Drinking Patterns and Alcohol Use Disorders in São Paulo, Brazil: The Role of Neighborhood Social Deprivation and Socioeconomic Status

Camila Magalhães Silveira1,2,*, Erica Rosanna Siu1,*, James C. Anthony2, Luis Paulo Saito1, Arthur Guerra de Andrade2, Andressa Kutschenko1, Maria Carmen Viana1, Yuan-Pang Wang1, Silvia S. Martins4, Laura Helena Andrade1

1 Section of Psychiatric Epidemiology - LIM 23, Institute of Psychiatry, School of Medicine, University of São Paulo, São Paulo, São Paulo, Brazil, 2 Program of the Interdisciplinary Group of Studies on Alcohol and Drugs (GREA), Department and Institute of Psychiatry, School of Medicine, University of São Paulo, São Paulo, São Paulo, Brazil, 3 Department of Epidemiology and Statistics, Michigan State University, East Lansing, Michigan, United States of America, 4 Department of Epidemiology, Mailman School Of Public Health, Columbia University, New York, New York, United States of America

Abstract

Background: Research conducted in high-income countries has investigated influences of socioeconomic inequalities on drinking outcomes such as alcohol use disorders (AUD), however, associations between area-level neighborhood social deprivation (NSD) and individual socioeconomic status with these outcomes have not been explored in Brazil. Thus, we investigated the role of these factors on drink-related outcomes in a Brazilian population, attending to male-female variations.

Methods: A multi-stage area probability sample of adult household residents in the São Paulo Metropolitan Area was assessed using the WHO Composite International Diagnostic Interview (WMH-CIDI) (n = 5,037). Estimation focused on prevalence and correlates of past-year alcohol disturbances [heavy drinking of lower frequency (HDLF), heavy drinking of higher frequency (HDHF), abuse, dependence, and DMS-5 AUD] among regular users (RU); odds ratio (OR) were obtained.

Results: Higher NSD, measured as an area-level variable with individual level variables held constant, showed an excess odds for most alcohol disturbances analyzed. Prevalence estimates for HDHF and HDHF among RU were 9% and 20%, respectively, with excess odds in higher NSD areas; schooling (inverse association) and low income were associated with male HDLF. The only individual-level association with female HDLF involved employment status. Prevalence estimates for abuse, dependence, and DMS-5 AUD among RU were 8%, 4%, and 8%, respectively, with excess odds of: dependence in higher NSD areas for males; abuse and AUD for females. Among RU, AUD was associated with unemployment, and low education with dependence and AUD.

Conclusions: Regular alcohol users with alcohol-related disturbances are more likely to be found where area-level neighborhood characteristics reflect social disadvantage. Although we cannot draw inferences about causal influence, the associations are strong enough to warrant future longitudinal alcohol studies to explore causal mechanisms related to the heterogeneous patterns of association and male-female variations observed herein. Hopefully, these findings may help guide future directions for public health.

Citation: Silveira CM, Siu ER, Anthony JC, Saito LP, Andrade AGd. et al. (2014) Drinking Patterns and Alcohol Use Disorders in São Paulo, Brazil: The Role of Neighborhood Social Deprivation and Socioeconomic Status. PLoS ONE 9(10): e108355. doi:10.1371/journal.pone.0108355

Editor: Svetlana Popova, Centre for Addiction and Mental Health, Canada

Received January 16, 2014; Accepted August 26, 2014; Published October 1, 2014

Copyright: © 2014 Silveira et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: The São Paulo Megacity Mental Health Survey was funded by the State of São Paulo Research Foundation, Brazil (FAPESP Grants 03/00204-3 and 2011/50517-4, URL: http://www.fapesp.br/materia/176/projeto-tematico/projeto-tematico.htm), National Council for Scientific and Technological Development (CNPq - grant 313675/2009-0), Instrument development was supported by the Foundation for Science and Technology of Vitória, Espírito Santo, Brazil (Fundu de Apoio à Ciência e Tecnologia do Município de Vitória - FACITEC 002/2003). Dr. Martins received research support from National Institute on Drug Abuse (NIDA) grants DA020667 and DA023434 and from National Institute of Child and Human Development (NICHD) grant HD06072, USA while working on this manuscript. Dr. Anthony also had NIDA grants to support his work: R01DA016558, and K05DA015799. The São Paulo Megacity Mental Health Survey is carried out in conjunction with the World Health Organization (WHO) WMH Survey Initiative. The authors thank the WMH staff for assistance with instrumentation, fieldwork, and data analysis. The main coordination center activities, at Harvard University, were supported by the United States National Institutes of Mental Health (R01MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069664, and R01 DA016558), the Fogarty International Center (FIRCA R03-TW006481), the Pan American Health Organization, the Eli Lilly and Company Foundation, Ortho-McNeil Pharmaceutical, Inc., GlaxoSmithKline, Bristol-Myers Squibb, and Shire. The authors declare that the funders of the SPMS had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. The authors also declare that the commercial funders of the Harvard coordination center had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. The authors thank the SPMS staff members, Beatriz Margarita Adler, Marlene Galavitcis Teixeira, Indaiá de Santana Bassani, and Fidel Beiralin. Thanks also are due to the WMH staff for assistance with instrumentation, fieldwork, and data analysis. A complete list of WMH publications can be found at http://www.hcp.med.harvard.edu/wmh/.

Competing Interests: The authors have read the journal's policy and have the following conflicts: The main coordination center activities, at Harvard University, were supported by the United States National Institutes of Mental Health (R01MH070884), the John D. and Catherine T. MacArthur Foundation, the Pfizer Foundation, the US Public Health Service (R13-MH066849, R01-MH069664, and R01 DA016558), the Fogarty International Center (FIRCA R03-TW006481), the Pan American Health Organization, the Eli Lilly and Company Foundation, Ortho-McNeil Pharmaceutical, Inc., GlaxoSmithKline, Bristol-Myers Squibb, and Shire. The authors confirm that this does not alter their adherence to PLOS ONE policies on sharing data and materials.
Introduction

Alcohol consumption is a leading risk factor for global disability-adjusted life years (DALYs). In 2010, alcohol use was the 5th ranked DALYs determinant at the global level and was in the 1st rank for parts of Latin America, Eastern Europe, and southern sub-Saharan Africa [1]. Moreover, alcohol ranks as a major determinant of non-communicable diseases, especially in middle-income countries [2,3]. In Brazil, the largest middle-income country in Latin America and the site of the São Paulo Megacity Mental Health Survey, alcohol consumption represents a significant burden. In 2004, countries were ranked by size of alcohol-attributable DALYs affecting men; Russia was top-ranked at #1 on the list; Brazil was #2. Among women, the alcohol-attributable DALYs placed Brazil at #3 behind Russia and the USA [4].

