MAGIC MASSACHUSETTS GAMBLING IMPACT COHORT STUDY

UNIVERSITY OF MASSACHUSETTS SCHOOL OF PUBLIC HEALTH AND HEALTH SCIENCES

ANALYSIS OF MAGIC WAVE 2: INCIDENCE AND TRANSITIONS

Abstract

In 2015, the first adult longitudinal cohort study of gambling and problem gambling was launched in Massachusetts. This report presents results from the first wave of the study with a focus on the establishment of the cohort and on the incidence of new cases of problem gambling since 2013/2014.

Rachel A. Volberg
Robert J. Williams
Edward J. Stanek III
Martha Zorn
Alissa Mazar

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Authorship

Rachel A. Volberg, Research Associate Professor, University of Massachusetts Amherst School of Public Health and Health Sciences, is the study Principal Investigator and responsible for overall leadership of the project as well as oversight of the cohort study design, implementation, and analysis. Dr. Volberg is the lead author of the current report.

Robert J. Williams, Professor, University of Lethbridge, Faculty of Health Sciences, is Co-Principal Investigator on the project and provided oversight of the study design, implementation, and analysis. Dr. Williams is a co-author of the current report.

Edward J. Stanek, Professor Emeritus, University of Massachusetts Amherst School of Public Health and Health Sciences, provided technical oversight and review of the study design and analysis. Dr. Stanek contributed sections of the report related to weighting and imputation.

Martha Zorn, Data Manager, University of Massachusetts Amherst School of Public Health and Health Sciences, was responsible for data management, data cleaning, and data analysis and contributed to all sections of the report.

Alissa Mazar, Project Manager, University of Massachusetts Amherst School of Public Health and Health Sciences, contributed to revisions of the report and sections related to key findings, weighting, and limitations of this report.

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Abbreviations/Glossary

AAPOR – American Association of Public Opinion Research
ABS – Address Based Sampling
BGPS – Baseline General Population Survey
CASRO – Council of American Survey Research Organizations
CATI – Computer Assisted Telephone Interview
CAWI – Computer Assisted Web Interview
CI – Confidence Interval
CPGI – Canadian Problem Gambling Index
DSM – Diagnostic and Statistical Manual of Mental Disorders
EGM – Electronic Gaming Machines
Etiology – the cause or causes of a disease or condition
Incidence – proportion of a population that newly develops a condition over a specified period of time
IRB – Institutional Review Board
LLLP – Leisure, Lifestyle, Lifecycle Project
MAGIC – Massachusetts Gambling Impact Cohort Study
MGC – Massachusetts Gaming Commission
NORC – National Opinion Research Center at the University of Chicago
NZ NGS – New Zealand National Gambling Study
PG – Problem Gambling
PPGM – Problem and Pathological Gambling Measure
Prevalence – proportion of a population that has a condition at a given point in time
PUMS – Public Use Microdata Sample
QLS – Quintile Longitudinal Study
SAQ – Self Administered Questionnaire
SEIGMA – Social and Economic Impacts of Gambling in Massachusetts
SFTP - Secure File Transfer Protocol
Swelogs - Swedish Longitudinal Gambling Study
UMass – University of Massachusetts
VGS – Victorian Gambling Study

Executive Summary

This report presents results from a new cohort study of gambling and problem gambling underway in Massachusetts. While recent large-scale cohort studies have been carried out in Australia, Canada, New Zealand, and Sweden, there have been no major adult cohort studies of gambling in the United States. This report focuses on (1) establishment of the Massachusetts cohort, (2) changes in gambling participation within the cohort between 2013/2014 and 2015, (3) the "natural" incidence of problem gambling in Massachusetts (i.e., prior to the availability of casino gambling), and (4) transitions within the cohort between Wave 1 and Wave 2 of the study.

The cohort was established from a stratified sample of 3,139 respondents who completed the SEIGMA Baseline General Population Survey (BGPS), an address-based multi-mode probability sample survey conducted between September 2013 and May 2014 with adult (18+) Massachusetts residents. The main purpose of the stratified sample was to ensure that the cohort included the largest possible number of individuals who might be expected to change their gambling status over the course of the study, including Problem Gamblers, At-Risk Gamblers, and individuals who gambled regularly or spent substantial amounts on gambling. Wave 2 was conducted from March 2015 – September 2015 (an average of 16.5 months after Wave 1).

Changes in Gambling Participation

Changes in gambling participation within the cohort were examined by comparing the self-reported past-year behaviors of the members of the cohort at Wave 1 and Wave 2. Within the cohort, there was a statistically significant increase in overall gambling participation as well as in participation in casino gambling and horse race betting. There was also a statistically significant increase within the cohort in the average number of gambling formats engaged in over the previous 12 months. However, in all cases, the magnitude of the increase was quite small (2.0% – 3.2%).

Incidence of Problem Gambling

The "natural" problem gambling incidence rate within the cohort from 2013/2014 to 2015 in Massachusetts (prior to the opening of any casinos) was 2.4% (95% CI [1.5%, 3.7%]). This estimate is based on new problem gamblers in the past 12 months in the cohort who were not problem gamblers in the BGPS, weighted to the Massachusetts population. Calculating incidence via a longitudinal cohort study has limitations. For instance, despite the research team's efforts to account for biases influencing the estimates between Wave 1 and 2, there may still be unknown factors affecting the rates. The incidence rate in Massachusetts is high relative to other jurisdictions where longitudinal cohort studies have obtained rates ranging from 0.12% to 1.4%. However, it is important to recognize that these other jurisdictions have different gambling landscapes, most of the studies in these jurisdictions utilized different measures of problem gambling to establish incidence, and the inter-assessment interval in MAGIC (16.5 months) is longer than the intervals in most of these other studies (with 12 months being typical).

If the unanticipated high incidence is accurate, the basis for this is somewhat unclear given that there was no significant change in the actual availability of legal gambling opportunities in Massachusetts during this time period. In addition to possible unaccounted biasing factors related to respondents, possible factors that may be related to high incidence include: high public awareness of casino gambling in the wake of publicity about developments in the Commonwealth and nearby states; political advertising associated with a ballot initiative to repeal casinos in Massachusetts; heavy advertising by casinos in Connecticut and Rhode Island seeking to maintain their competitive advantage; and

concurrent advertising and news stories surrounding daily fantasy sports (DFS) as these games became widely available in 2015 and 2016.

Transitions, Stability, and Change

Another goal of the present analysis was to determine the rate of transitions, or the degree of stability and change among the members of the cohort between Wave 1 and Wave 2. This analysis found that Recreational Gamblers had the most stable pattern of gambling behavior with 80.3% being Recreational Gamblers in both waves. Non-Gamblers were the next most stable group, with 64.4% being Non-Gamblers in both waves, but with a sizeable portion transitioning into Recreational Gambling in Wave 2. Only 49.4% of individuals who were Problem or Pathological Gamblers in Wave 1 were in this same category in Wave 2, with a sizeable portion transitioning into At-Risk Gambling and Recreational Gambling. Finally, At-Risk Gamblers were the most unstable, with only 37.5% being in the same category in both waves. Most of these individuals transitioned to Recreational Gambling, but a significant minority transitioned to become Problem or Pathological Gamblers. In general, these results are very similar to findings in cohort studies from other jurisdictions.

Limitations

There are several factors that deserve attention when interpreting results from the MAGIC cohort study. One important limitation concerns whether all sampling biases have been accounted for. The response rate to the BGPS/Wave 1 was 36.6% and the response rate to Wave 2 was 65.1%. This produces a cumulative response rate of 23.3%, which provides ample opportunity for differential rates of response for subgroups of the population. Various adjustments and weighting partially accounted for some differential response rates within the cohort, but the methods by necessity were limited to a few factors and available information. Other factors could be related to response rates and affect estimates and interpretation. In particular, the first wave of the study (BGPS/Wave 1) was introduced as a survey of "health and recreation" in an effort to prevent participation bias related to respondents' attitudes toward gambling. In Wave 2, however, respondents were aware that the survey was predominantly about gambling, which may have influenced their decision to stay in the cohort or drop out.

There are several other limitations of all cohort studies. For one, repeated surveying is known to have some influence on self-report of behavior (e.g., social desirability to convey "improvement"), as well as perhaps some influence on actual behavior (i.e., intensive scrutiny of one's behavior may serve as a sort of intervention). For another, observed changes over time are sensitive to the reliability of the measurement instruments. For less reliable measures, repeated assessments typically lead to regression to the mean, resulting in some artefactual accentuation of transitions from more to less severe states.

Implications and Future Directions

Results from the Massachusetts cohort study suggest that the incidence of problem gambling may be relatively high, despite the fact that casinos are not yet operating in the Commonwealth. If true, it would indicate that additional prevention and treatment resources for the state are required. The results also suggest that remission from problem gambling is quite high. If true, then additional treatment resources may be especially beneficial in accelerating such transitions.

The first priority going forward is triangulating the present results with other data sources to either confirm or disconfirm the high incidence found in the present study. More specifically, we intend to examine whether there was a significant change in (a) the prevalence of problem gambling in the Baseline Targeted Population Survey in the Plainville region in 2014 compared to the Follow-Up Targeted Population Survey in 2017; (b) the prevalence rate of problem gambling in the Springfield

region subsample of the Baseline General Population Survey in 2013/2014 compared to the Baseline Targeted Population Survey in the Springfield region in 2015; (c) the incidence of problem gambling in Wave 3 of MAGIC in 2016 relative to Wave 2 in 2015; and (d) any secondary data sources pertaining to problem gambling rates over this time period (i.e., Department of Public Health admissions data, Massachusetts Council on Compulsive Gambling helpline calls, Gamblers Anonymous chapters).

Future analyses will focus on predictors of problem gambling onset and whether there are gender differences in these predictors as well as predictors of problem gambling remission and the extent to which accessing treatment is one of these factors.

Introduction

The MGC Research Agenda

In November, 2011, an Act Establishing Expanded Gaming in the Commonwealth was passed by the Legislature and signed by Governor Deval Patrick (Chapter 194 of the Acts of 2011). This legislation permits casinos and slot parlors to be introduced in Massachusetts under the regulatory auspices of the Massachusetts Gaming Commission (MGC). Three casino licenses are available, with one allocated for the Greater Boston area, one for Western Massachusetts, and one for Southeastern Massachusetts. A single license for a slot parlor is also available, with no geographic restriction as to its location.

Section 71 of the Expanded Gaming Act requires the MGC to establish "an annual research agenda" and identifies three essential elements of this research agenda:

- Understanding the social and economic effects of expanded gambling
- Implementing a baseline study of problem gambling and the existing prevention and treatment programs that address its harmful consequences
- Obtaining scientific information relative to the neuroscience, psychology, sociology, epidemiology, and etiology of gambling

In March 2013, the MGC selected a research team based at the University of Massachusetts Amherst School of Public Health and Health Sciences to carry out the first two elements of this research agenda through the Social and Economic Impacts of Gambling in Massachusetts (SEIGMA) project. While robust in many regards, the SEIGMA methodology provides population-based "snap shots" of the dynamic process of behavior change during a time of gaming expansion. The cross-sectional design of the SEIGMA project is in contrast to a longitudinal cohort design that follows a group of people with a shared experience (exposure to expanded gaming) at intervals over time. A cohort study can provide etiological information about how gambling and problem gambling develops, progresses, and remits over time. The information collected through a cohort study has significant value as it can highlight risk and protective factors important in developing effective prevention, intervention, treatment, and recovery support services.

In October of 2013, the MGC, with the unanimous support of the Gaming Policy Advisory Committee, recommended to the Legislature that a longitudinal cohort study be added to the MGC Research Agenda. In November of 2013, the MGC issued a Request for Proposals to conduct a multi-year cohort study to provide insight into the causes of problem gambling and variables influencing changes in gambling status. In April of 2014, the MGC selected the same University of Massachusetts Amherst School of Public Health and Health Sciences research team to conduct the cohort study. Due to uncertainties associated with possible repeal of the Expanded Gaming Act, the MGC directed that the study not begin until after the results of the referendum had been determined in November of 2014. The Massachusetts Gambling Impact Cohort (MAGIC) study was launched in December of 2014.

Cohort Studies of Gambling and Problem Gambling

Several small-scale cohort studies of gambling and problem gambling exist (for reviews see el-Guebaly et al., 2008; Slutske, 2007; Williams et al., 2015). While all of these studies provide useful information, they all have one or more of the following limitations:

- A very circumscribed demographic (e.g., youth, elderly, casino employees)
- A very small sample size and/or a very small number of people who became problem gamblers during the course of the study
- A very short time span and/or a small number of assessment periods
- A study of either gambling or problem gambling, but not both
- A short questionnaire that examined only a small subset of variables potentially involved in the etiology of problem gambling
- Poor retention rates with differentially higher attrition for certain demographic groups (e.g., males, younger people) and people who are heavy gamblers and/or problem gamblers

The limitations of these smaller studies led to the launch of five more recent large-scale longitudinal cohort studies of gambling and problem gambling in four different countries:

The Leisure, Lifestyle, Lifecycle Project (LLLP) was funded by the Alberta Gambling Research Institute (el-Guebaly et al., 2015; el-Guebaly et al., 2008). A total of 1,808 Albertans were recruited in 2006, with representative sampling from the major regions of Alberta, Canada. Five age cohorts were established at baseline (13-15; 18-20; 23-25; 43-45; 63-65) with equal numbers in each group. A subset of 524 individuals were from a "high risk" sample of individuals presumed to be at elevated risk for developing gambling problems because of their greater expenditure and frequency of gambling (screened to be in the 70th percentile for either expenditure or frequency). All participants received a comprehensive 2-to-3 hour assessment of all variables of etiological relevance to gambling and problem gambling. LLLP had a 19-to-21 month interval between the start of each assessment period, and an 8-to-9 month period of time in which people could complete their assessment ("assessment window"). The final assessment period ended in 2011. A total of 1,030 adults completed the fourth assessment, for an overall retention rate of 76.1% and a total of 313 adolescents completed the fourth assessment, for a retention rate of 71.8% (combined retention rate of 75.1%).

The Quinte Longitudinal Study (QLS) was funded by the Ontario Problem Gambling Research Centre (Williams et al., 2015). A total of 4,123 Ontario adults aged 17-90 were recruited in 2006 from the Quinte region in Ontario, Canada. A subset of 1,216 individuals constituted a "high risk" sample of individuals at elevated risk for developing gambling problems by virtue of their greater expenditure on gambling; playing either slot machines or betting on horse racing in the past year; or an intention to gamble at a new slots-at-racetrack facility. All participants received a comprehensive 1-to-2 hour assessment of all variables of etiological relevance to gambling and problem gambling. The QLS had 5 assessment periods, with a 12-month interval between the start of each period, and a 5-month assessment window. The final assessment period ended in 2011. An exceptionally high retention rate of 93.9% was attained in the QLS.

The Swedish Longitudinal Gambling Study (Swelogs) was funded by the Public Health Agency of Sweden. The study began in 2008/2009 with a brief 15-minute telephone prevalence survey[1] of gambling and problem gambling in a random sample of 8,165 Swedes aged 16-84 stratified by gender, age, and risk for problem gambling. A total of 6,021 of these individuals were reassessed in 2009/10 and 4,188 were assessed again in 2012 (retention rate of 51.3%). The final epidemiological assessment occurred in 2014. In addition, a more comprehensive 60-minute telephone interview was completed with 2,400 of these

[1] The telephone survey data was supplemented with information taken from the Swedish population registers which contain extensive information on income, taxes, education, occupation, immigration, etc.

individuals in 2011, with another wave of in-depth interviews completed in 2013, and a third qualitative wave implemented in 2015. A case control design was used in this In-Depth track of the Swelogs, whereby all moderate risk and problem gamblers[2] were selected for interviews, as was a sample of low risk and non-problem gamblers. Each moderate risk and problem gambler was matched on basic demographics with three controls selected from the general population sample. A final feature of the study is the follow up of 578 individuals from the 1997/1998 Swedish gambling prevalence study (289 problem gamblers and a matched set of controls). The Swelogs research team has published several reports in Swedish and three peer-reviewed articles in English, detailing the study methodology (Romild, Volberg, & Abbott, 2014), comparing the results of the 1997/1998 prevalence survey in Sweden with the Swelogs baseline epidemiological survey in 2009 (Abbott, Romild, & Volberg, 2014), and examining problem gambling prevalence and incidence in Sweden (Abbott, Romild, & Volberg, 2017).

The Victorian Gambling Study (VGS) was funded by the Victoria Department of Justice in Australia. The study began in 2008 with a telephone prevalence survey of gambling behavior in 15,000 adults in the state of Victoria, with oversampling of local government areas having higher electronic gaming machine (EGM) expenditure. There were three subsequent waves roughly 12 months apart in 2009/2010, 2010/2011, and 2011/2012. A 5-month assessment window was used. A total of 5,003 people took part in Wave 2, 5,618 in Wave 3, and 3,700 in Wave 4 (24.7% retention). The assessment itself consisted of a 15–25 minute telephone interview focusing on gambling practices, health and well-being, important life events in the past 12 months, and demographic information. A small group of 44 people identified as problem gamblers in at least one wave participated in in-depth face-to-face interviews to collect qualitative information. Reports on the first three waves of the study as well as the qualitative component have been published (Victoria Department of Justice, 2009, 2011; Victorian Responsible Gambling Foundation, 2012a, 2012b). The final results of this study are contained in a report from the Victorian Responsible Gambling Foundation (2014). A series of four technical reports published in 2016 examine social determinants and comorbidities of gambling and problem gambling using multivariate approaches. Since the questionnaire used in the VGS is very similar to that employed in the Swelogs epidemiological track, future cross-cultural analyses are planned. This is facilitated by the overlap in international advisors to the two studies (Volberg, the primary author of the current report, serves as an advisor to both studies along with Abbott, who is currently leading a cohort study in New Zealand).

The New Zealand National Gambling Study (NZ NGS) is funded by the New Zealand Ministry of Health. The study began in 2012 with a face-to-face prevalence survey of gambling and problem gambling among 6,251 people aged 18 years and older living in private households. This survey oversamples important ethnic groups in the country, including Maori, Pacific Island, and Asian. An 8-month assessment window was used. The response rate for Wave 1 was 64%. A second wave of the NZ NGS took place in 2013 in which 3,745 people took part. Due to budgetary constraints, the researchers only attempted to re-contact 5,266 (84%) of the original participants. The researchers note that the 71% response rate achieved in 2013 represents a retention rate of 60% of the original sample interviewed in Wave 1. The assessment consisted of a 45-minute interview focusing on gambling behavior, problem gambling, life events, mental health, alcohol and substance use and misuse, health conditions, social connectedness, level of deprivation, and demographics. Three reports on the first wave of the study, a fourth report on the second wave of the study, and a fifth report on the third wave of the study are available online (Abbott, Bellringer, Garrett, & Mundy-McPherson, 2014a, 2014b, 2015a, 2015b, 2016). Given the substantial overlap of the New Zealand questionnaire with those used in Sweden and Victoria as well as the overlap in investigators, cross-cultural analyses are planned.

[2] Problem gambling status in Swelogs is based on the Canadian Problem Gambling Index (Ferris & Wynne, 2001).

The following table summarizes key features of the five large cohort studies:

Table 1: Comparing Five Cohort Studies of Gambling and Problem Gambling (PG)

	Alberta, Canada LLLP	Ontario, Canada QLS	Sweden Swelogs	Australia VGS	New Zealand NGS
Data collection period	2006-2011	2006-2011	2008-2014	2008-2012	2012-2014
Recruited sample	1,808	4,123	8,165	15,000	6,251
Assessment length	2-3 hour	1-2 hour	15-25 min	15-25 min	45 min
Interval (months)	17-22[1]	12	12[2]	12	12
PG Measure	CPGI 5+	PPGM	CPGI 5+	CPGI 8+	CPGI 8+
Baseline PG prevalence	3.6%	3.1%	1.0%	2.6%	2.5%
Wave 2 PG prevalence	2.0%	2.9%	1.1%	1.5%	2.0%
Incidence (Wave 1 – Wave 2)	N/A	1.4%	0.8%	0.12%	0.28%
Proportion of Wave 2 PGs that are new cases	N/A	49.0%	73.5%	33.3%	51.6%

[1] This is the median elapsed time between waves for all respondents.
[2] Between Wave 1 and Wave 2; the interval between subsequent waves was 24 months.

The Massachusetts Gambling Impact Cohort Study

The design of the Massachusetts longitudinal cohort study of gambling and problem gambling builds on existing longitudinal problem gambling research. As the prior discussion illustrates, significant progress has been made in understanding the incidence and etiology of problem gambling in other countries. However, further work is needed and there are several reasons why a Massachusetts longitudinal cohort study of gambling and problem gambling is warranted:

- First, there have been no longitudinal research studies of gambling and problem gambling in Massachusetts (and no major cohort studies of gambling in the United States). There are important differences between Massachusetts and other jurisdictions where longitudinal cohort studies have been conducted. These differences include demographic composition, the availability of casino gambling, the extent of efforts to prevent problem gambling, and the time period in which incidence within the cohort will be examined. It is possible that the nature, incidence, and etiology of problem gambling may be somewhat different in Massachusetts compared with other jurisdictions where similar studies have been carried out.
- Second, the change in gambling availability in Massachusetts during the course of this study (due to the introduction of at least three and possibly four major new gambling venues) will be much more substantive than the fairly stable availability of gambling that occurred in the Alberta, New Zealand, Ontario, Sweden, and Victorian studies. Thus, Massachusetts presents a much better opportunity to understand the role of increased gambling availability, and casino gambling specifically, in the development of problem gambling.
- Third, this research addresses two important limitations of previous research: (a) a low number of problem gamblers, limiting the robustness of the findings; and (b) a limited and circumscribed time frame (2 years to 6 years), which precludes a fuller understanding of transitions in and out of

problem gambling. MAGIC endeavors to rectify these shortcomings with a much greater oversampling of high risk groups and a much longer time frame.

- Finally, the findings from the MAGIC study will be synergistic with those of the Social and Economic Impacts of Gambling in Massachusetts (SEIGMA) study, producing results much richer than either study on its own. While the emphasis in the MAGIC study is on incidence and etiology of problem gambling, and the emphasis in the SEIGMA study is on the prevalence of problem gambling, and on social and economic impacts, both studies will produce considerable evidence pertaining to the other study's focus. The impacts identified in SEIGMA can be explored in greater depth in MAGIC and the factors contributing to incidence and relapse can be explored in greater depth in SEIGMA.

Principal Study Questions

The three primary research goals of the MAGIC study are to determine the **incidence** of problem gambling, understand the **stability and transitions** associated with problem gambling, and to develop an **etiological model** of problem gambling. We discuss each of these goals in detail below.

Determine the Incidence of Problem Gambling

Incidence studies in the context of a longitudinal cohort can provide a full picture of the nature of the disorder. For example, a stable prevalence rate over time can be the result of either (a) ongoing unremitting problem gambling in the same group of individuals, or it could be that (b) the rate of new cases is roughly equivalent to the rate of remission among existing problem gamblers. In the context of a longitudinal cohort, we want to understand which of these two different scenarios is occurring, as they have different implications for prevention and treatment. A cohort study is best suited to examining these issues and best suited to establishing incidence.

The specific research questions to be addressed in relation to incidence are as follows:

1. What is the incidence of problem gambling prior to the introduction of new gambling venues?
2. What is the incidence of problem gambling immediately after the introduction of new gambling venues?
3. Does the incidence of problem gambling decrease after several years of new gambling venues being open?

Determine the Stability and Transitions Associated with Problem Gambling

Previous research has found the duration of Problem Gambling to be relatively short, with one year being the modal duration. In contrast, persons classified as Recreational Gamblers and Non-Gamblers have been found to be much more stable gambling classifications over time. This same research has also found high rates of problem gambling relapse following recovery. The present research will re-examine these same issues. An important advantage of the present research is potentially having a greater number of problem gamblers as well as a longer timeframe to examine these transitions.

The specific research questions associated with this issue are as follows:

1. What are the specific patterns of continuity and discontinuity in gambling and problem gambling over time?
2. Are these patterns stable or unstable over time?

Develop an Etiological Model of Problem Gambling

Internationally, considerable effort is currently going into the development of strategies to prevent problem gambling. Unfortunately, the majority of these initiatives appear to be fairly ineffectual (Williams, West, & Simpson, 2012). This is partly due to the fact that most of these educational and policy initiatives have been put in place because they "seemed like good ideas" and/or were being used in other jurisdictions, rather than having demonstrated scientific efficacy or being derived from a clear understanding of effective prevention practices. However, it is also due to the fact that there is no comprehensive and well established etiological model of disordered gambling to guide these efforts.

While there are many well established correlates of problem gambling (e.g., gambling fallacies, mental health problems, etc.), their association with problem gambling may occur either because they *caused* problem gambling, developed *concurrently* with problem gambling, or developed as a *consequence* of problem gambling. From a prevention standpoint, knowing how and where to effectively intervene hinges on having research that clearly identifies the variables that are etiologically involved in problem gambling, their temporal sequence, and their causal connections. Similarly, knowing the factors implicated in sustained recovery from problem gambling is very important for the purposes of treatment. Longitudinal research is the best way of disentangling these complex relationships and understanding the chronology and causal directions, potentially allowing for the creation of a detailed etiological model of how gambling and problem gambling develops, continues, and remits. Longitudinal research has been applied successfully many times in the fields of health, mental health, and addiction to elucidate these connections. To date, however, comprehensive longitudinal studies are relatively uncommon in the area of gambling and problem gambling.

The specific research questions to be addressed in creating an etiological model of problem gambling are as follows:

1. What individual, social, and environmental variables (e.g., casino proximity, public attitudes, gambling advertising, media coverage) are most predictive of, and most influence the development of, future gambling and problem gambling?
2. What variables are most predictive of recovery from problem gambling?
3. What is the best way of translating the findings from #1 and #2 so as to optimize prevention and treatment services in Massachusetts?

There are two other research questions indirectly related to the question of etiology:

4. Are there "safe levels" of gambling involvement that usually do not lead to problem gambling, that could be used in an analogous way to the guidelines that have been developed for "safe levels" of alcohol consumption? (see Currie et al., 2006; Currie et al., 2008 for discussion of this issue)
5. What characteristics differentiate problem gamblers who seek treatment from those who do not?

Organization of Report

This report describes how respondents from the SEIGMA Baseline General Population Survey (BGPS) were selected for the MAGIC study and presents results from the first two waves of the study. Information about MAGIC cohort members from the BGPS is referred to as Wave 1 of the MAGIC study. The MAGIC cohort was selected and interviewed on average 16.5 months after the BGPS, with the results of the second survey constituting Wave 2 of the cohort study.

This report is organized into several sections for clarity of presentation. Following this *Introduction*, an *Overview of Methods* details how the study sample was selected and recruited for the study. The next sections present findings in the following areas:

- Changes in gambling participation
- Changes in problem gambling status
- Incidence of problem gambling
- Transitions, stability, and change

The report concludes with a summary of the results and a discussion of the implications of these findings for problem gambling prevention and treatment. Appendices to the report include a detailed explanation of the study methodology and a copy of the questionnaire.

Overview of Methods

This section presents an overview of the methods used in selecting and recruiting the sample for the study. Additional information on the study methodology, intended for technical readers, is provided in Appendices A1 through A4. A copy of the questionnaire is provided in Appendix B.

Sampling Strategy

Baseline General Population Survey (BGPS)

As noted above, responses to the SEIGMA Baseline General Population Survey (BGPS) constituted Wave 1 of the MAGIC study. The BGPS was completed in several stages. In the first stage of the survey, the SEIGMA research team and staff from the National Opinion Research Center at the University of Chicago (NORC) worked together to finalize the questionnaire and sampling frame. NORC programmed the questionnaire for computer-assisted web interviewing (CAWI) and computer-assisted telephone interviewing (CATI) administration, as well as creating a self-administered paper-and-pencil questionnaire (SAQ) and advance materials such as letters, postcards and brochures. All materials were translated into Spanish and back-translated to verify consistency.

In the second stage, the survey was completed by 9,578 Massachusetts adults (aged 18+) between September 2013 and May 2014. Participants were selected by means of address-based sampling (ABS), a method that ensured that each Massachusetts household had a known probability of selection into the sample, independent of their telephone status (i.e., landline, cell, or no telephone) (Iannacchione, 2011; Link, 2008). To achieve a random sample, the study targeted the adult in the household who had the most recent birthday.

The third stage of the survey involved data cleaning and data weighting to increase confidence in generalizing results to the adult population of Massachusetts and preparation of a comprehensive report. Descriptive results from the BGPS were originally published in June 2015 with an updated report published in September 2017 (Volberg et al., 2017). A report on deeper, multivariate analyses of the BGPS results was published in March 2017 (Williams et al., 2017).

Establishing the Cohort

A cohort study follows a group of people with a shared experience (exposure to expanded gambling) at intervals over time. The MAGIC cohort is a subset of participants from the BGPS.

To establish the cohort, a stratified sample of 4,860 adult residents of Massachusetts aged 18 and older was selected from the 9,578 respondents in the BGPS. The sample was drawn to ensure that a cohort of at least 2,600 would be achieved (assuming a 55% participation rate among selected BGPS respondents[3]). The sample was selected from five high-risk strata, including respondents to the baseline survey who were (a) Problem Gamblers, (b) At-Risk Gamblers, (c) gamblers who spent $1200 or more annually on gambling, (d) those who gambled weekly, and (e) those who had served in the military since September 2001. The remaining BGPS respondents constituted a single low-risk stratum. All of the respondents in the high-risk strata were selected for the MAGIC study along with a randomly selected third of respondents from the low-risk stratum.

[3] The assumption of a 55% participation rate among selected BGPS respondents was based on experience at NORC with other longitudinal cohort studies.

Table 2 illustrates the sampling strategy for the MAGIC study. The first column lists the strata, while the second column lists the number of respondents from the BGPS in each stratum. In the third column, under the heading *Sampling Framework*, we show the *Sampling Proportion* for each stratum. The next column presents the number of respondents sampled for the MAGIC cohort in each stratum. For example, 450 respondents in the BGPS were classified as *At-Risk Gamblers* and the sampling proportion is 1 (100%), so 450 *At-Risk Gamblers* were included in the sample drawn for MAGIC.

Table 2: Sampling Strategy for Cohort Study

	BGPS	Sampling Framework	
Strata	**N**	**Sampling Proportion**	**# in Sample**
Problem Gambler	133	1	133
At-Risk Gambler	450	1	450
Spends $1200+ annually	1088	1	1088
Gambles weekly	792	1	792
Military service Sept 2001 or later	49	1	49
All other BGPS participants	7066	0.33	2348
Totals	9578		4860

Wave 2 of MAGIC started with a sample of 4,860 participants who previously participated in BGPS. Those who completed the second wave of data collection define the MAGIC cohort for future rounds of data collection. Based on an anticipated response rate of 55%, we expected that the MAGIC cohort would consist of 2,673 participants.

Questionnaire

With the exception of five new questions, the Wave 2 survey instrument was the same as the Wave 1 questionnaire.[4] The questionnaire included sections on recreation, physical and mental health, alcohol and drug use, gambling attitudes, gambling behavior, gambling motivations, importance of gambling as a recreational activity, awareness of problem gambling services, gambling-related problems, and demographics. The sections of the questionnaire are described in more detail in Appendix A1 and a copy of the questionnaire is included in Appendix B. As with the Wave 1 questionnaire, if respondents reported experiencing problems with certain issues while completing the Wave 2 questionnaire, contact information for treatment providers was provided. In contrast to Wave 1, all surveys were completed in English in Wave 2, regardless of interview mode.[5]

Two instruments were used to assess problem gambling in the MAGIC survey: the Canadian Problem Gambling Index (CPGI) (Ferris & Wynne, 2001) and the Problem and Pathological Gambling Measure (PPGM) (Williams & Volberg, 2010, 2014). Worldwide, the CPGI is presently the most common instrument for the assessment of problem gambling (surpassing both the South Oaks Gambling Screen

[4] The BGPS/Wave 1 questionnaire is available as Appendix B of the SEIGMA Baseline General Population Survey report (https://www.umass.edu/seigma/sites/default/files/Updated%20BGPS%20Report_Final.pdf).

