00%	1.32%	0.00%	3.60%	0.00%	2.42%	4.10%	8.24%
Geauga	9.45%	3.76%	0.00%	0.68%	0.00%	0.09%	0.00%	1.32%	7.89%	1.55%	11.01%	6.79%
Hamilton	12.81%	13.04%	5.45%	4.95%	1.68%	2.50%	1.63%	2.95%	4.99%	5.57%	13.91%	9.31%
Hancock	4.95%	6.43%	0.00%	4.82%	4.95%	0.64%	0.00%	1.10%	0.00%	2.66%	31.33%	9.36%
Huron	0.00%	7.26%	0.00%	4.01%	0.00%	0.35%	0.00%	0.82%	0.00%	3.02%	0.00%	8.73%
Jefferson	8.00%	6.44%	0.00%	2.69%	0.00%	0.17%	0.00%	0.79%	2.66%	2.67%	2.66%	6.55%
Lake	11.52%	6.13%	2.51%	2.07%	1.25%	0.29%	4.09%	1.26%	5.21%	2.53%	5.53%	8.56%
Licking/Knox	11.84%	7.06%	6.95%	3.42%	0.00%	0.78%	0.00%	1.29%	7.21%	2.93%	10.69%	8.80%
Logan/Champaign	0.00%	6.01%	3.91%	3.14%	0.00%	0.72%	0.00%	1.47%	0.00%	2.49%	6.81%	8.45%
Lorain	5.33%	7.32%	4.99%	4.47%	0.74%	0.34%	0.57%	0.65%	3.25%	3.04%	13.39%	9.19%
Lucas	9.39%	9.54%	4.09%	5.15%	0.84%	1.60%	1.59%	1.88%	3.77%	4.00%	7.74%	9.72%
Mahoning	4.38%	7.14%	1.97%	2.04%	1.20%	0.37%	1.97%	0.97%	2.74%	2.97%	6.93%	7.08%

(continued)

Table 3.9 (continued)

Board Name	Drug Use		Heavy Drinking		Drug Treatment Need		Alcohol Treatment Need		Drug Intervention Need		Alcohol Intervention Need	
	observed	predicted	observed	predicted	observed	predicted	observed	predicted	observed	predicted	observed	predicted
Marion/Crawford	17.58%	7.38%	5.21%	4.24%	4.53%	1.99%	2.63%	2.25%	1.90%	3.07%	11.47%	9.03%
Medina	4.49%	5.16%	1.78%	1.73%	0.00%	0.16%	1.49%	1.23%	1.69%	2.13%	9.25%	8.09%
Tri-Co. (Mercer)	0.98%	4.55%	0.00%	3.52%	0.00%	0.50%	0.00%	1.29%	0.98%	1.87%	4.63%	8.39%
Tri-Co. (Miami)	9.65%	6.55%	7.47%	3.91%	3.10%	0.44%	4.09%	1.06%	2.60%	2.71%	15.65%	8.38%
Montgomery	11.08%	10.67%	3.35%	3.08%	1.20%	1.32%	2.01%	1.69%	5.08%	4.50%	6.78%	9.35%
Muskingum Area	7.71%	5.85%	2.33%	3.45%	0.00%	1.42%	2.04%	3.08%	1.65%	2.42%	4.37%	7.96%
Portage	6.64%	7.74%	9.66%	2.77%	0.00%	0.57%	5.77%	2.28%	6.64%	3.22%	16.32%	12.49%
Preble	16.27%	5.59%	0.00%	3.05%	0.00%	0.34%	0.00%	1.44%	0.00%	2.31%	0.00%	8.01%
Putnam	0.00%	4.00%	0.00%	1.91%	0.00%	0.14%	0.00%	0.78%	0.00%	1.64%	6.12%	9.34%
Richland	2.01%	7.52%	8.09%	6.47%	0.00%	1.05%	0.00%	1.46%	2.01%	3.13%	10.11%	9.91%
Paint Valley	4.17%	7.50%	0.00%	2.95%	0.00%	0.93%	0.00%	1.63%	1.85%	3.12%	9.53%	11.55%
Adams/Lawrence/Scioto	11.36%	7.12%	11.70%	3.97%	1.95%	2.33%	11.98%	5.30%	7.29%	2.96%	1.48%	8.08%
Seneca/Sandusky/ Wyandot	5.06%	6.36%	2.84%	3.34%	0.00%	1.09%	1.43%	2.36%	4.21%	2.63%	8.23%	8.73%
Stark	8.62%	7.83%	2.10%	4.28%	0.71%	1.38%	1.06%	1.64%	5.94%	3.26%	2.08%	7.91%
Summit	10.06%	8.30%	4.23%	4.55%	5.35%	4.17%	2.95%	2.50%	2.78%	3.46%	10.75%	8.77%
Trumbull	8.37%	6.82%	6.74%	2.66%	0.00%	0.20%	1.17%	0.64%	6.46%	2.83%	22.76%	7.41%
Tuscarawas/Carroll	2.01%	5.74%	4.71%	3.07%	0.00%	0.59%	0.80%	2.24%	2.01%	2.37%	16.30%	7.38%
Union	0.00%	6.43%	14.74%	.	0.00%	0.37%	0.00%	1.40%	0.00%	2.66%	14.74%	8.51%
Warren/Clinton	6.31%	6.94%	2.63%	2.25%	0.00%	0.36%	0.00%	1.44%	0.00%	2.88%	12.07%	10.37%
Washington	0.00%	6.11%	0.00%	2.67%	0.00%	0.98%	4.88%	4.37%	0.00%	2.53%	0.00%	8.07%
Wayne/Holmes	0.00%	7.08%	0.00%	3.93%	0.00%	0.68%	0.00%	1.94%	0.00%	2.94%	0.00%	9.10%
Wood	5.43%	7.89%	2.16%	1.09%	2.16%	0.15%	2.16%	1.41%	0.00%	3.29%	9.52%	12.91%