The worrisome impact of alcohol use on health outcomes in Brazil might derive from separately identifiable drinking patterns and alcohol-related disturbances such as alcohol use disorders (AUD). These, in turn, are subject to both individual-level and society-level influences, including macro area-level contextual influences [5–7]. For instance, the top 10% of drinkers by volume in Brazil drink about half of all alcohol consumed in the country [9]. An estimated 12% of the adult general population in Brazil meet criteria for lifetime history of AUD [9–11]. Brazil’s rather permissive drinking culture is reflected in data showing that most alcohol users initiate alcohol consumption when they are 17 years old [9] or even earlier [10,12,13] and also drink in risky patterns [10,12,14–16]. Furthermore, Brazil ranks well above many other countries on the 5-point harmful drinking score created for the Comparative Risk Assessment module of the Global Burden of Diseases project in an effort to estimate how changes in population health might depend upon harmful drinking. Brazil’s summary score value of three out of five is based on its relatively high position on indicators such as frequency of drinking, frequency of heavy drinking occasions, usual quantity of alcohol consumed per occasion, drinking in public settings and during festive events, proportion of drinking events when drinkers get drunk, proportion of drinkers who drink daily or nearly daily, and only drinking with meals [17–19].

As for male-female variations, as is true in many countries, Brazilian women are more likely to abstain from alcohol. Other research has shown that males in the total population (including abstainers) are more than twice as likely as women to be heavy drinkers or to meet criteria for AUD [15,16,20–23]. Distinctive and innovative features of this study include diversity of neighborhoods within the megacity and the study team’s attempt to shed light on male-female variations in the associations between alcohol outcomes with individual-level facets of socioeconomic status (SES), such as income, employment and educational attainment [22,24–27], within the context of a conceptual model that holds constant macro area-level neighborhood social deprivation (NSD) using source of data that are external and not reliant on the responses of the survey participants [28]. For the first time in Brazil, and for males and for females separately, we have estimated associations linking alcohol outcomes with independently derived area-level NSD scores, within a conceptual model that holds constant potentially influential individual-level variables.

We are not the first to study SES in relation to drinking outcomes, and our study has the character of an initial exploratory step in Brazil, with a primary focus on whether there might be statistically robust associations linking higher NSD with greater occurrence of heavy drinking and other alcohol-related disturbances (such as AUD) among drinkers who have consumed at least 12 drinks in the past year. In prior studies, from other countries, there is evidence that social position is associated with alcohol use and related problems [29–33], but alcohol consumption does not seem to follow the conventional pattern of lower socioeconomic groups having worse health than those at higher SES [31,34]. Previous research in North America found that household income, education, and employment status were positively associated with current and frequent drinking, but were negatively associated with heavy drinking and AUD (e.g. [34,35]). Hemmingson’s research group [36] found comparatively more diversity among suspected causal influences for alcohol dependence among lower SES and unemployed individuals. Conversely, research from low-middle income countries and from countries in transition such as Russia found higher SES to be positively associated with AUD and problem drinking [37].

Attempts to integrate lines of sex differences research with lines of SES research add some complexity. In higher income countries, well-educated professional women sometimes have been found with equal or greater occurrence of heavy drinking and alcohol problems as compared to men [38,39]. Adding more complexity, research conducted in high-income countries recently discloses evidence of potential neighborhood-level deprivation effects on drinking patterns and AUD, which might vary across the sexes [40,41]. Nonetheless, in general, living in less deprived neighborhoods has been associated with being an alcohol drinker [42,43] and regularly using alcohol [44], while living in more deprived areas has been associated with abstention from alcohol [45], heavy drinking [45,46], and alcohol-related problems [45,47].

We designed this project with a focus on investigating male-female variations in associations linking various alcohol outcomes with neighborhood social deprivation measured as a macro characteristic of areas of residence, with an emphasis on active alcohol-related disturbances (heavy drinking through AUD) among adults with at least 12 drinks in the past year. We also offer estimates for prevalence of alcohol outcomes in Brazil, in an exploration of those more basic epidemiological topics. To clarify which NSD-alcohol associations might be strong enough to warrant future prospective or longitudinal research to build upon this initial foundation of cross-sectional data, our modeling of these outcomes allows for statistical control of individual-level covariates (e.g., SES) when estimating the NSD associations. We understand that the cross-sectional character of the data from Brazil means that we can draw no firm causal inferences, but what is most interesting to us is whether there is a consistently observed and sufficiently large association linking area-level NSD with alcohol-related disturbances among recently active drinkers, even with individual-level covariates held constant. If there is no robust NSD association with these alcohol outcomes, then research planning should be directed toward other facets of neighborhood context beyond the boundaries set for the area-level NSD construct as studied in this project.
Table 1. Estimated subgroup-specific prevalence proportions for recently active alcohol use, drinking patterns and related disturbances.