[5] A small number of the BGPS respondents drawn for the cohort (n=73, 1.5%) completed the BGPS in Spanish. Among these respondents, 39.7% (n=29) participated in Wave 2. While the decision to administer the MAGIC survey only in English was based on budget constraints, the overall impact on the results is likely small since these respondents represent less than 1% of the cohort.

[SOGS] and the DSM-IV criteria for pathological gambling) (Williams, Volberg, & Stevens, 2012). However, the PPGM has superior sensitivity, positive predictive power, diagnostic efficiency, and overall classification accuracy compared to the CPGI as well as other problem gambling instruments (Williams & Volberg, 2014).

Five questions were added to the Wave 2 instrument. These new questions related to the respondent's internet access, whether the respondent had gambled at an underground casino or slot parlor, and whether the respondent had gambled at the new Plainridge Park Casino, which opened in Plainville, Massachusetts in June 2015. The new questions are listed below (also see Appendix A1, which provides an overview of the questionnaire content and Appendix B, which provides a full copy of the questionnaire):

- Do you have an internet connection either at home or at work? (Yes/No)
- Overall, how often do you use the internet? (Daily, A few times a week, A few times a month, A few times a year, Not at all)
- Have you gambled at any "underground" casino or slot parlor in Massachusetts in the past 12 months? (Yes/No)
- The Plainridge Park Casino recently opened in Plainville, Massachusetts. Have you gambled at this new casino? If you visited the casino, but did not gamble, please select No. (Yes/No)
- How many times have you gambled at the Plainridge Park Casino?

Since the Wave 2 questionnaire used the Wave 1 questionnaire as a foundation, relatively little work was required to update the questionnaire prior to the start of data collection. NORC formatted the self-administered questionnaire (SAQ) to include the new internet-related questions. The two questions related to gambling at Plainridge Park Casino were added late in the field period to coincide with the opening of the new venue on June 24, 2015 and were available only in Web and CATI. Although changes to the questionnaire were minimal, NORC completed extensive testing to verify that the entire survey functioned as intended in both web and telephone modes. Testing included ensuring that question text, skip logic, case disposition assignment, and callback rules all functioned as expected.

Ethical Review

All data collection efforts were subject to approval by the Institutional Review Boards (IRBs) from both NORC and UMass Amherst. NORC received IRB approval on February 17, 2015; UMass Amherst received approval shortly thereafter on February 23, 2015. As part of the IRB submission, NORC requested that the IRB waive the requirement of obtaining informed consent documentation in exchange for including informed consent statements in each survey mode.

For web respondents, the informed consent statement was read as part of the screening process, with a hyperlink to the Federal Certificate of Confidentiality printed within the frequently asked questions (FAQs) document. If the respondent clicked 'Next' to move past the informed consent screen, he or she was presumed to be informed of his or her rights as a participant. For mail, the informed consent statement was printed on the inside cover of the hardcopy questionnaire with a printed link to the Federal Certificate of Confidentiality. Respondents returning a booklet with valid response data were considered to have provided consent. Finally, respondents completing by telephone were read the informed consent script. Interviewers captured consent by clicking "Continue" if the respondent did not voice any objections. Respondents were also notified that the calls would be recorded. If the respondent objected, the interviewer would select that the respondent refused to be recorded.

All materials provided to potential respondents (letters, postcards, brochure, and questionnaire) were submitted to the two IRBs for review. As data collection progressed, any materials requiring modification or new materials not included in the original submission were sent as an amendment to both IRBs for review.

Data Collection

The Wave 2 survey began in March 2015 and ended in September 2015.[6] A series of mailings were scheduled to encourage respondent participation, to inform households about the survey and how they were selected, and to provide contact information for NORC and UMass Amherst. Mailings were scheduled approximately two weeks apart to give respondents enough time to receive and complete the questionnaire, so that NORC could remove completed cases from follow-up mailings. Prior to each mailing, households that had already completed the survey were removed from the mailing list.

To enhance the overall response rate, the survey was offered in three modes – web, mail, and telephone. Participants were introduced to these modes sequentially. Figure 1 illustrates the multi-mode approach that was employed for reaching the sampled respondents.

Figure 1: Multi-Mode Data Collection Approach

Respondents were first invited to participate in the survey online.[7] If respondents did not complete the survey online, they were sent a hardcopy questionnaire with a postage-paid business reply envelope. Respondents who did not reply in the first two modes were contacted by telephone. Respondents could also call the study's toll-free line to complete the survey over the telephone at any time. All cases not reached via any of the three modes were sent to a "locating case management system," as described below.

Locating Procedures

The locating case management approach involved the following:

- Calling to determine the status of any existing telephone numbers for the respondent or any telephone numbers for contacts provided by the respondent during Wave 1
- Performing extensive internet searches for the person
- Conducting searches using a third party locating vendor (Accurint)

All locating activities were reviewed and approved by the NORC IRB and the UMass Amherst IRB.

In the first approach, locators dialed any telephone numbers associated with the case from Wave 1. Locators also followed up with the three contacts provided by respondents in Wave 1 to find alternate

[6] Although the MGC agreed to contract with UMass Amherst for the cohort study in April 2014, the start of the project was delayed until after the November 2014 election which included a ballot question regarding repeal of the Expanded Gaming Act.

[7] The web survey remained open throughout the data collection period.

telephone numbers for the respondent. When locators successfully identified a respondent, the case was opened in the telephone survey and the case was completed. In the second approach, after all alternate telephone numbers were exhausted, locators conducted internet searches for contact leads. Internet sites used during this approach included Google, White Pages, and LinkedIn. As leads were generated, locators followed steps to: confirm the respondent and complete the telephone survey; schedule an appointment to complete the telephone survey; probe for new address and telephone information if the respondent no longer lived in the household; and leave information about how to contact the project if an informant refused to provide new contact information. In the third approach, specially trained locators used Accurint to obtain new address and telephone information for respondents by matching a combination of respondent name, address, telephone number, gender, and age. If all protocols were followed and no further leads identified, indicating that the respondent could not be found, the case was finalized as not locatable.

Data Collection Procedures

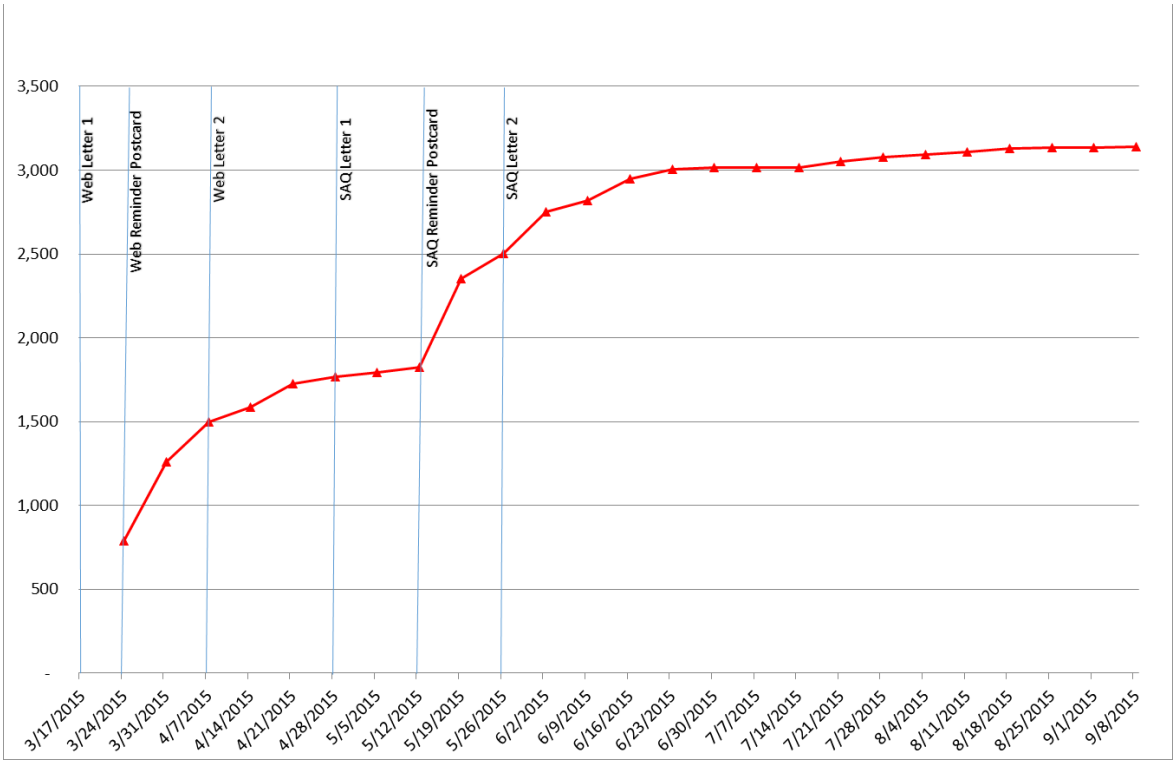
The first mailed letter outlined the purpose of the survey and requested that the individual who completed the BGPS questionnaire participate in Wave 2 of MAGIC. Potential respondents were provided with a $5 prepaid incentive and offered a $20 Amazon gift code if they completed the survey online within 14 days (the website where they could do this was identified in the letter). The first self-administered printed questionnaire (SAQ) was mailed approximately one month after the first "web packet" mailing. The letter asked respondents to complete the enclosed printed questionnaire and return it in the postage paid envelope. The letter also provided instructions for completing the questionnaire online if desired. A $5 prepaid incentive was included in the first SAQ packet. Dialing for the telephone component began July 15, 2015, approximately five months after the first web packet was mailed. Interviews were conducted using computer-assisted telephone interviewing (CATI), which minimized potential for interviewer errors by controlling progression through the questionnaire and preventing out-of-range responses.

Key to this study, and to the overall validity of the data collected, was ensuring that the respondent who completed the Wave 2 questionnaire was the same respondent from Wave 1. While respondent name, gender, and year of birth in Wave 1 were available in the majority of cases, one or more of these items were missing in some cases (n=208, or 4.3% of the drawn sample). Information about the month and year when respondents completed the Wave 1 questionnaire was available for all respondents. Screener questions were created to increase the likelihood that the same person completed both the Wave 1 and Wave 2 questionnaires.

To confirm that the individual who completed Wave 1 was screened into the Wave 2 survey, respondent demographic information (name, gender, and year of birth) collected during Wave 1 was preloaded into the main screener question for the Wave 2 web and telephone interviews. In cases where respondents from Wave 1 did not provide all of the demographic information, the screener question presented alternate text based on the information that was available.

Figure 2 presents the progress in recruiting respondents into the MAGIC study over the entire data collection period:

Figure 2: MAGIC Wave 2 Recruitment Progress



A total of 58% of the questionnaires completed by the cohort were self-administered online, 36% were completed using the self-administered paper-and-pencil format, and 5% were completed by telephone interview. In total, 95% of the cohort questionnaires were self-administered. It is also worth noting that 95% of the questionnaires (n=2,972) were completed or returned by June 24, 2015, which was when Plainridge Park Casino opened.

Data Processing

Before delivering the data to the UMass Amherst research team, NORC completed a series of data editing and cleaning procedures. Throughout data collection, SAS programs were run to identify any errors that occurred in the Web or CATI systems. This allowed NORC to reconcile inconsistencies in the data and fix system or questionnaire errors as they occurred, thus minimizing data cleaning required after data collection was complete.

Once data collection was complete, NORC reviewed verbatim responses for several questions that offered an "Other" response category. The verbatim responses were back-coded into existing response categories where appropriate. Both the original verbatim and the original response to the root question were maintained in the final dataset. NORC then combined the data from all data collection modes into a single analytic file which included a variable to indicate the mode of data collection used to complete each interview. NORC delivered the data to the UMass Amherst team via a secure file transfer protocol (SFTP).

The dataset delivered to the UMass Amherst research team contained 3,139 complete records. A case was considered complete when 7 or more of the GY questions (questions about gambling in the past 12 months) were answered. After the dataset was received, skip patterns and outliers were reviewed and a

cleaned dataset was created. Using the cleaned data, several additional composite variables were created and added to the final dataset. Finally, a variable was added to the dataset to link Wave 1 data with the Wave 2 respondents.

Matching Respondents Across Waves

Procedures used by NORC to screen respondents from the BGPS into the cohort study involved the use of programmed questions based on preloaded information (name, gender, year of birth, month and year of Wave 1 survey completion) in the Web and CATI modes. For most of the respondents (n=3,052, 97%), gender and year of birth exactly matched the respondent at Wave 1 and Wave 2. For these respondents, it seemed reasonable to assume the same person in the household responded to each wave.

There were discrepancies in gender and/or year of birth for a small number of respondents (n=87, 3%). Table 3 presents information about the different types of disagreement and number of respondents with each type of disagreement in the cohort. The largest group (n=64, 74%) included respondents whose gender matched but whose year of birth did not match. A smaller group (n=23, 26%) included respondents whose gender did not match or whose gender and year of birth did not match across the two waves.

Table 3: Respondents with Disagreement in Gender, Year of Birth, or Both

Gender	Year of Birth	Frequency	Wave 1 and Wave 2 Match
Match	**Mismatch** **1-2 years difference**	36	Yes
Match	**Mismatch** **3-5 years difference**	6	Yes
Match	**Mismatch** **>5 years difference** **2 digit year**	2	Yes
Match	**Mismatch** **>5 years difference**	20	No
Mismatch	**Match**	9	No
Mismatch	**Mismatch**	14	No
TOTAL		**87**	

Among the respondents with matching gender and mismatching year of birth, 42 respondents reported a mismatch in year of birth of five years or less. Review of these individuals' responses to other items in the Wave 1 and Wave 2 surveys led the research team to conclude that the same respondent completed both questionnaires. Another two respondents with matching gender but with year of birth mismatched by more than five years appeared to have indicated their age using a two-digit response rather than year of birth in Wave 1. Based on this assumption, these respondents' year of birth matched across the two waves and the research team concluded that the same respondent had completed both questionnaires.

Finally, there were 20 instances where respondents' gender matched across Wave 1 and Wave 2 but the difference in year of birth was greater than five years. There were also nine instances where respondents' year of birth matched across the two waves but gender did not and 14 instances where neither gender nor year of birth matched across the two waves. For these 43 individuals, we elected not to include Wave 1 data in the analytic file, since we considered the Wave 1 data to come from a

different respondent. As a consequence, the MAGIC cohort includes Wave 1 data on 3,096 respondents and Wave 2 data on 3,139 respondents. The 3,139 Wave 2 respondents define the MAGIC cohort.

Figure 3: Sample Size for Analytic Purposes

Missing Data

Missing data is anticipated in the MAGIC study due to incomplete responses to the questionnaire and, in the future, to sample attrition. A consequence of missing data is (a) reduction in power to address key hypotheses and (b) the potential for bias in reporting results and interpreting conclusions.

The issue of missing data due to attrition is not relevant to Wave 2 since this is the first full wave of the cohort study.[8] Item non-response was similar for each of the data collection modes. Respondents were allowed to refuse to answer any question or to give a "don't know" response. The percentage of complete responses was extremely high for nearly all of the items. The non-response rate was greater than 10% for only one question in both waves: household income. For interested readers, the response rate for individual questions by data collection mode for each wave is shown in Appendix A4.

Weighting and Comparability Across Two Waves

MAGIC is a longitudinal study of a cohort of Massachusetts residents aged 18 and over who were selected using a probability sample of respondents in the SEIGMA Baseline General Population Survey (BGPS). For this reason, the weights for Wave 2 of MAGIC are closely related to the weights developed for the BGPS. The BGPS was a stratified, multi-mode address-based (ABS) probability sample survey with Massachusetts addresses serving as the primary sampling frame. One individual per household aged 18 and over with the closest birthday to the mailing date was invited to participate in the survey. Weights were developed for respondents in the BGPS that accounted for the following:

1. Baseline stratified sampling weight (Baseline Design weight: WT1)
2. Adjustment for unknown eligibility (Eligibility weight: WT2)
3. Adjustment for non-response to the Wave 1 questionnaire (Non-response weight: WT3)
4. Accounting for number of persons 18+ in the household (with the number of 18+ household members truncated to a maximum of 4) (Household Size weight: WT4)
5. Raked to MA population based on the variables region, gender, age, race/ethnicity, education. (Raking weight: WT5)
6. Trimming the weights by setting the minimum weight to be the average weight over 8, and the maximum weight to be average weight times 8 (Trimmed Raking Weight: WT6)

[8] We noted above that Wave 1 data is missing for 1% (n=43) of the respondents in the cohort due to mismatches in gender and/or year of birth between Wave 1 and Wave 2. These respondents will be included in future waves of the study, however, they are not included in the present analyses.

The first three steps in developing the weights for MAGIC Wave 2 respondents were completed by NORC. The 9,578 addresses where a complete response was obtained from an eligible adult in the BGPS is the address frame for MAGIC Wave 2. Associated with each address is a weight (WT3) that accounts for the BGPS survey design, address screening rates, and survey completion rates. This weight is referred to as MWT0.

The MAGIC Wave 2 sample was selected from respondents in the BGPS who were stratified into six risk groups. The base sampling weight (MWT1) is formed by multiplying the weight MWT0 by the inverse of the probability of selection for each of the six strata. The weights are then adjusted to compensate for differences in completed response rates across subgroups for respondents selected in the MAGIC cohort.

Not all subjects selected to participate in MAGIC completed the Wave 2 interview. The base weight (MWT1) is adjusted to account for varying completion rates in different strata. A stepwise logistic regression analysis was used by NORC to determine the variables most strongly related to completing MAGIC Wave 2. The initial plan adjusted for non-response rates using the three most significant independent variables (own/rent status of household, presence of children, and education of respondent). This plan was revised to include an additional variable controlling for gambling participation in the past year (i.e., to account for the lower response rate of Non-Gamblers). This variable was identified via investigation by the research team as well as consultation with the MGC and its Research Review Committee. The resulting non-response weight is named MWT2.

The third adjustment in the weights is for household size (MWT3). Household size is truncated to a maximum of 4 in an effort to limit the variability of the survey weights. The average household size (i.e., 1.95) is assigned to respondents where this information is missing from both surveys.

The next adjustment to the weights (MWT4) is raking based on cross-classified pairs of five variables (i.e., region, age, gender, race/ethnicity, education) to more closely align with the distribution of Massachusetts adults aged 18 and over. Raking variables were determined based on a preliminary analysis of the 2013 one-year American Community Survey Public Use Microdata Sample (PUMS) files. Our reason for using cross-classified pairs of variables is to avoid instances where the PUMS data itself is based on small samples.

The process of weighting to account for sample design and response rates leads to different weights for different respondents. The weights are constructed so that an unbiased estimate can be made for the Massachusetts adult population. If the expected value of a response (e.g., incidence of problem gambling) varies between respondents with different weights, the overall weighted estimator is an unbiased estimate for the population mean. An additional consequence of varying weights is a decrease in the precision of the estimator. When there is a weak relationship between the variables used for weighting and the expected value of response, reducing the range of the weights can increase the precision of the estimator while not creating appreciable bias. This process is called weight trimming and its appropriate use allows the construction of a more accurate estimator. The same criteria for weight trimming used in the BGPS were used in MAGIC Wave 2. The maximum weight was set to be 8 times the mean weight and the minimum weight was assigned as 1/8 the mean weight (MWT6).

MAGIC Wave 2 Response Rates by Strata

Table 4 presents information about the number of BGPS respondents drawn for the MAGIC cohort, the size of the achieved sample from each risk group (or stratum), and the AAPOR RR3[9] response rate for each group.

Table 4: Sample Composition by Risk Groups

Group	Drawn Sample	Achieved Sample	Response Rate by Group %
Problem Gambler	133	81	61.4
At-Risk Gambler	450	295	65.7
Spends $1,200+ annually	1,088	726	67.2
Gambles weekly	792	534	67.6
Military service Sept 2001 or later	49	37	78.7
All other BGPS participants	2,348	1,466	63.1
Total	4,860	3,139	65.1

The overall response rate for the achieved sample was 65.1%. Table 4 shows that the response rate differed somewhat by risk group, with a lower proportion of Problem Gamblers and "All other BGPS participants" completing the questionnaire and a higher proportion of veterans who served after 9/11 completing the questionnaire.

Demographic Characteristics of the Cohort

Table 5 compares key demographic characteristics of the cohort with information about the Massachusetts adult population. The comparison summarizes the success of weighting in aligning the cohort with the Massachusetts adult population.

Table 5: Demographics of MAGIC Wave 2 Sample

		MAGIC Wave 2 Sample						Massachusetts 2015[3]	
		Unweighted[1]			Weighted[2]				
		N	%	SE	N	%	SE	%	SE
Gender	Male	1,458	46.5	0.9	2,534,904	47.0	1.6	47.9	0.3
	Female	1,678	53.5	0.9	2,863,128	53.0	1.6	52.1	0.3
Age	18-20	*8*	*0.3*	*0.1*	*84,430*	*1.6*	*0.6*	5.6	0.1
	21-24	37	1.2	0.2	330,075	6.3	1.1	7.3	0.1
	25-34	260	8.5	0.5	1,033,360	19.8	1.5	17.4	0.2
	35-54	887	29.1	0.8	1,768,647	33.8	1.5	33.6	0.2
	55-64	751	24.6	0.8	989,947	18.9	1.1	16.8	0.2
	65-79	846	27.7	0.8	749,977	14.3	0.8	13.9	0.2
	80+	264	8.6	0.5	273,841	5.2	0.5	5.3	0.1

[9] The AAPOR RR3 is equivalent to the CASRO response rate; both take into account the proportion of households whose eligibility status could not be determined.

		MAGIC Wave 2 Sample						Massachusetts 2015[3]	
		Unweighted[1]			Weighted[2]				
Ethnicity	Hispanic	131	4.3	0.4	427,931	8.2	1.0	9.6	0.2
	White alone	2,653	87.0	0.6	3,990,651	76.3	1.5	75.5	0.2
	Black alone	84	2.8	0.3	311,147	5.9	0.9	6.4	0.1
	Asian alone	95	3.1	0.3	340,825	6.5	0.9	6.4	0.1
	Some other race alone	24	0.8	0.2	43,605	0.8	0.3	0.8	0.1
	Two or more races	61	2.0	0.3	119,083	2.3	0.5	1.3	0.1
Education	Less than high school	97	3.1	0.3	278,142	5.3	0.8	9.7	0.2
	High School or GED	473	15.3	0.6	1,360,692	25.7	1.6	25.5	0.2
	Some college	911	29.4	0.8	1,262,122	23.8	1.3	26.2	0.2
	Bachelor degree	758	24.5	0.8	1,451,126	27.4	1.4	22.4	0.2
	Graduate or prof. degree	690	22.3	0.7	750,038	14.2	0.8	13.7	0.2
	Doctoral degree	166	5.4	0.4	192,420	3.6	0.4	2.4	0.1
Income	Less than $15,000	176	6.7	0.5	468,860	10.4	1.2	6.9	0.1
	$15,000-<$30,000	300	11.4	0.6	580,320	12.9	1.3	8.7	0.2
	$30,000-<$50,000	427	16.2	0.7	685,348	15.2	1.3	12.6	0.2
	$50,000-<$100,000	842	32.0	0.9	1,379,927	30.6	1.6	27.9	0.2
	$100,000-<$150,000	474	18.0	0.7	721,094	16.0	1.2	20.6	0.2
	$150,000 and more	409	15.6	0.7	675,038	15.0	1.1	23.2	0.2

[1] Unweighted N refers to the total number of respondents who answered this question

[2] Weighted N is the total number of respondents who answered the question weighted to the MA population

[3] Source: Census Bureau, 2015 American Community Survey PUMS

Note: Italics indicates estimates are unreliable, relative standard error > 30%

Comparison of percentages in the weighted column and the Massachusetts 2015 column in Table 5 shows that the weighted sample is a relatively close match for gender, age, race/ethnicity, and education. This is to be expected since these factors were used in the weighting. However, the age and education categories reported in Table 5 are more detailed than the categories used for weighting, revealing the limitations of the weighting procedure. For example, the youngest age category used in weighting is 18-24. The percentage of MA adults in this category is 12.9%, compared to 7.9% for the weighted cohort. However, the difference in percentages is in the opposite direction for 25-34 year olds, with 17.4% of the MA adults in this category, compared with 19.8% of the weighted cohort.[10] This illustrates that using the broader age category of 18-34 fails to properly adjust for the more detailed age distribution. A similar situation arises for education, where the category of High School or less education (35.2% of MA adults, and 31.0% of the weighted cohort) fails to account for the larger difference in the category of less than high school education (9.7% of MA adults versus 5.3% of the weighted cohort).

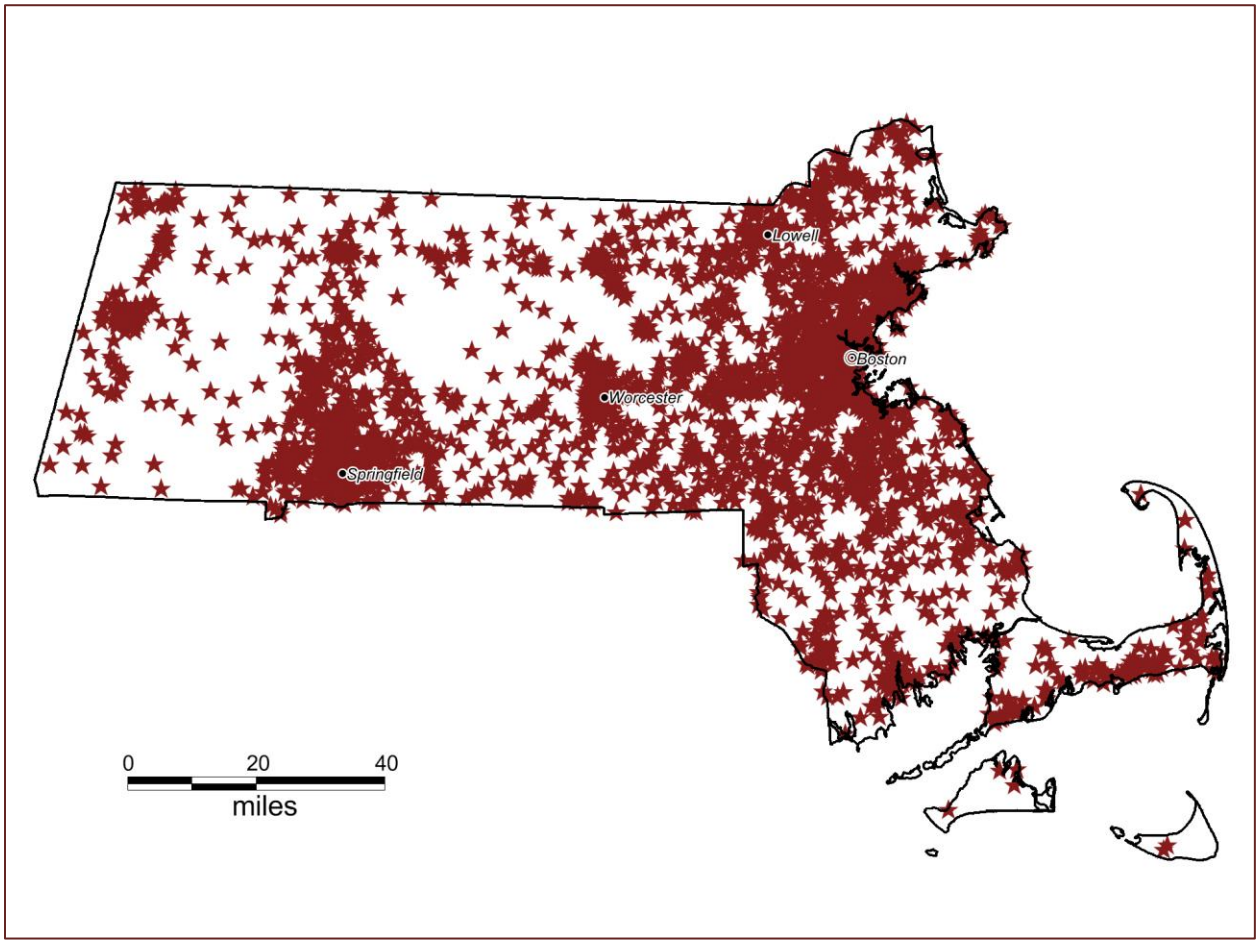
The under-representation of persons 18-24 years old and persons with less than a high school education in the weighted cohort suggests that households with lower income might also be under-represented since younger individuals and those with lower education typically have lower incomes. However, this is not the case, as a comparison of the distribution of household income in the weighted and Massachusetts population columns demonstrates. The weighted results over-represent adults in lower

[10] Another important reason for discrepancies between the cohort and the population is that the cohort had aged on average 18 months since the baseline survey. Some of the respondents who were 18-20 in the baseline survey would have aged out of this category by the time the cohort was established.

income households in the adult population of Massachusetts and under-represent adults in higher income households. The impact of these differences will be examined further in future analyses of the data.

Finally, it is helpful to understand where in Massachusetts the members of the cohort reside. Figure 4 shows that the distribution of the cohort is quite similar to the distribution of the population of Massachusetts. The majority of the cohort lives in the Greater Boston and Southeastern regions of the Commonwealth and there is a sizable proportion of the respondents from Western Massachusetts.

Figure 4: Residential Location of MAGIC Respondents



Statistical Analysis

Statistical analysis of survey data where respondents have unequal weights is more complex than standard statistical analysis due to the need to properly account for the weights in estimating parameters and their variance. Special software and statistics have been developed for such situations. Both the BGPS and the MAGIC Wave 2 cohort data were analyzed using SAS-callable SUDAAN, release 11.0.1. SUDAAN, which enables appropriate calculation of variance estimations for data from surveys using complex sampling strategies. When exact expressions for the variance were not possible, the Taylor series linearization method was used combined with variance estimation formulas specific to the sample design.

Results

The cohort established in MAGIC Wave 2 is not, nor is it intended to be, a representative sample of the adult population of Massachusetts. Furthermore, findings in this section of the report should be interpreted with caution as they refer only to the first two assessments of the respondents. More waves are needed to confirm the results presented here. Following the approach taken in some other gambling cohort studies (e.g., Victoria Department of Justice, 2011), weighted data was used in the calculation of the incidence rate to more confidently generalize to the Massachusetts adult population. Other findings are based on unweighted data and refer only to the population in the study rather than the broader Massachusetts adult population.

The BGPS established the baseline prevalence of problem gambling in Massachusetts prior to the opening of any casinos and also provided other important information about gambling participation and problem gambling. This included prevalence rates among important demographic groups and among past-year participants in different gambling activities (Volberg et al., 2017). Our focus in this section of the report is on changes in cohort gambling participation prior to the opening of any casinos. In addition to looking at changes in participation, we present information about the incidence of problem gambling within the cohort prior to the opening of any casinos in Massachusetts as well as information about changes in problem gambling status between 2013/2014 and 2015 within MAGIC.