3.4 A Tool for Predicting Future Drug and Alcohol Problems at the Board Level

Table 3.10 presents the unstandardized logistic regression coefficients for each of the six models. They are the parameters of the model:

log odds= log(p/1-p)=intercept+b1 times social indicator 1 value +b2 times social indicator 2 value.

In the case of one independent variable the term for the 2nd indicator drops out. For our purposes, we want to predict p, the proportion, itself for a particular Board so we transform the above equation to

p= exp(bo+b1SI+b2SI2/ 1+exp(bo+b1SI1+b2SI2)

where bo is the intercept, b1 and b2 are the regression parameters presented in Table 3.10 and SI1 and SI2 are the corresponding values of social indicators 1 and 2 for the particular outcome being modeled. The term exp(.....) means that exp which is the base of the natural logarithm and is equal to 2.718....is raised to the power of the value in the parentheses.

This formula looks forbidding, but the predicted value p can be easily obtained on a pocket calculator. This formula can be used by any Board to predict any of the 6 drug and alcohol use outcomes at a given future time by substituting the values of the appropriate updated social indicators.

We will now illustrate the use of this tool. From Table 3.9, which contains the predicted proportions for all 6 outcomes for all 50 Boards we see that the predicted proportion or, equivalently, percentage of those in need of drug use treatment for the Cuyahoga Board is 3.40% which is close to the observed percentage of 2.97%. Suppose that 2 years from now the Cuyahoga Board wants to predict this same percentage. We use their current updated values of the two social indicators, percentage of population that moved within the county and rate of child abuse and neglect referrals.

Let us also suppose that the within county mobility increased from its current value of 29.26% in Table 3.8 to 33% and the value of rate of child abuse increased from its current value of 44.36 per thousans to 55 per thousand. Then using the regression parameters from the drug use treatment model from Table 3.10, we find that

exp(-9.2770+.1045(33)+.0616(55)) equals .0871.

This term is calculated on a pocket calculator by computing the term in the parentheses and using the e to the x power button to raise e to the value in the parentheses. Then substituting into the above formula for p, we find p equals .0871/ 1+.0871 or .0801 or 8.01%. So the predicted value of drug abuse treatment need 2 years down the road is 8.01 %, a substantial increase from 3.40% of 2 years previously, the current value.

Table 3.10 Parameters of Logistic Regression Models for Use in Board Level Predictions

Outcome	Intercept	b1	Variable	b2	Variable
Illicit Drug Use	-3.9732	.0531	(percent residential properties that are renter occupied)		
Heavy Drinking	-6.5119	.1481	(percent population that moved within county)	.-2293	(drug related death rate)
Drug Use Treatment Need	-9.2770	.1045	(percent population that moved within county)	.0616	(rate of child abuse and neglect referrals)
Alcohol Use Treatment Need	-4.6522	.0484	(rate of child abuse and neglect referrals)	-.1375	(adult admission rate to publicly funded treatment programs)
Drug Use Intervention Need	-4.8721	.0522	(percent residential properties that are renter occupied)		
Alcohol Use Intervention Need	-4.4670	.1548	(percent of population that is male aged 15-34)		

Correlation Between Observed and Predicted Values = .40

3.5 Summary

This study indicated that only 5 factors or underlying dimensions were required to explain most of the variation in the 40 social indicators. In order of importance, they were as follows: Social Disorder/Social Consequences; Socioeconomic Deprivation; Community Mobility; Substance Abuse Treatment; and Alcohol Related Problems.

Six indicators representing the first four dimensions were found to be predictive of the 6 drug and alcohol outcomes. Three of these indicators were significant predictors in 2 logistic regression models. Three of the models yielded good fits to the observed Board proportions and three yielded moderate fits. The three best fitting models were those predicting heavy drinking, drug use treatment need, and alcohol use treatment need. Two of the six indicators were strong predictors in the 3 best fitting models: percentage of the population that moved within a county and the rate of child abuse and neglect referral. It was suggested that these two indicators be given priority for tracking over time since significant changes in these over time might signal significant changes in Board level alcohol or drug problems. However, it would be worthwhile monitoring all 6 indicators for significant changes. Note that we have narrowed the original set of 40 candidate social indicators to a small set of 6 indicators that are predictive of drug and

alcohol problems and hence worth tracking over time. We also presented a tool for the Boards to predict drug and alcohol use outcomes in the future by using future values of the appropriate social indicator variables.