| Characteristics | N | Past-year use (n = 2180) | Regular use (n = 1513) | Among Regular Drinkers | Abuse (n = 125) | Dependence (n = 59) | DSM-5 AUD (n = 132) |
|-----------------|---|-------------------------|------------------------|------------------------|-----------------|---------------------|----------------------|
|                 | n | % (SE) P (χ²) | n | % (SE) P (χ²) | n | % (SE) P (χ²) | n | % (SE) P (χ²) | n | % (SE) P (χ²) |
| Age, years      |   |            |   |            |   |            |   |            |   |            |   |            |
| 18–34           | 1841 | 879 | 49.8 (1.2) | 579 | 69.7 (2.1) | 378 | 61.9 (2.4) | 77 | 14.2 (1.3) | 142 | 24.0 (2.0) | 59 | 9.5 (1.5) | 22 | 4.0 (1.1) | 54 | 8.8 (1.6) |
| 35–54           | 2160 | 966 | 46.6 (1.9) | 676 | 72.4 (2.1) | 511 | 75.5 (2.2) | 29 | 4.3 (1.2) | 136 | 20.3 (2.4) | 60 | 8.2 (1.4) | 33 | 4.0 (0.8) | 70 | 8.9 (1.3) |
| 55+             | 1036 | 335 | 32.6 (2.2) | 240 | 72.9 (3.8) | 216 | 92.0 (2.4) | 5 | 1.3 (0.6) | 19 | 6.7 (2.0) | 6 | 1.2 (0.6) | 4 | 2.4 (1.8) | 8 | 3.2 (1.9) |
| Sex             |   |            |   |            |   |            |   |            |   |            |   |            |   |            |   |            |
| Men             | 2187 | 1330 | 61.8 (1.2) | 1040 | 78.6 (1.5) | 744 | 69.1 (1.9) | 77 | 8.7 (1.0) | 219 | 22.2 (1.5) | 102 | 6.3 (1.2) | 45 | 4.4 (.7) | 108 | 9.1 (1.0) |
| Women           | 2850 | 850 | 31.3 (1.1) | 473 | 58.1 (2.2) | 361 | 75.6 (2.5) | 34 | 8.4 (2.0) | 78 | 15.9 (2.1) | 23 | 1.7 (1.4) | 14 | 2.5 (.6) | 24 | 5.9 (1.4) |
| Marital status  |   |            |   |            |   |            |   |            |   |            |   |            |   |            |   |            |
| Married/cohabiting | 3250 | 1397 | 45.0 (1.1) | 981 | 72.0 (1.4) | 736 | 74.8 (2.0) | 61 | 6.2 (1.0) | 184 | 19.0 (1.6) | 74 | 7.1 (1.2) | 37 | 3.5 (.7) | 78 | 7.1 (1.1) |
| Previously married | 894 | 353 | 42.0 (1.8) | 238 | 70.2 (4.6) | 179 | 73.4 (2.7) | 13 | 7.3 (2.9) | 46 | 19.4 (2.5) | 18 | 7.0 (1.7) | 11 | 4.2 (1.4) | 20 | 7.1 (1.6) |
| Never married   | 893 | 430 | 49.3 (1.4) | 294 | 69.9 (2.5) | 190 | 61.7 (3.4) | 37 | 14.6 (2.3) | 67 | 23.7 (2.8) | 33 | 10.2 (2.0) | 11 | 4.2 (1.6) | 34 | 10.8 (1.9) |
| Education       |   |            |   |            |   |            |   |            |   |            |   |            |   |            |   |            |
| Low             | 1344 | 453 | 34.9 (1.8) | 314 | 71.0 (2.8) | 239 | 74.4 (3.8) | 11 | 3.4 (1.2) | 64 | 22.2 (4.4) | 32 | 8.6 (1.8) | 25 | 7.8 (1.8) | 42 | 11.4 (2.4) |
| Low-average     | 1262 | 546 | 45.8 (1.4) | 387 | 71.0 (1.8) | 289 | 72.4 (3.5) | 23 | 6.0 (1.5) | 75 | 21.6 (3.4) | 34 | 8.9 (2.2) | 14 | 3.4 (1.4) | 39 | 9.8 (2.2) |
| High-average+High | 2431 | 1181 | 49.9 (0.9) | 812 | 71.3 (2.0) | 577 | 69.5 (1.4) | 77 | 11.2 (1.1) | 158 | 19.3 (1.3) | 59 | 7.4 (1.3) | 20 | 2.8 (0.8) | 51 | 6.5 (1.1) |
| Income          |   |            |   |            |   |            |   |            |   |            |   |            |   |            |   |            |
| Low             | 1200 | 443 | 39.4 (2.2) | 302 | 69.6 (2.4) | 204 | 65.5 (2.9) | 28 | 11.0 (1.9) | 70 | 23.5 (3.1) | 35 | 11.8 (2.3) | 16 | 4.1 (1.2) | 38 | 11.4 (2.1) |
| Low-average     | 1367 | 557 | 42.5 (1.8) | 399 | 72.7 (2.4) | 283 | 70.6 (2.7) | 31 | 8.5 (1.7) | 85 | 20.9 (2.4) | 41 | 9.6 (1.7) | 23 | 6.4 (1.4) | 42 | 9.9 (1.9) |
| High-average    | 1212 | 525 | 47.6 (1.7) | 345 | 65.3 (2.0) | 266 | 71.3 (3.9) | 23 | 9.2 (2.0) | 56 | 19.5 (3.5) | 21 | 5.1 (1.5) | 12 | 3.0 (1.2) | 23 | 5.2 (1.4) |
| Characteristics | N | Past-year use (n = 2180) | Regular use\(^1\) (n = 1513) | Among Regular Drinkers | Abuse\(^2\) (n = 125) | Dependence\(^2\) (n = 59) | DSM-S AUD\(^2\) (n = 132) |
|----------------|---|------------------------|-------------------------------|------------------------|---------------------|---------------------|----------------------|
|                | n | % (SE) | P (x\(^2\)) | n | % (SE) | P (x\(^2\)) | n | % (SE) | P (x\(^2\)) | n | % (SE) | P (x\(^2\)) | n | % (SE) | P (x\(^2\)) |
| Employment status |   |        |             |    |        |             |    |        |             |    |        |             |    |        |             |
| Working (including student) | 3086 | 1539 | 51.0 (1.1) | 1095 | 72.7 (1.4) | 791 | 70.7 (1.6) | 87 | 9.1 (1.0) | 217 | 20.2 (1.5) | 80 | 6.7 (0.8) | 33 | 2.7 (0.5) | 84 | 6.8 (0.9) |
| Retired and homemaker | 1330 | 364 | 28.4 (1.2) | 214 | 57.0 (3.4) | 180 | 84.8 (3.8) | 8 | 2.4 (0.9) | 26 | 12.8 (3.7) | 8 | 3.3 (1.6) | 6 | 2.0 (0.7) | 8 | 3.2 (1.4) |
| Unemployed | 621 | 277 | 47.2 (2.6) | 204 | 76.8 (2.8) | 134 | 63.1 (4.1) | 16 | 10.6 (2.9) | 54 | 26.3 (3.0) | 37 | 17.6 (3.7) | 20 | 10.4 (2.9) | 40 | 18.0 (3.6) |
| Neighborhood Social Deprivation level |   |        |             |    |        |             |    |        |             |    |        |             |    |        |             |
| No+Low | 1369 | 675 | 49.6 (1.3) | 478 | 70.5 (3.1) | 389 | 80.9 (1.5) | 28 | 5.7 (1.2) | 61 | 13.4 (1.7) | 30 | 5.7 (1.3) | 11 | 1.9 (0.6) | 31 | 5.8 (1.2) |
| Medium-low+Medium | 1878 | 775 | 45.0 (1.3) | 547 | 72.7 (1.2) | 379 | 64.4 (2.5) | 42 | 10.1 (1.8) | 126 | 25.5 (2.5) | 42 | 6.6 (1.6) | 27 | 4.8 (0.9) | 49 | 8.2 (1.5) |
| High+Very-high | 1729 | 709 | 42.5 (1.7) | 477 | 70.5 (2.8) | 328 | 67.4 (2.5) | 41 | 10.4 (1.5) | 108 | 22.2 (1.8) | 53 | 12.5 (2.3) | 21 | 4.9 (1.1) | 52 | 10.9 (1.7) |
| Total | 5037 | 2180 | 45.6 (0.72) | 1513 | 71.2 (1.5) | 1105 | 71.0 (1.2) | 111 | 8.6 (0.9) | 297 | 20.3 (1.3) | 125 | 7.9 (1.0) | 59 | 3.8 (0.5) | 132 | 8.1 (0.9) |