Changes in Gambling Participation

In this section, we present information about changes in gambling participation between Wave 1, which was carried out in 2013/2014, and Wave 2 of the cohort study in 2015 for the 3,096 respondents who completed both Wave 1 and Wave 2 surveys. The number of respondents reported in Table 6 is less than the overall number of respondents due to specific question non-response. Table 6 presents differences in overall past-year gambling participation as well as past-year participation in specific activities for the respondents in the BGPS (Wave 1) who completed the Wave 2 questionnaire. Examination of Table 6 shows that there has been an overall increase in past-year gambling participation as well as specific increases in casino gambling[11] and horse race betting (as the confidence intervals do not overlap zero). However, in all cases the magnitudes of the increase is quite small (ranging from 2.3% to 3.4%)

Table 7 presents information about changes in number of gambling formats engaged in, maximum frequency of gambling, and overall gambling expenditure between Wave 1 and Wave 2. As can be seen, there is a small but significant increase from Wave 1 to Wave 2 in the mean number of gambling formats engaged in (an increase in the mean of 0.2 activities, 95% CI [0.1, 0.3]). However, no significant changes in maximum frequency of gambling or overall gambling expenditure were detected.

[11] Although the change in past-year casino gambling is higher than changes in other types of gambling, this is an unstable result and should be interpreted with caution.

Table 6: Pairwise Comparison of Gambling Participation Activities between Wave 1 and Wave 2 (weighted)

	MAGIC Wave 1			MAGIC Wave 2			Change (Wave 2 - Wave 1)		
Behavior	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**
Any gambling	3,086	74.9%	(72.0% , 77.8%)	3,086	78.3%	(75.7% , 81.0%)	*3,086*	*3.4%*	*(0.7% , 6.2%)*
All Lottery	3,072	62.3%	(59.2% , 65.4%)	3,072	64.3%	(61.2% , 67.3%)	*3,072*	*2.0%*	*(-0.5% , 4.5%)*
Traditional Lottery	3,085	58.5%	(55.3% , 61.6%)	3,085	60.7%	(57.7% , 63.8%)	*3,085*	*2.3%*	*(-0.6% , 5.1%)*
Instant Games	3,065	37.6%	(34.6% , 40.5%)	3,065	39.7%	(36.7% , 42.7%)	*3,065*	*2.1%*	*(-0.8% , 5.0%)*
Daily Games	3,062	15.1%	(12.9% , 17.2%)	3,062	16.5%	(14.4% , 18.7%)	*3,062*	*1.5%*	*(-0.7% , 3.7%)*
Raffle	3,057	32.7%	(30.0% , 35.4%)	3,057	35.5%	(32.6% , 38.4%)	*3,057*	*2.8%*	*(-0.2% , 5.7%)*
Casino	2,892	23.9%	(21.3% , 26.4%)	2,892	27.1%	(24.2% , 29.9%)	*2,892*	*3.2%*	*(0.4% , 6.0%)*
Bingo	3,062	4.2%	(3.0% , 5.5%)	3,062	4.7%	(3.4% , 6.1%)	*3,062*	*0.5%*	*(-0.7% , 1.8%)*
Horse racing	3,077	3.2%	(2.3% , 4.1%)	3,077	5.5%	(4.0% , 7.0%)	*3,077*	*2.3%*	*(0.9% , 3.8%)*
Sports betting	3,077	13.1%	(11.1% , 15.1%)	3,077	15.3%	(13.1% , 17.5%)	*3,077*	*2.2%*	*(-0.1% , 4.4%)*
Private Betting	3,059	12.2%	(10.1% , 14.3%)	3,059	13.3%	(11.1% , 15.4%)	*3,059*	*1.1%*	*(-1.4% , 3.5%)*
Online	3,045	1.5%	(0.7% , 2.3%)	3,045	2.4%	(1.3% , 3.6%)	*3,045*	*0.9%*	*(-0.3% , 2.1%)*

Note: Italics indicates estimates are unreliable, relative standard error > 30%

Table 7: Pairwise Comparison of Gambling Involvement Measures between Wave 1 and Wave 2 (weighted)

	MAGIC Wave 1			MAGIC Wave 2			Change (Wave 2-Wave 1)		
Behavior	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**		**%**	**95% CI**
Total gambling expenditures:mean	3,085	-1,374.5	(-1,946.5, -802.4)	3,085	-1,374.5	(-2,016.4, -732.6)	3,085	-0.0	(-823.7, 823.7)
Total gambling expenditures:median		-39.4	(-57.3, -21.5)		-57.0	(-75.0, -39.1)		-0.5	(-11.0, 9.9)
Max. freq. of gambling:mean	3,086	29.5	(26.5, 32.4)	3,086	32.5	(29.1, 35.9)	*3,086*	*3.0*	*(-0.2, 6.2)*
Max. freq. of gambling:median		4.3	(4.1, 4.6)		4.5	(4.3, 4.7)		-2.7	(-3.7, -1.7)
Number of gambling formats:mean	3,096	2.0	(1.9, 2.1)	3,096	2.2	(2.1, 2.3)	3,096	0.2	(0.1, 0.3)
Number of gambling formats:median		1.3	(1.1, 1.4)		1.4	(1.3, 1.6)		-0.4	(-0.5, -0.3)

Note: Italics indicates estimates are unreliable, relative standard error > 30%

Changes in Problem Gambling Status

Beyond gambling participation, it is important to consider changes in problem gambling status among the members of the cohort between 2013/2014 and 2015. This is presented in Table 8. As can be seen, by far the largest group of people were individuals who were not problem gamblers in both waves. In addition, a total of 60 individuals became problem gamblers for the first time in Wave 2, 40 individuals who were problem gamblers in Wave 1 remitted in Wave 2, and 39 individuals remained problem gamblers across both time periods.

It is also important to consider how missing information in Wave 1 and/or Wave 2 affects the size of the cohort since this, in turn, determines the denominator on which problem gambling incidence is based. The bottom of Table 8 shows 57 people who were not included in the calculation of incidence because their problem gambling status was unavailable at either Wave 1 or Wave 2. Missing problem gambling status in Wave 1 is due to having obtained information from different respondents in Wave 1 and Wave 2 (n=43) or to missing responses to PPGM items (n=6). Missing problem gambling status in Wave 2 is due to missing responses to PPGM items in this iteration of the study.

Table 8: Problem Gambling Status in Wave 1 and Wave 2

Wave 1	Wave 2	Frequency
Not a problem gambler	**Not a problem gambler**	2,943
Not a problem gambler	**Problem gambler**	60
		3,003
Problem gambler	**Not a problem gambler**	40
Problem gambler	**Problem gambler**	39
		3,082
Missing	**Not a problem gambler**	45
Missing	**Problem gambler**	4
Not a problem gambler	**Missing**	8
		3,139

Incidence of Problem Gambling

Incidence in this study is defined as the number of individuals classified as PPGM Non-Gamblers, Recreational Gamblers, and At-Risk Gamblers in Wave 1 who are classified as Problem or Pathological Gamblers in Wave 2. This group includes the 3,003 respondents for whom we have complete information from both Wave 1 and Wave 2 (see Table 8 above). It does not include:

- Respondents who were problem gamblers at Wave 1 (n=79)
- Respondents for whom we could not determine problem gambling status at Wave 1 (n=49)
- Respondents for whom we could not determine problem gambling status at Wave 2 (n=8)

Table 9 presents information about the problem gambling status of all of the members of the cohort in Wave 2 as a proportion of the overall sample. Based on this approach, the incidence of problem gambling within the cohort in 2015 was 2.4% (95% CI [1.5%, 3.7%]).[12] Since incidence is defined as the proportion of "new" problem gamblers in Wave 2, the calculation of incidence excludes any respondents classified as Problem Gamblers in Wave 1. This is the reason that the incidence rate is slightly higher than the proportion of the cohort presented in Table 9.

Table 9: Problem Gambling Status in Wave 2

Group		UN[1]	N[2]	% [2]	95% CI[2]
Not problem gambler --> not a problem gambler		2,943	5,032,690	95.5	(93.9, 96.6)
Not problem gambler --> problem gambler		60	123,631	2.3	(1.5, 3.6)
Problem gambler --> not a problem gambler		*40*	*57,385*	*1.1*	*(0.6, 2.0)*
Problem gambler --> problem gambler		*39*	*58,764*	*1.1*	*(0.6, 2.1)*
Total		3,082	5,272,470	100.0	

[1]Unweighted N refers to the total number of respondents who answered this question
[2]Weighted N is the total number of respondents who answered the question weighted to the MA population
Note: Italics indicates estimates are unreliable, relative standard error > 30%

The incidence rate in Massachusetts is relatively high compared to other jurisdictions where longitudinal cohort studies have been conducted. In other jurisdictions, incidence rates have ranged from 0.12% to 1.4%. It is also important to note that while the remission rate within the cohort is approximately half of the incidence rate (1.1%, 95% CI [0.6%, 2.0%]), fully half of the Problem Gamblers in Wave 1 are no longer classified as Problem Gamblers in Wave 2.

Transitions, Stability, and Change

The second major goal of the present analysis was to determine whether respondents in the study moved from one risk category to another and, if so, whether they moved towards less severe or more severe problems. Assessing **transitions** in a two-wave study is generally done using a "transition table." As a reminder, the results in this section are based on unweighted data and refer only to the individuals in the study rather than the broader Massachusetts adult population.[13]

Table 10 shows that, between Wave 1 and Wave 2, the most stable group in the cohort was Recreational Gamblers. Four out of five Recreational Gamblers in Wave 1 (80.3%) remained Recreational Gamblers in Wave 2. The next most stable group was Non-Gamblers in Wave 1, of whom 64.4% remained Non-Gamblers in Wave 2. It is notable that At-Risk Gamblers and Problem Gamblers were substantially less stable than the other two groups. Only two in five At-Risk Gamblers in Wave 1 (37.5%) maintained that status in Wave 2 while half of Problem/Pathological Gamblers in Wave 1 (49.4%) remained Problem/Pathological Gamblers in Wave 2.

[12] Incidence is calculated based on the weighted Ns in Table 9: 123,631/(123,631+5,032,690) = 123,631/5,156,321 = 2.4%. In contrast, the unweighted incidence rate is 2.0% (60/(60+2943) = 60/3003 = 2.0%). The higher weighted incidence rate is related to higher weights associated with the demographic characteristics of members of the cohort who became problem gamblers in Wave 2 of the study.
[13] Very similar results were obtained using weighted data.

Table 10: Transitions Between PPGM Groups from Wave 1 to Wave 2 (unweighted)

Complete data Wave 2												
		Non-Gambler		Recreational Gambler		At-Risk Gambler		Problem or Pathological Gambler		Shift		Total
	Wave 1: PPGM status	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
Complete data Wave1	Non-Gambler	298	64.4	158	34.1	*7*	*1.5*	0	0.0	165	35.6	463
	Recreational Gambler	177	8.3	1,723	80.3	223	10.4	22	1.0	422	19.7	2,145
	At-Risk Gambler	*8*	*2.0*	201	50.9	148	37.5	38	9.6	247	62.5	395
	Problem/Pathological Gambler	---	---	16	20.3	23	29.1	39	49.4	40	50.6	79
Total		484		2098		401		99				3,082

[1]Unweighted N refers to the total number of respondents who answered this question
Note: Cells with sample size of 5 or less are blank
Note: Italics indicates estimates are unreliable, relative standard error > 30%

It is also interesting to note the direction of the transitions between Wave 1 and Wave 2 within the different groups. For example, one-third (34.1%) of the Non-Gamblers in Wave 1 moved into Recreational Gambling at Wave 2. An additional small number (1.5%) of Non-Gamblers in Wave 1 moved into At-Risk Gambling at Wave 2. Among Recreational Gamblers in Wave 1, about one in ten moved into Non-Gambling (8.3%), one in ten (10.4%) moved into At-Risk Gambling, and 1.0% moved into Problem/ Pathological Gambling. Among At-Risk Gamblers in Wave 1, just over half (50.9%) moved into Recreational Gambling and another 2.0% moved into Non-Gambling. About one in ten At-Risk Gamblers (9.6%) moved into Problem/Pathological Gambling. Among Problem/Pathological Gamblers in Wave 1, 29.1% moved into At-Risk Gambling and 20.3% moved into Recreational Gambling at Wave 2. Overall, Table 10 shows that 13.8% of the respondents for whom we had complete information transitioned into a less severe group in the PPGM typology while 14.5% moved into a more severe group in the typology. Nearly three-quarters of the respondents (71.6%) remained in the same group between Wave 1 and Wave 2 of MAGIC.[14]

Finally, it is helpful to consider the potential of the Massachusetts cohort study to inform etiological research on problem gambling. In preparing this report, we sought information from the research teams that have conducted other large-scale gambling cohort studies internationally regarding the total number of problem gamblers identified over the course of each study as well as the total number of "new" or first-onset problem gamblers beyond Wave 1 of each study. The total number of problem gamblers identified over the entire course of each study (involving four or five assessments) ranged from 277 in the QLS to 134 in the LLLP. The total number of "new" problem gamblers beyond Wave 1 of each study ranged from 134 in the QLS to 43 in the LLLP. During Wave 1 and Wave 2 of the Massachusetts study, 139 persons were classified as Problem Gamblers. This includes 60 respondents in Wave 2 who were not classified as Problem Gamblers in Wave 1. Based on this comparison, it appears that the MAGIC study is well positioned to produce new and more detailed information about the etiology of problem gambling in the future.

[14] Overall transition rates are calculated by adding the number of respondents across all of the groups in the typology who transitioned or remained stable and dividing by the total number of respondents. For example, the "increasing risk" proportion of the sample was determined as follows: (158+7 NG) + (223+22 RG) + (38 AR) = 448/3082 = 14.5%.

Discussion

This report presents results from a new cohort study of gambling and problem gambling underway in Massachusetts. While recent large-scale cohort studies have been carried out in Australia, Canada, New Zealand, and Sweden, there have been no major adult cohort studies of gambling in the United States. This report focuses on (1) establishment of the Massachusetts cohort, (2) changes in gambling participation within the cohort between 2013/2014 and 2015, (3) the "natural" incidence of problem gambling within the cohort prior to the availability of casino gambling in the Commonwealth, and (4) transitions within the cohort between Wave 1 and Wave 2 of the study.

The cohort was established from a stratified sample of 3,139 respondents who completed the SEIGMA Baseline General Population Survey (BGPS). The main purpose of the stratified sample was to ensure that the cohort included the largest possible number of individuals who might be expected to change their gambling status over the course of the study (i.e., At-Risk and Problem Gamblers).

Care was taken in recruiting the sample to ensure that the same individual who completed the BGPS questionnaire was enrolled into the cohort. Locating procedures were used to help find individuals who moved between the two waves of the study and respondent information (name, gender, year of birth, and month and year of survey completion) was used to screen individuals into the sample. These procedures helped ensure that 97% of the respondents who completed the Wave 2 questionnaire were the same respondents who completed the BGPS questionnaire. Among the small group of respondents with discrepancies in gender and/or year of birth, 51% were deemed to be the same individual who completed the BGPS. The 43 respondents whose gender and/or year of birth could not be matched to BGPS data are included in the cohort but have missing data for Wave 1 of the study. These 43 individuals are not included in any of the analyses in this report.

Changes in Gambling Participation

Change in gambling participation within the cohort was examined by comparing the self-reported behaviors of the members of the cohort at Wave 1 and Wave 2. Within the cohort, a significant increase in overall gambling participation was identified along with significant increases in casino gambling and horse race betting. In all cases, the magnitude of the increases was quite small (2.0% - 3.2%). No changes were found in the participation rates for traditional lotteries, instant games, daily lottery games, raffles, bingo, sports betting, private betting, or online gambling. There was a small but statistically significant increase in the average number of gambling formats engaged in by cohort members between Wave 1 and Wave 2, but no observed changes in overall gambling frequency or expenditure.

Incidence of Problem Gambling

The "natural" problem gambling incidence rate within the cohort between 2013/2014 to 2015, prior to the opening of any casinos in Massachusetts, was 2.4% (95% CI [1.5%, 3.7%]).[15] This rate is relatively high compared to other jurisdictions where longitudinal cohort studies have been conducted. Internationally, incidence rates have ranged from 0.12% to 1.4%. Possible methodological reasons for this difference are discussed below in the Limitations Section. In addition to incidence, it is interesting that remission within the cohort is also quite high, with half of the Problem Gamblers in Wave 1 no longer classified as such in Wave 2.

[15] As described in the section, Weighting and Comparability Across Two Waves, these estimates were computed using weights established for Wave 2 of the cohort.

If this high incidence is accurate, the basis for it is somewhat unclear given that there was no significant change in the actual availability of legal gambling opportunities in Massachusetts during this time. Possible factors include: greater public awareness of casino gambling in the wake of publicity about developments in the Commonwealth and nearby states; political advertising associated with a ballot initiative to repeal casinos in Massachusetts; heavy advertising by casinos in Connecticut and Rhode Island seeking to maintain their competitive advantage; and increased advertising and news stories surrounding daily fantasy sports (DFS) as these games became more widely available. It should also be noted that Plainridge Park Casino opened in late June of 2015, approximately 12 weeks before data collection ended. However, only a small number of respondents (n=167, 5.3% of the cohort) completed the survey during this period.

This high incidence, if confirmed, could have important implications for the SEIGMA study, as SEIGMA employs before-and-after cross-sectional population surveys of problem gambling prevalence to ascertain the potential impact of the introduction of new casinos. If the high incidence rate is not offset by a high rate of remission, the present findings could mean that any observed change in the prevalence of problem gambling subsequent to the introduction of casinos may not be due exclusively to the increased availability of casinos.

Transitions, Stability, and Change

Another goal of the present analysis is to determine the rate of transitions, or the degree of stability and change, among the members of the cohort between Wave 1 and Wave 2. This analysis suggests that Recreational Gamblers and Non-Gamblers were the most stable members in the cohort while At-Risk Gamblers and Problem Gamblers were the least stable. More specifically, 80.3% of Recreational Gamblers remained in this category in both waves, compared to 64.4% of Non-Gamblers, 49.4% of Problem/Pathological Gamblers, and 37.5% of At-Risk Gamblers. Most Non-Gamblers who transitioned moved into the Recreational Gambling category (34.1%). Of Recreational Gamblers who transitioned, there was an even split into At-Risk Gambling (10.4%) and Non-Gambling (8.3%). Of Problem Gamblers who transitioned, most moved into At-Risk Gambling (29.1%) and a smaller percentage into Recreational Gambling (20.3%). The large majority of At-Risk Gamblers moved into Recreational Gambling (50.9%), whereas 9.6% became Problem/Pathological Gamblers

These results are similar to cohort studies in other jurisdictions, which have generally found Recreational Gamblers to be the most stable group, with Non-Gamblers being moderately stable, and At-Risk and Problem Gamblers the least stable. One difference between Massachusetts and gambling cohort studies in other jurisdictions is the somewhat larger proportion of the Massachusetts cohort that transitioned over the 16.5 months between assessments. In Victoria, for example, 4.3% of the cohort transitioned down while 5.6% transitioned up; in contrast, 13.8% of the Massachusetts cohort transitioned to a lower PPGM status while 14.5% transitioned to a higher PPGM status.[16] Some portion of the differences between the Massachusetts and Victoria transition rates may be due to differences in how problem gambling was measured (i.e., MAGIC used the PPGM and the Victoria study used the CPGI). Another difference is the longer time period in the MAGIC study relative to most other studies (typically 12 months).

Limitations

Large-scale cohort studies using an ostensibly representative sample with weighting to correct for any known sampling biases are the best way of trying to establish incidence for a population. Cross-sectional

[16] All of the gambling cohort studies used problem gambling measures that utilized a 12-month timeframe.

studies can also be used, but in situations where the presence or absence of something is based on self-report (e.g., problem gambling), accurate incidence rates are dependent on accurate long-term retrospective reports, which are typically unreliable.

Nevertheless, cohort studies always come with limitations. As a result, our estimates may be subject to biases and should be interpreted with caution. One important limitation concerns whether all sampling biases have been accounted for. The response rate to the BGPS/Wave 1 was 36.6% and the response rate to Wave 2 was 65.1%. This produces a cumulative response rate of 23.3%, which provides ample opportunity for differential rates of response for subgroups of the population despite our best efforts to identify and rectify any biases. The BGPS/Wave 1 was introduced as a survey of "health and recreation" in an effort to prevent participation bias related to respondents' attitudes toward gambling. In Wave 2, however, eligible respondents were aware that the survey they were being invited to complete was about gambling. Therefore, their decision of whether to participate in Wave 2 could have been shaped by knowing that the topic of the survey was gambling. In weighting the data, we made extensive efforts to control for this bias by accounting for gambling involvement—along with other demographic variables (i.e., own/rent status of household, presence of children, and education of respondent)—which influenced response. Nevertheless, there may be other unknown factors influencing the likelihood of response.

In addition, population mobility (i.e., people moving into the state since baseline who have no probability of being included in the cohort sample) and aging of the cohort may create biases in the estimates. While these factors are relatively minor concerns at this early stage of the study, they will pose a growing challenge in future waves.

Another factor to consider is that repeated surveying is known to have some influence on self-report of behavior. More specifically, it is not uncommon for people with problems to progressively report fewer problems simply because of the social desirability to convey some improvement to the researchers. A related issue is the fact that the survey itself might have a real impact on the person's behavior. For individuals who have never sought treatment for their problems, having to provide a comprehensive report on their behavior may cause them to re-evaluate their actions and potentially moderate their behavior.

An additional factor concerns the inter-assessment time interval, which was longer in the present study (16.5 months[17]) than the 12 months typically used in other studies. Even though the questions ask about behavior in the past 12 months, the last time people had to report on their behavior often serves as an easier time marker for individuals. Even if people are reliably reporting on the past 12 months, the fact that more actual time has elapsed means that inherently unstable entities (e.g., problem gambling) have more time to both appear and remit (i.e., accentuating the ostensible rate of transitions).

A final issue is that observed changes over time are sensitive to the reliability of the measurement instrument. For less reliable instruments, repeated assessments typically lead to regression to the mean, resulting in some artefactual accentuation of transitions from more to less severe states. Unlike many clinical entities where highly reliable diagnostic measures are possible (e.g., diabetes, cancer), all measures of problem gambling have limitations in their reliability. This is due to the fact that the

[17] The average time between assessments was computed using an unweighted pairwise comparison of the dates that each Wave 2 respondent completed their Wave 1 and Wave 2 questionnaires. The weighted interval was 16.4 months.

assessments are largely based on a person's self-reported perception of their behavior and mental state over the past year. However, the accuracy of this perception is compromised by incomplete recall, recency bias, self-deception, mood state, social desirability, the short period of time participants are given to answer the questions, and genuine uncertainty about whether they meet the criteria being asked about. Thus, the identification of the presence or absence of problem gambling as well as apparent transitions from one gambling category to another over time are partly a function of this measurement error. It is important to note that the present study employed the Problem and Pathological Gambling Measure (PPGM) (Williams & Volberg, 2010, 2014) because of its superior classification accuracy in population-based research of problem gambling. However, it is also true that this instrument has lower measurement error compared to the Canadian Problem Gambling Index (CPGI), (Ferris & Wynne, 2001) that has been employed in most other longitudinal studies of gambling.[18] This compromises potential comparisons between studies. Reassuringly, with the possible exception of incidence, the rate of transitions appear comparable between MAGIC and these other studies.

Implications for Problem Gambling Prevention and Treatment

One of the main negative social impacts of expanded gambling availability is the potential for an increase in problem gambling (Williams, Rehm, & Stevens, 2011). Despite increases in the availability of gambling, the prevalence of problem gambling has stabilized or gone down in most Western jurisdictions since the late 1990s to early 2000s (Williams, Volberg, et al., 2012). Many people have taken this to mean that gambling-related harm is reducing and that further efforts to mitigate this harm may be unnecessary.

However, a stable prevalence rate over time can either be a result of: (a) ongoing unremitting problem gambling in the same group of individuals or (b) the rate of new cases is roughly equivalent to the rate of remission among existing problem gamblers. These different scenarios have very different implications for problem gambling prevention and treatment. If problem gambling is a chronic condition and new cases are relatively uncommon, then it may be preferable to devote resources primarily to treatment rather than prevention. However, if both incidence and recovery from problem gambling are quite high, an argument can be made that more resources should be devoted to prevention. This would function to forestall the development of "new" problem gamblers and to support the continued remission of problem gamblers in recovery.

Results from the MAGIC study suggest that the incidence of problem gambling may be relatively high, despite the fact that casinos are not yet operating in the Commonwealth. Moreover, the proportion of new problem gamblers in 2015 (n=60, 60.6%) relative to the overall rate of problem gambling is higher than the number of ongoing unremitting cases (n=39, 39.4%). Taken together, these results suggest that substantial resources may be needed for both problem gambling prevention and treatment well ahead of the opening of casinos in Massachusetts.

In planning and implementing problem gambling prevention and treatment services in Massachusetts, it is helpful to consider recent findings from our deeper analyses of the BGPS data (Williams et al., 2017).

[18] The Reliable Change Index (RCI) was developed by jacobson & Truax (1991) to detect genuine differences in scores above and beyond the natural variation in scores that are simply reflective of measurement error at each time point. The size of the difference between two scores that is needed to represent statistically significant change at $p < .05$ level (i.e., the RCI) is a function of the test-retest reliability of the instrument and the standard deviation of test scores. Applying the RCI in the five year Quinte Longitudinal Study of Gambling found only 7 out of 1,180 (0.6%) of gambling categorizations were changed, compared to 7.0% of CPGI categorizations (Williams et al, 2015, pp. 68-69).

Discussing the implications of multivariate analyses of the BGPS, we noted that efforts to prevent harm from gambling in Massachusetts should be directed towards reducing excessive levels of gambling. With the emergence of portion of friends and family that are regular gamblers as one of the strongest predictors of all levels of gambling, we further recommended that prevention efforts aim at educating gamblers about the normalizing effect that their social group has on their gambling behavior. In addition, educating friends and family of regular gamblers about their role in facilitating that person's gambling would also aid in reducing harm. Given the riskiness of specific forms of gambling in Massachusetts, including casinos, instant and daily lottery games, and online gambling, work is needed to foster public health partnerships with gaming operators to develop and implement effective prevention efforts within gambling venues. Finally, given the role of tobacco use, binge drinking, drug and alcohol problems, behavioral addictions, and mental health problems in predicting At-Risk Gambling and Problem/Pathological Gambling in Massachusetts, it seems advisable to include screening for problem gambling in both addiction and mental health treatment settings. This would include providing training for treatment professionals in how to effectively help individuals with gambling-related difficulties as well as other conditions.

Future Directions

The first priority in going forward is triangulating the present results with other data sources to either confirm or disconfirm the high incidence found in the present study. More specifically, we will examine whether there was a significant change in (a) the prevalence rate of problem gambling in the Baseline Targeted Survey in the Plainville region in 2014 to the Follow-Up Targeted Population Survey in 2017; (b) the prevalence rate of problem gambling in the Springfield region subsample of the Baseline General Population Survey in 2013/2014 to the Baseline Targeted Population Survey in the Springfield region in 2015; (c) in the incidence of problem gambling in Wave 3 of MAGIC in 2016 relative to Wave 2 in 2015; and (d) any secondary data sources pertaining to problem gambling (i.e., Department of Public Health admissions data, Massachusetts Council on Compulsive Gambling helpline calls, Gamblers Anonymous chapters).

If the triangulating data supports the present findings, then this represents a novel and important result that has profound implications for the SEIGMA project, as it indicates that some (or a large) portion of the anticipated increase in problem gambling prevalence assessed after all casinos have been opened may not be attributable to an increased availability of gambling. If disconfirmed, it suggests that not all potential biasing factors have been accounted for.

In addition, we plan to carry out a variety of deeper analyses of the data from Wave 1 and Wave 2 of the cohort study. For example, we believe it would be useful to examine whether there are differences in problem gambling incidence and problem gambling stability and transitions by gender. We are also interested in examining whether involvement with specific types of gambling in Wave 1 is predictive of problem gambling status in Wave 2. Additionally, we plan to investigate predictors of change in PPGM status between Wave 1 and Wave 2, with a specific focus on predictors of problem gambling onset as well as predictors of problem gambling remission (and the role of treatment in this).

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Appendix A1: NORC Methodology Report

Appendix A1 describes in detail how the survey was fielded. This includes information about ethical and peer review, development and final content of the questionnaire, how the appropriate sample size was calculated, and how the survey was designed and conducted to obtain a representative sample of the adult Massachusetts population. This section includes discussion of several obstacles encountered and addressed during data collection and concludes with a description of our data preparation procedures, including cleaning and weighting.

Section 1. Introduction and Background

1.1 Background

In November 2011, the state of Massachusetts passed new legislation permitting the introduction of casinos and slots parlors in Massachusetts for the first time (Chapter 194 of the Acts of 2011). As part of this legislation, the Massachusetts Gaming Commission (MGC) was created, assigned with the task of developing and conducting a research agenda that seeks to understand the social and economic impacts of gambling within the state. As part of this agenda, the University of Massachusetts Amherst (UMass Amherst) and NORC at the University of Chicago (NORC) conducted the Social and Economic Impacts of Gambling in Massachusetts (SEIGMA) study and its counterpart, the Massachusetts Gambling Impact Cohort (MAGIC) study.

SEIGMA (Wave 1)

Data collection for the baseline study, SEIGMA, was conducted from September 2013 through May 2014. SEIGMA provided a unique opportunity to collect pre-casino baseline data on the status of resident health, participation in recreational activities including gambling, attitudes pertaining to the introduction of gambling within the state, and issues associated with problem gambling. Participants were selected by means of address-based sampling (ABS), a method that ensured that each Massachusetts household had an equal probability of selection into the sample, independent of their telephone status (i.e. landline, cell, or no telephone) (Iannacchione, 2011; Linke et al., 2008). To achieve a random sample, the study targeted an adult in the household (18 year of age or older) who had the most recent birthday. Conducted in both English and Spanish, the survey was offered in three modes – web, mail, and telephone. Approximately 10,000 Massachusetts residents participated in the baseline study, which, moving forward, we refer to as Wave 1.

MAGIC (Wave 2)

In October 2013, the MGC recommended the addition of a longitudinal component to the research agenda to expand upon the research from the baseline survey. As a result, MAGIC was developed as the longitudinal component that would provide information on the etiology of gambling over time. The MAGIC study aims to collect data from a cohort of individuals within Massachusetts; Wave 2 started with a subset of participants who previously participated in Wave 1 (n=4,860). Similar to Wave 1, Wave 2 of the study was offered in three modes (web, mail, and telephone); however, interviews were conducted only in English for Wave 2. Those who completed the second wave of data collection formed the cohort for future rounds of data collection. This methodology report details the core design and procedures of Wave 2, including an overview of data collection, data cleaning procedures, and any obstacles encountered.

Section 2. Questionnaire

2.1 Overview of the Questionnaire

The primary goal of the SEIGMA study is to understand the social and economic effects of expanded gambling in Massachusetts. The baseline general population survey provided a unique opportunity to collect pre-casino baseline data on the status of residents' health, participation in recreational activities including gambling, attitudes pertaining to the introduction of gambling in the state, and issues associated with problem gambling. To achieve a random sample, the survey targeted an adult in the household (18 years or older) who had the most recent birthday. Estimated survey completion time for most respondents was 10 to 15 minutes.

NORC worked alongside the SEIGMA research team to finalize the questionnaire, which included sections on respondent physical and mental health, employment and finances, relationship status, treatment sought for gambling, attitudes toward gambling, and past year gambling behavior. A few sensitive topics were addressed including drug and alcohol use and mental health. If respondents reported experiencing problems with these issues, contact information was provided for treatment providers. The Problem and Pathological Gambling Measure (PPGM) was used as the primary measure of problem gambling.

If respondents completed the survey online or by telephone, *only those who reported gambling in the past year* were directed to this series of questions. Those respondents who reported not gambling within the past year, or who failed to report gambling activity, were skipped past the problem gambling section. Respondents completing the SAQ could have answered the problem gambling questions regardless of whether they reported gambling in the past year. The skip logic involved was too complex to include as respondent instructions within the SAQ. If a respondent did not report gambling in the past year, but provided responses to the series of questions, these responses were removed during the data cleaning process.