4. SUMMARY AND IMPLICATIONS

This study found that social indicator modeling can serve as an alternative to annual survey data collection to estimate and update Board level prevalence for substance abuse planning and resource allocation decision making in Ohio. Social indicators have a long history of use in health planning and are valued because they contribute rationality and objectivity to the decision-making process (McAuliffe et al., 1993). The underlying premise of social indicator approaches is that existing information is already available about the social, demographic, and economic characteristics of counties or planning areas that are associated with substance use and need for treatment.

In Chapter 1, we introduced two methods for indirect data collection: synthetic estimation and social indicator modeling. We hypothesized that social indicator modeling would be more effective than synthetic estimation procedures for predicting substance abuse and treatment needs because it expands beyond strictly demographic predictors and incorporates alcohol- or drug-related variables (e.g., drug-related death rates). This approach was recommended by the National Technical Center (NTC) for Substance Abuse Needs Assessment (McAuliffe et al., 1993). In this study, we found that admission rate to public funded treatment programs and drug-related death rate along with four social indicators representing social disorganization and poverty were highly significant predictors of drug and alcohol use outcomes.

4.1 Summary of Findings

The logistic regression models for heavy drinking, drug use treatment need, and alcohol use treatment need were the best fitting models. The remaining three models for drug use, alcohol use intervention need, and drug use intervention need only fit the observed data moderately well. Each of the best fitting models had two social indicators as predictors while each of the moderately fitting models had a single social indicator as a predictor. Altogether only six social indicators were included as predictors in the 6 models. Three of the social indicators emerged as predictors in two models. They were as follows: within county mobility; rate of child abuse and neglect; and percentage of residential properties that were renter occupied. Within county mobility and rate of child abuse and neglect were the strongest predictors.

A formula was presented that Boards can use to predict the six drug and alcohol outcomes from changed values of the social indicators at future points in time.

4.2 Interpretation of Results

Since the social indicators are highly intercorrelated, other models for the six drug and alcohol outcomes could be specified that would essentially have the same predictive power as the models presented here. However, the models presented here were conceptually appealing and were based on a number of considerations including previous research, results of the factor analysis, bivariate correlations, and preliminary stepwise regression models.

4.3 Future Considerations

One of the important policy issues yet to be resolved is the choice of outcome measures that are most relevant and appropriate for the State's planning and resource allocation decisions. We propose the continued use of treatment need as opposed to treatment utilization. Models based on treatment utilization do not take into account under-utilization due to limited access or finances and may bias resource allocation in favor of areas with high levels of current use. Furthermore, if those planning decisions are most directly pertinent to substance abuse treatment services, as traditionally defined, then the models of treatment needs might be most appropriate. However, this choice must be balanced with the consideration that the other models (i.e., the need for intervention and the prevalence of use) are based on outcomes in which we have more confidence in their measurement because of the larger number of persons on which they are based. We want to stress the utility of continuing to collect an array of social indicators, especially the 6 that turned out to be significant predictors in this study. Large changes in them could signal significant changes in drug and alcohol outcomes.

There are several limitations of this study. First, for many Boards, the household survey estimates are based on relatively small samples. Therefore, the survey-based estimates may have large sampling errors, and some attenuation of correlations with the predictors (i.e., the social indicators) would be expected. Second, some of the State-collected indicators may contain significant measurement error, thereby limiting their effectiveness in the models. To enhance the use of these indicators in the future, we suggest that State agencies pay careful attention to collecting data in a consistent and reliable manner across all Boards of the State. Third, the models are based on outcomes from the Ohio household telephone survey. To the extent there was error in the estimates of drug and alcohol prevalence and need for treatment and intervention, then the models developed here may be in error.

4.4 Conclusion

Findings from this study suggest that social indicators may be useful for health service planning, because they are correlated with various measures of substance use and treatment needs. Furthermore, the results show that these outcomes may be successfully modeled by a few

easy-to-obtain and reliably measured variables describing the population characteristics of the Boards. Thus, these findings suggest that in the absence of up-to-date, comprehensive population surveys, social indicator studies may be very useful in estimating differences in substance abuse treatment and intervention needs, both within and across Boards in the State of Ohio. More importantly, the social indicator models can be used to estimate drug and alcohol related problems at future times without the use of expensive surveys.

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APPENDIX A

Data Sources, Definitions, and Methodology

APPENDIX A

Data Sources, Definitions, and Methodology

The indicator data used for the analyses described in this report were either obtained directly from the Internet or from a variety of sources by the Ohio Division of Alcohol and Drug Abuse and forwarded to the Research Triangle Institute (RTI) for cleaning, management, and analysis. This section describes the data sources and indicator definitions, summarizes the data collection procedures, and notes any features of the data that may influence how they should be interpreted. Information in this section is organized by source. In some instances, a source agency may have provided more than one kind or set of data. Table A.1 identifies the sources for the data and the indicators presented in this report. All rates and percentages are based on averages of up to the five most recent available data years.