Data from the São Paulo Megacity Mental Health Survey (SPMHS), Brazil, 2005–2007 (n = 5037).
\(^1\)Among past-year users.
\(^2\)Among regular users.

doi:10.1371/journal.pone.0108355.t001
Table 2. Comparison of non-heavy drinkers, heavy drinkers of lower frequency and heavy drinkers of higher frequency in terms of quantity and frequency of alcohol consumption, by sex, in the São Paulo Megacity Mental Health Survey (SPMHS).

| Quantity and frequency of alcohol consumption | Non-heavy drinkers | Heavy drinkers of lower frequency, HDLF (n = 111) | Heavy drinkers of higher frequency, HDHF (n = 297) |
|----------------------------------------------|--------------------|---------------------------------------------|---------------------------------------------|
|                                              | Men                | Women                                       | Men                                         | Women                                       |
| Modal frequency of consumption               | 1–3 days per month | 1–3 days per month                          | 1–2 days per week                           | 1–2 days per week                           |
| Modal doses on a typical drinking day        | 2                  | 1                                           | 5                                           | 6                                           |
| Median number of doses on a typical drinking day | 2                  | 2                                           | 6                                           | 7                                           |

Materials and Methods

Survey characteristics and study population
The “São Paulo Megacity Mental Health Survey” (SPMHS) is part of the World Mental Health Initiative (WMHS), which was launched by WHO in 2000 and has been carried out in 28 countries with similar methodology. The present study assessed a probabilistic sample of household residents aged 18 years or older in the São Paulo Metropolitan Area (SPMA), which is composed by 38 municipalities and the city of São Paulo, Brazil. A detailed overview of the survey, including aims, design, sampling procedures and field implementation, has been reported elsewhere [49].

Eligible respondents were selected from a stratified multistage-clustered area probability sample of households. In all strata, the primary sampling units (PSUs) were 2,000 census count areas, according to updated geographical definitions of the Instituto Brasileiro de Geografia e Estatística (IBGE - Brazilian Institute of Geography and Statistics) [49]. The 38 municipalities composed 60% of the total sample, with municipalities being self-representative and contributing to the total sample size proportional to their population density. In complement, the city of São Paulo, formed by five regions with 96 PSUs, contributed to 40% of the total sample. Within each sampled household, one respondent per dwelling was sampled by a Kish selection table [50].

The total observed sample consisted of 5,037 individuals, with a summary participation level of 81%. Before fieldwork, lay-interviewers received a 7-day standardized training by the Principal Investigators (LHA and MCV). For all respondents, interviewers received a 7-day standardized training by the Principal Investigators (LHA and MCV).

Ethics Statements
The SPMHS procedures for recruitment, obtaining informed consent, and protecting human subjects during field procedures were approved by the Research and Ethics Committee of the University of São Paulo Medical School. Respondents were interviewed only after informed written consent was obtained, and total confidentiality was assured. Eligible respondents were those who were 18 or older, Portuguese-speaking, and without any disability or handicap that would otherwise impair their ability to participate in the interview.

Assessment procedures
The WMH version of the Composite International Diagnostic Interview 3.0 (WMH-CIDI 3.0) was translated and adapted to the Brazilian-Portuguese language [48]. The WMH-CIDI 3.0 is a fully structured diagnostic interview that generates psychiatric diagnoses according to both ICD-10 (International Statistical Classification of Diseases and Related Health Problems, 10th revision) and DSM-IV criteria [51,52].

The WMH-CIDI has clinical and non-clinical modules distributed across Part 1 and Part 2 sections, with ‘core’ psychiatric disturbances assessed in Part 1. Part 1 is administered to all WMH respondents. Based on Part 1 responses, those who meet criteria for lifetime history of core disturbances, plus a 25% random sample of all others, are asked to complete Part 2 modules, which include non-clinical and non-core diagnostic assessments.

The alcohol module of WMH-CIDI 3.0 is in Part 1 so that all participants answered questions regarding alcohol use, drinking patterns, and related disturbances. Those who consumed at least one drink in the previous year are termed ‘past-year users’. Across a broad range from the most frequent alcohol consumers to those who consumed at least 12 drinks in the previous 12 months, we have a heterogeneous subgroup of past year drinkers, distinguished with the somewhat arbitrary term ‘regular user’ (RU) [9,53–55]. Within this RU subgroup, three mutually exclusive subgroups were formed to distinguish between (1) heavy drinkers of lower frequency (HDLF, sometimes termed ‘heavy episodic drinkers’) who have consumed five or more drinks in a row for men and four or more drinks in a row for women, but no more often than two times per month; (2) heavy drinkers of higher frequency for whom heavy drinking occurs at least three times per month (HDHF). Alcohol use disorders qualify as separate alcohol-related disturbances among regular users, and were identified via the WMH-CIDI and its diagnostic algorithm’s application of both DSM-IV (abuse and dependence), independently assessed via the ‘unagged’ approach described in prior papers [9,56] and DSM-5 criteria (for AUD: alcohol use disorders) diagnoses.

Many of this study’s prevalence analyses are ‘conditional’ in that they restrict the denominator of each proportion to ‘past-year drinkers’, while other analyses are ‘conditional’ because the denominator is restricted to individuals who had consumed at least 12 drinks in the past year (RU); all others are assumed to be effectively not at risk for being an active heavy drinker or for qualifying as a case of a DSM-IV or DSM-5 alcohol disorder in the past year.