2.2 Questionnaire Development

Because the Wave 2 questionnaire used the BGPS questionnaire as a base, little development work was required to update the questionnaire prior to the start of data collection. NORC's Desktop Publishing staff formatted the self-administered questionnaire (SAQ) to include the new internet-related questions on the hardcopy questionnaire.[19] NORC IT staff programmed the new questions into the web and telephone versions of the survey for Wave 2 data collection.

Even though changes were minimal, extensive testing was completed in order to verify that the entire survey functioned as intended in both web and telephone modes. Testing included ensuring that question text, skip logic, case disposition assignment, and callback rules all functioned as expected. NORC utilized Voxco, a commercial online case management system (CMS) that stores data for each case. The CMS was designed to manage mixed-mode surveys without sacrificing data quality. In addition, the system allowed for extensive flexibility in manipulating test data to accommodate various testing scenarios. Following development, the research team conducted mock interviews internally to review the flow and logic of the survey and to gauge completion time.

2.2.1 Questionnaire Content

With the exception of a few new questions, the Wave 2 survey instrument was the same as the BGPS questionnaire. Therefore, the Wave 2 questionnaire reassessed respondent's health status, participation in recreational activities, attitudes pertaining to gambling, and issues associated with problem gambling. Similar to the BGPS, sections included in the questionnaire related to respondent physical and mental health, employment and finances, relationship status, treatment sought for gambling, attitudes toward gambling, and past year gambling behavior. Other sensitive topics were included in the questionnaire, such as questions on drug and alcohol use. As with the BGPS questionnaire, if respondents reported experiencing problems with these issues within the Wave 2 study, contact information was provided for treatment providers.

[19] The two questions related to gambling at the Plainridge Park Casino were available only in Web and CATI. These were added later in the field period to coincide with the opening of the new venue; at that time, it was not feasible to add these questions to the hardcopy questionnaire.

Comorbidities

The questions that started the survey had two purposes. The first was to provide legitimacy to the "health and recreation" description of the survey to eligible respondents. The second purpose was to establish the presence or absence of typically reported comorbidities for problem gambling (e.g., substance use, mental health problems). All respondents were asked general questions about their preferred recreational activities and their physical and mental health status before more specific questions were posed about their use of tobacco, alcohol and illicit drugs. Additional questions in this section inquired about respondents' perception of their physical health, experience of stress, and overall level of happiness.

Gambling Attitudes

All respondents were asked questions about their beliefs about the benefit versus harm of gambling, the morality of gambling, whether gambling should be legal, and their opinion about the availability of gambling opportunities in Massachusetts and in their own communities. Additional questions in this section assessed views about the anticipated impacts of expanded gambling in Massachusetts.

Past-Year Gambling Behavior

All respondents were asked about the frequency of their participation and their expenditure on 11 types of gambling, using questions with optimal wording for obtaining this information (Wood & Williams, 2007). Participation and expenditure were assessed for traditional, large jackpot lottery games, instant lottery tickets, daily lottery games, charitable raffles, sports events, bingo, casino gambling, pari-mutuel wagering on horse races, private wagering, high risk stocks and online gambling.

As mentioned above, several new questions were added to the Wave 2 instrument. These new questions related to the respondent's internet access, past-year participation in illegal forms of gambling in Massachusetts, and whether the respondent ever gambled at the new Plainridge Park Casino, which had recently opened in Plainville, Massachusetts. The new questions are listed below; Appendix B presents the full questionnaire.

- Do you have an internet connection either at home or at work? (Yes/No)
- Overall, how often do you use the internet? (Daily, A few times a week, A few times a month, A few times a year, Not at all)
- Have you gambled at any "underground" casino or slot parlor in Massachusetts in the past 12 months? (Yes/No)
- The Plainridge Park Casino recently opened in Plainville, Massachusetts. Have you gambled at this new casino? If you visited the casino, but did not gamble, please select No. (Yes/No)
- How many times have you gambled at the Plainridge Park Casino?

Gambling Motivation

All respondents who had gambled in the past year were asked one question about their primary motivation for gambling.

Gambling Recreation/Entertainment

All respondents who had gambled in the past year were asked about the importance to them of gambling as a recreational activity and whether gambling had replaced other recreational activities.

Prevention Awareness

All respondents were asked questions to assess their awareness of problem gambling prevention activities in Massachusetts. Prevention activities included media campaigns and programs offered in

schools, workplaces or in the community. Respondents were asked if they had participated in any problem gambling prevention programs and if so, whether any of these programs had led them to alter their gambling behavior.

Gambling Problems (Others)

All respondents were asked questions about people in their own social circle who gambled regularly and whether there was anyone in their social circle who they felt gambled too much. Respondents who indicated that there was such a person were asked about that person's relationship to them and how that person's gambling had affected them.

Gambling Problems (Self)

All respondents who had engaged in one or more of the gambling activities included in the Gambling Behavior section once a month or more often or indicated that gambling was an important recreational activity or had replaced other recreational activities in the past five years were administered two validated problem gambling instruments.

The first nine questions of this section comprise the Problem Gambling Severity Index (PGSI) from the Canadian Problem Gambling Index (CPGI) (Ferris & Wynne, 2001). The PGSI has very good internal consistency (alpha = .89) and good test-retest reliability (r = .78). Criterion validity is established by its correlation (r = .83) with the SOGS and DSM-IV. Construct validity of the PGSI is established by its significant correlations with gambling involvement.

The remaining questions in this section comprise the Problem and Pathological Gambling Measure (PPGM). The PPGM is a relatively new instrument with superior sensitivity, positive predictive power, diagnostic efficiency, and overall classification accuracy compared to the PGSI/CPGI, DSM-IV, and SOGS (Williams & Volberg, 2010, 2014). The PPGM serves as the primary problem gambling measure in both MAGIC and SEIGMA while the PGSI/CPGI provides a direct comparison to other gambling surveys conducted worldwide.

Several branching questions were added to many of the CPGI and PPGM questions if the person answered the "stem" question in the affirmative. These supplemental questions provide an important quantification of the social and economic impacts of gambling in Massachusetts by assessing the number of bankruptcies, health care visits, suicide attempts, incidents of domestic violence, divorces, cases of child welfare involvement, illegal acts, arrests, incarcerations, and lost work/school days attributable to problem gambling.

Demographics

All respondents were asked about gender, age, marital status, number of children in the household, highest level of education, employment status, veteran status, healthcare coverage, household income, household debt, immigrant status, Massachusetts residence status, and race/ ethnicity. All respondents were also asked to provide contact information to allow the SEIGMA research team to reach them in the future and invite them to participate in related studies.

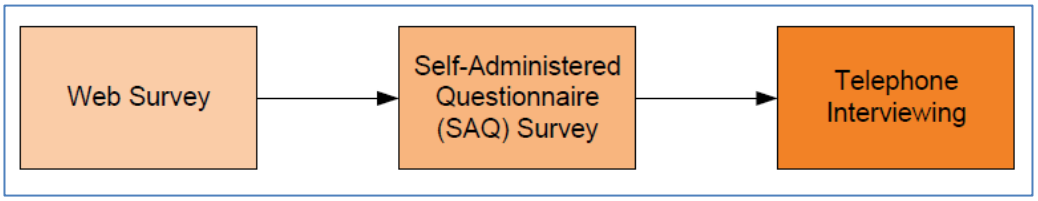
To allow for alignment with other gambling surveys conducted in Massachusetts in the same period, the research team reviewed the wording of items with overlapping content in the 2013 BRFSS and revised some items in the questionnaire to match the questions included in the BRFSS. Items that were aligned with the 2013 BRFSS included questions about tobacco use, alcohol use, mental health problems, suicide ideation and attempts, health problems that require the use of special equipment, and level of education.

Section 3. Survey Design

3.1 Multi-Mode Process

In an effort to increase overall response rates, the survey was offered in three modes – web, mail, and telephone. Participants were introduced to these modes sequentially. Figure 1 below demonstrates the multi-mode approach that was employed for reaching sampled Wave 2 respondents.

Figure 1: Multi-mode Data Collection Approach



3.2 Sample Size and Selection

Based on sampling criteria that UMass Amherst developed, a sample of 4,860 adults were selected from the Wave 1 study for inclusion in Wave 2. The sample was divided into six risk groups based on the respondent's calculated problem gambling status. Table 3.1 below provides a breakdown of the different risk groups, including the target number of completes for each group.

Table 3.1: Sample Breakdown by Risk Groups

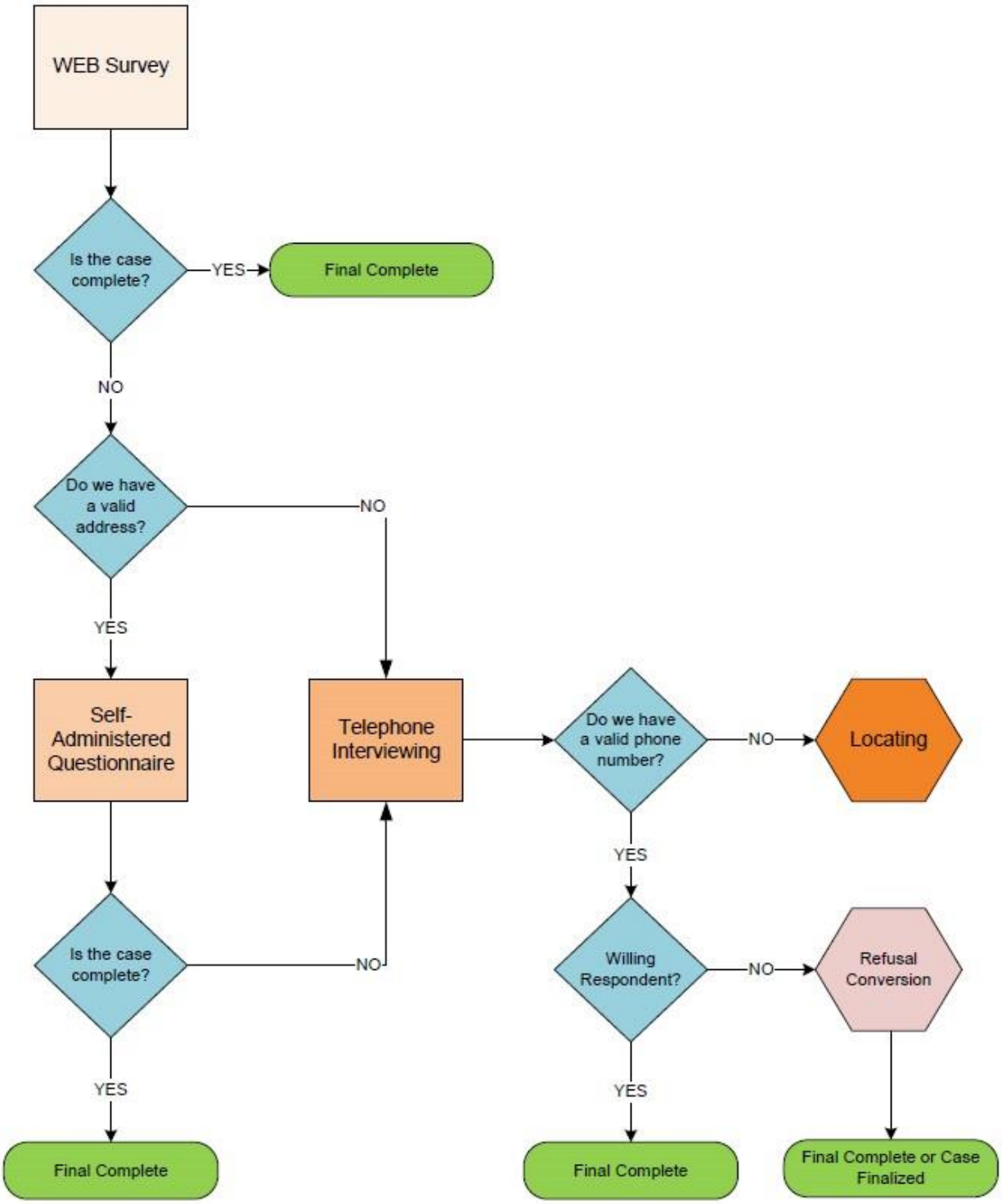
Group	Total Sample Number	Target Number of Completes
Group 1: ***Problem Gambler***	133	73
Group 2: ***At risk of becoming a Problem Gambler***	450	248
Group 3: ***Expends $1,200 or more annually***	1,088	598
Group 4: ***Gambling weekly***	792	531
Group 5: ***Served Sept 2001 or later***	49	27
Group 6: ***Low risk of problem gambling***	2,348	1,291

3.3 Case Flow

Respondents were first invited to participate in the survey online[20]. If respondents did not complete the survey online, they were sent a hardcopy questionnaire with a postage-paid business reply envelope. Respondents who did not reply in the first two modes were contacted by phone. Respondents could also call the study's toll-free line to complete the survey over the phone at any time. If respondents were not reached via either three modes, those cases were sent to locating. Figure 2 below details the case flow lifecycle for Wave 2 sample cases.

[20] The web survey remained open throughout data collection.

Figure 2: MAGIC Case Flow Lifecycle



Section 4. Data Collection

Data collection began in March 2015 with the mailing of the first web invitation packet. Mailings were scheduled approximately two weeks apart to give respondents enough time to receive and complete the questionnaire, so that NORC could remove completed cases from follow-up mailings.

4.1 IRB Review

All data collection efforts were subject to approval by the Institutional Review Boards (IRB) from both UMass Amherst and NORC. NORC received IRB approval on February 17, 2015; UMass Amherst received approval shortly thereafter on February 24, 2015. As part of the IRB submission, NORC requested that the IRB waive the requirement of obtaining informed consent documentation in exchange for including informed consent statements in each survey mode. The informed consent statement read as follows:

"The University of Massachusetts is conducting a longitudinal study about gambling in Massachusetts. This survey is private and confidential. We have a Federal Certificate of Confidentiality that is designed to protect the confidentiality of your research data from a court order or subpoena. We can provide you with more information if you would like. Taking part is up to you. You don't have to answer any question you don't want to, and you can stop at any time. Almost everyone will be able to finish the survey within 15 to 20 minutes."

For web respondents, the informed consent statement was read as part of the screening process, with a hyperlink to the Federal Certificate of Confidentiality printed within the frequently asked questions (FAQs) document. If the respondent clicked 'Next' to move past the informed consent screen, he or she was presumed to be informed of his or her rights as a participant. For mail, the informed consent statement was printed on the inside cover of the hardcopy questionnaire with a printed link to the Federal Certificate of Confidentiality. Respondents returning a booklet with valid response data were considered to have provided consent. Finally, respondents completing by phone were read the informed consent script. Interviewers captured consent by clicking 'Continue' if the respondent did not voice any objections. Respondents were also notified that the calls would be recorded. If the respondent objected, the interviewer would select that the respondent refused to be recorded. NORC submitted all materials (letters, brochures, and questionnaire) to the IRB for review. As data collection progressed, any materials requiring modification or new materials not included in the original submission were sent as an amendment to the IRB for review.

4.2 Advance Letter Mailings

A series of mailings were scheduled to encourage respondent participation, to inform households about the survey and how they were selected, and to provide contact information for NORC and UMass Amherst. Following protocol outlined by Don Dillman and colleagues (2009), NORC utilized the following contacts:

- **Web invitation letter.** Respondents were first mailed a web packet asking them to complete the survey online. Enclosed with this mailing was a web invitation letter, $5 pre-incentive, survey brochure, web insert outlining how to access the web survey, and a list of FAQs. The invitation letter informed respondents of the purpose of the study and provided a web link and PIN to access the survey. The letter also offered a $20 Amazon gift code if the respondent completed the survey online within 14 days.
- **Thank you/reminder postcard.** A reminder postcard was mailed thanking those who had previously completed the survey, while reminding non-responders to complete the survey online.

- **Follow-up web letter.** A second web packet mailing followed the postcard mailing. The letter encouraged respondents to complete the survey online and included the web link and PIN to access the survey.
- **Initial questionnaire mailing.** Those who had not completed the survey via the web were sent a SAQ packet. The SAQ packet included a letter, hardcopy questionnaire, postage-paid business reply envelope (BRE), $5 pre-incentive, and survey brochure. The letter provided instructions for completing the questionnaire online and for returning the hardcopy questionnaire.
- **Thank you/reminder postcard.** A second reminder postcard was mailed thanking those who had previously completed the survey while reminding non-responders to complete the survey.
- **Replacement survey.** The final mailing was a replacement questionnaire to the remaining non-responders with a letter emphasizing the importance of the study.

Prior to each mailing, households that had already completed the survey were removed from the mailing list. Letters were typed on UMass Amherst letterhead with the signature of Dr. Rachel Volberg, Co-Principal Investigator. Each mailing provided the study's toll-free number and email address so that the respondents could contact NORC with questions or requests for assistance. Two versions of each letter were prepared to accommodate those cases were we did not have the respondent's full name. For these cases, the letter was addressed to the "Participant in the Massachusetts Survey of Health and Recreation." Refer to Appendix B for copies of the above-referenced mail materials. The data collection schedule for the mailing component for Wave 2 is outlined in Table 4.1 below.

Table 4.1: Wave 2 Mailing Schedule

Mailing Item	2015										
	3/17	3/24	3/31	4/7	4/14	4/21	4/28	5/5	5/12	5/19	5/26
Web Packet 1											
Web Reminder Postcard											
Web Packet 2											
SAQ Packet 1											
SAQ Reminder Postcard											
SAQ Packet 2											

4.3 Web Survey Procedures

The first web letter outlined the purpose of the survey and requested that the individual who completed the Wave 1 questionnaire participate in Wave 2. The website URL and unique Personal Identification Number (PIN) to access the survey were provided along with a $5 prepaid incentive. The letter also stated that if the survey was completed online within 14 days, the respondent would receive a $20 Amazon gift code. This 14-day early bird incentive was offered with the initial web packet mailing only.

Upon accessing the survey website, a welcome screen asked respondents to enter their assigned PIN. Respondents were then asked a series of screener questions before continuing the survey. If a respondent did not meet the eligibility requirements, he or she was taken to an exit screen. Eligible respondents would progress past the screener into the online instrument. Respondents could skip any question they did not wish to answer. If the web survey was completed within the 14-day window, respondents were asked at the end of the survey if they would like to receive the $20 Amazon.com gift

code. If the respondent answered yes, the next screen displayed the full gift code. Respondents could also elect to have the gift code mailed to them or to reject the gift code altogether.

4.4 Self-Administered Questionnaire (SAQ) or Mailed Survey Procedures

The first SAQ packet was mailed approximately one month after the first web packet mailing. The letter asked respondents to complete the enclosed hardcopy questionnaire and to return it in the postage paid envelope. The letter also provided the URL and PIN for completing the questionnaire online, along with a $5 prepaid incentive. The hardcopy questionnaire outlined instructions for completing the survey and contained the confidentiality statement. The back cover contained instructions for returning the completed questionnaire to NORC, the study's toll-free number to complete the survey over the phone, and the survey link and assigned PIN to complete online. This information was included in each mailing to provide respondents with several options for completing the survey.

The Telephone Survey and Support Operations (TSSO) department at NORC processed returned SAQs. A barcode was printed on each letter and SAQ allowing trained mail clerks to code each returned mailing efficiently. Completed or partially completed SAQs were sent to Data Services, Inc. (DSI) for data entry. NORC provided DSI with a set of data cleaning rules to follow when entering responses. DSI sent electronic data files to NORC each week followed by the returned hardcopy questionnaires. Electronic data files were shared safely using a Secure File Transfer Protocol (SFTP) site.

4.5 Telephone Interviewing Procedures

Dialing began July 15, 2015, approximately five months after the first web packet was mailed. Telephone surveys were conducted and monitored by the TSSO department.

4.5.1 Interview Training

Trained telephone interviewers in the NORC Chicago office conducted interviews. Interviewers were closely monitored for technique and adherence to procedures. In addition to general training in telephone interviewing techniques, interviewers received training in the specific requirements for the study, including screening eligible households and maintaining data integrity and confidentiality.

4.5.2 Conducting the Interview

Interviews were conducted using computer-assisted telephone interviewing (CATI) which minimized potential for interviewer errors by controlling progression through the questionnaire and preventing out-of-range responses. Additionally, the case management system allowed for "blended" inbound dialing, which allowed interviewers to make outbound calls, while also receiving inbound calls to the study's toll-free line.

If the respondent was not available, a callback was scheduled. In the event of respondent refusals, the case was finalized if it was a hostile or second refusal from the household; no other household members were allowed to continue the interview. At the end of each call, the interviewer was directed through a series of universal exit questions to establish the call disposition and set a callback time if necessary.

4.5.3 Refusal Conversion

Each interviewer was given a project-specific job-aid and a list of frequently asked questions (FAQs). The FAQs provided interviewers with example statements for generic refusal aversion and gaining respondent cooperation. If a case was coded as a refusal and scheduled for a callback, an experienced refusal converter was assigned to the case. If a respondent contacted UMass Amherst or the IRB office at NORC at any point during data collection to refuse participation in the study, the case was finalized in the case management system. These cases would no longer receive mailings, or be dialed in CATI. Refusal notes

submitted by respondents via email or mail were documented and analyzed for recurring issues or concerns.

4.6 Web and Telephone Screening

Key to this study, and the overall validity of the data collected, was ensuring that the respondent who completed the Wave 2 questionnaire was the same respondent from Wave 1. In order to confirm that the same respondent was being screened into the Wave 2 survey, respondent demographic information (name, age, and gender) collected during Wave 1 was preloaded into the main screener question. The screener question was programmed to use the available preload information when screening the Wave 2 respondent. Since several respondents from Wave 1 did not provide all of the requested demographic information, the screener question had alternate text that would display based on the level of demographic information available. The Wave 1 interview month and year was also preloaded as a text fill within the screener question text in order to help respondent's recall. Screener question text was also modified to accommodate the mode in which the text was employed (i.e. web or CATI). Below are the versions of the screener questions that were created to confirm that the Wave 2 respondent was also the Wave 1 respondent.

Screener Text 1: For cases that provided full name (first and last name), the following screener question was used:

- ***Web****: Please confirm that you are [NAME], the individual who completed the Massachusetts Survey of Health and Recreation in [INTERVIEW MONTH AND YEAR].*
- ***CATI****: We would like to speak with [NAME]. In [INTERVIEW MONTH AND YEAR], (he/she) participated in a survey on health and recreation in Massachusetts. Is [NAME} available?*

Screener Text 2: Cases that did not provide adequate name information to use as a text fill, but had provided gender and age information in Wave 1, were prompted with the following screener confirmation text:

- ***Web****: Please confirm that you are the [female respondent/male respondent/individual] who previously completed the Massachusetts Survey of Health and Recreation, which was conducted in [INTERVIEW MONTH AND YEAR].* ***[IF AGE AND GENDER WERE NOT MISSING***
- ***THEN ASK:*** *The person who filled out that survey told us [he was/she was/they were] [AGE] years old at the time of the survey.****]***
- ***CATI****: In [INTERVIEW MONTH AND YEAR], we conducted a survey on health and recreation in Massachusetts with [a female respondent/a male respondent/an individual] in your household.*
- ***[IF AGE AND GENDER WERE NOT MISSING THEN ASK:*** *The person we contacted told us [he was/she was/they were] [AGE] years old at the time of the survey.****]*** *We are interested in speaking with them again. Is that person available?*

Screener Text 3: For cases that provided insufficient demographic information, a generic confirmation screener text was prompted at the screener question instead:

- ***Web****: Please confirm that you are the individual who previously completed the Massachusetts*
- *Survey of Health and Recreation, which was conducted in [INTERVIEW MONTH AND YEAR].*
- ***CATI****: In [INTERVIEW MONTH AND YEAR] we conducted a survey on health and recreation in*
- *Massachusetts with an individual in your household. We are interested in speaking with them again. Is that individual available?*

Section 5. Locating

5.1 Identifying Cases for Locating

NORC performed various locating activities on the Wave 2 sample once the cases had cycled through the first three modes of contact (web, mail, and telephone). Five paths were mapped out to help the survey research team identify cases that required further locating activities. The five possible paths were:

- **Path 1:** Cases that did not complete the survey via web or via SAQ and did not provide a phone number during Wave 1 to reach them again.
- **Path 2:** Contact was made using the provided telephone number, but the number no longer reached the respondent.
- **Path 3:** No contact was made using the provided telephone number and the number was determined to be non-working (e.g. disconnected, fast busy, fax/modem, etc.).
- **Path 4:** No contact was made using the provided telephone number after a number of attempts, but the number was working (e.g. ring no answer, busy signals, answering machine, etc.).
- **Path 5:** The research team found that the wrong respondent had completed the Wave 2 survey, or the Wave 2 respondent required validation (see Section 7.3 for more information on the validation process).

5.2 Locating Protocol

For Wave 2, NORC used an Access-based locating case management system to manage and track the progress of all cases that were identified as requiring locating. The locating system allowed locators to view, add, and update respondent and lead information for each case sent to locating. Locators followed a specific locating protocol for all cases that were identified for locating. This protocol required the locator to:

1. Call and determine the outcome for any existing telephone number(s) for the respondent or any telephone numbers for contacts provided by the respondent during Wave 1;
2. Perform extensive internet searches using various internet sites; and
3. Conduct searches using a third party locating vendor called Accurint®.

Each of these steps, referred to as "tiers", is described in more detail below. All activities related to locating were reviewed and approved by NORC's and UMass Amherst's IRBs.

5.2.1 Tier 1: Alternate Telephone Number Dialing

The first step taken by locators was to dial any alternate telephone numbers associated with the case, if they existed. These phone numbers included the respondent's telephone number (unless it had already been proved a dead end in CATI), and any alternate telephone numbers provided in Wave 1. Locators also followed up with the three contacts provided by the respondent in Wave 1 to find alternate telephone numbers for the respondent[21]. When the locators successfully identified the respondent, the case was opened in the telephone survey instrument and the case completed. If a respondent could not be located via any of the contact numbers provided, then the case was sent to Tier 2 for further locating steps.

[21] In Wave 1, respondents were asked to provide the name, telephone number, and email address for up to three people who would know how to locate the respondent for future surveys.

5.2.2 Tier 2: Internet Searches/Reverse Telephone Number Searches

After any alternate telephone numbers were exhausted, or numbers for any contacts were tried, the case was moved to Tier 2, which involved internet searches for contact leads. For this study, leads are considered any contact information that may be for, or lead to, the respondent. A lead can be an actual contact person associated with the respondent, or any new contact information related to the respondent (i.e. new telephone number, address, or email). For this tier's activities, extensive internet searches were performed to generate leads, which were used to try to find the respondent. Internet sites used during this activity included Google, White Pages, and LinkedIn. In each of these sites, locators specified search criteria ranging from very specific to very general information until valid leads were found. As leads were generated, locators would call to determine a lead's status before moving on to the next search type.

While dialing leads, locators introduce themselves, using a variant of this introduction: ***"Hello, my name is _____and I am calling from NORC at the University of Chicago. May I please speak with [LEAD]?"*** After the introduction, locators followed a process that guided them through the different scenarios encountered during locating. Common scenarios encountered are described below.

- If the respondent was confirmed and available, the locator immediately updated the telephone survey instrument with the located telephone number and attempted to complete the interview in the CATI system.
- Appointments were scheduled in the CATI system to callback households that were confirmed to be the correct household, but the respondent was unavailable to complete the interview at the time of the call.
- If the respondent did not live in the household, but the informant knew him or her, locators probed to obtain new address and telephone information.
- If the informant refused to provide new information, the locator left the project's toll-free number and asked that it be passed along to the respondent.

5.2.3 Tier 3: Individual Accurint Searches

If a respondent was not located through the free internet search sites, the case was then moved into Tier 3. Specially trained locators used Accurint® to search for, and locate, new information for the respondent. These locators could search for new contact information using a combination of respondent name with address, phone number, gender, or age. Locators were instructed to enter any information they received from the search results for follow-up. For each case, Accurint® may provide one or more of the following pieces of information:

- New phone number for the respondent;
- New address for a given phone number or person;
- Any names associated with a phone number or address (and when they were associated).

5.3 Supervisor Review

Throughout the locating process, trained supervisors reviewed pending cases for completeness in following search protocols. If all required searches were not completed and the case was identified as unlocatable, the case was sent for further locating activities with instructions from the supervisor. If all protocols were followed and no further leads were identified, indicating that the Wave 2 respondent could not be found, the case was finalized as unlocatable. Only a supervisor had permission to disposition a case in this manner.

Section 6. Data Preparation

6.1 Sample Disposition and Response Rate

NORC prepared weekly production reports throughout data collection, utilizing the standard AAPOR Response Rate 3 calculation. NORC also calculated the resolution rate, screener completion rate, and interview completion rate. At the end of data collection, each case was assigned a final disposition code, which identified the ending status of the case. Table 6.1 lists the available disposition codes and corresponding descriptions.

Table 6.1: Wave 2 Disposition Codes

Disposition Code	Description
U1	**Confirmed household, unconfirmed address (only for CATI)**
U2	**Assumed household/No contact**
U0	**Confirmed address, known household, unscreened**
NR	**Non-residential**
MM	**Mail received**
ER	**Eligible household, no member completes (only partial complete)**
C	**Complete**

6.2 Data Editing and Cleaning

A series of data editing and cleaning procedures were implemented in order to provide UMass Amherst with the most accurate and comprehensive data files. Throughout data collection, SAS programs were run to identify any errors that occurred in the Web or CATI systems. This allowed NORC to reconcile inconsistencies in the data and fix system or questionnaire errors as they occurred, minimizing additional data cleaning that would be required at the end of data collection.

NORC worked alongside UMass Amherst to establish a series of data cleaning steps in order to ensure that the data files for delivery met the expected standards and criteria set out by UMass Amherst. Interview data from all data collection modes were combined into a single analytic file, which included a variable to indicate the mode of data collection used to complete each interview.

6.3 Coding of Verbatim Answers into Question Responses

Several questions throughout the survey offered an "Other" response category that, if selected, would direct the respondent to an open-end follow-up question to specify his or her answers. At the end of the data collection period, the verbatim responses for most open-end questions were reviewed by NORC and back-coded into existing response categories where appropriate. Both the original verbatim and the original response to the root question were maintained in the raw variables. Back-coded variables, which contained the original response as well as any back-coding that took place, were identified in the interview file by "_CODE" at the end of the variable name. Back-coding occurred for a number of variables, shown in Table 6.2 below.

Table 6.2: Wave 2 Variables Requiring Back-Coding

Question	Root Variable	Verbatim Variable	Question Type
Which of the following is your preferred recreational activity?	C1	C1A	Select only one
Which specific activities have you had problems with?	C10B	C10C	Check all that apply
Which types of gambling do you believe should be illegal?	GA3B	GA3C	Check all that apply
What do you believe will the single most positive impact for Massachusetts?	GA6A	GA6A1	Select only one
What do you believe will be the single most negative impact for Massachusetts?	GA6B	GA6C	Select only one
Which state do you most often go to for this gambling?	GY8D	GY8D1	Select only one
Which specific casino, racino, or slots parlor do you most often go to?	GY8E	GY8F	Select only one
Where do you most often go to bet on horse racing?	GY9C	GY9D	Select only one
What is the main type of online gambling you engage in?	GY12C	GY13	Select only one
What would you say is the main reason that you gamble?	GM1	GM2	Select only one
What is this person's relationship to you?	GPO3	GPO3A	Select only one
In what ways has this person's gambling affected you during the last 12 months?	GPO4	GPO4A	Check all that apply
Which types of gambling have contributed to your problems?	GP22	GP22A	Check all that apply
Where did you seek help from?	GP23C	GP23C1	Check all that apply
What type of healthcare coverage do you have?	**D8**	**D8A**	Select only one

6.4 Derived Variables

Several derived variables were created for the final dataset in order to provide additional descriptive information for each household. For example, derived variables were created to indicate if a respondent was active in each mode – web, mail, and phone. SAS programs were written utilizing data from existing variables to create the derived variables.