A.1 U.S. Bureau of the Census

The county-level data used for this study were abstracted from the *USA Counties 1998* on the Internet at http://tier2.census.gov/usac/index.html-ssi. A limitation of the census data is that they are several years old and updated only every 10 years. Data obtained on rental properties, vacant properties, mobility, density, urban population, and adults without a high school education are based on the Census Bureau's 1990 decennial survey of the U.S. population. Additional data were obtained from non-decennial years including race, sex, and age group; poverty; and income. These figures are estimates based on the 1990 census. Presidential election voter turnout for 1992 and 1996 was also obtained from the *USA Counties 1998* website.

The percentage of residential properties that are renter-occupied and the percentage of all residential properties, rental and private, that are unoccupied use data on the total number of rental units and vacant residential units. Both are divided by the total number of all residential properties. Mobility indicators include the percentage of the population that moved within the past 5 years from a) outside the county and b) within the same county. Population density, or the average number of inhabitants per square mile of land area, is determined by dividing the total population by the square miles of land per county. The percentage of the population living in urban areas is determined by the population living in areas defined as urban divided by the total population. The percentage of adults without a high school degree is determined by dividing the number of adults (aged 25 and older) who completed less than 12 years of school by the total number of people aged 25 years and older.

Indicators of race such as the percentage of the population who are identified as white, black, Native American, or Asian are calculated by dividing the total population who classify

Table A.1 Indicators and Data Sources

Indicator		Source
Arrests		Federal Bureau of Investigation (FBI) Uniform Crime Report (UCR) data obtained for the University of Michigan Interuniversity Consortium for Political and Social Research (ICPSR)
DUIs Traffic Crashes		Ohio Department of Public Safety
Admissions to Treatment Programs		Ohio Department of Alcohol and Drug Addiction Services
Alcohol- and Drug-Related Deaths Divorces Teen Pregnancies Sexually Transmitted Diseases		Ohio Department of Health
Alcohol- and Drug-Related Hospital Discharges		Ohio Hospital Association
Population Property Voter Turnout Mobility Density	Urbanicity Poverty Income Adult Education	U.S. Bureau of the Census
Migration Homelessness Unemployment Single-Parent Families		Ohio Department of Development
Voter Registration		Ohio Secretary of State
Unemployment Claims (Temporary Aid to Needy Families) TANF		Ohio Department of Job and Family Services
Retail Liquor Permits Alcohol Sales		Ohio Department of Commerce
Child Abuse and Neglect		Ohio Department of Human Services

themselves as such by the total population. The percentage of the population who are males aged 15 to 34 was calculated similarly. Poverty measures are based on the percentage of all persons and the percentage of all children under the age of 18 in families with incomes below the Federal poverty threshold. These percentages are calculated by dividing the total number of persons/children below the poverty threshold by the total number of persons/children for whom a poverty status was determined. Median household income is the family income at which 50% of all families have a higher income and 50% of all families have a lower income. The percentage of adults who voted in presidential elections was calculated by dividing the total number of votes cast by the total population aged 18 and older.

A.2 Uniform Crime Report

Crime and arrest data are collected by the Federal Bureau of Investigation (FBI) from reports submitted by agencies participating in the Uniform Crime Report (UCR). The agency-level files are aggregated to the county level by the Interuniversity Consortium for Political and Social Research (ICPSR). Arrest data must be interpreted cautiously for several reasons. First, the number of arrests almost always underestimates the true incidence of criminal activity because many crimes do not result in an arrest. Second, the likelihood of an arrest for a given crime may be influenced by local policies, police practices, and law enforcement resources. Third, if multiple crimes are involved, the arrest is classified according to the most serious crime committed. Finally, not all agencies report data to the UCR or they report data sporadically.

In 1994, the ICPSR implemented an algorithm to adjust for incomplete reporting. Data from agencies reporting 3 to 11 months of information were weighted to yield 12-month equivalents. Data for agencies reporting less than 3 months of data were replaced with data estimated by rates calculated from agencies reporting 12 months of data located in the agency's geographic stratum within their state. A coverage index for each county was constructed by ICPSR that reflects the degree to which data for that county were imputed. The index serves as a combined indicator of the total extent to which data for a given county have been imputed (as a result of agency data being either weighted to compensate for missing months or being replaced by stratum-wide estimates).

Data for jurisdictions located in multiple counties are reported in the county containing the largest component of the jurisdiction. Some jurisdictions, such as State parks and some State police agencies, provide data only on a statewide basis. In these cases, data are allocated to counties proportionate to their share of the total State population of the agencies reporting 6 months of data or more. The percentage of arrests for any type of crime that are reported by statewide agencies is small or negligible and thus not a potentially significant source of bias in the county-level arrest rates.