An alternative approach is used when the goal is to produce total population estimates for alcohol outcomes that are directly comparable to total population estimates for some other condition (e.g., cannabis outcomes), in which case the denominator for the proportion is the total population, and the resulting estimates can be used to derive an estimated count of cases in the population.
Table 3. Total sample: Estimated odds ratios (OR) linking alcohol outcomes with Neighborhood Social Deprivation and other suspected determinants.

| Characteristics                        | Past-year use | Regular use | Heavy drinking of lower frequency (HDLF) | Heavy drinking of higher frequency (HDHF) | Abuse | Dependence | DSM-5 AUD |
|----------------------------------------|---------------|-------------|------------------------------------------|------------------------------------------|-------|------------|-----------|
|                                        | AOR (95% CI)  | AOR (95% CI)| AOR (95% CI)                              | AOR (95% CI)                             | AOR (95% CI) | AOR (95% CI)| AOR (95% CI) |
| **Sex**                                |               |             |                                          |                                          |       |            |           |
| Men                                    | 3.5 (2.9–4.2) | 2.5 (1.9–3.4) | 1.3 (0.6–2.5)                              | 1.6 (1.1–2.5)                            | 1.7 (0.8–3.6) | 1.6 (0.7–3.6) | 1.5 (0.8–2.8) |
| Women                                  | 1.0           | 1.0         | 1.0                                       | 1.0                                      | 1.0   | 1.0        | 1.0       |
| **Age, years**                         |               |             |                                          |                                          |       |            |           |
| 18–34                                   | 2.0 (1.6–2.6) | 0.7 (0.5–1.1)| 7.3 (2.7–19.9)                            | 5.9 (2.1–17.0)                           | 7.0 (2.4–20.8) | 2.0 (0.5–9.0) | 2.3 (0.7–7.0) |
| 35–54                                   | 1.7 (1.2–2.3) | 0.8 (0.5–1.2)| 2.5 (0.8–7.1)                              | 4.1 (1.4–12.7)                           | 6.8 (2.6–17.7) | 1.9 (0.4–8.7) | 2.8 (0.9–9.1) |
| 55+                                     | 1.0           | 1.0         | 1.0                                       | 1.0                                      | 1.0   | 1.0        | 1.0       |
| **Marital status**                     |               |             |                                          |                                          |       |            |           |
| Previously married                     | 1.4 (1.1–1.8) | 1.1 (0.7–1.8)| 1.1 (0.5–2.5)                              | 1.1 (0.8–1.5)                            | 1.0 (0.5–2.2) | 1.2 (0.5–3.1) | 1.0 (0.5–2.0) |
| Never married                          | 0.9 (0.7–1.1) | 0.9 (0.6–1.2)| 1.3 (0.7–2.4)                              | 1.2 (0.8–1.8)                            | 1.3 (0.7–2.5) | 1.2 (0.4–3.3) | 1.9 (1.0–3.4)* |
| Married/cohabiting                     | 1.0           | 1.0         | 1.0                                       | 1.0                                      | 1.0   | 1.0        | 1.0       |
| **Education**                          |               |             |                                          |                                          |       |            |           |
| Low                                    | 0.8 (0.6–1.0) | 0.9 (0.7–1.3)| 0.4 (0.2–0.9)                            | 1.4 (0.7–2.6)                            | 1.3 (0.7–2.5) | 3.0 (1.2–7.5)* | 2.2 (1.0–5.0)* |
| Low-average                            | 1.0 (0.8–1.2) | 1.0 (0.7–1.3)| 0.5 (0.2–1.0)                              | 1.1 (0.6–1.9)                            | 1.1 (0.5–2.4) | 1.1 (0.3–3.3) | 1.6 (0.8–3.3) |
| High-average                           | 1.0           | 1.0         | 1.0                                       | 1.0                                      | 1.0   | 1.0        | 1.0       |
| **Income**                             |               |             |                                          |                                          |       |            |           |
| Low                                    | 0.6 (0.4–0.9) | 0.8 (0.5–1.0)| 1.8 (0.8–3.9)                              | 0.9 (0.5–1.5)                            | 1.0 (0.5–2.0) | 0.9 (0.2–4.0) | 0.9 (0.4–2.3) |
| Low-average                            | 0.6 (0.5–0.8) | 0.8 (0.6–1.0)| 1.1 (0.6–1.9)                              | 0.8 (0.5–1.2)                            | 0.9 (0.5–1.7) | 1.8 (0.6–5.5) | 0.9 (0.3–2.2) |
| High                                   | 0.8 (0.6–1.0) | 0.5 (0.4–0.7)| 1.2 (0.6–2.4)                              | 0.8 (0.5–1.4)                            | 0.6 (0.3–1.2) | 1.0 (0.2–4.0) | 0.5 (0.2–1.2) |
| **Employment status**                  |               |             |                                          |                                          |       |            |           |
| Working (including student)            | 1.3 (1.1–1.5) | 1.6 (1.2–2.1)| 1.8 (0.7–4.5)                              | 0.8 (0.4–1.7)                            | 0.9 (0.3–3.0) | 0.9 (0.3–2.6) | 1.3 (0.4–3.8) |
| Unemployed                             | 1.3 (1.0–1.8) | 2.2 (1.4–3.5)| 1.7 (0.4–6.5)                              | 1.8 (0.7–4.5)                            | 2.5 (1.0–6.8) | 3.5 (0.7–16.2) | 3.5 (1.1–11.3)* |
| Retired and homemaker                 | 1.0           | 1.0         | 1.0                                       | 1.0                                      | 1.0   | 1.0        | 1.0       |
| **Neighborhood Social Deprivation level**|           |             |                                          |                                          |       |            |           |
| No+Low                                 | 1.0           | 1.0         | 1.0                                       | 1.0                                      | 1.0   | 1.0        | 1.0       |
| Medium-low+Medium                      | 0.8 (0.7–0.9) | 1.1 (0.8–1.4)| 2.0 (1.1–3.8)*                            | 2.1 (1.4–3.1)*                           | 0.9 (0.4–2.1) | 1.7 (0.8–3.9) | 1.1 (0.5–2.2) |
who might need alcohol treatment services or cannabis treatment services. Here, we have restricted some denominators to 'past year drinkers' and to 'regular drinkers' so as to understand the relative occurrence and patterns of association of alcohol outcomes among the recently active users, as explained in footnotes to the tables. For example, for the 'conditional prevalence' of RU among past-year drinkers, the denominator excludes lifelong abstainers as well as those who drank in past years but have not had a drink in the past year. Further in 'conditional prevalence' analyses restricted to regular users, the interpretation of the estimates involves thinking about how many of the current regular users now qualify as cases of heavy drinking, or DSM-IV abuse, dependence or DSM-5 AUD.