Section 7. Strengths and Limitations of the Study

7.1 Strengths

One of the primary strengths to MAGIC is that as a longitudinal study, it allows NORC and UMass Amherst to follow a cohort of individuals at regular intervals over a period of five to ten years in order to determine the incidence of problem gambling in Massachusetts. Wave 1 offered a robust and unique contribution to the existing literature in that it was the first problem gambling survey to collect data in a state prior to the introduction of casino gambling. Wave 2 was an extension of that contribution, which will allow researchers and policymakers to gain access to etiological information about how gambling problems develop and progress over time. The MAGIC study overall will allow researchers to understand what individual, social, and environmental variables (e.g., casino proximity, public attitudes, gambling advertising, media coverage) are most predictive of, and mediate the development of, future gambling and problem gambling. This in turn will provide a comprehensive understanding of the types of risks and protective factors that would help adapt and develop effective prevention, treatment, and recovery support services to the population.

Also of importance is the final response rate from Wave 2, as those who completed this wave formed the cohort for the future waves. The initial target response rate was 2,768 completes, or 57.0% of the overall sample. At the end of Wave 2, 3,139 individuals in the initial sample completed the survey. This higher than anticipated response not only provided additional data for analysis in Wave 2, but also helped establish a larger cohort of respondents moving forward in future waves of data collection.

The multi-mode data collection strategy offered was also a strength for Wave 2. Offering the survey in three modes (web, mail, and telephone) increased opportunity for response and allowed for a more expansive demographic to be included. For example, respondents without access to a computer or the internet were able to complete by hardcopy or phone.

Further, data validity was improved this round through the implementation of a screener question confirmation text as well as utilizing locators to find new respondent contact information. By confirming that the same respondent completed the Wave 1 and Wave 2 surveys, further support was established for the overall validity of data collected across waves.

7.2 Limitations

A primary concern for MAGIC is maintaining high retention rates amongst the study cohort participants. In order to ensure that the research maintains both internal and external validity, retention of survey participants in the longitudinal study is of primary importance. Research has shown that males, young people, ethnic minorities, substance users, and individuals with mental health problems are generally more prone to have higher attrition (Claus et al., 2002; de Graaf et al., 2000; Eaton et al., 1992; Morrison et al., 1997). Many of these characteristics are typical amongst problem gamblers, which makes retention rates a particular challenge for studies such as MAGIC. By employing the right research methods, the UMass Amherst and NORC team has developed a methodological framework that borrows from past

research (such as the Quinte Longitudinal Study) as well as past experiences on longitudinal studies that NORC has become proficient at employing (see NORC's National Longitudinal Surveys of Youth) in order to mitigate challenges associated with retention.

7.3 Obstacles Encountered and Solutions Implemented

Since the goal of the MAGIC study is to follow a cohort of individuals that completed during the first wave of the study over the next five to ten years, it is critical to identify and confirm that the same respondents are participating in the study within each wave. During the course of data collection for Wave 2 of MAGIC, a number of respondents provided demographic information, such as name, gender, and/or year of birth, which conflicted with the data they had provided in Wave 1. While NORC was able to resolve some discrepancies through locating, there were discrepancies that could not have been attributed to a simple typo or a name update after a life event.

In order to ensure that the same respondents were participating in both surveys, the NORC research team followed up with these respondents to confirm that the same respondent participated in both waves of data collection. The NORC research team developed a validation protocol and trained a NORC phone interviewer to administer the protocol to the cases that were flagged for validation. NORC used the following protocol to validate respondents in the Wave 2:

- The telephone interviewer was given a validation form to complete for all cases with discrepancies (see Appendix C for Validation Questionnaire). The form included pre-written scripts, with basic respondent information merged into the text. The validation questions were structured in such a way that the interviewer would verify that the same respondent completed both Wave 1 and Wave 2.
- If the individual on the phone verified that he or she completed the Wave 1 and Wave 2 studies, the telephone interviewer confirmed the correct demographic information with the respondent. Confirming this information will allow NORC to preload the correct demographic information in future waves of data collection.
- If the individual on the phone verified that he or she completed Wave 1, but did not complete Wave 2, the telephone interviewer would then administer the Wave 2 questionnaire. In these cases, NORC removed the data originally collected under that respondent's specific case ID, replacing it with the new data collected after validation.
- If it was determined that the wrong respondent completed Wave 2, and the correct respondent requested compensation, NORC sent the correct individual a $20 Amazon gift code. This same incentive amount was provided during the early bird period for Wave 2.

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Appendix A2: AAPOR Response Rates

Appendix A2 provides the final disposition report submitted by NORC to the SEIGMA research team with enough information to allow technical readers to calculate alternate response rates for the survey.

Table A1 below presents a summary of AAPOR response rate categories, descriptions, and counts following AAPOR standards. Table A2 presents the response rates for the MAGIC Wave 2 alone using AAPOR-recommended calculations. Table A3 presents the cumulative AAPOR standard rates for the first two waves. The AAPOR response rates document for SEIGMA base line survey is "AAPOR_CASRO_Rates.docx". The AAPOR standard reference is "http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions2015_8theditionwithchanges_April2015_logo.pdf".

Table A1. Counts by AAPOR Disposition Category

AAPOR Category	Description	AAPOR Dispositions Included *	MAGIC Count 2	SEIGMA Count 1	Note
I	Complete interview	1.1	3,139 (1,466 from Low risk group, and 1,673 from Other risk groups)	9,581	
P	Partial interview	1.2	16 (9 from Low risk group, and 7 from Other risk groups)	261	
R	Eligible household, refusal or break-off	2.1	0	0	MAGIC considered all identified eligible households to be "Partial interview".
NC	Eligible household, non-contact	2.2	1,665	0	MAGIC considered all unidentified households to be eligible non-contact.
O	Eligible household, other	2.3	0	0	MAGIC considered all unidentified households to be eligible non-contact.
UH	Unknown if household/occupied HU	3.1	0	19,647	MAGIC considered all unidentified households to be eligible non-contact.
UO	Household, eligibility undetermined	3.2	0	923	MAGIC considered all unidentified households to be eligible non-contact.
e	Estimated proportion of cases of unknown eligibility that is eligible.		100%	79.4%	Assume that all the sample selected from SEIGMA baseline survey is eligible
J**	Ineligible household	4.7		10	
NR**	Non-residential or otherwise out of scope	4.50, 4.60	40 (26 from Low risk group, and 14 from Other risk groups)	2,946	

* Dispositions included in each AAPOR category taken from p. 40 of 2011 AAPOR Standard Definitions report. These dispositions are defined in Table 2 of that report.

** AAPOR does not include these categories on p. 40 of the 2011 AAPOR Standard Definitions report, but we include them here so as to have a complete accounting of all released cases. These are cases that are ineligible, either because they are not residential housing units or because there were no eligible members in the household.

Table A2. MAGIC AAPOR Response Rates, Second Wave alone

Response Rates	Formula	%
RR1	$\frac{I_2}{(I_2+P_2)+(R_2+NC_2+O_2)+(UH_2+UO_2)}$	65.1
RR2	$\frac{(I_2+P_2)}{(I_2+P_2)+(R_2+NC_2+O_2)+(UH_2+UO_2)}$	65.5
RR3**	$\frac{I_2}{(I_2+P_2)+(R_2+NC_2+O_2)+e_2(UH_2+UO_2)}$	65.1
RR4**	$\frac{(I_2+P_2)}{(I_2+P_2)+(R_2+NC_2+O_2)+e_2(UH_2+UO_2)}$	65.5
RR5**	$\frac{I_2}{(I_2+P_2)+(R_2+NC_2+O_2)}$	65.1
RR6**	$\frac{(I_2+P_2)}{(I_2+P_2)+(R_2+NC_2+O_2)}$	65.5

**MAGIC targeted individuals are completed interviews from SEIGMA baseline survey. From RR3 to RR6, we assume that everyone is eligible. Thus, RR3 and RR5 is the same as RR1; RR4 and RR6 is the same as RR2.

Table A3. MAGIC Cumulative AAPOR Response Rates, Cumulative Rates of Two Waves

Response Rates	Formula*	%
RR1	$\frac{I_2\ of\ Low\ risk\ group \times 3 + I_2\ of\ Other\ risk\ groups}{(I_1+P_1)+(R_1+NC_1+O_1)+(UH_1+UO_1)-NR_2\ of\ Other\ risk\ groups - NR_2\ of\ Low\ risk\ group \times 3}$	20.0
RR2	$\frac{(I_2+P_2)\ of\ Low\ risk\ group \times 3 + (I_2+P_2)\ of\ Other\ risk\ groups}{(I_1+P_1)+(R_1+NC_1+O_1)+(UH_1+UO_1)-NR_2\ of\ Other\ risk\ groups - NR_2\ of\ Low\ risk\ group \times 3}$	20.1
RR3	$\frac{I_2\ of\ Low\ risk\ group \times 3 + I_2\ of\ Other\ risk\ groups}{(I_1+P_1)+(R_1+NC_1+O_1)+e_1(UH_1+UO_1)-NR_2\ of\ Other\ risk\ groups - NR_2\ of\ Low\ risk\ group \times 3}$	23.3
RR4	$\frac{(I_2+P_2)\ of\ Low\ risk\ group \times 3 + (I_2+P_2)\ of\ Other\ risk\ groups}{(I_1+P_1)+(R_1+NC_1+O_1)+e_1(UH_1+UO_1)-NR_2\ of\ Other\ risk\ groups - NR_2\ of\ Low\ risk\ group \times 3}$	23.4
RR5**	$\frac{I_2\ of\ Low\ risk\ group \times 3 + I_2\ of\ Other\ risk\ groups}{(I_1+P_1)+(R_1+NC_1+O_1)-NR_2\ of\ Other\ risk\ groups - NR_2\ of\ Low\ risk\ group \times 3}$	62.3
RR6**	$\frac{(I_2+P_2)\ of\ Low\ risk\ group \times 3 + (I_2+P_2)\ of\ Other\ risk\ groups}{(I_1+P_1)+(R_1+NC_1+O_1)-NR_2\ of\ Other\ risk\ groups - NR_2\ of\ Low\ risk\ group \times 3}$	62.6

*The denominators are counts of SEIGMA baseline cases minus the number of non-residential cases determined in MAGIC. Since we randomly sampled one third of the SIGMA respondents in the "Low risk" group for MAGIC, we weight any MAGIC respondents, partial completes, and NRs from the "Low risk" group by three.
**SEIGMA targeted households with adult age 18 and above. RR5 and RR6 assume that everyone not screened and not identified is ineligible, which is not a realistic assumption. Thus, it is not appropriate to use RR5 and RR6.

Appendix A3: Weighting Procedures

Appendix A3 describes the procedures used in weighting the MAGIC Wave 2 sample for analysis.

Summary of Weighting for the MAGIC Longitudinal Study

Prepared by Edward J. Stanek III

Introduction

The Massachusetts Gambling Impacts Cohort (MAGIC) study is a longitudinal study of adults aged 18 and over who were selected using a probability sample of respondents to the Baseline General Population Survey (BGPS). For this reason, the weights for the second wave of the MAGIC survey (MW2S) and BGPS weights are closely connected.

An initial weighting plan was developed and reviewed by the Research Review Committee (RDASC) (document m16ed01v2.docx). The initial plan adjusted for non-response rates using variables provided by NORC from the BGPS corresponding to (own/rent or other; *OWN_D9*), presence of children (Yes, No; *CHILDREN_D5*), and educational achievement (HS or less, some post-high school education including college graduate, some post-graduate education; *EDUCATION_D6*). The plan was revised based on the RDASC review to include an additional variable, attitude toward gambling. This variable corresponded to response from the BGPS concerning the respondent's belief concerning the benefit/harm of gambling to society (*GA5*).

Subsequently, additional investigation by the UMASS investigators revealed that a variable for frequency of gambling (*ANYGAMEF1*) was a stronger predictor of MW2S response rates than the variable *GA5* (see mag17ed08.docx). This variable, dichotomized to yes/no for gambled in the past year, was used with the variables *OWN_D9*, *CHILDREN_D5*, and *EDUCATION_D6* to adjust weights for differential non-response.

The initial weighting for the second wave of the MAGIC study was conducted in 2016 using variables from the BGPS provided by NORC. These variables differed slightly from variables in the final cleaned data set. The survey weights for MW2S respondents are based on weights for respondents from the BGPS. Beginning with the weight from the BGPS, there are four additional steps:

Step 0. Identify weight from the BGPS for sample address with respondents

Step 1. Adjust for MW2S sampling weight

Step 2. Adjust for response rates to the MW2S

Step 3. Adjust for household size

Step 4. Adjust for MA population via raking

A detailed description of the development of survey weights for the MW2S sample follows.

Step 0. Initial Weight from the BGPS (*MWT0*)

The BGPS was a stratified, multi-mode address-based (ABS) probability sample survey with MA addresses serving as the primary sampling frame. One individual per household aged 18+ years with the closest birthdate to the first contact date was invited to participate in the survey. Surveys were completed between 3/20/2015 and 10/13/2015. Weights were developed for respondents in the BGPS that accounted for the following:

1. Baseline stratified sampling weight (Baseline Design weight: *WT1*);

2. Adjustment for unknown eligibility (Eligibility weight: *WT2*);
3. Adjustment for completion of the questionnaire (Completion weight : *WT3*);
4. Accounting for number of persons 18+ in the household (with the number of 18+ household members truncated to a maximum of 4) (Household Size weight: *WT4*);
5. Raked to MA population based on the variables region, age, gender, age, race/ethnicity, education. (Raking weight: *WT5*);
6. Trim the weights by setting the minimum weight to be the average weight over 8, and the maximum weight to be average weight times 8 (Trimmed Raking Weight: *WT6*).

The initial weight for MW2S respondents is *WT3* from the BGPS. This weight was constructed via inverse probability sampling weights that accounted for the BGPS design (*WT1*), adjustment for unknown eligibility (based on the frame variables for region, language, and address type) (*WT2*), and adjustment for completion rates (based on the variables for region, language, and last mode of contact (Web, SAQ, CATI) (*WT3*). More details on the development of weights for the BGPS are given in G16ed15v4.docx.

The MW2S was based on the 9,578 addresses where a complete response was obtained from an eligible adult in the BGPS. This is the address frame for the MW2S. Associated with each address is a weight, *WT3*, from the BGPS that accounts for the BGPS survey design, address screening rates, and survey completion rates. The total of these weights is 2,714,193.45. We refer to this weight as *MWT0* in the MW2S.

Step 1. Base sampling weight (*MWT1*)

The MAGIC sample was selected by the SEIGMA team at UMASS, with data collection completed by NORC. The MW2S sample was selected from completed respondents of the 2014 BGPS who were stratified into six risk groups, $k = 1,...,6$. The base sampling (MWT1) weight is formed by multiplying the weight MWT0 from the BGPS by the inverse of the probability of selection π_k for each of six strata (See Table 1). The probability of selection of the i^{th} address from each of the first five risk groups is $\pi_k = 1$ for $k = 1,...,5$. The probability of selection of the low risk group is $\pi_6 = \frac{2348}{7066}$. The base weight assigned to address i in risk group k is defined by

$$W_{1,ik}^{*} = \left(\frac{1}{\pi_k}\right) W_{0,ik} .$$

The total of the weights $W_{1,ik}^{*}$ for the 4,860 MAGIC sample subjects is 2,721,061.67. We multiply $W_{1,ik}^{*}$ by 2,714,193.45/2,721,061.67 to preserve the total weight, such that

$$W_{1,ik} = \left(\frac{2,714,193.45}{2,721,061.67}\right) W_{1,ik}^{*} .$$

Table 1. Numerator and Denominator Values by Strata.

Risk Groups (k)	Total SEIGMA Completed Interviews (Numerator)	Sampled MAGIC Cases (Denominator)	π_k
1. Problem Gambler	133	133	1.00
2. At Risk of PG	450	450	1.00
3. Expend $1,200 or More Annually	1,088	1,088	1.00
4. Gamble Weekly	792	792	1.00
5. Served Sept 2001 or Later	49	49	1.00
6. Low Risk	7,066	2,348	0.3335*
Total	9,578	4,860	

*The exact value of $\pi_6 = \frac{2348}{7066}$ is used.

Table 2 summarizes the number of MW2S sample addresses by risk status.

Table 2. Number of sample addresses in MAGIC Sample by Risk Class

Massachusetts Region: REGION	Language (Pooled): LANGSP2	Mode of Resp: MODE_ATTEMPT	Type of Address: ADDTYP	PG	At Risk	$1200 per y	Gamb Weekly	Vet 2001+	Low Risk
1=West	0=Non-Span	Web	1=SFDU-SFam	7	19	49	71	7	147
1=West	0=Non-Span	Web	2=MFDU-MFam	3	4	11	7	1	51
1=West	0=Non-Span	Web	9=PO Box	.	2	2	.	.	3
1=West	0=Non-Span	SAQ	1=SFDU-SFam	15	55	183	108	6	253
1=West	0=Non-Span	SAQ	2=MFDU-MFam	8	11	21	25	1	65
1=West	0=Non-Span	SAQ	9=PO Box	1	.	3	3	.	7
1=West	0=Non-Span	CATI	1=SFDU-SFam	.	6	14	19	1	36
1=West	0=Non-Span	CATI	2=MFDU-MFam	.	1	2	1	1	12
1=West	0=Non-Span	CATI	9=PO Box	.	.	.	.	1	
1=West	1=Spanish	Web	1=SFDU-SFam	1	3	2	4	.	8
1=West	1=Spanish	Web	2=MFDU-MFam	2	3	3	4	.	8
1=West	1=Spanish	SAQ	1=SFDU-SFam	1	11	15	10	5	38
1=West	1=Spanish	SAQ	2=MFDU-MFam	1	8	9	12	.	27
1=West	1=Spanish	CATI	1=SFDU-SFam	.	1	3	2	.	2
1=West	1=Spanish	CATI	2=MFDU-MFam	.	2	.	1	.	.
2=East	0=Non-Span	Web	1=SFDU-SFam	10	65	121	116	8	362
2=East	0=Non-Span	Web	2=MFDU-MFam	6	29	39	26	5	140
2=East	0=Non-Span	SAQ	1=SFDU-SFam	34	118	353	201	7	625

```
   2=East      0=Non-Span      SAQ       2=MFDU-MFam      21      44     113      80       4
242
   2=East      0=Non-Span      CATI      1=SFDU-SFam       4      14      56      39       2
113
   2=East      0=Non-Span      CATI      2=MFDU-MFam       3       8      17      14       1
47
   2=East      2=Any Lang      Web       9=PO Box          . . 1       1       . 2
   2=East      2=Any Lang      SAQ       9=PO Box          1       1       7       5       . 12
   2=East      1=Spanish       Web       1=SFDU-SFam       1       6       4       3       . 17
   2=East      1=Spanish       Web       2=MFDU-MFam       2       6       2       4       . 19
   2=East      1=Spanish       SAQ       1=SFDU-SFam       2       8      24      15       . 42
   2=East      1=Spanish       SAQ       2=MFDU-MFam       8      14      24      11       . 52
   2=East      1=Spanish       CATI      1=SFDU-SFam       . 3       4       3       . 9
   2=East      1=Spanish       CATI      2=MFDU-MFam       2       7       6       7       . 8
   2=East      2=Any Lang      Web       9=PO Box          . 1       . . . .
                                                        ======  ======  ======  ======  ======
======
                                                          133     450    1088     792      49
2348
Source: GMed17p026.sas on 11/7/2017 by ejs
```

The weights adjusted for the MAGIC sample design given by *MWT1* for these sample addresses are given in Table 3.

Table 3. Average Weight for Sample (*MWT1*) by Risk Class and Address Characteristics for MAGIC Sampl

```
              Language    Mode of      Type of
  Region of   (Pooled):     Resp:     Address:              At  $1200  Gamb     Vet     Low
Massachusetts LANGSP2   MODE_ATTEMPT   ADDTYP        PG  Risk   per y Weekly  2001+    Risk

   1=West     0=Non-Span     Web      1=SFDU-SFam 104.34 104.34 104.34 104.34 104.34  314.00
   1=West     0=Non-Span     Web      2=MFDU-MFam 128.94 128.94 128.94 128.94 128.94  388.04
   1=West     0=Non-Span     Web      9=PO Box       . 146.78 146.78    . . 441.70
   1=West     0=Non-Span     SAQ      1=SFDU-SFam 106.79 106.79 106.79 106.79 106.79  321.36
   1=West     0=Non-Span     SAQ      2=MFDU-MFam 131.97 131.97 131.97 131.97 131.97  397.14
   1=West     0=Non-Span     SAQ      9=PO Box    150.22    . 150.22 150.22    . 452.07
   1=West     0=Non-Span     CATI     1=SFDU-SFam    . 114.28 114.28 114.28 114.28  343.90
   1=West     0=Non-Span     CATI     2=MFDU-MFam    . 141.22 141.22 141.22 141.22  424.99
   1=West     0=Non-Span     CATI     9=PO Box       . . . . . 483.77
   1=West     1=Spanish      Web      1=SFDU-SFam 173.88 173.88 173.88 173.88    . 523.27
   1=West     1=Spanish      Web      2=MFDU-MFam 207.16 207.16 207.16 207.16    . 623.41
   1=West     1=Spanish      SAQ      1=SFDU-SFam 179.98 179.98 179.98 179.98 179.98  541.63
   1=West     1=Spanish      SAQ      2=MFDU-MFam 214.43 214.43 214.43 214.43    . 645.29
   1=West     1=Spanish      CATI     1=SFDU-SFam    . 209.86 209.86 209.86    . 631.53
   1=West     1=Spanish      CATI     2=MFDU-MFam    . 250.02    . 250.02    . .
   2=East     0=Non-Span     Web      1=SFDU-SFam 289.98 289.98 289.98 289.98 289.98  872.66
   2=East     0=Non-Span     Web      2=MFDU-MFam 407.62 407.62 407.62 407.62 407.62 1226.68
   2=East     0=Non-Span     SAQ      1=SFDU-SFam 296.68 296.68 296.68 296.68 296.68  892.82
   2=East     0=Non-Span     SAQ      2=MFDU-MFam 417.10 417.10 417.10 417.10 417.10 1255.20
   2=East     0=Non-Span     CATI     1=SFDU-SFam 321.37 321.37 321.37 321.37 321.37  967.13
   2=East     0=Non-Span     CATI     2=MFDU-MFam 407.62 407.62 407.62 407.62 407.62 1226.68
   2=East     2=Any Lang     Web      9=PO Box       . . 549.40 549.40    . 1653.35
   2=East     2=Any Lang     SAQ      9=PO Box    562.18 562.18 562.18 562.18    . 1691.80
   2=East     1=Spanish      Web      1=SFDU-SFam 428.66 428.66 428.66 428.66    . 1290.00
   2=East     1=Spanish      Web      2=MFDU-MFam 557.83 557.83 557.83 557.83    . 1678.70
   2=East     1=Spanish      SAQ      1=SFDU-SFam 444.71 444.71 444.71 444.71    . 1338.29
```

```
   2=East     1=Spanish      SAQ      2=MFDU-MFam 557.83 557.83 557.83 557.83    . 1678.70
   2=East     1=Spanish      CATI     1=SFDU-SFam    . 523.30 523.30 523.30    . 1574.81
   2=East     1=Spanish      CATI     2=MFDU-MFam 680.98 680.98 680.98 680.98    . 2049.32
   2=East     2=Any Lang     Web      9=PO Box       . 549.40    . . . .

Source: GMed17p026.sas on 11/7/2017 by ejs
```

Step 2. Adjustment for Response Rates to MW2S (*MWT2*)

We identified groups of sample addresses with different response rates based on variables collected in the BGPS. The initial development was conducted by NORC for the MAGIC respondents (Summarized in MAGIC weighting_12082015.docx). We used NORC's development as a starting point for developing non-response weight adjustments.

Table 4 summarizes the completion status for each address selected in the MW2S study. The results indicate that a survey was completed at 64.6% of the sample MW2S addresses. The majority of uncompleted surveys were from addresses where it was not possible to confirm the household status (n=1,549). We note that a baseline survey was completed by a respondent at each of these addresses.

Table 4. Completion Status for MAGIC Wave 2 Sample

COMBINED_CATCODE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Completed Survey	3139	64.59	3139	64.59
Selected a respondent but not complete	16	0.33	3155	64.92
Undeliverable mail, emancipated minor households, or confirmed business	40	0.82	3195	65.74
Contact with correct address if confirmed either through returning mail, logging in, or confirming address on the phone but have not determined household member with most recent birthday	64	1.32	3259	67.06
Contact was not made via mail or web, but has been made with an adult household member via CATI. Address confirmation questions are not yet answered.	52	1.07	3311	68.13
Released sample line, but no contact has been made to confirm household status	1549	31.87	4860	100.00

Source: GMed17p026.sas on 11/7/2017 by ejs

The non-response adjustment is an adjustment to the weights (*MWT1*) to compensate for differences in completed response rates across subgroups for addresses selected in the MW2S. The weights *MWT1* are

adjusted to account for varying completion rates. The adjustment is made by forming non-response adjustment cells (ℓ).

A stepwise logistic regression analysis was used to determine the variables most strongly related to completing the MW2S survey. The dependent variable of interest was whether a survey was completed. The independent variables used in the logistic regression to form the groups are given in Table 5. All variables were statistically significantly related to response rates at the 0.10 level, and nearly all were significant at the 0.05 level. For each variable, an additional category was created when a variable was missing, and included as a possible response category for the variable. Categorical variables were tested using chi-square tests. Number of gambling formats (NGAMBF) was tested via a two-sample t-test, and gambling expenditures was tested using a Wilcoxon Rank sum test.

Table 5. Variables used to identify groups of sample addresses with different response rates.

Variable	**Categories**	**Variable Name**	**P-Value**
Gender	Male, Female	D2_RM	0.054
Age	18-34;35-49;50-64;65+	AGE_PS	0.0001
Race	Black, Hispanic, Asian, White/other	RACE1_M	0.0001
Marital Status	Never married; living with partner; married; separated; divorced; widowed	D4_RM	0.0001
Education	HS or less; some college/college grad; some post-graduate	D6_RM	0.0001
Disabilities	No; yes	C12_RM	0.0592
Children	none; some	D5_RM	0.0001
Employment	employed; other	D7A_RM	0.0149
Home Ownership	own; rent/other	D9_RBCM	0.0001
Citizen Status	citizen; not citizen	D12_RM	0.0001
Family Gambling Issues around gambling	No; yes	GPO2_RM	0.024
Attitude toward Gambling	Very harmful; harmful; neutral; beneficial; very beneficial	GA5_RM	0.0137
Frequency of Gambling	none; in past year; monthly; weekly	ANYGAMEF1M	0.0001
# of Gambling Formats	Range from 0 to 10	NGAMBF	0.0001
Gambling Expenditures	ranges with reported expenditure	NEXP_GAME1	0.0202

Source: gmed17p23.sas with
Table in MAGIC2017-documentation-stanek.xlsx

The entire set of 15 variables (in Table 5) was entered into a step-wise logistic regression to predict response rates. A detailed description of this process is given in a separate document (mag17ed08.docx). A number of logistic regression models were fit, with nearly all models including seven variables (given in order of inclusion as Home Ownership, Children, Education, Frequency of

Gambling, Age, Citizen Status, and Employment). Models with interactions were fit using the first four variables (Home Ownership, Children, Education, Frequency of Gambling). These models revealed that the interaction of each variable with frequency of gambling (FGAMB, when categorized as none/some) was statistically significant (at $p<0.10$). To avoid small group sizes, we limited non-response adjustment to the first four variables.

Prior to forming sample address groups, sample addresses where one or more of the four variable was missing in the BGPS were removed to form a single non-response group (n=350). The remaining sample addresses (n=4510) were classified into groups by the BGPS response to the four variables corresponding to:

- home ownership (D9_RBCM: own; rent/other)
- presence of children (D5_RM: none; some)
- education (D6_RM: HS or less; some college/college grad; post-graduate education) and
- frequency of gambling in the past year (FGAMB: none; some).

The number of sample addresses, and non-response rates for each group are given in Table 6. There are 25 groups in the initial grouping in Table 6. The listing of groups in Table 6 is organized mainly by the number of sample addresses in a group. For the first several groups with relatively few sample addresses, the groups are further clustered by response rates, using 2 or 3-variable clusters. The groups in a cluster have similar definitions and response rates.

Table 6. Response rates by Address Groups for MAGIC 2 Sample

Non-response Group: GRP	# Sample Addresses: N_ADDR	# Of Responses: N_RESP	Response Rate (Pct): P_RESP
7=LT HS, nokids,rent, no gamb	58	18	31.03%
13=LT HS, kids,rent, no gamb	21	7	33.33%
4=LT HS, kids, own, no gamb	13	8	61.54%
1=LT HS, nokids, own, no gamb	54	30	55.56%
9= Grad, nokids,rent, no gamb	61	29	47.54%
14= Coll, kids,rent, no gamb	42	19	45.24%
15= Grad, kids,rent, no gamb	15	8	53.33%
5= Coll, kids, own, no gamb	56	41	73.21%
6= Grad, kids, own, no gamb	59	42	71.19%
18=Grad , kids, own, gamb	255	173	67.84%
24=Grad , kids,rent, gamb	31	21	67.74%
16=LT HS, kids, own, gamb	77	58	75.32%
22=LT HS, kids,rent, gamb	78	28	35.90%
8= Coll, nokids,rent, no gamb	106	52	49.06%
23=Coll , kids,rent, gamb	126	58	46.03%
3= Grad, nokids, own, no gamb	134	106	79.10%
2= Coll, nokids, own, no gamb	144	88	61.11%
21=Grad , nokids,rent, gamb	149	84	56.38%

```
19=LT HS, nokids,rent,    gamb        216           130        60.19%
25= Some Missing                      350           185        52.86%
1O=LT HS, nokids, own,    gamb        420           287        68.33%
17=Coll ,   kids, own,    gamb        433           267        61.66%
12= Grad, nokids, own,    gamb        439           345        78.59%
2O=Coll , nokids,rent,    gamb        445           265        59.55%
11= Coll, nokids, own,    gamb       1078           790        73.28%
                                  ==========    ==========
                                     4860          3139
Source: GMed17pO26.sas on 11/7/2O17 by ejs
```

We collapse the groups in each cluster to increase the number of sampled addresses, and stabilize the response rates. We summarize response rates for the resulting $m = 1,\ldots,M = 19$ groups in Table 7.