For this report, UCR arrest data for calendar years 1994 to 1997 were used to construct the rate of adults aged 18 and older and juveniles aged 10 to 17 (per 1,000) who were arrested for alcohol-related crimes and drug-related crimes. In order to more accurately reflect the rate of crimes attributable to alcohol or drugs, fractions were applied to several categories of crime in developing the alcohol- and drug-related crime indicators. The fractions were obtained from the STNAP Core Protocol and can be found in Table A.2. These indicators include 2% to 30% of the number of homicides, aggravated assaults, sexual assaults, other assaults, robberies, burglaries, larcenies thefts, and motor vehicle thefts. In addition, 100% of DUIs, liquor law violations, and public drunkenness, were attributable to alcohol; and 13% of prostitution, 15% of

stolen property, and 100% of drug law violations were attributable to drugs. Rates were based on a 4-year average and calculated as 1,000 times the annual weighted number of arrests divided by the estimated county population for each appropriate age group.

Table A.2 Fractions Applied for Calculating Alcohol- and Drug-Related Crime Indicators

Type of Crime	Alcohol Factors	Drug Factors
	Fraction Attributable	Fraction Attributable
Homicide	30.0	15.8
Aggravated assault	30.0	2.4
Sexual assault	22.5	5.1
Other assaults	30.0	5.1
Robbery	3.4	27.2
Burglary	3.6	30.0
Larceny-theft	2.8	29.6
Auto theft	3.5	6.8
Driving under the influence	100.0	0.0
Liquor laws	100.0	0.0
Public drunkenness	100.0	0.0
Stolen property	0.0	15.1
Prostitution	0.0	12.8
Drug laws	0.0	100.0

Source: State Treatment Needs Assessment Program Social Indicators Core Protocol, Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Treatment, Office of Evaluation, Scientific Analysis and Synthesis, 2001.

A.3 Ohio Department of Public Safety

DUI Charges: The Ohio Department of Public Safety maintains a database of all traffic convictions for the State in cooperation with the Office of the Court Administrator. County data are based on the charged individual's county of residence. Data reflect convictions, not persons charged. Therefore, a person could have multiple convictions during a year. In addition, data may also reflect differences in charging practices by county prosecutors in each county and result in persons being charged under two different sections of the DUI statute.

DUI data were broken out into five categories: 1) Alcohol/Liquor 2) Drugs/Opiates 3) Municipal 4) Commercial .04 and 5) 4th DUI Felony. To reflect the number of DUI charges for alcohol in the general population, only those classified as alcohol/liquor or municipal were used. These data were obtained for calendar years 1995 to 1999. Rates were calculated by dividing the

total number of DUI charges by the total number of people aged 18 and older multiplied by 1,000.

Motor Vehicle Crashes in which Impairment was a Factor: Police officers report motor vehicle crashes to the Bureau of Motor Vehicles (BMV) using crash reports. Crash report data are entered into the Ohio Integrated Traffic Records System (ITRS) database. Police reports are supposed to be filed on all crashes, although it is not certain what percentage of crashes have filed reports. Impairment is based on the police officer's indication that the operator was driving while impaired. Breathalyzer or urine tests are administered, however impairment measures may not be reflected on the crash report depending upon timing of administration

The data on traffic crashes were abstracted from the Ohio Integrated Traffic Records System on the Ohio Department of Public Safety website (http://www.state.oh.us/odps/crash_reports.htm). A crash is defined as an occurrence involving a moving motor vehicle that produces bodily injury or property damage. An alcohol-related crash is one in which a vehicle driver or pedestrian had been drinking. These data were obtained for calendar years 1994 to 1998. The percent of traffic crashes that were alcohol-related was calculated by dividing the number of alcohol-related crashes by the total number of crashes, multiplied by 100.

A.4 Ohio Department of Alcohol and Drug Addiction Services

When an individual enters a treatment facility, admissions data, diagnostic information, service transactions data, and discharge data are collected and entered into a database. The database makes it possible to obtain both the duplicated and unduplicated count of persons because a unique identification number is assigned to each individual. For this report, the unduplicated count was used.

Treatment admissions data were obtained for alcohol only, drugs only, and alcohol and drugs. These data were obtained for 1995 to 1999. The adult admission rate to publicly funded treatment programs was calculated by dividing the unduplicated number of adults (aged 18 and older) in treatment programs by the population aged 18 and older, multiplied by 1,000. The juvenile admission rate to publicly funded treatment programs was calculated by dividing the unduplicated number of juveniles (aged 10 to 17) in treatment programs by the population aged 10 to 17, multiplied by 1,000.

A.5 Ohio Department of Health

Alcohol- and Drug-Related Deaths: Death certificates are completed by the physician or medical examiner who determines the cause of death. The certificate is then delivered to the

funeral director or family member in charge of the body, who completes all of the personal data. The certificate is taken to the clerk of the town where the death occurred for filing. Once filed, the clerk or deputy registrar issues a burial transit permit for disposition of the body. The city or town clerk sends the Vital Records Office at the Department of Health certified copies of each death either monthly or weekly. Computerized data are sent to the National Center for Health Statistics (NCHS).

The cause of death noted on death certificates is categorized according to codes from the International Classification of Diseases (ICD-9). There does not appear to be a standard and uniformly agreed upon set of codes that indicate whether a death is related to alcohol or drug use. For this study, the source agency compiled alcohol- and drug-related deaths based on the following ICD-9 codes shown in Table A.3. Death data were obtained for 1994 to 1998. Rates were calculated as 100,000 times the number of alcohol- or drug-related deaths divided by the total population.