**Covariates**

The key covariate focus is on the macro area-level NSD values related to alcohol outcomes, with individual-level SES held constant via terms for education, employment status, and income. Regression models also held constant age (18–34, 35–54, 55 years or more) and marital status (never married; previously married; married or cohabiting); for total sample (men and women combined), sex was held constant as well. For women with DSM-IV abuse, dependence or DSM-5 AUD age strata were divided into two subgroups of 18–34, 34–54 because no woman over the age of 55 years filled criteria for these diagnoses.

Education was coded by years of schooling: 0–4 (low); 5–8 (low-average); and 9+ (high-average and high). Employment status was coded as (1) workers paid outside the household and students, (2) unemployed, and (3) retired or working as a homemaker in one's own household.

For income, the standard international labor economics method was used [57], with per capita income calculated by dividing total household income by the number of household members. Income levels were defined according to the per capita income in comparison with the Brazilian median per capita income (7,050 dollars/year): low (less than half the Brazilian median), lower-middle (more than half of the Brazilian median up to the median), high-middle (above the Brazilian median up to three times the median), and high (above three times the Brazilian median).

The area-level NSD variable was developed by the Center of Metropolitan Studies (http://www.centrodametropole.org.br) and assigned to each census unit, to reflect social conditions in the SPMA geographical space using data from the 2000 Census. This index, derived from external census sources, combines socio-economic deprivation indicators (income, level of education, family size, and percentage of families headed by a woman with low educational level) and the population's age structure. The NSD index ranges from 1 (no social deprivation) to 8 (high social deprivation). These eight levels were summarized in 3 indicators: no-low (combined index of 1, 2, and 3 NSD level), medium-low/medium (6 and 4), and high/very high NSD (5, 7, and 8).

**Data analysis**

Since data were obtained from a complex stratified sample design, sample weights and design variables that account for sample clustering were applied. Prior to analysis, all respondents received a pre-stratification weight to adjust for within household and PSU probabilities of selection, and a post-stratification weight to adjust for the known age and sex structure of the SPMA population and non-response [48].

The analysis weight for the World Mental Health Surveys initiative, for this study's prevalence estimates, and for this study's regression analyses is based on (a) the inverse of the probability of selection into the sample, and (b) a post-stratification adjustment...
| Characteristics                              | Past-year use *(n = 1330)*   | Regular use *(n = 1040)* | Heavy drinking of lower frequency, HDLFC *(n = 77)* | Heavy drinking of higher frequency, HDHF *(n = 219)* | Abuse *(n = 102)* | Dependence *(n = 45)* | DSM-5 AUD *(n = 108)* |
|---------------------------------------------|------------------------------|--------------------------|-----------------------------------------------|-----------------------------------------------|-----------------|---------------------|----------------------|
|                                             | AOR (95% CI)                 | AOR (95% CI)             | AOR (95% CI)                                  | AOR (95% CI)                                  | AOR (95% CI)    | AOR (95% CI)        | AOR (95% CI)         |
| Age, years                                  |                              |                          |                                               |                                               |                 |                     |                      |
| 18–34                                       | 1.3 (0.9–2.0)                | 0.7 (0.4–1.2)            | 40.0 (3.6–449.9)†                            | 4.9 (1.6–15.2)†                               | 12.9 (3.7–45.0)²| 2.0 (0.4–9.3)       | 2.4 (0.8–6.7)        |
| 35–54                                       | 1.2 (0.8–1.9)                | 0.7 (0.4–1.3)            | 9.9 (1.0–99.6)                               | 2.7 (0.8–8.7)                                 | 8.2 (2.9–23.4)²| 1.5 (0.3–8.0)       | 2.0 (0.6–6.7)        |
| 55+                                         | 1.0                          | 1.0                      | 1.0                                           | 1.0                                           | 1.0             | 1.0                 | 1.0                  |
| Marital status                              |                              |                          |                                               |                                               |                 |                     |                      |
| Previously married                          | 1.3 (0.8–2.1)                | 1.1 (0.5–2.1)            | 0.3 (0.1–1.3)                                | 1.0 (0.7–1.6)                                 | 1.4 (0.7–2.7)  | 1.3 (0.5–3.2)       | 1.3 (0.7–2.5)        |
| Never married                               | 0.8 (0.6–1.2)                | 0.7 (0.5–1.0)            | 1.4 (0.6–3.7)                                | 1.2 (0.7–2.0)                                 | 0.8 (0.4–1.8)  | 1.1 (0.3–4.4)       | 1.3 (0.6–3.0)        |
| Married/cohabiting                          | 1.0                          | 1.0                      | 1.0                                           | 1.0                                           | 1.0             | 1.0                 | 1.0                  |
| Education                                   |                              |                          |                                               |                                               |                 |                     |                      |
| Low                                         | 1.0 (0.7–1.3)                | 1.1 (0.7–1.7)            | 0.2 (0.1–0.6)†                               | 1.2 (0.7–2.3)                                 | 1.3 (0.6–2.6)  | 2.6 (0.9–7.3)       | 2.3 (0.9–6.0)        |
| Low-average                                 | 0.9 (0.6–1.2)                | 1.4 (0.9–2.1)            | 0.6 (0.2–1.4)                                | 1.1 (0.7–1.9)                                 | 1.1 (0.5–2.2)  | 0.9 (0.3–2.8)       | 1.6 (0.9–3.0)        |
| High-average/High                           | 1.0                          | 1.0                      | 1.0                                           | 1.0                                           | 1.0             | 1.0                 | 1.0                  |
| Income                                      |                              |                          |                                               |                                               |                 |                     |                      |
| Low                                         | 0.5 (0.3–0.7)†               | 0.5 (0.2–1.0)            | 2.1 (1.0–4.5)†                               | 0.8 (0.4–1.6)                                 | 1.2 (0.6–2.4)  | 0.9 (0.1–5.6)       | 1.0 (0.4–2.9)        |
| Low-average                                 | 0.6 (0.5–0.9)†               | 0.7 (0.5–1.1)            | 1.0 (0.5–2.2)                                | 0.6 (0.4–1.0)                                 | 0.9 (0.5–1.6)  | 1.5 (0.4–5.0)       | 0.8 (0.3–2.2)        |
| High-average                                | 0.9 (0.7–1.3)                | 0.4 (0.3–0.7)†           | 1.5 (0.6–3.4)                                | 0.9 (0.5–1.6)                                 | 0.5 (0.2–2.2)  | 0.6 (0.1–2.7)       | 0.5 (0.2–1.3)        |
| High                                        | 1.0                          | 1.0                      | 1.0                                           | 1.0                                           | 1.0             | 1.0                 | 1.0                  |
| Employment status                           |                              |                          |                                               |                                               |                 |                     |                      |
| Working (including student)                 | 2.0 (1.4–2.8)§               | 1.7 (0.9–3.3)            | 0.3 (0.03–2.4)                               | 1.3 (0.4–4.3)                                 | 0.3 (0.1–1.2)  | 0.8 (0.1–5.7)       | 1.6 (0.3–8.6)        |
| Unemployed                                  | 2.4 (1.6–3.6)§               | 2.8 (1.2–6.2)§           | 0.2 (0.02–1.3)                               | 1.5 (0.5–4.7)                                 | 1.0 (0.2–4.6)  | 3.1 (0.2–40.7)      | 4.3 (0.6–30.4)       |
| Retired and homemaker                       | 1.0                          | 1.0                      | 1.0                                           | 1.0                                           | 1.0             | 1.0                 | 1.0                  |
| Neighborhood Social Deprivation level       |                              |                          |                                               |                                               |                 |                     |                      |
| No+Low                                      | 1.0                          | 1.0                      | 1.0                                           | 1.0                                           | 1.0             | 1.0                 | 1.0                  |
| Medium-low+Medium                           | 1.0 (0.7–1.4)                | 1.0 (0.7–1.6)            | 1.6 (0.8–3.3)                                | 2.1 (1.3–3.3)†                               | 0.8 (0.3–2.3)  | 2.4 (1.2–4.9)§      | 1.1 (0.5–2.5)        |
| High+Very-high                              | 0.8 (0.6–1.2)                | 1.2 (0.6–2.1)            | 1.6 (0.5–5.0)                                | 1.5 (0.9–2.5)                                 | 1.3 (0.6–3.1)  | 1.5 (0.5–4.0)       | 1.1 (0.6–2.2)        |