Table 7. Response rates for MAGIC Wave 2 Sample Addresses by Collapsed Groups

```
                                                                  Response
                                    # Sample        # Of           Rate
    Collapsed Non-response         Addresses:    Responses:      (Pct):
      Group (m): CGRP                N_ADDR        N_RESP        P_RESP
Educ   Kids?     Own/   Freq of
                Rent   Gambling
LT HS,anykids,    rent, no gamb         79            25        31.65%
LT HS,   kids,    rent,    gamb         78            28        35.90%
Coll ,   kids,    rent,    gamb        126            58        46.03%
Coll+,anykids,    rent, no gamb        118            56        47.46%
 Coll, nokids,    rent, no gamb        106            52        49.06%
        Some Missing                   350           185        52.86%
Grad , nokids,    rent,    gamb        149            84        56.38%
LT HS,anykids,     own, no gamb         67            38        56.72%
Coll , nokids,    rent,    gamb        445           265        59.55%
LT HS, nokids,    rent,    gamb        216           130        60.19%
 Coll, nokids,     own, no gamb        144            88        61.11%
Coll ,   kids,     own,    gamb        433           267        61.66%
Grad ,   kids,own/rent,    gamb        286           194        67.83%
LT HS, nokids,     own,    gamb        420           287        68.33%
Coll+,   kids,     own, no gamb        115            83        72.17%
 Coll, nokids,     own,    gamb       1078           790        73.28%
LT HS,   kids,     own,    gamb         77            58        75.32%
 Grad, nokids,     own,    gamb        439           345        78.59%
 Grad, nokids,     own, no gamb        134           106        79.10%
                                  ==========    ==========
                                     4860          3139
Source: GMed17pO26.sas on 11/7/2O17 by ejs
```

The smallest group had 67 sampled addresses. The response rate ranged from 31.65% to 79.10% between the groups.

The adjustment to the weights for the completion status is made using the design weight (MWT1) for sample subjects in each of the $m = 1,\ldots,M = 19$ groups. Let $W_{1,jm}$ represent the MWT1 weight for the j^{th} sample subject in group m, where $j = 1,\ldots,n_m$ indexes the subjects in group m. Also, define c_{jm} to be an indicator variable that has a value of 1 if subject j completes the survey, and 0 otherwise. The completion adjusted weights are given by

$$W_{2A,jm} = \left(\frac{T_m}{C_m} \right) W_{1,jm}$$

where $C_m = \sum_{j=1}^{n_m} c_{jm} W_{1,jm}$ and $T_m = \sum_{j=1}^{n_m} W_{1,jm}$.

The ratios, $\frac{T_m}{C_m}$, determine how different the design weight, $W_{1,jm}$ i.e. MWT1, is from the weight adjusted for non-response adjusted weight, $W_{2,jm}$ i.e. MWT2. The reciprocal of this ratio is closely related to the completion rate (i.e. the proportion of sample subjects who complete the survey). When there are few sample subjects in a group, the relative standard deviation of the completion rate is large. This is particularly true when the completion rate is low, leading to large ratios $\frac{T_m}{C_m}$. Table 8 illustrates the non-response weight ratios and relative standard deviation of the weighted completion rates (given by $\sqrt{\frac{C_m}{T_m}\left(1-\frac{C_m}{T_m}\right)\frac{1}{n_m}}$)(in increasing order) for the groups.

We note that none of the relative standard deviations are greater than 30%, indicating adequate stability in the response-weight adjustment. A summary of the weights adjusting for non-response is given in Table 9.

Table 8. Non-response Ratios and Relative Standard Deviation of Completion rates by Group
for MAGIC Wave 2 Sample Addresses

Collapsed Non-response Group (m): CGRP			Total MWT1 by Group: MWT1_S	Total Comp MWT1 by Grp: CMWT1_S	WT2 ratio: RATIO2	N Sample: N_SAMP	N Complete: N_COMP	Completion Rate: P_RESP	RSD Prop Complete: RSDP
Educ	Kids?	Own/ Rent	Freq of Gambling	T_m	C_m	$\frac{T_m}{C_m}$	n_m		
LT HS	anykids	rent	no gamb	77,140	24,460	3.15377	79	25	31.65%	16.5%
LT HS	kids	rent	gamb	42,317	13,818	3.06257	78	28	35.90%	16.3%
Coll	kids	rent	gamb	72,063	31,056	2.32040	126	58	46.03%	10.2%
Coll+	anykids	rent	no gamb	114,986	52,949	2.17162	118	56	47.46%	10.0%
Coll	nokids	rent	no gamb	103,229	51,573	2.00161	106	52	49.06%	9.7%
Some Missing				214,580	106,242	2.01972	350	185	52.86%	5.4%
Grad	nokids	rent	gamb	106,283	63,638	1.67011	149	84	56.38%	6.7%
LT HS	anykids	own	no gamb	50,890	26,705	1.90564	67	38	56.72%	11.6%
Coll	nokids	rent	gamb	245,496	146,771	1.67265	445	265	59.55%	3.9%
LT HS	nokids	rent	gamb	97,099	58,534	1.65885	216	130	60.19%	5.5%
Coll	nokids	own	no gamb	111,441	67,121	1.66029	144	88	61.11%	6.8%
Coll	kids	own	gamb	210,131	124,066	1.69370	433	267	61.66%	4.0%
Grad	kids	own/rent	gamb	171,729	115,677	1.48456	286	194	67.83%	4.1%
LT HS	nokids	own	gamb	157,324	108,022	1.45640	420	287	68.33%	3.3%
Coll+	kids	own	no gamb	91,791	65,405	1.40342	115	83	72.17%	5.9%
Coll	nokids	own	gamb	473,642	336,992	1.40550	1078	790	73.28%	1.9%
LT HS	kids	own	gamb	30,936	24,779	1.24847	77	58	75.32%	5.7%
Grad	nokids	own	gamb	233,579	187,669	1.24463	439	345	78.59%	2.4%
Grad	nokids	own	no gamb	109,539	84,823	1.29138	134	106	79.10%	4.7%
				2,714,193	1,690,301		4860	3139		

Source: GMed17p026.sas on 11/7/2017 by ejs

Table 9. MAGIC Wave 2 MWT1 and MWT2 adjusting for Sampling and Non-response by Group

Collapsed Non-response Group: CGRP	# Sample Addresses	Magic Design Wt: MWT1	# Complete Surveys	Completed Survey Weight MWT2: MWT2
Coll, nokids, own, no gamb	144	111,441	88	111,441
Grad, nokids, own, no gamb	134	109,539	106	109,539
Coll, nokids, rent, no gamb	106	103,229	52	103,229
LT HS, nokids, own, gamb	420	157,324	287	157,324
Coll, nokids, own, gamb	1,078	473,642	790	473,642
Grad, nokids, own, gamb	439	233,579	345	233,579
LT HS, kids, own, gamb	77	30,936	58	30,936
Coll , kids, own, gamb	433	210,131	267	210,131
LT HS, nokids, rent, gamb	216	97,099	130	97,099
Coll , nokids, rent, gamb	445	245,496	265	245,496
Grad , nokids, rent, gamb	149	106,283	84	106,283
LT HS, kids, rent, gamb	78	42,317	28	42,317
Coll , kids, rent, gamb	126	72,063	58	72,063
Some Missing	350	214,580	185	214,580
LT HS,anykids, rent, no gamb	79	77,140	25	77,140
LT HS,anykids, own, no gamb	67	50,890	38	50,890
Coll+,anykids, rent, no gamb	118	114,986	56	114,986
Coll+, kids, own, no gamb	115	91,791	83	91,791
Grad , kids,own/rent, gamb	286	171,729	194	171,729
	4,860	2,714,193	3,139	2,714,193

Source: GMed17p026.sas on 11/7/2017 by ejs

We define the MAGIC wave 2 weight adjusted for groups $m=1,\ldots,M=19$ (formed by rent/own, kids, education, and frequency of gambling) as $W_{2,j}$, where $j=1,\ldots,3139$ indexes the MAGIC wave 2 sample subjects who completed the questionnaire.

Step 3. Adjustment for household size (*MWT3*)

The third adjustment in the weights is for household size. The number of persons 18 years or older living the household was recorded in the MAGIC survey, or recovered from the BGPS if missing. The distribution of household size (truncated to a maximum of 7) for completed respondents is given in Table 10.

Table 10. Household Size by Region for Wave 2 Respondents

d1_MAGIC(HH Size :D1_MAGIC)
REGION(Region :REGION)

Frequency	Western Massachusetts	Eastern Massachusetts	Total
.	38	85	123
1	273	539	812
2	472	1086	1558
3	110	299	409
4	35	133	168
5	9	43	52
6	0	7	7
7	1	9	10
Total	938	2201	3139

Source: GMed17p026.sas on 11/7/2017 by ejs

In Western MA, the total number of persons age 18+ based on the 2015 PUMS data is 665,863 (see gmed17p011.sas), while the total weight (MWT2) for respondents in Western MA is 343,045 (see gmed17p026.sas, Table 10a). This corresponds to an average household size of $1.94 = \frac{665,863}{343,045}$. In Eastern MA, the total number of persons age 18+ based on the 2015 PUMS data is 4,742,932 (see gmed17p011.sas), while the total weight (MWT2) for respondents in Western MA is 2,371,149. This corresponds to an average household size of $2.00 = \frac{4,742,932}{2,371,149}$. We assign these average household sizes to respondents where household size was missing. We further truncated the household size, represented by h_j for respondent j, to a maximum of 4 in an effort to limit the variability of the survey weights. The weight adjusted for household size is given by

$$W^*_{3,j} = h_j W_{2,j}.$$

The average weight assigned by household size and region is given in Table 11.

Table 11. Initial Household Size (Max=4) Adjusted Weight for MAGIC Wave 2 by Region

	Region :REGION					
	Western Massachusetts			Eastern Massachusetts		
	Magic Wt3*			Magic Wt3*		
	N	Ave MWT3*	Sum MWT3*	N	Ave MWT3*	Sum MWT3*
HH Size						
1.00	273	403	110,030	539	1,203	648,517
1.94	38	945	35,904	.	.	.
2.00	472	674	318,260	1171	2,057	2,408,869
3.00	110	1,123	123,512	299	3,229	965,509
4.00	45	1,264	56,867	192	4,091	785,496
All	938	687	644,573	2201	2,185	4,808,390

Source: GMed17p027.sas on 11/10/2017 by ejs

We compare the total weight in Western MA and Eastern MA with the number of persons 18+ years of age based on the 2015 PUMS data by region. In Western MA, the 2015 PUMS total is 665,863, while the total weight accounting for household size is 644,573. In order to have the weights total to the MA PUMS total in Western MA, we multiply the household size adjusted weights in Western MA by $k_w = \frac{665,863}{644,573}$. As a result, the household size adjusted weight in Western MA is given by

$$\begin{aligned} W_{3,j} &= k_w W^*_{3,j} \\ &= k_w h_j W_{2,j} \end{aligned}.$$

Similarly, in Eastern MA, the 2015 PUMS total is 4,742,932, while the total weight accounting for household size is 4,808,390. In order to have the weights total to the MA PUMS total in Eastern MA, we multiply the household size adjusted weights in Eastern MA by $k_e = \frac{4,742,932}{4,808,390}$. As a result, the household size adjusted weight in Eastern MA is given by

$$\begin{aligned} W_{3,j} &= k_e W^*_{3,j} \\ &= k_e h_j W_{2,j} \end{aligned}.$$

With these adjustments, the total weight of 5,408,795 matches the 18+ year old MA population in 2015.

Step 4. Adjusting weights using raking based on cross-classified pairs of the variables region, age, gender, age, race/ethnicity, education (*MWT4*)

We adjusted weights assigned to subjects to more closely align with the distribution of 18+ year old persons in MA by region (Western, Eastern MA), age (18-34, 35-49, 50-64, 65+), gender (male, female),

race/ethnicity (Hispanic, Black (only), Asian (only), White and other), and education (high school or less, some college/college graduate, some post graduate education). We determined raking variables via a preliminary analysis of the 2015 one-year American Community Survey Public Use Microdata Sample (PUMS) files. In an ideal setting, reliable PUMS data for population totals would be available for a full cross-classification of adjustment variables. In practice, estimates of the population based on the PUMS data are based on an approximate 1% sample of the MA population, and the PUMS data themselves are weighted to estimate the number of subjects in each post-stratum. For this reason, we did not use a cross-classification of all 5 variables to define post-strata for weighting. Instead, we constructed pairs of variables, using 10 pairs (i.e., region x age, region x gender, etc.).

The maximum coefficient of variation of the mean statistical weight for subjects in a stratum was 41.7% (for n=202 Western MA, Asian PUMS respondents) (See SAS program gmed17p011.sas). The coefficient of variation for all other strata was less than 30%, and all strata had more than 200 subjects. We elected to rake on pairs of primary variables and to use all possible pairs of the primary variables as raking variables. By cross-classifying pairs of primary variables, a large number of PUMS respondents were in each cell for the cross classifications. Smaller numbers of subjects were present in cells based on subjects with completed MAGIC surveys.

Raking by pairs of the primary variables guarantees a representative weight (i.e., a weight that matches the population weight) for each pair. This means that fitted models using weighting will properly represent the population distribution for up to two-way interactions with the primary outcome variables.

Region was reported for all respondents, but each of the other variables was missing for one or more respondents. Age was missing on 42 respondents (1.34%), while less than 1% of the respondents were missing gender, race, or education. A summary of the respondents by a detailed cross-classification of the raking variables is given in Table 12a,b.

Table 12a. Summary of age, race, gender, and education for Magic Respondents (Western MA)

		Post-str. Edu: EDU_PS							
		1=<=HS			2=Col.		3=Grad		
		1=Male	2=Fem.	3=Miss	1=Male	2=Fem.	1=Male	2=Fem.	All
1=18-34	1=Hisp.	.	2	.	2	6	.	1	11
	2=White	1	3	.	18	20	4	9	55
	3=Black	.	.	.	.	1	1	1	3
	4=Asian	.	.	.	.	1	1	.	2
2=35-49	1=Hisp.	2	4	.	1	10	.	2	19
	2=White	7	10	.	33	46	17	23	136
	3=Black	.	.	.	2	3	2	.	7
	4=Asian	.	.	.	1	1	.	3	5
	5=Miss	.	.	.	.	1	.	.	1
3=50-64	1=Hisp.	3	3	.	3	6	1	3	19
	2=White	24	41	.	79	97	20	28	289
	3=Black	1	.	.	5	3	1	3	13
	4=Asian	.	.	.	1	.	.	1	2
	5=Miss	.	.	.	1	.	.	.	1
4=65+	1=Hisp.	1	2	.	1	1	.	.	5
	2=White	51	61	.	88	67	46	35	348
	3=Black	.	2	.	1	3	.	.	6
	4=Asian	.	.	.	.	.	1	.	1
	5=Miss	.	1	.	.	.	.	.	1
5=Miss	2=White	.	.	1	1	7	.	3	12
	3=Black	.	1	.	.	.	.	.	1
	4=Asian	.	.	.	.	.	.	1	1
All		90	130	1	237	273	94	113	938

Source: GMed17p027.sas on 11/10/2017 by ejs

Table 12b. Summary of age, race, gender, and education for Magic Respondents (Eastern MA)

		Post-str. Edu: EDU_PS								
		1=<=HS			2=Col.		3=Grad		4=Miss		
		1=Male	2=Fem.	3=Miss	1=Male	2=Fem.	1=Male	2=Fem.	1=Male	2=Fem.	All
1=18-34	1=Hisp.	2	3	.	1	7	1	4	.	.	18
	2=White	3	6	.	39	53	21	33	.	.	155
	3=Black	1	1	.	3	4	1	.	.	.	10
	4=Asian	1	.	.	5	7	5	1	.	.	19
	5=Miss	.	.	.	.	1	.	.	.	.	1
2=35-49	1=Hisp.	1	2	.	5	9	2	6	1	.	26
	2=White	10	14	1	76	101	48	78	.	.	328
	3=Black	1	2	.	6	1	.	1	.	.	11
	4=Asian	2	2	.	9	7	6	6	.	.	32
	5=Miss	.	.	.	.	.	1	2	.	.	3
3=50-64	1=Hisp.	2	6	.	4	6	1	4	.	.	23
	2=White	45	35	.	175	208	97	116	1	.	677
	3=Black	.	1	.	7	3	1	1	.	.	13
	4=Asian	3	2	.	4	5	4	4	.	.	22
	5=Miss	.	.	.	.	1	2	1	.	1	5
4=65+	1=Hisp.	6	1	.	2	2	1	.	.	.	12
	2=White	82	112	.	210	186	112	75	.	1	778
	3=Black	3	7	.	3	6	.	3	.	.	22
	4=Asian	1	1	.	6	.	3	1	.	.	12
	5=Miss	.	.	.	.	.	3	1	1	1	6
5=Miss	1=Hisp.	1	.	.	.	.	.	.	.	.	1
	2=White	.	1	.	2	10	1	3	.	2	19
	3=Black	.	.	.	.	.	1	.	.	.	1
	4=Asian	.	.	.	.	2	1	2	.	.	5
	5=Miss	1	.	.	1	.	.	.	.	.	2

All	165	196	1	558	619	312	342	3	5	2201

Source: GMed17p027.sas on 11/10/2017 by ejs

We allowed for missing values for the primary variables when defining cells for raking. For example the first raking variable, V1, was region x age. If each of the primary variables was known on each respondent, V1 would have 8 categories corresponding to a cross-classification of the region x age categories=2 x 4. Since age was not reported by all respondents, we added a 5th category to age corresponding to "missing age". As a result, the variable V1 used for raking had 10=2 x 5 categories.

With 5 primary variables, there are 10 ways of pairing primary variables to form raking variables. Each raking variable corresponds to a different pair of primary variables. Raking was accomplished in steps, by consecutively using each of the raking variables to align the sample weighted marginal to the population marginal. We refer to the consecutive raking of all 10 raking variables as an iteration. This process was continued until the sample weights converged to the population weights for each of the raking variables.

Each of the MAGIC respondents was assigned a survey weight, MWT3, based on other characteristics prior to raking. The weights were assigned so that the total weight for the respondents matched the PUMS 2015 weight for MA.

Description of a Step in the Raking

Raking was accomplished using a SAS program written for this purpose (gmed16p012.sas and gmed16p013.sas). We summarize the process here using the first raking variable, V1, corresponding to region x age (additional details are available in the document g16ed04v1.docx). The first step was to evaluate the total weight (MWT4) in each of the 2 x 5 =10 cells for the sample. Let us refer to these weights by x_{ij} for $i=1,...,2$ (corresponding to regions), and $j=1,...,5$ (corresponding to age categories, where j=5 corresponds to 'missing age'). The population weights, p_{ij} , were based on the 2015 PUMS data (created by gmed17p017.sas). Among the population data, there were no missing values. Using the categories of region and age, the total population was the sum over 2 x 4 = 8 cells, $p_{++}=\sum_{i=1}^{2}\sum_{j=1}^{4}p_{ij}$. As a result, when raking by the variable V1, we first re-allocated PUMS data to form categories representing "missing age."

Forming Adjusted Population Weights Accounting for Missing Values in Primary Variables

We illustrate the process of forming adjusted population weights using the adjustment for V1, region x age, as an example. Let the total sample and population weight in region i be given by $x_{i+}=\sum_{j=1}^{5}x_{ij}$ and $p_{i+}=\sum_{j=1}^{4}p_{ij}$, respectively. We assign population weights to cells in a region where age is missing proportional to the weight assigned to these cells in the sample in the region, $p^{*}_{i5}=p_{i+}\left(\frac{x_{i5}}{x_{i+}}\right)$. We refer to these population weights as 'adjusted' weights, since they are adjusted for missing values in the primary variables. Population weights for individual cells with age known in a region are adjusted to

preserve the overall population weight in the region, p_{i+} , such that $p_{ij}^{*} = p_{ij}\left(\frac{p_{i+} - p_{i5}^{*}}{p_{i+}}\right)$, for $i = 1,...,2$ and $j = 1,...,4$.

We illustrate this for V1, corresponding to Region x Age in Table 13. The first column contains the initial 2015 PUMS data, while the second column has the PUMS totals adjusted for missing data. The third column contains the totals based on MWT3 prior to accounting for missing values.

Table 13. PUMS and MWT3 Weight Totals For Wave 2 MAGIC Respondents Adjusting for Missing Data for V1

	ps		
	1=PUMS Original	2=PUMS Adjusted	3=Sample
1=W 18-34	204,332	200,623	66,382
2=W 35-49	146,143	143,490	134,432
3=W 50-64	178,079	174,846	220,849
4=W 65+	137,309	134,816	232,111
5=W Miss	0	12,088	12,088
6=E 18-34	1,434,153	1,410,281	643,997
7=E 35-49	1,164,683	1,145,296	898,528
8=E 50-64	1,239,478	1,218,846	1,702,742
9=E 65+	904,618	889,560	1,418,716
10=E Miss	0	78,949	78,949
All	5,408,795	5,408,796	5,408,796

Source: GMed17p027.sas on 11/10/2017 by ejs

A similar process was followed to adjust the population weights for missing values with other primary variables.

Matching Sample to Population Marginals for Steps with Raking Variables 1-10.

The total sample weight assigned to a cell for a raking variable is the sum of MWT4 assigned to respondents in that cell. We index categories for the 5 primary variables by $i = 1,2$ for region, $j = 1,...,5$ for age, $k = 1,...,3$ for gender, $l = 1,...,5$ for race, and $m = 1,...,4$ for education. Respondents within a cell are indexed by $q = 1,...,n_{ijklm}$. The total sample weight assigned to a cell for the first raking variable, V1, is given by

$$x_{ij} = \sum_{k=1}^{3}\sum_{l=1}^{5}\sum_{m=1}^{4} x_{ijklm}$$
$$= \sum_{k=1}^{3}\sum_{l=1}^{5}\sum_{m=1}^{4}\left(\sum_{q=1}^{n_{ijklm}} x_{ijklmq}\right)'$$

where $x_{ijklm} = \sum_{q=1}^{n_{ijklm}} x_{ijklmq}$. The first step in an iteration of raking aligns the sample marginal to the population marginal by forming the new weight for cells based on the full cross-classification of the five variables, such that

$$x_{ijklm}^{(1)} = x_{ijklm}\left(\frac{p_{ij}^{*}}{x_{ij}}\right).$$

Using these weights, the total weight is evaluated for each cell corresponding to the next raking variable, V2 (corresponding to region x sex), i.e. $x_{ik}^{(1)} = \sum_{j=1}^{5}\sum_{l=1}^{5}\sum_{m=1}^{4} x_{ijklm}^{(1)}$. Once again, using the population marginal weights, we align the sample marginal to the population marginal for V2, such that

$$x_{ijklm}^{(2)} = x_{ijklm}^{(1)}\left(\frac{p_{ik}^{*}}{x_{ik}^{(1)}}\right).$$

This process is continued for each of the 10 raking variables, resulting in the marginal total weights in each cell after one iteration given by $r_{ijklm}^{1} = x_{ijklm}^{(10)}$. Table 14 summarizes the sample and aligned population weights prior to raking for each of the 10 raking variables.

Table 14a. Magic (Wave 2) Sample and Aligned Population Weights Prior to Raking on 10 Variables

Step 1: Region x Age		Western MA					Eastern MA				
		18-34	35-49	50-64	65+	Missing	18-34	35-49	50-64	65+	Missing
Pop	Margin	200,623	143,490	174,846	134,816	12,088	1,410,281	1,145,296	1,218,846	889,560	78,949
Samp	Margin	66,382	134,432	220,849	232,111	12,088	643,997	898,528	1,702,742	1,418,716	78,949

Step 2: Region x Sex		Western MA			Eastern MA		
		Male	Female	Missing	Male	Female	Missing
Pop	Margin	313,965	350,829	1,069	2,273,545	2,467,925	1,461
Samp	Margin	255,423	409,371	1,069	2,092,105	2,649,366	1,461

Step 3: Region x Race		Western MA					Eastern MA				
		Hispanic	White	Black	Asian	Missing	Hispanic	White	Black	Asian	Missing
Pop	Margin	84,662	527,411	34,698	17,295	1,797	427,410	3,629,998	309,178	322,789	53,558
Samp	Margin	84,251	535,916	31,719	12,179	1,797	290,334	3,985,096	153,662	260,283	53,558

Step 4: Region x Edu		Western MA				Eastern MA			
		LE HS	College	Grad	Missing	LE HS	College	Grad	Missing
Pop	Margin	261,987	323,703	80,173	0	1,631,157	2,288,118	788,466	35,191
Samp	Margin	157,174	364,963	143,726	0	755,647	2,466,405	1,485,690	35,191

Step 5: Age x Sex	18-34			35-49			50-64			65+			Miss		
	Male	Female	Miss	Male	Female	Miss	Male	Female	Miss	Male	Female	Miss	Male	Female	Miss
Pop Marg	803548	806916	0	628107	660302	1,461	671932	721,383	0	440858	583250	0	34,083	55,886	1,069
Samp Mar	259435	450945	0	387762	643737	1,461	821988	1101603	0	844261	806566	0	34,083	55,886	1,069

Source: GMed17p027.sas on 11/10/2017 by ejs

Table 14b (continued). Magic (Wave 2) Sample and Aligned Population Weights Prior to Raking on 10 Variables

Step 6: Age x Race

	18-34					35-49				
	Hisp	White	Black	Asian	Miss	Hisp	White	Black	Asian	Miss
Pop	228,115	1112250	122,019	134,594	5,539	151,994	931,195	93,703	100,727	9,378
Samp	90,925	494,014	41,728	78,173	5,539	119,233	793,029	25,842	85,479	9,378

	35-49					65+				
	Hisp	White	Black	Asian	Miss	Hisp	White	Black	Asian	Miss
Pop	85,749	1148751	79,918	67,228	17,128	38,222	901,692	43,059	32,560	13,938
Samp	97,270	1692795	46,655	69,743	17,128	59,447	1482047	68,145	27,251	13,938

	Miss Age				
	Hisp	White	Black	Asian	Miss
Pop	7,710	59,127	3,012	11,816	9,372
Samp	7,710	59,127	3,012	11,816	9,372

Step 7: Age x Edu

	18-34				35-49			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	496,714	921,184	184,504	0	395,928	623,469	262,563	2,501
Samp	64,449	445,972	199,958	0	113,318	544,600	372,541	2,501

	35-49				65+			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	495,138	652,742	238,460	18,028	475,599	373,637	169,747	7,546
Samp	264,342	1037335	603,886	18,028	456,109	759,746	427,427	7,546

	Miss Age			
	HS	Coll	Grad	Miss
Pop	14,603	43,715	25,604	7,116
Samp	14,603	43,715	25,604	7,116

Source: GMed17p027.sas on 11/10/2017 by ejs

Table 14c (continued). Magic (Wave 2) Sample and Aligned Population Weights Prior to Raking on 10 Variables

Step 8: Sex x Race	Male					Female				
	Hisp	White	Black	Asian	Miss	Hisp	White	Black	Asian	Miss
Pop	250,649	1989061	161,228	160,074	24,108	260,999	2166281	182,554	180,064	31,247
Samp	138,126	1962809	92,359	130,126	24,108	236,458	2555673	93,022	142,336	31,247

	Missing				
	Hisp	White	Black	Asian	Miss
Pop	0	2,530	0	0	0
Samp	0	2,530	0	0	0

Step 9: Sex x Edu	Male				Female			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	964,597	1200671	405,395	16,373	927,452	1409920	463,039	18,818
Samp	362,725	1225572	742,859	16,373	547,566	1605796	886,557	18,818

	Missing			
	HS	Coll	Grad	Miss
Pop	2,530	0	0	0
Samp	2,530	0	0	0

Step 10: Race x Edu	Hisp				White			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	303,085	175,898	30,589	2,501	1323542	2104546	710,404	21,728
Samp	123,912	181,025	67,147	2,501	701,000	2386725	1411559	21,728

	Black				Asian			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	152,383	165,409	24,596	0	98,292	144,391	96,076	0
Samp	49,741	111,933	23,707	0	36,354	135,659	100,449	0

	Missing			
	HS	Coll	Grad	Miss
Pop	1,814	16,025	26,554	10,962
Samp	1,814	16,025	26,554	10,962

Source: GMed17p027.sas on 11/10/2017 by ejs

Iterating Raking

We repeat the process of aligning the marginals over the 10 raking variables using the raked marginal, $r_{ijklm}^{(t-1)}$, until the marginal totals based on the raked weights, i.e. $r_{ij}^{t} = \sum_{k=1}^{3}\sum_{l=1}^{5}\sum_{m=1}^{4} r_{ijklm}^{t}$ for cells in V1-V10 at iteration t, are sufficiently close to the population marginal weights, p_{ij}^{*}. The criterion for closeness is the maximum (over all cells) of the percent difference in weight between the raked sample weight and the population weight. This criterion is determined by evaluating the maximum percent difference in marginal weight for each raking variable, given by

$$\mathrm{m}_1^t = \max\left[100\left(\frac{r_{ij}^t - p_{ij}^*}{p_{ij}^*} \right); i = 1,2; \mathrm{j} = 1,...,5 \right]$$

for V1, $\mathrm{m}_2^t = \max\left[100\left(\frac{r_{ik}^t - p_{ik}^*}{p_{ik}^*} \right); i = 1,2; \mathrm{k} = 1,...,3 \right]$ for V2, etc., and then taking the maximum of these percent differences, given by $\mathrm{m}^t = \max\left(m_1^t, m_2^t, m_3^t, ..., m_{10}^t \right)$.

The raking procedure stops when m^t is below a value that is set as the largest possible acceptable percent difference between sample and population marginal weights. This difference is set at $m(\max) = 10\%$, implying that the maximum difference between the raked weights and the population weights is at most 10%.

The criteria for stopping iterations for raking is based in part on the coefficient of variation for population values for the marginals and in part on the performance of the raking procedure using the 10 raking variables. The population marginals are constructed from PUMS data, which in turn are based on a weighted one percent sample of MA subjects. Using the basic PUMS data, we calculated the coefficient of variation of the total for each marginal population cell. While most of the coefficients of variation are less than 1 or 2 percent, the coefficient of variation for "Asians in Western MA" is 5.9% (based on 202 respondents in the PUMS 2015 data (Source: gmed17p018.sas)). A value of $m(\max) = 10\%$ is large enough to account for this level of population variability.

The second factor leading to setting $m(\max) = 10\%$ is based on experience with the raking program. We initially set the raking to evaluate 50 iterations, stopping when $m(\max) < 10\%$. After 5 iterations, the maximum percent difference was $m = 3.07\%$. The final raked weight totals are summarized in Table 15.