Divorce: Each family court in the State is required to send certificates of divorce or annulment to the Vital Records Office at the Department of Health on a monthly basis. Divorce data were abstracted from the Ohio Department of Health website (http://www.odh.state.oh.us/Data/whare/mardiv/mardiv1.htm) for 1994 to 1998. The divorce rate was calculated by dividing the number of divorces by the total population, multiplied by 1,000.

Teen Births: Doctors, midwives, or other persons attending a birth are required to file a birth certificate within 10 days after delivery. The original certificate, containing the age of the mother, is filed with the town or city clerk where the birth occurred. The clerk provides the Vital Records Office at the Department of Health with a certified copy of each birth certificate. Computerized data are sent to the NCHS.

Live births to teen mothers data were abstracted from the Ohio Department of Health website (http://www.odh.state.oh.us/Data/whare/bth/birth1.htm) for 1994 to 1998. Defined as the number of live births per 1,000 women aged 10 to 19, rates were calculated by dividing the number of births to women aged 10 to 19 multiplied by 1,000 by the total population aged 10 to 19.

Divorce: Each family court in the State is required to send certificates of divorce or annulment to the Vital Records Office at the Department of Health on a monthly basis. Divorce data were abstracted from the Ohio Department of Health website (http://www.odh.state.oh.us/Data/whare/mardiv/mardiv1.htm) for 1994 to 1998. The divorce

rate was calculated by dividing the number of divorces by the total population, multiplied by 1,000.

Table A.3 International Classification of Disease (ICD-9) Codes and Categories for Collecting Death Data

ICD-9 Codes	ICD-9 Code Definitions
Alcohol:	
291	Alcohol psychoses
303	Alcohol dependence syndrome
305	Nondependent abuse of alcohol
357.5	Alcoholic polyneuropathy
425.5	Alcoholic cardiomyopathy
535.3	Alcoholic gastritis
571	Alcoholic fatty liver
571.1	Acute alcoholic hepatitis
571.2	Alcoholic cirrhosis of liver
571.3	Alcoholic liver damage, unspecified
760.71	Fetal alcohol syndrome
790.3	Excessive blood level of alcohol
980	Toxic effects of ethyl alcohol
Drug:	
292	Drug psychoses
304	Drug dependence
305.2-305.9	Nondependent abuse of drugs
357.6	Polyneuropathy due to drugs
760.72	Narcotics affecting fetus or newborn via placenta or breast
760.73	Hallucinogens affecting fetus or newborn via placenta or breast
779.5	Drug withdrawl syndrome in newborn
965	Poisoning by opiates and related narcotics
967	Poisoning by sedatives and hypnotics
968	Poisoning by CNS muscle tone depressants
969	Poisoning by psychotropic agents
970	Poisoning by CNS stimulants
010-018	Tuberculosis
70.20-70.23	Viral hepatitis B with hepatic coma
70.30-70.33	Viral hepatitis B w/o mention of hepatic coma
265.2	Pellagra
571.40-571.49	Chronic hepatitis
571.8	Other chronic nonalcoholic liver disease
571.9	Unspecified chronic liver disease w/o mention of alcohol
572.3	Portal hypertension
573.3	Hepatitis, unspecified
760.7	Noxious influences affecting fetus via placenta or breast milk
977.0, 977.1, 977.2, 977.3, 977.4, 977.8,	Poisoning by dietetics, lipotropic drugs, antidotes and chelating
980.1, 980.2, 980.3, 980.8, 980.9	Toxic effect of methyl alcohol, isopropyl alcohol, fusel oil, other

Teen Births: Doctors, midwives, or other persons attending a birth are required to file a birth certificate within 10 days after delivery. The original certificate, containing the age of the mother, is filed with the town or city clerk where the birth occurred. The clerk provides the Vital Records Office at the Department of Health with a certified copy of each birth certificate. Computerized data are sent to the NCHS.

Live births to teen mothers data were abstracted from the Ohio Department of Health website (http://www.odh.state.oh.us/Data/whare/bth/birth1.htm) for 1994 to 1998. Defined as the number of live births per 1,000 women aged 10 to 19, rates were calculated by dividing the number of births to women aged 10 to 19 multiplied by 1,000 by the total population aged 10 to 19.

Sexually Transmitted Disease: Sexually transmitted disease (STD) data are collected from morbidity rates on a daily basis. Health care providers and labs are required by law to report cases of gonorrhea, chlamydia, and syphilis directly to the Ohio State Department of Health. Reports can be phoned in or sent via mail on a weekly lab report. If the STD program receives a lab report without subsequently receiving a report from the provider, the STD program will call the provider for verification. Reports are received daily and entered into the STD-management information system (MIS) program database by Department of Health staff. The STD-MIS program is offered to all States by the Centers for Disease Control and Prevention (CDC). The reports are electronically transmitted to the CDC via modem once a week.