Data from the São Paulo Megacity Mental Health Survey (SPMHS), Brazil, 2005–2007 (n = 2187).
Reference categories: a) non-past year users; b) non-regular users; c) non-heavy drinkers; d) regular users who did not fulfill criteria for abuse; e) regular users who did not fulfill criteria for dependence; f) regular users who did not fulfill criteria for DSM-5 AUD.
AOR, adjusted odds-ratio; CI, confidence interval.
All OR were adjusted for age.
*p < 0.05;  
"p < 0.01;  
"p < 0.001.
doi:10.1371/journal.pone.0108355.t004
| Characteristics                  | Past-year use\(^a\) (n = 850) | Regular use\(^b\) (n = 473) | Heavy drinking of lower frequency, HDLF\(^c\) (n = 34) | Heavy drinking of higher frequency, HDHF\(^d\) (n = 78) | Abuse\(^e\) (n = 23) | Dependence\(^f\) (n = 14) | DSM-5 AUD\(^g\) (n = 24) |
|---------------------------------|---------------------------------|------------------------------|-----------------------------------------------|-----------------------------------------------|---------------------|---------------------|---------------------|
| Age, years                      |                                 |                              |                                               |                                               |                     |                     |                     |
| 18–34                           | 3.0 (1.8–4.8)\(^2\)            | 0.8 (0.5–1.5)                | 2.3 (0.4–12.0)                               | 15.6 (3.1–78.1)\(^2\)                         | 0.3 (0.1–1.2)       | 0.7 (0.2–3.4)       | 0.3 (0.1–1.2)       |
| 35–54                           | 2.1 (1.3–3.4)\(^2\)            | 0.9 (0.5–1.5)                | 1.7 (0.4–8.1)                                | 21.7 (4.3–111.2)\(^2\)                        | 1.0                 | 1.0                 | 1.0                 |
| 55+                             | 1.0                             | 1.0                           | 1.0                                           | 1.0                                           | 1.0                 | 1.0                 | 1.0                 |
| Marital status                  |                                 |                              |                                               |                                               |                     |                     |                     |
| Previously married              | 1.6 (1.2–2.2)\(^1\)            | 1.2 (0.7–2.0)                | 1.8 (0.5–5.8)                                | 1.0 (0.5–1.9)                                 | 0.7 (0.1–3.3)       | 1.0 (0.3–3.5)       | 0.9 (0.3–3.0)       |
| Never married                   | 1.0 (0.8–1.4)                  | 1.1 (0.6–1.9)                | 1.1 (0.3–4.1)                                | 1.3 (0.5–3.5)                                 | 5.0 (1.2–21.0)\(^*\) | 1.8 (0.5–7.0)       | 6.3 (1.6–25.2)\(^1\) |
| Married/cohabiting              | 1.0                             | 1.0                           | 1.0                                           | 1.0                                           | 1.0                 | 1.0                 | 1.0                 |
| Education                       |                                 |                              |                                               |                                               |                     |                     |                     |
| Low                             | 0.7 (0.4–0.9)\(^2\)            | 0.8 (0.5–1.2)                | 1.1 (0.3–4.2)                                | 2.2 (0.7–7.0)                                 | 1.3 (0.3–6.3)       | 6.4 (1.3–31.4)\(^*\) | 1.9 (0.4–8.5)       |
| Low-average                     | 1.1 (0.8–1.4)                  | 0.7 (0.4–1.1)                | 0.4 (0.1–1.8)                                | 0.9 (0.2–3.5)                                 | 1.7 (0.1–18.1)      | 2.2 (0.3–17.8)      | 2.2 (0.2–20.3)      |
| High-average/High               | 1.0                             | 1.0                           | 1.0                                           | 1.0                                           | 1.0                 | 1.0                 | 1.0                 |
| Income                          |                                 |                              |                                               |                                               |                     |                     |                     |
| Low                             | 0.8 (0.5–1.2)                  | 1.1 (0.6–1.9)                | 1.1 (0.3–5.1)                                | 1.2 (0.3–4.2)                                 | 0.7 (0.1–3.4)       | 0.4 (0.1–2.4)       | 0.7 (0.1–3.2)       |
| Low-average                     | 0.6 (0.4–0.8)\(^*\)            | 0.8 (0.5–1.2)                | 1.2 (0.3–4.9)                                | 1.8 (0.6–4.9)                                 | 1.3 (0.3–5.1)       | 1.5 (0.2–13.4)      | 1.6 (0.4–6.6)       |
| High-average                    | 0.7 (0.4–1.0)                  | 0.7 (0.4–1.0)                | 0.8 (0.2–3.0)                                | 0.7 (0.2–2.8)                                 | 0.9 (0.2–3.4)       | 1.0                 | 0.8 (0.2–3.4)       |
| High                            | 1.0                             | 1.0                           | 1.0                                           | 1.0                                           | 1.0                 | 1.0                 | 1.0                 |
| Employment status               |                                 |                              |                                               |                                               |                     |                     |                     |
| Working (including student)     | 1.1 (0.9–1.4)                  | 1.5 (1.0–2.2)\(^*\)         | 3.1 (1.3–7.5)\(^*\)                         | 0.8 (0.3–2.0)                                 | 1.6 (0.2–10.6)      | 1.8 (0.5–5.9)       | 1.2 (0.3–6.0)       |
| Unemployed                      | 1.1 (0.7–1.6)                  | 1.9 (1.1–3.1)\(^*\)         | 6.1 (1.5–23.8)\(^*\)                        | 1.7 (0.5–5.9)                                 | 4.8 (0.9–26.8)      | 6.9 (0.7–66.5)      | 4.4 (0.9–22.3)      |
| Retired and homemaker           | 1.0                             | 1.0                           | 1.0                                           | 1.0                                           | 1.0                 | 1.0                 | 1.0                 |
| Neighborhood Social Deprivation level |                                |                              |                                               |                                               |                     |                     |                     |
| No+Low                          | 1.0                             | 1.0                           | 1.0                                           | 1.0                                           | 1.0                 | 1.0                 | 1.0                 |
| Medium-low+Medium               | 0.6 (0.4–0.8)\(^2\)            | 1.1 (0.8–1.5)                | 4.9 (0.9–25.6)                               | 2.3 (1.0–5.2)\(^*\)                          | 1.4 (0.3–5.7)       | 0.4 (0.1–3.2)       | 1.4 (0.4–5.4)       |
| High+Very-high                  | 0.6 (0.4–0.9)\(^2\)            | 0.8 (0.5–1.4)                | 5.8 (1.0–33.9)\(^*\)                        | 2.4 (1.1–5.3)\(^*\)                          | 3.7 (1.0–13.6)\(^*\) | 2.6 (0.6–10.3)      | 3.2 (0.9–11.6)      |