Table 15. MAGIC (Wave 2) Comparison of Raking Variable Weights with Population Weights after 5 Iterations

Step 1: Region x Age		Western MA					Eastern MA				
		18-34	35-49	50-64	65+	Missing	18-34	35-49	50-64	65+	Missing
Pop	Margin	200,623	143,490	174,846	134,816	12,088	1,410,281	1,145,296	1,218,846	889,560	78,949
Samp	Margin	199,176	143,146	175,943	135,110	11,982	1,401,197	1,141,470	1,229,733	891,964	79,075

Step 2: Region x Sex		Western MA			Eastern MA		
		Male	Female	Missing	Male	Female	Missing
Pop	Margin	313,965	350,829	1,069	2,273,545	2,467,925	1,461
Samp	Margin	313,803	351,006	1,054	2,273,066	2,468,394	1,472

Step 3: Region x Race		Western MA					Eastern MA				
		Hispanic	White	Black	Asian	Missing	Hispanic	White	Black	Asian	Missing
Pop	Margin	84,662	527,411	34,698	17,295	1,797	427,410	3,629,998	309,178	322,789	53,558
Samp	Margin	84,768	527,312	34,731	17,296	1,755	428,446	3,631,064	307,995	321,969	53,458

Step 4: Region x Edu		Western MA				Eastern MA			
		LE HS	College	Grad	Missing	LE HS	College	Grad	Missing
Pop	Margin	261,987	323,703	80,173	0	1,631,157	2,288,118	788,466	35,191
Samp	Margin	260,372	323,504	81,987	0	1,617,696	2,284,378	805,841	35,017

Step 5: Age x Sex		18-34			35-49			50-64			65+			Miss		
		Male	Female	Miss	Male	Female	Miss	Male	Female	Miss	Male	Female	Miss	Male	Female	Miss
Pop	Marg	803548	806916	0	628107	660302	1,461	671932	721,383	0	440858	583250	0	34,083	55,886	1,069
Samp	Mar	806691	805634	0	628970	656803	1,473	674494	718,981	0	443897	581131	0	34,072	55,574	1,076

Source: GMed17p027.sas on 11/10/2017 by ejs

Table 15 (continued). MAGIC (Wave 2) Comparison of Raking Variable Weights with Population Weights after 5 Iterations

Step 6: Age x Race

	18-34					35-49				
	Hisp	White	Black	Asian	Miss	Hisp	White	Black	Asian	Miss
Pop	228,115	1112250	122,019	134,594	5,539	151,994	931,195	93,703	100,727	9,378
Samp	230,785	1118678	123,913	131,719	5,369	152,468	934,779	94,530	98,787	9,306

	35-49					65+				
	Hisp	White	Black	Asian	Miss	Hisp	White	Black	Asian	Miss
Pop	85,749	1148751	79,918	67,228	17,128	38,222	901,692	43,059	32,560	13,938
Samp	85,484	1145075	80,409	65,376	16,970	37,806	897,654	43,118	31,623	13,907

	Miss Age				
	Hisp	White	Black	Asian	Miss
Pop	7,710	59,127	3,012	11,816	9,372
Samp	7,491	59,567	2,975	11,633	9,371

Step 7: Age x Edu

	18-34				35-49			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	496,714	921,184	184,504	0	395,928	623,469	262,563	2,501
Samp	499,618	920,459	182,440	0	400,153	624,115	260,224	2,505

	35-49				65+			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	495,138	652,742	238,460	18,028	475,599	373,637	169,747	7,546
Samp	497,520	648,762	234,592	17,900	480,290	373,677	167,964	7,539

	Miss Age			
	HS	Coll	Grad	Miss
Pop	14,603	43,715	25,604	7,116
Samp	15,036	43,436	25,249	7,316

Source: GMed17p027.sas on 11/10/2017 by ejs

Table 15 (continued). MAGIC (Wave 2) Comparison of Raking Variable Weights with Population Weights after 5 Iterations

Step 8: Sex x Race	Male					Female				
	Hisp	White	Black	Asian	Miss	Hisp	White	Black	Asian	Miss
Pop	250,649	1989061	161,228	160,074	24,108	260,999	2166281	182,554	180,064	31,247
Samp	249,643	1981210	159,643	163,191	24,000	260,346	2170860	181,460	184,237	31,734

	Missing				
	Hisp	White	Black	Asian	Miss
Pop	0	2,530	0	0	0
Samp	0	2,471	0	0	0

Step 9: Sex x Edu	Male				Female			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	964,597	1200671	405,395	16,373	927,452	1409920	463,039	18,818
Samp	955,939	1202162	410,437	16,582	920,889	1412694	469,052	18,510

	Missing			
	HS	Coll	Grad	Miss
Pop	2,530	0	0	0
Samp	2,530	0	0	0

Step 10: Race x Edu	Hisp				White			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	303,085	175,898	30,589	2,501	1323542	2104546	710,404	21,728
Samp	305,155	175,913	29,874	2,479	1333614	2106903	694,151	21,613

	Black				Asian			
	HS	Coll	Grad	Miss	HS	Coll	Grad	Miss
Pop	152,383	165,409	24,596	0	98,292	144,391	96,076	0
Samp	154,347	165,961	24,134	0	99,659	145,524	94,318	0

	Missing			
	HS	Coll	Grad	Miss
Pop	1,814	16,025	26,554	10,962
Samp	1,805	16,290	25,957	11,099

Source: GMed17p027.sas on 11/10/2017 by ejs

Step 5. Trimming of weights by setting the minimum weight to be the average weight/8, and the maximum weight to be average weight x 8 (*MWT6*)

The process of weighting to account for the sample design and response rates leads to different weights for different respondents. The weights ensure that if the expected value of response (such as the prevalence of problem gambling) varies between respondents with different weights, the overall weighted estimator is an unbiased estimate for the population mean. An additional consequence of varying weights is a decrease in the precision of the estimator. When there is a weak relationship between the variables used for weighting and the expected value of response, reducing the range of weights can increase the precision of the estimator, while not creating appreciable bias. Such a reduction in the range of weights is accomplished by reducing the maximum weight, and increasing the minimum weight. This process is called weight trimming. By trimming weights appropriately, a more accurate estimator may be constructed.

We first review the impact of raking on MWT3. Raking will increase, or decrease a weight in an effort to make the marginal weights based on the raking variables more closely match the PUMS 2015 data. For some groups of subjects, this may alter the rate by a large amount. Table 16 lists the most extreme (less than 0.333, or more than 3) alterations in the ratio of total weights (MWT4a/MWT3) by respondent group characteristics.

Table 16. List of the Smallest and Largest Raking Weight factors

region	age_ps	sex_ps	race_ps	edu_ps	Multiplier for Raked MWT4: RMWT4M	Total MWT3 for cell: MWT3_S	Total Raked rMWT3 for cell: RMWT3_S
1=West	4=65+	1=Male	3=Black	2=Col.	0.078	945	73
2=East	4=65+	1=Male	3=Black	2=Col.	0.141	9,398	1,325
1=West	4=65+	1=Male	1=Hisp.	2=Col.	0.153	1,573	240
2=East	4=65+	1=Male	1=Hisp.	3=Grad	0.162	1,071	174
1=West	3=50-64	2=Fem.	1=Hisp.	3=Grad	0.207	1,722	356
1=West	2=35-49	2=Fem.	1=Hisp.	3=Grad	0.213	3,694	787
1=West	4=65+	2=Fem.	1=Hisp.	2=Col.	0.217	1,872	406
1=West	3=50-64	1=Male	1=Hisp.	3=Grad	0.255	240	61
2=East	4=65+	1=Male	2=White	3=Grad	0.274	197,227	54,119
2=East	4=65+	1=Male	1=Hisp.	2=Col.	0.283	13,224	3,741
1=West	4=65+	1=Male	2=White	3=Grad	0.283	28,910	8,187
1=West	4=65+	2=Fem.	3=Black	2=Col.	0.308	2,670	823
1=West	3=50-64	1=Male	2=White	1=<=HS	3.008	10,316	31,028
2=East	1=18-34	1=Male	2=White	2=Col.	3.106	100,479	312,045
2=East	3=50-64	2=Fem.	3=Black	2=Col.	3.145	6,373	20,042
1=West	1=18-34	1=Male	4=Asian	3=Grad	3.147	670	2,110
2=East	3=50-64	1=Male	1=Hisp.	1=<=HS	3.406	4,054	13,808
1=West	1=18-34	2=Fem.	1=Hisp.	1=<=HS	3.600	2,130	7,670
2=East	1=18-34	2=Fem.	1=Hisp.	1=<=HS	3.905	17,699	69,122
2=East	2=35-49	2=Fem.	3=Black	2=Col.	3.959	1,345	5,326
2=East	2=35-49	1=Male	4=Asian	1=<=HS	3.960	3,916	15,508
1=West	3=50-64	1=Male	3=Black	1=<=HS	4.196	340	1,428
1=West	2=35-49	1=Male	1=Hisp.	1=<=HS	4.201	4,435	18,631
1=West	1=18-34	1=Male	2=White	2=Col.	5.136	14,787	75,953
2=East	1=18-34	2=Fem.	2=White	1=<=HS	5.707	26,930	153,689
1=West	2=35-49	1=Male	2=White	1=<=HS	6.292	3,896	24,513
2=East	3=50-64	2=Fem.	3=Black	1=<=HS	7.252	1,365	9,899
2=East	1=18-34	2=Fem.	3=Black	1=<=HS	7.629	1,685	12,856
2=East	2=35-49	1=Male	2=White	1=<=HS	7.666	13,866	106,289
2=East	2=35-49	1=Male	1=Hisp.	1=<=HS	8.755	1,826	15,982
1=West	1=18-34	2=Fem.	2=White	1=<=HS	9.001	2,742	24,680
2=East	2=35-49	2=Fem.	3=Black	1=<=HS	10.750	2,826	30,379
2=East	1=18-34	1=Male	4=Asian	1=<=HS	11.825	1,773	20,967
2=East	1=18-34	1=Male	3=Black	1=<=HS	12.513	3,816	47,749
2=East	2=35-49	1=Male	3=Black	1=<=HS	13.602	1,374	18,688
2=East	1=18-34	1=Male	1=Hisp.	1=<=HS	17.919	4,498	80,608
2=East	1=18-34	1=Male	2=White	1=<=HS	23.914	2,972	71,071
1=West	1=18-34	1=Male	2=White	1=<=HS	43.315	202	8,766

Source: GMed17p027.sas on 11/10/2017 by ejs

The largest adjustment down (i.e. 0.078) in the weight occurred for black, male, college graduate, age 65+ respondents in Western MA, while the largest adjustment up (i.e. 43.315) occurred for male, white, HS or less educated, 18-34 year old respondents in Western MA.

The distribution of weights for the 3,139 respondents is summarized in Table 17 for each step in the weight development. Notice the large differences that occur in the maximum weight when accounting for household size, or aligning the weights to the Massachusetts population (using the raked weights). The distribution of the weights generated by NORC based on post-stratification by region, age, race, and gender is given in the last row of Table 17 for comparison.

Table 17. Description of MAGIC Weights Prior to Trimming

Weight	Min	Median	Mean	Max
MWT0- Base WT3	105	297	277	683
MWT1- Design	104	321	538	2,049
MWT2- Complete	130	586	865	5,294
MWT3- HHSize	134	1182	1723	15,619
MWT4- Raked	38	812	1723	57,882

Source: GMed17p027.sas on 11/8/2017 by ejs

Trimming Raked Weights

We describe the procedure for trimming raked weights next. Let $w_{\min}$ represent the minimum weight, w_{mean} represent the mean weight, and $w_{\max}$ represent the maximum weight. We define trimmed weight by setting the minimum and maximum weight to be a simple multiplier, m, times the average weight, w_{mean}. The initial trimmed weight is given by

$$w_{i,\mathrm{m}}^{0} = \begin{cases} w_{\max,m} \text{ if } w_i \geq w_{\max,m} \\ w_i \\ w_{\min,m} \text{ if } w_i \leq w_{\min,m} \end{cases}.$$

where $w_{\max,m} = m\left(w_{mean}\right)$ and $w_{\min,m} = \left(w_{mean}\right)/m$. By changing the minimum and maximum weight, the total weight is changed. In order to insure that the total weight is equal to the total population size in each region (which is equal to $T_{3R} = \sum_{j \in \mathrm{Region}} W_{3,j}$, where j indexes the respondents in region R) we adjust the initial trimmed weight by a factor $\frac{T_{3R}}{T_{mR}}$, where $T_{mR} = \sum_{j \in \mathrm{Region}} w_{5j}^{(m)}$ represents the total trimmed raked weight in a region. The final step in forming the trimmed weight is to multiply the initial trimmed weight in region R by $\frac{T_{3R}}{T_{mR}}$, to form the trimmed weight

$$w_{6j} = \left(\frac{T_{3R}}{T_{mR}}\right) w_{5,j}^{(m)}.$$

Determining the Extent of Trimming

We used the same criteria for weight trimming that was used in the BGPS. Using the average weight $\bar{W} = 1,723$, we truncated weights so they fell in the range determined by (min, max), where $\min = \frac{\bar{W}}{8} = 215$, and $\max = 8\bar{W} = 13,785$. This resulted in adjusting 361 weights up to the minimum, and adjusting 36 weights down to the maximum. The total weight in each region based on weights adjusted for household size (MWT3) and trimmed raked weights (MWT5) are given in Table 18.

Table 18.Total weight by region for Wave 2 Respondents

	Magic HH-size Wt3: MWT3	Magic Wave2 Trimmed Wt before centering: MWT5
Western Massachusetts	665,863	684,223
Eastern Massachusetts	4,742,932	4,424,074
All	5,408,796	5,108,298

Source: GMed17p027.sas on 11/10/2017 by ejs

After adjusting the weights so that the average total weight, when multiplied by the number of respondents, will equal the total MA population based on the 2015 PUMS, the final weight is called MWT6, with a minimum of 210, and a maximum of 14,778. The weight MWT6 is the weight that should be used in analyses of the MAGIC Wave 2 data.

Table 19. Description of MAGIC Weights

Weight	Min	Median	Mean	Max
MWT0- Base WT3	105	297	277	683
MWT1- Design	104	321	538	2,049
MWT2- Complete	130	586	865	5,294
MWT3- HHSize	134	1182	1723	15,619
MWT4- Raked	38	812	1723	57,882
MWT5- Trimmed	215	812	1627	13,785
MWT6- Final wt	210	853	1723	14,778

Source: gmed17p027.sas on 11/10/2017 by ejs

Appendix A4: Item Response Rate by Mode and Wave

Appendix A4 presents response rates for each question in the survey separately by mode of data collection (online, SAQ and telephone).

Item response rate by data collection mode across waves

	Percent complete					
	Wave 1			Wave 2		
	WEB	SAQ	PHONE	WEB	SAQ	PHONE
D1_R RECODED: How many members of your household, including yourself, are 18 years of age or older?	98.4	1.6	100.0	98.7	95.7	97.6
D2_R RECODED: Are you male or female?	99.5	98.8	100.0	99.9	99.8	100.0
C1_RBC RECODED AND BACKCODED: Which of the following is your preferred recreational activity? Would you say…?	99.9	98.3	98.4	100.0	99.3	100.0
C2_R RECODED: Do you enjoy participating in extreme sports such as hang gliding or sky diving?	99.9	99.7	100.0	99.9	100.0	100.0
C2A_R RECODED: Do you have an internet connection either at home or at work?	NA	NA	NA	99.8	99.5	99.4
C2B_R RECODED: Overall, how often do you use the Internet?	NA	NA	NA	99.9	99.0	100.0
C3_R RECODED: Over the past 12 months, would you say that in general your health has been…?	99.9	99.9	100.0	99.8	99.8	99.4
C4_R RECODED: In the past 12 months, how would you rate your overall level of stress?	99.6	99.9	99.5	99.6	99.6	99.4
C5_R RECODED: In the past 12 months, how would you rate your overall level of happiness?	99.6	99.7	99.5	99.1	99.6	100.0
C6A_R RECODED: Have you smoked at least 100 cigarettes in your entire life?	99.9	99.3	99.5	99.9	99.2	99.4
C6B_R RECODED: Would you say you now smoke cigarettes…	99.9	97.2	99.5	99.8	96.8	99.4
C6C_R RECODED: Do you currently smoke cigars, pipe tobacco, or hookah tobacco (shisha), or use dipping tobacco (including snus), chewing tobacco, or snuff…?	99.8	99.2	100.0	99.8	99.4	100.0
C6D_R RECODED: During the past 30 days, how many days would you estimate you have used any form of tobacco?	98.4	93.8	100.0	98.4	91.8	99.4
C7A_R RECODED: Have you used alcohol in the past 12 months?	99.9	99.7	100.0	99.8	99.5	100.0
C7C_R RECODED: One drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor. During the past 30 days, on the days when you drank, about how many drinks did y	96.6	98.1	93.2	95.2	97.5	95.3
C8_R RECODED: In the past 12 months have you used any marijuana, hallucinogens (such as LSD, mushrooms, or PCP), cocaine, heroin or opium, or any other drugs not intended for medical use?	99.6	98.6	100.0	99.7	99.7	100.0
C9A_R RECODED: Have you had any problems with drugs or alcohol in the past 12 months? By this we mean difficulties in controlling their use that have led to negative consequences for you or other people	99.7	98.7	100.0	99.5	98.9	100.0
C9B_R RECODED: During the past 12 months, have you sought help for your use of alcohol or drugs?	99.7	98.7	100.0	99.5	98.9	100.0
C10A_R RECODED: Have you had problems with other behavior in the past 12 months such as overeating, sex or pornography, shopping, exercise, Internet chat lines, or other things?	99.4	98.8	99.5	99.5	99.1	98.8
C11A_R RECODED: In the past 30 days, have you had any serious problems with depression, anxiety or other mental health problems?	99.5	98.5	98.9	99.6	99.3	99.4
C11B_R RECODED: How about in the last 12 months?	98.9	90.3	98.9	99.3	92.2	98.8
C11D_R RECODED: During the past 12 months, did you ever seriously consider attempting suicide?	99.5	98.8	98.9	99.6	88.8	99.4
C11E_R RECODED: During the past 12 months, did you actually attempt suicide?	99.5	98.8	98.9	99.6	88.8	99.4
C12_R RECODED: Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?	99.8	98.8	100.0	99.6	99.2	100.0
C13_R RECODED: How would you describe your childhood?	99.7	98.6	100.0	99.7	99.3	99.4
GA1_R RECODED: Which best describes your belief about the benefit or harm that gambling has for society?	99.3	97.5	93.2	99.6	97.3	90.6
GA2_R RECODED: Do you believe that gambling is morally wrong?	99.6	98.1	100.0	99.7	98.2	100.0
GA3A_R RECODED: Which of the following best describes your opinion about legalized gambling?	99.6	96.9	94.2	99.7	97.8	95.9
GA4_R RECODED: Which of the following best describes your opinion about gambling opportunities in Massachusetts?	98.5	97.4	93.2	99.2	97.0	92.9
GA5_R RECODED: There may be 3 new casinos and a slot parlor built in Massachusetts in the next few years. What sort of overall impact do you believe these may have?	99.7	98.8	96.3	99.7	99.2	95.9

	Percent complete					
		Wave 1			Wave 2	
	WEB	SAQ	PHONE	WEB	SAQ	PHONE
GA6A_RBC RECODED AND BACKCODED: What do you believe will be the single most positive impact for Massachusetts? Would you say…	99.7	98.8	95.3	99.6	99.5	98.2
GA6B_RBC RECODED AND BACKCODED: What do you believe will be the single most negative impact for Massachusetts? Would you say…	99.4	99.0	94.2	99.5	98.4	97.1
GA7_R RECODED: What sort of overall impact do you believe a new casino or slot parlor would have for your own community?	99.3	99.2	97.9	99.5	98.9	97.6
GY1A_R RECODED: In the past 12 months, how often have you purchased lottery tickets such as Megabucks, Powerball, Lucky for Life, or Mass Cash?	100.0	99.7	100.0	99.8	99.5	100.0
GY2A_R RECODED: In the past 12 months, how often have you purchased instant tickets or pull tabs?	99.6	99.3	99.5	99.5	99.3	97.6
GY2C_R RECODED: In the past 12 months, how often have you purchased raffle tickets?	99.6	98.8	100.0	99.8	98.6	98.8
GY3A_R RECODED: In the past 12 months, how often have you purchased daily lottery games such as Keno or Jackpot Poker?	99.6	98.6	100.0	99.6	98.9	100.0
GY4A_R RECODED: In the past 12 months, how often have you bet money on sporting events (this includes sports pools)?	99.6	99.8	100.0	99.4	99.6	100.0
GY5A_R RECODED: In the past 12 months, how often have you gone to a bingo hall to gamble?	99.6	99.2	99.5	99.6	98.9	100.0
GY8A_R RECODED: In the past 12 months, how many times have you gambled at a casino, racino, or slots parlor outside of Massachusetts?	99.6	90.5	100.0	99.8	90.3	100.0
GY8D_RBC - RECODED and BACKCODED:Please Specify the State	99.9	90.7	100.0	99.9	91.8	100.0
GY8E_RBC RECODED and BACKCODED: Which specific casino, racino, or slots parlor do you most often go to? (CATI)	99.4	89.2	98.4	99.7	91.2	98.8
GY8G_R RECODED: Have you gambled at any underground casino or slots parlor in Massachusetts in the past 12 months?	NA	NA	NA	99.8	99.5	100.0
RECODED: The Plainridge Park Casino recently opened in Plainville, Massachusetts. Have you gambled at this new casino?	NA	NA	NA	0.4	NA	73.5
GY8I_R RECODED: How many times have you gambled at the Plainridge Park Casino?	NA	NA	NA	0.4	NA	73.5
GY9A_R RECODED: In the past 12 months, how often have you bet on a horse race at either a horse race track or an off-track site?	99.6	99.4	100.0	99.8	99.6	100.0
GY9C_RBC- RECODED and BACKCODED:Please specify where you go most often?	99.8	98.5	100.0	99.9	98.6	100.0
GY10A_R RECODED: In the past 12 months, how often have you gambled or bet money against other people on things such as card games; golf, pool, darts, bowling; video games; board games, or poker outsid	99.6	98.6	100.0	99.7	99.5	99.4
GY11A_R RECODED: In the past 12 months, how often did you purchase high risk stocks, options or futures or day trade on the stock market?	99.6	98.3	100.0	99.6	99.0	98.2
GY12A_R RECODED: In the past 12 months, have you gambled online?	99.3	98.3	100.0	99.6	99.3	98.8
GM1_R RECODED: What would you say is the main reason that you gamble?				97.5	95.5	96.5
GR1_R RECODED: How important is gambling to you as a recreational activity?	99.4	98.6	98.9	99.7	99.2	98.2
GY2A_R RECODED: In the past 12 months, how often have you purchased instant tickets or pull tabs?	99.6	99.3	99.5	99.5	99.3	97.6
PA1_R RECODED: In the past 12 months have you seen or heard any media campaigns to prevent problem gambling in Massachusetts?	99.0	98.2	98.9	99.5	98.5	98.2
PA2A_R RECODED: In the past 12 months have you been aware of any programs to prevent problem gambling (other than media campaigns) offered at your school, your place of work, in your community or else	98.9	98.9	99.5	99.6	99.3	98.2
PA2B_R RECODED: Did you participate in any of the problem gambling prevention programs that you heard of in the past 12 months?	99.6	100.0	98.9	100.0	99.9	97.6
PA3_R RECODED: Did any of these media campaigns or programs cause you to alter your own gambling behavior?	99.3	99.5	98.4	99.5	99.6	98.2
GPO1_R RECODED: What portion of your close friends and family members are regular gamblers?	99.6	98.8	96.8	99.8	99.0	97.6
GPO2_R RECODED: During the last 12 months, has there been a person in your life that you consider gambles too much?	99.3	99.1	97.9	99.8	99.6	97.1
GPO3_R RECODED: What is this person's relationship to you?				99.8	99.4	95.9
GPO5_R RECODED: Overall, on a scale from 1 to 10 how much has this person's gambling affected you negatively during the last 12 months?	99.2	98.3	97.9	99.7	99.1	97.1
GP1_R RECODED: Thinking about the past 12 months, have you bet more than you could really afford to lose?	99.7	99.5	99.5	99.6	99.8	98.2
GP2_R RECODED: Thinking about the past 12 months, have you felt guilty about the way you gamble or what happens when you gamble?	99.4	99.5	98.4	99.7	99.8	98.2

	Percent complete					
		Wave 1			Wave 2	
	WEB	SAQ	PHONE	WEB	SAQ	PHONE
GP3_R RECODED: In the past 12 months, have you needed to gamble with larger amounts of money to get the same feeling of excitement?	99.2	99.5	98.4	99.7	99.7	98.2
GP4_R RECODED: In the past 12 months, when you gambled, did you go back another day to try to win back the money you lost?	99.1	99.4	98.4	99.5	99.6	97.1
GP5A_R RECODED: In the past 12 months, have you borrowed money or sold anything to get money to gamble?	99.6	99.4	98.4	99.5	99.6	97.6
GP5B_R RECODED: In the past 12 months, about how much money have you borrowed or obtained from selling possessions in order to gamble?	99.9	99.9	98.4	99.9	99.6	97.6
GP6A_R RECODED: In the past 12 months, has your gambling caused any financial problems for you or your household?	99.5	99.0	98.4	99.7	99.4	97.1
GP6B_R RECODED: In the past 12 months, have you filed for bankruptcy because of gambling?	99.9	100.0	98.4	99.9	99.8	97.6
GP7A_R RECODED: In the past 12 months, has your gambling caused you any health problems, including stress or anxiety?	99.3	99.4	98.4	99.6	99.5	97.1
GP7B_R RECODED: In the past 12 months have these health problems caused you to seek medical or psychological help?	99.9	99.9	98.4	99.9	99.9	97.1
GP8_R RECODED: In the past 12 months, have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?	99.6	99.4	98.4	99.7	99.7	97.6
GP9_R RECODED: In the past 12 months, have you felt that you might have a problem with gambling?	99.4	99.4	98.4	99.8	99.6	97.6
GP10A_R RECODED: Has your involvement in gambling caused significant mental stress in the form of guilt, anxiety, or depression for you or someone close to you in the past 12 months?	99.3	99.5	98.4	99.7	99.6	97.1
GP10B_R RECODED: In the past 12 months, have you thought of committing suicide because of gambling?	99.9	99.7	98.4	99.9	99.6	96.5
GP10C_R RECODED: In the past 12 months, have you attempted suicide because of gambling?	99.9	100.0	98.4	99.9	99.9	96.5
GP10D_R RECODED: Would you like to know about the free gambling and mental health treatment services in your local area?	99.9	99.8	98.4	99.9	99.9	96.5
GP11A_R RECODED: Has your involvement in gambling caused significant problems in your relationship with your spouse/partner or important friends or family in the past 12 months?	99.1	99.2	97.9	99.3	99.1	97.1
GP11B_R RECODED: In the past 12 months, has your involvement in gambling caused an instance of domestic violence in your household?	99.9	100.0	98.4	99.9	99.9	97.1
GP11C_R RECODED: In the past 12 months, has your involvement in gambling resulted in separation or divorce?	99.9	100.0	98.4	99.9	99.9	97.1
GP12A_R RECODED: In the past 12 months, has your involvement in gambling caused you to repeatedly neglect your children or family?	99.1	99.3	98.4	99.6	99.4	97.1
GP12B_R RECODED: In the past 12 months, has child welfare services become involved because of your gambling?	99.9	100.0	98.4	99.9	99.9	97.1
GP13A_R RECODED: Has your involvement in gambling caused significant work or school problems for you or someone close to you in the past 12 months or caused you to miss a significant amount of time of	99.0	99.4	98.4	99.7	99.6	97.1
GP13B_R RECODED: In the past 12 months, about how many work or school days have you lost due to gambling?	99.9	99.9	98.4	99.9	99.7	97.1
GP13C_R RECODED: In the past 12 months, have you lost your job or had to quit school due to gambling?	99.9	100.0	98.4	99.9	99.9	97.1
GP13D_R RECODED: In the past 12 months, did anyone in this household receive public assistance or other welfare payments as a result of losing your job because of gambling?	99.9	100.0	98.4	99.9	99.9	97.1
GP13E_R RECODED: Roughly how much money did you receive from public assistance in the past 12 months?	99.9	100.0	98.4	99.9	99.8	97.1
GP14A_R RECODED: In the past 12 months, has your involvement in gambling caused you or someone close to you to write bad checks, take money that didn't belong to you or commit other illegal acts to su	99.2	99.4	98.4	99.5	99.4	95.9
GP14B_R RECODED: In the past 12 months, about how much money have you illegally obtained in order to gamble?	99.9	99.9	98.4	99.9	99.9	96.5
GP14C_R RECODED: In the past 12 months, has your gambling been a factor in your committing a crime for which you have been arrested?	99.9	99.9	98.4	99.9	99.9	96.5
GP14D_R RECODED: Were you convicted for this crime?	99.9	100.0	98.4	99.9	99.9	96.5
GP14G_R RECODED: Were you incarcerated for this crime?	99.9	100.0	98.4	99.9	99.9	96.5
GP14H_R RECODED: For how many days were you incarcerated?	99.9	100.0	98.4	99.9	99.9	96.5

	Percent complete					
		Wave 1			Wave 2	
	WEB	SAQ	PHONE	WEB	SAQ	PHONE
GP15_R RECODED: In the past 12 months, have you often gambled longer, with more money or more frequently than you intended to?	99.3	98.3	98.4	99.7	98.9	97.1
GP16A_R RECODED: In the past 12 months, have you made attempts to either cut down, control or stop gambling?	99.1	97.6	97.9	99.4	98.5	95.9
GP16B_R RECODED: Were you successful in these attempts to cut down, control or stop gambling?	99.9	99.8	97.9	99.9	99.7	95.9
GP17_R RECODED: In the past 12 months, is there anyone else who would say that you had difficulty controlling your gambling, regardless of whether you agreed with them or not?	99.3	98.5	98.4	99.4	98.7	95.3
GP18_R RECODED: In the past 12 months, would you say you have been preoccupied with gambling?	99.3	98.5	98.4	99.5	98.6	95.3
GP19_R RECODED: In the past 12 months, when you did try cutting down or stopping did you find you were very restless or irritable or that you had strong cravings for it?	98.3	97.0	97.4	98.7	97.6	92.4
GP20_R RECODED: In the past 12 months, did you find you needed to gamble with larger and larger amounts of money to achieve the same level of excitement?	99.0	98.3	97.9	99.5	98.8	94.1
GP21_R RECODED: Are there particular types of gambling that have contributed to your problems more than others?	99.6	99.3	98.4	99.7	99.1	97.1
GP23A_R RECODED: Have you wanted help for gambling problems in the past 12 months?	99.6	99.4	98.4	99.7	99.3	97.1
GP23B_R RECODED: Have you sought help for gambling problems in the past 12 months?	99.6	99.4	98.4	99.7	99.3	97.1
GP23D_R RECODED: How helpful was this?	99.6	99.4	98.4	99.7	99.3	97.1
GP23E_R RECODED: Have you excluded yourself from any casino or slots parlor in the past 12 months?	99.6	99.3	98.4	99.7	99.3	97.1
GP23F_R RECODED: In which state?	100.0	100.0	100.0	100.0	100.0	100.0
GP24_R RECODED: Have you had problems with gambling in your lifetime prior to the past 12 months?	99.6	99.4	98.4	99.7	99.3	97.1
Canadian Problem Gambling Index	99.6	99.4	98.4	99.7	99.4	97.6
D4_R RECODED: At present are you…?	97.8	98.6	96.8	98.1	99.0	94.1
D5_R RECODED: How many children under 18 years old live in your household?	95.1	95.9	97.9	96.0	95.3	93.5
D6_R RECODED: What is the highest degree or level of school you have completed?	99.2	98.6	97.4	98.9	98.9	92.9
D7B_R RECODED: Have you ever served on active duty in the U.S. Armed Forces, military Reserves, or National Guard?	99.0	98.1	97.9	98.8	98.0	94.1
D8_ RBC RECODED AND BACKCODED: What type of healthcare coverage do you have?	96.9	98.0	94.7	96.0	98.5	94.1
D9_RBC RECODED AND BACKCODED: Do you own the place where you currently live, pay rent or something else?	98.1	98.4	96.8	97.6	97.8	94.1
D12_R RECODED: Were you born in the United States?	99.0	98.6	97.4	98.7	98.2	94.7
D12A_R RECODED: Do you live in Massachusetts for 6 or more months out of the year?	99.0	97.6	97.4	99.3	96.7	94.1
D13_R RECODED: Are you Hispanic or Latino?	98.2	97.5	97.4	98.3	96.8	94.7
Age (based on 2015-year of birth)	93.1	97.4	97.9	95.9	99.3	98.2
Alcohol use (3 categories)	99.9	99.7	100.0	99.8	99.5	100.0
Current tobacco use	99.6	97.1	99.5	99.7	96.8	99.4
Education (6 categories)	99.2	98.6	97.4	98.9	98.9	92.9
Employment (6 categories)	98.3	98.7	96.8	98.7	98.8	94.1
Household income (6 categories)	81.8	91.8	85.8	79.8	90.1	83.5
Marital status (5 categories)	97.8	98.6	96.8	98.1	99.0	94.1
ethnicity1	96.5	98.1	96.8	97.1	97.7	92.9

Appendix B: Questionnaire

Massachusetts Gambling Impact Cohort Study

Please have the adult in your household (18 years or older) who previously participated in the Massachusetts Survey of Health and Recreation complete this survey.