The number of reported cases of gonorrhea, syphilis, chlamydia, and HIV/AIDS were abstracted from the Ohio Department of Health website (http://www.odh.state.oh.us/Data/Inf_Dis/id1.htm). Defined as the rate of gonorrhea, syphilis, and chlamydia per 100,000 persons, a STD rate was calculated by dividing the total cases of gonorrhea, syphilis, and chlamydia by the total population, multiplied by 100,000, using data from 1996 to 1998. Defined as the number of cases of HIV per 100,000 persons, a HIV rate was calculated by dividing the total number of people living with HIV/AIDS by the total populations, multiplied by 100,000, using data from 1998 to 1999.

A.6 Ohio Hospital Association

Alcohol- and Drug-Related Hospital Discharges: Ohio's acute care hospitals participate in the State's hospital data system by supplying discharge abstracts or compatible information to the Ohio Hospital Association. Cuyahoga County hospitals (Cleveland) will not provide data to the Ohio Hospital Association. Once the data year is closed and the data have been edited, the Ohio Hospital Association provides data to the Department of Health. The Veterans Administration (VA) provides discharge records from Ohio's VA hospital. Currently, data are

supplied using the Uniform Hospital Discharge Data Set (UHDDS). However, since 1998, data have been based on the UB92 data set consisting of data from UB92 hospital claim forms. County information is calculated from a patient's recorded ZIP code and town code. Records contain calendar year data based on the date of discharge, not the date of admission. Hospitals that are strictly psychiatric hospitals are not included in these data. There is no unique client identifier. Therefore, there is no way to ensure an unduplicated count.

Data for this study were obtained for 1995 to 1998 and compiled based on the diagnosis-related group (DRG) codes in Table A.4.

Table A.4 Diagnosis-Related Group (DRG) Codes and Categories for Collecting Hospital Admissions Data

100 Percent Drug-Caused Conditions	ICD-9 Code	Fraction	Age Range
Drug psychoses	292	100	all
Drug dependence	304	100	all
Nondependent abuse of drugs	305.2–305.9	100	all
Polyneuropathy due to drugs	357.6	100	all
Narcotics affecting fetus or newborn via placenta or breast	760.72	100	all
Hallucinogens affecting fetus or newborn via placenta or breast	760.73	100	all
Drug withdrawal syndrome in newborn	779.5	100	all
Poisoning by opiates and related narcotics	965.0	100	all
Poisoning by sedatives and hypnotics	967	100	all
Poisoning by CNS muscle tone depressants	968.0	100	all
Poisoning by psychotropic agents	969	100	all
Poisoning by CNS stimulants	970	100	all
Drug-Related Conditions	**ICD-9 Code**	**Fraction**	**Age Range**
Tuberculosis	010–018	50*	all
100 Percent Alcohol-Caused Conditions	**ICD-9 Codes**	**Fraction**	**Age Range**
Alcohol psychoses	291	100	all
Alcohol dependence syndrome	303	100	all
Nondependent abuse of alcohol	305.0	100	all
Alcoholic polyneuropathy	357.5	100	all
Alcoholic cardiomyopathy	425.5	100	all
Alcoholic gastritis	535.3	100	All

Table A.4 (Continued)

100 Percent Alcohol-Caused Conditions	ICD-9 Codes	Fraction	Age Range
Alcoholic fatty liver	571.0	100	all
Acute alcoholic hepatitis	571.1	100	all
Alcoholic cirrhosis of liver	571.2	100	all
Alcoholic liver damage, unspecified	571.3	100	all
Fetal alcohol syndrome	760.71	100	all
Excessive blood level of alcohol	790.3	100	all
Toxic effects of ethyl alcohol	980.0	100	all
Alcohol-Related Conditions	**ICD-9 Code**	**Fraction**	**Age Range**
Respiratory tuberculosis	011–012	25	≥35
Malignant neoplasm of lip, oral cavity, and pharynx	140–149	50 men 40 women	≥35
Malignant neoplasm of esophagus	150	75	≥35
Malignant neoplasm of stomach	151	20	≥35
Diabetes mellitus	250	5	≥35
Essential hypertension	401	8	≥35
Cerebrovascular disease	430–438	7	≥35
Pneumonia and influenza	480–487	5	≥35
Diseases of esophagus, stomach, and duodenum	530–537 (excluding 535.3)	10	≥35
Chronic hepatitis	571.4	50	≥35
Cirrhosis of liver without mention of alcohol	571.5	50	≥35
Other chronic nonalcoholic liver damage	571.8	50	≥35
Unspecified chronic liver disease without mention of alcohol	571.9	50	≥35
Portal hypertension	572.3	50	≥35
Acute pancreatitis	577.0	42	≥35
Chronic pancreatitis	577.1	60	≥35
Alcohol-Related Injuries/Incidents	**ICD-9Codes**	**Fraction**	**Age Range**
Injuries and poisoning	800–968, 980–995 (excluding 965.0, 967, 968.0, and 980.0)	10	≥15

* No fraction was available for tuberculosis. A fraction of 50 was applied to the number of tuberculosis hospitalizations.