MAGIC MASSACHUSETTS GAMBLING IMPACT COHORT STUDY

UNIVERSITY OF MASSACHUSETTS SCHOOL OF PUBLIC HEALTH AND HEALTH SCIENCES

Instructions for Completing the Booklet

This booklet contains several types of questions. Each question should be answered only about yourself, not anyone else in your household.

- For some questions, you answer the question by marking a box, like this:
  1 ☒ Yes
  2 ☐ No
- For some questions, you answer the question by filling in one number per box, like this:
  0 **9** *Number of Days*
- You will sometimes be instructed to skip one or more questions. In this example, if your choice is 'No', you skip to question 10; otherwise, you continue to the next question.
  1 ☐ Yes
  2 ☒ No → GO TO 10
- This survey asks many questions about gambling as a recreational activity. We would like you to participate even if you have never gambled. It is important that we collect information that is representative of the state of Massachusetts.

Definitions

For the purposes of this survey, please refer to the definitions below for the following terms.

- "Non-medical" drug use means using it to get high or experience pleasurable effects, see what the effects are like, or use with friends.
- "Serious" means something that either you or someone else would say is considerable, important, or major, either because of its frequency or significance.
- A high risk stock is a stock from a company that has a real risk of going out of business and/or having their stock price double or triple in value in the next year.
- An "underground" casino is a place with unlicensed slot machines or casino game tables.

The University of Massachusetts is conducting a longitudinal study about gambling in Massachusetts. This survey is private and confidential. We have a Federal Certificate of Confidentiality that is designed to protect the confidentiality of your research data from a court order or subpoena. We can provide you with more information if you would like. You don't have to answer any question you don't want to, and you can stop at any time. Almost everyone will be able to finish the survey within 15 to 20 minutes.

If you have questions about the Federal Certificate of Confidentiality, please visit: http://grants.nih.gov/grants/policy/coc/faqs.htm#187.

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  2 ☒ No → GO TO 10
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Health Section

We would like to start by asking you questions about your health.

1. **Which of the following is your preferred recreational activity? Would you say…**
   - 1 ☐ Watching TV
   - 2 ☐ Walking or hiking
   - 3 ☐ Gardening
   - 4 ☐ Reading
   - 5 ☐ Socializing with friends or family
   - 6 ☐ Traveling
   - 7 ☐ Gambling
   - 91 ☐ Other

2. **Do you enjoy participating in extreme sports such as hang gliding or sky diving?**
   - 1 ☐ Yes
   - 2 ☐ No

3. **Do you have an internet connection either at home or at work?**
   - 1 ☐ Yes
   - 2 ☐ No

4. **Overall, how often do you use the Internet?**
   - 1 ☐ Daily
   - 2 ☐ A few times a week
   - 3 ☐ A few times a month
   - 4 ☐ A few times a year
   - 5 ☐ Not at all

5. **Over the past 12 months, would you say that in general your health has been…?**
   - 1 ☐ Excellent
   - 2 ☐ Very good
   - 3 ☐ Good
   - 4 ☐ Fair
   - 5 ☐ Poor

6. **In the past 12 months, how would you rate your overall level of stress? Would you say…?**
   - 1 ☐ Very high
   - 2 ☐ High
   - 3 ☐ Moderate
   - 4 ☐ Low
   - 5 ☐ Very low

7. **In the past 12 months, how would you rate your overall level of happiness? Would you say…?**
   - 1 ☐ Very high
   - 2 ☐ High
   - 3 ☐ Moderate
   - 4 ☐ Low
   - 5 ☐ Very low

8. **Have you smoked at least 100 cigarettes in your entire life?**
   - 1 ☐ Yes
   - 2 ☐ No → **GO TO 10**

9. **Would you say you now smoke cigarettes…?**
   - 1 ☐ Every day
   - 2 ☐ Some days
   - 3 ☐ Not at all

10. **Do you currently smoke cigars, pipe tobacco, or hookah tobacco (shisha); or use dipping tobacco (including snus), chewing tobacco, or snuff…**
    - 1 ☐ Every day
    - 2 ☐ Some days
    - 3 ☐ Not at all

11. **During the past 30 days, how many days would you estimate you have used any form of tobacco?**
    ☐☐ *Days*

12. **Have you used alcohol in the past 12 months?**
    - 1 ☐ Yes
    - 2 ☐ No → **GO TO 16 ON PAGE 2**

13. **During the past 30 days, how many days per week or per month did you have at least one drink of any alcohol beverage such as beer, wine, a malt beverage or liquor?** *Please enter the number of days per week or days per month.*
    - 1 ☐ *Days per Week*

    or
    - 2 ☐☐ *Days per Month*

14. **One drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor. During the past 30 days, on the days when you drank, about how many drinks did you drink on average?**

☐☐ *Number of Drinks*

15. **Considering all types of alcoholic beverages, how many times during the past 30 days did you have:**

If you are male: 5 or more drinks on an occasion?

☐☐ *Number of Times*

If you are female: 4 or more drinks on an occasion?

☐☐ *Number of Times*

16. **In the past 12 months have you used any marijuana, hallucinogens (such as LSD, mushrooms, or PCP), cocaine, heroin or opium, or any other drugs not intended for medical use?** *If you are not sure what is considered non-medical drug use, please refer to the definitions on the inside cover.*

1 ☐ Yes
2 ☐ No

17. **Have you had any problems with drugs or alcohol in the past 12 months? By this we mean difficulties in controlling their use that have led to negative consequences for you or other people.**

1 ☐ Yes
2 ☐ No → **GO TO 19**

18. **During the past 12 months, have you sought help for your use of alcohol or drugs?**

1 ☐ Yes
2 ☐ No

19. **Have you had any problems with other behavior in the past 12 months such as overeating, sex or pornography, shopping, exercise, Internet chat lines, or other things? What we mean is difficulties controlling the behavior which has led to significant negative consequences for you or other people.**

1 ☐ Yes
2 ☐ No → **GO TO 21**

20. **Which specific activities have you had problems with? Have you had problems with…?** *Check all that apply.*

1 ☐ Overeating
2 ☐ Sex or pornography
3 ☐ Exercise
4 ☐ Shopping
5 ☐ Internet chat lines
6 ☐ Video or internet gaming
91 ☐ Other

21. **In the past 30 days, have you had any serious problems with depression, anxiety or other mental health problems?** *If you are not sure what is considered serious, please refer to the definitions on the inside cover.*

1 ☐ Yes → **GO TO 23**
2 ☐ No

22. **How about in the last 12 months?**

1 ☐ Yes
2 ☐ No → **GO TO 26 ON PAGE 3**

23. **Which problems have you experienced?**

24. **During the past 12 months, did you ever seriously consider attempting suicide?**

1 ☐ Yes
2 ☐ No → **GO TO 26 ON PAGE 3**

25. **During the past 12 months, did you actually attempt suicide?**

1 ☐ Yes
2 ☐ No

If you would like information regarding treatment resources, please see page 13 for contact information.

26. Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?

1 ☐ Yes
2 ☐ No

27. How would you describe your childhood? Would you say…?

1 ☐ Very happy
2 ☐ Happy
3 ☐ Neither happy nor unhappy
4 ☐ Unhappy
5 ☐ Very unhappy

Recreation Questions

The primary recreational activity we have chosen to ask you about is gambling.

We define gambling as betting money or material goods on an event with an uncertain outcome in the hopes of winning additional money or material goods. It includes things such as lottery tickets, scratch tickets, bingo, betting against a friend on a game of skill or chance, betting on horse racing or sports, investing in high risk stocks, etc.

28. Which best describes your belief about the benefit or harm that gambling has for society? Would you say...?

1 ☐ The harm far outweighs the benefits
2 ☐ The harm somewhat outweighs the benefits
3 ☐ The benefits are about equal to the harm
4 ☐ The benefits somewhat outweigh the harm
5 ☐ The benefits far outweigh the harm

29. Do you believe that gambling is morally wrong?

1 ☐ Yes
2 ☐ No

30. Which of the following best describes your opinion about *legalized* gambling? Would you say…?

1 ☐ All types of gambling should be legal → GO TO 32
2 ☐ Some types of gambling should be legal and some should be illegal
3 ☐ All types of gambling should be illegal → GO TO 32

31. Which types of gambling do you believe should be illegal?

32. Which of the following best describes your opinion about gambling opportunities in Massachusetts? Would you say…?

1 ☐ Gambling is too widely available
2 ☐ Gambling is not available enough
3 ☐ The current availability of gambling is fine

33. There may be 3 new casinos and a slot parlor built in Massachusetts in the next few years. What sort of overall impact do you believe these may have? Would you say…?

1 ☐ Very beneficial
2 ☐ Somewhat beneficial
3 ☐ Neither beneficial nor harmful
4 ☐ Somewhat harmful
5 ☐ Very harmful

34. What do you believe will be the single most positive impact for Massachusetts? Would you say…?

1 ☐ Employment
2 ☐ Benefit to other local businesses
3 ☐ Increased government revenue
4 ☐ Retaining money that was leaving Massachusetts
5 ☐ Increased local leisure options (i.e., the ability to gamble locally)
6 ☐ No positive impacts
91 ☐ Other

35. **What do you believe will be the single most negative impact for Massachusetts? Would you say…?**
- 1 ☐ Increased gambling addiction (and associated consequences: bankruptcy, suicide, divorce, etc.)
- 2 ☐ Negative impact on other local businesses
- 3 ☐ Increased crime
- 4 ☐ Increased traffic congestion
- 5 ☐ No negative impacts
- 91 ☐ Other

36. **What sort of overall impact do you believe a new casino or slot parlor would have for your own community? Would you say…?**
- 1 ☐ Very beneficial
- 2 ☐ Somewhat beneficial
- 3 ☐ Neither beneficial nor harmful
- 4 ☐ Somewhat harmful
- 5 ☐ Very harmful

Past Gambling Behaviors

Now, we would like you to think about different times that you have gambled in the past year.

37. **In the past 12 months, how often have you purchased *lottery tickets* such as Megabucks, Powerball, Lucky for Life, or Mass Cash? Would you say…?**
- 1 ☐ 4 or more times a week
- 2 ☐ 2-3 times a week
- 3 ☐ Once a week
- 4 ☐ 2-3 times a month
- 5 ☐ Once a month
- 6 ☐ Less than once a month
- 7 ☐ Not at all → **GO TO 39**

38. **Roughly how much money do you spend on lottery tickets in a typical month? Spend means how much you are ahead (+$) or behind (–$), or your net win or loss in an average month in the past 12 months.**

☐ – $ ☐ , ☐☐☐ , ☐☐☐

39. **In the past 12 months, how often have you purchased *instant tickets or pull tabs?* Would you say…?**
- 1 ☐ 4 or more times a week
- 2 ☐ 2-3 times a week
- 3 ☐ Once a week
- 4 ☐ 2-3 times a month
- 5 ☐ Once a month
- 6 ☐ Less than once a month
- 7 ☐ Not at all → **GO TO 41**

40. **Roughly how much money do you spend on instant tickets or pull tabs in a typical month?**

☐ – $ ☐ , ☐☐☐ , ☐☐☐

41. **In the past 12 months, how often have you purchased *raffle tickets?* Would you say…?**
- 1 ☐ 4 or more times a week
- 2 ☐ 2-3 times a week
- 3 ☐ Once a week
- 4 ☐ 2-3 times a month
- 5 ☐ Once a month
- 6 ☐ Less than once a month
- 7 ☐ Not at all → **GO TO 43**

42. **Roughly how much money do you spend on raffle tickets in a typical month?**

☐ – $ ☐ , ☐☐☐ , ☐☐☐

43. **In the past 12 months, how often have you purchased *daily lottery games* such as *Keno or Jackpot Poker*? Would you say…?**
- 1 ☐ 4 or more times a week
- 2 ☐ 2-3 times a week
- 3 ☐ Once a week
- 4 ☐ 2-3 times a month
- 5 ☐ Once a month
- 6 ☐ Less than once a month
- 7 ☐ Not at all → **GO TO 45 ON PAGE 5**

44. **Roughly how much money do you spend on daily lottery games such as Keno or Jackpot Poker in a typical month?**

☐ – $ ☐ , ☐☐☐ , ☐☐☐

45. **In the past 12 months, how often have you bet money on *sporting events* (this includes sports pools)? Would you say…?**
   1 ☐ 4 or more times a week
   2 ☐ 2-3 times a week
   3 ☐ Once a week
   4 ☐ 2-3 times a month
   5 ☐ Once a month
   6 ☐ Less than once a month
   7 ☐ Not at all → **GO TO 47**

46. **Roughly how much money do you spend on sports betting in a typical month?**
   – $ ☐, ☐☐☐, ☐☐☐

47. **In the past 12 months, how often have you gone to a *bingo hall* to gamble? Would you say…?**
   1 ☐ 4 or more times a week
   2 ☐ 2-3 times a week
   3 ☐ Once a week
   4 ☐ 2-3 times a month
   5 ☐ Once a month
   6 ☐ Less than once a month
   7 ☐ Not at all → **GO TO 49**

48. **Roughly how much money do you spend at bingo halls in a typical month?**
   – $ ☐, ☐☐☐, ☐☐☐

49. **In the past 12 months, how many times have you gambled at a *casino, racino, or slots parlor outside of Massachusetts?***
   ☐☐☐ *Times* → **IF ZERO, GO TO 54**

50. **Roughly how much money do you spend on gambling per visit in out of state casinos, racinos, slots parlors, and slots at racetracks.?**
   – $ ☐, ☐☐☐, ☐☐☐

51. **Roughly how much money do you spend on nongambling activities (such as food, travel, lodging, entertainment) per visit in out-of-state casinos, racinos, slots parlors, and slots at racetracks?**
   $ ☐☐, ☐☐☐

52. **Which state do you most often go to for this gambling?**

53. **Which specific casino, racino, or slots parlor do you most often go to?**

54. **Have you gambled at any 'underground' casino or slots parlor in Massachusetts in the past 12 months?** *If you are not sure what is considered an 'underground' casino, please refer to the definitions on the inside cover.*
   1 ☐ Yes
   2 ☐ No

55. **In the past 12 months, how often have you bet on a *horse race* at either a horse race track or an off-track site? Would you say…?**
   1 ☐ 4 or more times a week
   2 ☐ 2-3 times a week
   3 ☐ Once a week
   4 ☐ 2-3 times a month
   5 ☐ Once a month
   6 ☐ Less than once a month
   7 ☐ Not at all → **GO TO 58 ON PAGE 6**

56. **Roughly how much money do you spend on horse racing in a typical month?**
   – $ ☐, ☐☐☐, ☐☐☐

57. **Where do you most often go to bet on horse racing?**

58. **In the past 12 months, how often have you gambled or *bet money against other people* on things such as card games; golf, pool, darts, bowling; video games; board games, or poker outside of a casino? Would you say…?**
Poker played in a casino and games played on the internet should NOT be included.

1 ☐ 4 or more times a week
2 ☐ 2-3 times a week
3 ☐ Once a week
4 ☐ 2-3 times a month
5 ☐ Once a month
6 ☐ Less than once a month
7 ☐ Not at all → **GO TO 60**

59. **Roughly how much money do you spend gambling or betting money against other people in a typical month?**

[–] $ [ ] , [ ][ ][ ] , [ ][ ][ ]

60. **In the past 12 months, how often did you purchase *high risk stocks, options or futures or day trade* on the stock market? Would you say…?** *If you are not sure what a high risk stock is, please refer to the definitions on the inside cover.*

1 ☐ 4 or more times a week
2 ☐ 2-3 times a week
3 ☐ Once a week
4 ☐ 2-3 times a month
5 ☐ Once a month
6 ☐ Less than once a month
7 ☐ Not at all → **GO TO 62**

61. **What do you estimate is your net loss or gain in a typical month from high risk stocks, options, futures, or day trading?**

[–] $ [ ] , [ ][ ][ ] , [ ][ ][ ]

62. **In the past 12 months, have you *gambled online?* This would include things such as playing poker, buying lottery tickets, betting on sports, bingo, slots or casino table games for money or playing interactive games for money?**

1 ☐ Yes
2 ☐ No → **GO TO 65**

63. **Roughly how much money do you spend gambling online in a typical month?**

[–] $ [ ] , [ ][ ][ ] , [ ][ ][ ]

64. **What is the main type of online gambling you engage in?**

65. **What would you say is the main reason that you gamble? Would you say…?**

1 ☐ For excitement/entertainment
2 ☐ To win money
3 ☐ To escape or distract yourself
4 ☐ To socialize with family or friends
5 ☐ To support worthy causes
6 ☐ Because it makes you feel good about yourself
91 ☐ Other

66. **How important is gambling to you as a recreational activity? Would you say…?**

1 ☐ Very important
2 ☐ Somewhat important
3 ☐ Not very important
4 ☐ Not at all important

67. **Has gambling replaced other recreational activities for you in the past 5 years?**

1 ☐ Yes
2 ☐ No → **GO TO 69**

68. **Which recreational activities has gambling replaced?**

Prevention Awareness

We would now like you to think about what you have heard about gambling prevention either from the media or from others.

69. **In the past 12 months have you seen or heard any media campaigns to prevent problem gambling in Massachusetts?**

1 ☐ Yes
2 ☐ No

70. **In the past 12 months have you been aware of any programs to prevent problem gambling [other than media campaigns] offered at your school, your place of work, in your community or elsewhere?**
   1 ☐ Yes
   2 ☐ No

71. **Did you participate in any of the problem gambling prevention programs that you heard of in the past 12 months?**
   1 ☐ Yes
   2 ☐ No

72. **Did any of these media campaigns or programs cause you to alter your own gambling behavior?**
   1 ☐ Yes
   2 ☐ No

73. **What portion of your close friends and family members are regular gamblers? Would you say…?**
   1 ☐ None of them
   2 ☐ Some of them
   3 ☐ Most of them
   4 ☐ All of them

74. **During the last 12 months, has there been a person in your life that you consider gambles too much?**
   1 ☐ Yes
   2 ☐ No → **GO TO 78**

75. **What is this person's relationship to you?**
   1 ☐ Spouse or Partner
   2 ☐ Parent or Step Parent
   3 ☐ Child or Step Child
   4 ☐ Other person in your household
   5 ☐ Other family member not living in your household
   6 ☐ Ex-partner
   7 ☐ Work colleague
   8 ☐ Friend
   9 ☐ Neighbor
   91 ☐ Someone else

76. **In what ways has this person's gambling affected you during the last 12 months?**

77. **Overall, on a scale from 1 to 10 how much has this person's gambling affected you negatively during the last 12 months?**

No Effect									Major Effect
1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Gambling Outcomes

When answering the questions throughout the remainder of the survey, please think about the past 12 months.

78. **Thinking about the past 12 months, have you bet more than you could really afford to lose? Would you say...?**
   1 ☐ Never
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

79. **Thinking about the past 12 months, have you felt guilty about the way you gamble or what happens when you gamble? Would you say…?**
   1 ☐ Never
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

80. **In the past 12 months, have you needed to gamble with larger amounts of money to get the same feeling of excitement? Would you say…?**
   1 ☐ Never
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

81. **In the past 12 months, when you gambled, did you go back another day to try to win back the money you lost? Would you say…?**
   1 ☐ Never
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

82. **In the past 12 months, have you borrowed money or sold anything to get money to gamble? Would you say…?**
   1 ☐ Never → **GO TO 84**
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

83. **In the past 12 months, about how much money have you borrowed or obtained from selling possessions in order to gamble?**
   $☐☐,☐☐☐

84. **In the past 12 months, has your gambling caused any financial problems for you or your household? Would you say…?**
   1 ☐ Never → **GO TO 86**
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

85. **In the past 12 months, have you filed for bankruptcy because of gambling?**
   1 ☐ Yes
   2 ☐ No

86. **In the past 12 months, has your gambling caused you any health problems, including stress or anxiety? Would you say…?**
   1 ☐ Never → **GO TO 88**
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

87. **In the past 12 months have these health problems caused you to seek medical or psychological help?**
   1 ☐ Yes
   2 ☐ No

88. **In the past 12 months, have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true? Would you say...?**
   1 ☐ Never
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

89. **In the past 12 months, have you felt that you might have a problem with gambling? Would you say...?**
   1 ☐ Never
   2 ☐ Sometimes
   3 ☐ Most of the time
   4 ☐ Almost always

90. **Has your involvement in gambling caused significant mental stress in the form of guilt, anxiety, or depression for you or someone close to you in the past 12 months?**
   1 ☐ Yes
   2 ☐ No → **GO TO 93**

91. **In the past 12 months, have you thought of committing suicide because of gambling?**
   1 ☐ Yes
   2 ☐ No → **GO TO 93**

92. **In the past 12 months, have you attempted suicide because of gambling?**
   1 ☐ Yes
   2 ☐ No

If you would like information regarding treatment resources, please see page 13 for contact information

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93. **Has your involvement in gambling caused significant problems in your relationship with your spouse/partner or important friends or family in the past 12 months?**
   1 ☐ Yes
   2 ☐ No → **GO TO 96 ON PAGE 9**

94. In the past 12 months, has your involvement in gambling caused an instance of domestic violence in your household?
1 ☐ Yes
2 ☐ No

95. In the past 12 months, has your involvement in gambling resulted in separation or divorce?
1 ☐ Yes
2 ☐ No

96. In the past 12 months, has your involvement in gambling caused you to repeatedly neglect your children or family?
1 ☐ Yes
2 ☐ No → GO TO 98

97. In the past 12 months, has child welfare services become involved because of your gambling?
1 ☐ Yes
2 ☐ No

98. Has your involvement in gambling caused significant work or school problems for you or someone close to you in the past 12 months or caused you to miss a significant amount of time off work or school?
1 ☐ Yes
2 ☐ No → GO TO 103

99. In the past 12 months, about how many work or school days have you lost due to gambling?
☐☐☐ *Days*

100. In the past 12 months, have you lost your job or had to quit school due to gambling?
1 ☐ Yes
2 ☐ No → GO TO 103

101. In the past 12 months, did anyone in this household receive any public assistance (food stamps, Temporary Assistance for Needy Families (TANF)) or any other welfare payments from the state or local welfare office as a result of losing your job because of gambling?
1 ☐ Yes
2 ☐ No → GO TO 103

102. Roughly how much money did you receive from public assistance in the past 12 months?
$☐☐,☐☐☐

103. In the past 12 months, has your involvement in gambling caused you or someone close to you to write bad checks, take money that didn't belong to you or commit other illegal acts to support your gambling?
1 ☐ Yes
2 ☐ No → GO TO 110 ON PAGE 10

104. In the past 12 months, about how much money have you illegally obtained in order to gamble?
$☐☐,☐☐☐

105. In the past 12 months, has your gambling been a factor in your committing a crime for which you have been arrested?
1 ☐ Yes
2 ☐ No → GO TO 110 ON PAGE 10

106. Were you convicted for this crime?
1 ☐ Yes
2 ☐ No → GO TO 110 ON PAGE 10

107. What was the offense?
☐

108. Were you incarcerated for this crime?
1 ☐ Yes
2 ☐ No → GO TO 110 ON PAGE 10

109. For how many days were you incarcerated?

☐☐☐ *Days*

110. In the past 12 months, have you often gambled longer, with more money or more frequently than you intended to?
1 ☐ Yes
2 ☐ No

111. In the past 12 months, have you made attempts to either cut down, control or stop gambling?
1 ☐ Yes
2 ☐ No → GO TO 113

112. Were you successful in these attempts to cut down, control or stop gambling?
1 ☐ Yes
2 ☐ No

113. In the past 12 months, is there anyone else who would say that you had difficulty controlling your gambling, regardless of whether you agreed with them or not?
1 ☐ Yes
2 ☐ No

114. In the past 12 months, would you say you have been preoccupied with gambling?
1 ☐ Yes
2 ☐ No

115. In the past 12 months, when you did try cutting down or stopping did you find you were very restless or irritable or that you had strong cravings for it?
1 ☐ Yes
2 ☐ No

116. In the past 12 months, did you find you needed to gamble with larger and larger amounts of money to achieve the same level of excitement?
1 ☐ Yes
2 ☐ No

117. Are there particular types of gambling that have contributed to your problems more than others?
1 ☐ Yes
2 ☐ No → GO TO 119

118. Which types of gambling have contributed to your problems?

119. Have you *wanted* help for gambling problems in the past 12 months?
1 ☐ Yes
2 ☐ No → GO TO 123

120. Have you *sought* help for gambling problems in the past 12 months?
1 ☐ Yes
2 ☐ No → GO TO 123

121. Where did you seek help from?

122. How helpful was this? Would you say…?
1 ☐ Very helpful
2 ☐ Somewhat helpful
3 ☐ Not very helpful
4 ☐ Not at all helpful

123. Have you excluded yourself from any casino or slots parlor in the past 12 months?
1 ☐ Yes
2 ☐ No → GO TO 125

124. In which state?

125. Have you had problems with gambling in your lifetime prior to the past 12 months?
1 ☐ Yes
2 ☐ No

Household Demographics

126. Are you male or female?
1 ☐ Male
2 ☐ Female

127. In what year were you born?

☐☐☐☐ *Year*

128. At present are you...?

1 ☐ Married
2 ☐ Living with your partner
3 ☐ Separated, but still legally married
4 ☐ Divorced
5 ☐ Widowed
6 ☐ Never been married

129. How many children under 18 years old live in your household?

☐☐ *Number of Children*

130. What is the highest degree or level of school you have completed?

1 ☐ Never attended school or only attended kindergarten
2 ☐ Grades 1 through 8
3 ☐ Grades 9 through 11
4 ☐ Regular high school diploma or GED
5 ☐ Some college credit, but less than 1 year of college credit
6 ☐ 1 or more years of college credit, no degree
7 ☐ Associate degree
8 ☐ Bachelor's degree
9 ☐ Master's degree
10 ☐ Professional degree beyond a bachelor's degree
11 ☐ Doctorate degree

131. Are you currently...?

1 ☐ Employed for wages
2 ☐ Self-employed
3 ☐ Out of work for more than 1 year
4 ☐ Out of work for less than 1 year
5 ☐ A homemaker
6 ☐ A student
7 ☐ Retired
8 ☐ Unable to work

132. Have you ever served on active duty in the U.S. Armed Forces, military Reserves, or National Guard? *Active duty does not include training for the Reserves or National Guard, but does include activation, for example, for the Persian Gulf War.*

1 ☐ Yes, now on active duty
2 ☐ Yes, on active duty in the past, but not during the last 12 months
3 ☐ No, training for Reserves or National Guard only → **GO TO 134**
4 ☐ No, never served in the military → **GO TO 134**

133. When did you serve on active duty in the U.S. Armed Forces? *Check all that apply.*

1 ☐ September 2001 or later
2 ☐ August 1990 to August 2001 (including Persian Gulf War)
3 ☐ September 1980 to July 1990
4 ☐ May 1975 to August 1980
5 ☐ Vietnam era (August 1964 to April 1975)
6 ☐ March 1961 to July 1964
7 ☐ Korean War (July 1950 to January 1955)
8 ☐ World War II (December 1941 to December 1946)
9 ☐ February 1955 to February 1961
10 ☐ January 1947 to June 1950
11 ☐ November 1941 or earlier

134. What type of healthcare coverage do you have?

1 ☐ Prepaid private plans such as HMOs or PPOs
2 ☐ Medicare
3 ☐ Medicaid
4 ☐ Commonwealth Care Program (Health Connector)
5 ☐ Indian Health Services
6 ☐ Veterans Affairs (VA)
91 ☐ Other Plan

7 ☐ No health insurance

135. Do you own the place where you currently live, pay rent or something else?

1 ☐ Own
2 ☐ Rent
91 ☐ Something else

136. Is your approximate annual household income from all sources...

1 ☐ Less than $15,000
2 ☐ $15,000 - $29,999
3 ☐ $30,000 - $49,999
4 ☐ $50,000 - $69,999
5 ☐ $70,000 - $99,999
6 ☐ $100,000 - $124,999
7 ☐ $125,000 - $149,999
8 ☐ $150,000 or more

137. What do you estimate your current debt to be? Please include mortgages, credit cards, loans, car payments, etc.

1 ☐ $0 (no debt)
2 ☐ Less than $10,000
3 ☐ $10,000 - $19,999
4 ☐ $20,000 - $39,999
5 ☐ $40,000 - $59,999
6 ☐ $60,000 - $79,999
7 ☐ $80,000 - $99,999
8 ☐ $100,000 - $119,999
9 ☐ $120,000 - $139,999
10 ☐ $140,000 - $159,999
11 ☐ $160,000 - $179,999
12 ☐ $180,000 - $199,999
13 ☐ $200,000 - $299,999
14 ☐ $300,000 - $399,999
15 ☐ $400,000 - $499,999
16 ☐ $500,000 or more

138. Were you born in the United States?

1 ☐ Yes
2 ☐ No

139. Many people only live in Massachusetts for part of the year. Do you live in Massachusetts for 6 or more months out of the year? *If you recently moved to Massachusetts and plan on staying for 6 months or longer, mark yes. If you are planning on moving out of Massachusetts but have lived there for at least 6 months in 2014, mark yes.*

1 ☐ Yes
2 ☐ No

140. Are you Hispanic or Latino?

1 ☐ Yes
2 ☐ No

141. Which one or more of the following would you say is your race? *Check all that apply.*

1 ☐ White or Caucasian
2 ☐ Black or African American
3 ☐ Asian
4 ☐ Native Hawaiian or Other Pacific Islander
5 ☐ Native American or Alaskan Native
91 ☐ Some other race

142. How many members of your household, including yourself, are 18 years of age or older?

☐☐

143. To document who completed the survey from your household, please enter your first and last name.

144. What is the best phone number to reach you if we have more questions about your household? *This number will only be used to contact you about this study. We are prohibited from sharing, distributing, or selling your information to anyone outside of this project.*

☐☐☐-☐☐☐-☐☐☐☐

145. Please enter your email address.

You have reached the end of the survey. Thank you for your participation! You may be re-contacted in the future to participate in related studies. If you are contacted to participate in future surveys, you have the right to refuse. Thank you on behalf of the University of Massachusetts for the time and effort you've spent answering these questions. If you have any questions about this survey, you may contact Dr. Rachel Volberg at 413-545-6700.

Thank you again.

If you would like information regarding treatment resources, please contact:

Massachusetts Substance
Abuse Information and Education Helpline
800-327-5050
TTY: 617-536-5872

Drug & Alcohol
Treatment Hotline
800-662-HELP

National Alliance on
Mental Illness
1-800-950-6264

Samaritans
877-870-4673

National Suicide
Prevention Lifeline
1-800-273-8255
1-800-799-4889

Because we are interested in how opinions change over time, we may be contacting you in the future. To help us contact you, please provide the name and contact information for three people who are likely to know where you can be reached. Do not include someone who lives in your household.

Contact #1
Name

Address

Phone

Email

Contact #2
Name

Address

Phone

Email

Contact #3
Name

Address

Phone

Email

Please return your completed questionnaire using the enclosed pre-paid envelope to:

University of Massachusetts Amherst
C/O NORC at the University of Chicago
1 North State Street, 16th Floor
Chicago, IL 60602

If you have misplaced the pre-paid envelope, please call 1-866-900-9601 for a new one.

NORC at the University of Chicago is conducting this study on behalf of the University of Massachusetts Amherst. If you have questions or would prefer to complete the survey by phone, please call NORC toll-free at 1-866-900-9601.

If you have questions about your rights as a study participant, you may call the NORC Institutional Review Board toll-free, at 1-866-309-0542.

If you would prefer to complete this survey online, please go to: https://MACohort.norc.org/go/MAGIC.

Your unique survey Personal Identification Number (PIN) is: XXXXX.

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Receipt		CADE		Verification		Adjudication	
Initials	Date	Initials	Date	Initials	Date	Initials	Date