In order to more accurately reflect the rate of hospitalizations attributable to alcohol or drugs, fractions were applied to each DRG in developing the alcohol- and drug-related hospital discharge indicators. The fractions were obtained from the STNAP Core Protocol and can be found in Table A.4. Defined as hospital discharges involving diagnoses related to alcohol and drug abuse per 100,000 population, rates were calculated by dividing the total weighted number of alcohol-related discharges and the total weighted number of drug-related discharges by the total population, multiplied by 100,000.

A.7 Ohio Department of Development

Data on migration, unemployment, and single parent families were abstracted from the Ohio County Profiles by the Office of Strategic Research at http://www.odod.state.oh.us/osr/profiles. Additionally, homeless data were obtained from the Office of Housing and Community Partnerships. A limitation to the homeless data is that not all homeless shelter report, and those that are "supposed" to report may not.

Migration. Defined as the number of residents who moved in/out of the county as a percentage of the total population, in- and out-migration rates were calculated for 1993 to 1997 by dividing the total number of persons who moved in/out of the county divided by the total population, multiplied by 100.

Unemployment. Defined as the percent of the labor force not employed, the percent of adults who were unemployed for 1995 to 1999 was calculated by dividing the total number of people in the labor force who were not employed by the total number of people in the labor force.

Single parent families. The percentage of households headed by a single parent is defined as families with a single head of household (male or female) with no spouse present and children aged 17 years and younger, as a percentage of all families with children aged 17 and younger. The percent of single-parent households was calculated by summing female- and male-headed households with children aged 17 and younger and dividing by the total number of families with children aged 17 and younger, multiplied by 100, using 1990 data.

Homeless. The percent of persons who are homeless is defined as the average number of homeless persons in state-supported shelters on a given night per year as a percentage of the total population. The percent of persons who are homeless was calculated using data from 1995 to 1999.

A.8 Ohio Secretary of State

After each statewide election, the Secretary of State, Division of Elections, sends a form to the registrars of voters in each town in Ohio who maintain voter registration lists for their towns. Using their own records, the clerks fill out the form, noting how many people are registered to vote in that specific town. All towns respond to this questionnaire. Once the forms are returned to the Division of Elections, the information is entered into the elections database.

Voter registration data were obtained for 1995 to 2000 for general (odd years) and primary (even years) elections. The percentage of adults registered to vote was calculated by dividing the number of registered voters by the total population aged 18 and older, multiplied by 100.

A.9 Ohio Department of Job and Family Services

The number of persons filing unemployment claims and the average number of adults and children receiving Temporary Aid to Needy Families (TANF) was provided by the Office of Research, Assessment, and Accountability, Bureau of Labor Market Information. Both of these data were obtained for 1995 to 1999. Defined as the unduplicated number of persons filing for unemployment benefits per 1,000 population, unemployment claims rates were calculated by dividing the total number of persons filing unemployment claims by the total population aged 18 and older, multiplied by 1,000. The percentage of the population receiving TANF was calculated by dividing the number of TANF cases by the total population, multiplied by 100.

A.10 Ohio Department of Commerce

Alcohol Sales: The Liquor Control Board (LCB) receives daily sales totals from all premises selling alcohol. The LCB receives sales data electronically from each licensed location. The data for this study represent the actual gallons of spirits sold in each county, but they do not equal the State's annual sales report, which includes store pilferage and damage.

The data for this study represent the number of gallons of liquor and mixed beverages sold from 1995 to 1999. Defined as the total sales of liquor and mixed beverages per person, the rate per person was calculated by dividing the number of gallons sold by the total population.

Retail Liquor Outlets: Licenses and permits to sell liquor are determined at the municipality level. Towns and municipalities vote on whether or not malt, vinous, or spirituous liquors are permitted to be sold within the town or municipality. The LCB, through the Department of Liquor Control (DLC), approves permits by verifying information such as

company status, compliance with regulations about citizenship, attendance at seminars, payment of fees, and so on. As the LCB issues and revokes permits, its database is updated.

Defined as the number of retail liquor licenses currently on record per capita, data were available for 1995 to 1999. The rate per capita was determined by dividing the total number of active liquor licenses (liquor outlets) by the total population.

A.11 Ohio Department of Human Services

Social Services staff in each of the district offices enters data on all child abuse and neglect investigations conducted. Data include child and family demographics as well as details or allegations, substantiations, and actions taken. This information is one part of a comprehensive client-tracking system and is replicated by a statewide database. Depending on need, tabulations can be family-, child-, or incident-based. Reports investigated since 1983 are included in this system.

Defined as the unduplicated number of children reported for maltreatment to the Child Protection Services System per 1,000 children, child abuse and neglect report data were available for 1995 to 1999. The rate was calculated by dividing the total number of substantiated child abuse and neglect reports by the total population aged 17 and under, multiplied by 1,000.

A.12 Ohio Division of Alcohol and Drug Abuse

Distance to the nearest highway is defined as the mileage from the largest municipality in the county to the nearest interstate highway exchange. The largest municipality was determined using the Ohio Department of Development Website. The mileage from the largest municipality in the county to the nearest interstate highway exchange was determined using a map at Expedia.com.