Data from the São Paulo Megacity Mental Health Survey (SPMHS), Brazil, 2005–2007 (n = 2850).

Reference categories: a) non-past year users; b) non-regular users; c) non-heavy drinkers; d) regular users who did not fulfill criteria for abuse; e) regular users who did not fulfill criteria for dependence; f) regular users who did not fulfill criteria for DSM-5 AUD.

AOR, adjusted odds-ratio; CI, confidence interval.

All OR were adjusted for age.

\(^*p<0.05\);
\(^{**}p<0.01\);
\(^{***}p<0.001\).

doi:10.1371/journal.pone.0108355.t005
factor such that, after weighting, the survey-based estimates for basic demographic distributions (e.g., age, sex) serve well as population projections for the São Paulo Megacity Mental Health Survey population (as best they are known from the most recent corresponding census distributions for the São Paulo Metropolitan Area that was surveyed). The application of these analysis weights in the survey analyses, via SAS procedures, are as described in Chapter 4 of a recently published textbook authored by WMHS collaborators [38].

Data analyses were conducted using the SAS software version 9.1 (SAS, 2004) and SUDAAN (Research Triangle Institute, 2004). Cross-tabulations were used to estimate overall prevalence of recently active (past-year) drinking, as well as ‘conditional prevalences’ for the other alcohol outcomes. Male-female variations in associations were estimated via stratified analyses.

Quantity and frequency of alcohol consumption in the last 12 months were determined for non-heavy drinkers, heavy drinkers of lower frequency and heavy drinkers of higher frequency by sex.

Bivariate analyses and multiple logistic regression were used to estimate area-level NSD associations with alcohol outcomes, and then to explore associations with covariates, with secondary focus on the SES indicators, holding area-level NSD constant and vice versa. For HDLF and HDHF, polychotomous logistic regression was performed with non-heavy drinking as the reference category.

Odds ratios (OR) were estimated for NSD and the other covariates, first in unadjusted form with Wald tests [59]. Thereafter, OR estimation was with covariate adjustment to obtain a final multivariate model. For total sample analysis, models were adjusted for both age and sex; while for male-female stratified analyses were adjusted for age. Significance testing, standard errors (SE) and 95% confidence intervals (95% CI) were estimated using Taylor series linearization methods for complex sample data [60], as implemented in SUDAAN (Research Triangle Institute, 2004). Multivariate significance tests were conducted with Wald χ² tests using Taylor series design-based coefficient variance-covariance matrices. All significance tests were based on two-sided tests at a 0.05 significance level.

**Results**

**Study Sample**

Socio-demographic characteristics of the study sample have been described elsewhere [48]. Briefly, there were more women (57%) than men in the sample, and it was a relatively young sample: 60% of the subjects aged less or equal to 45 years old; 71% of the men and 60% of the women were married. Approximately half of the subjects had low/low-average education and around 60% were employed (76% of men, 50% of women). Table S1 provides the full distribution of the NSD variable based on unweighted sample statistics, a distribution based on application of the analysis weights, (i) for the sample as a whole, and (ii) for males and for females, separately.

**Prevalences of alcohol use and outcomes: unconditional and conditional**

Table 1, bottom half, shows unconditional prevalence of recently active (past-year) drinking, as well as the estimated conditional prevalence for all recently active alcohol outcomes. Overall, an estimated 46% of the São Paulo adult population had consumed alcohol in the past year. Among past year drinkers, overall, 71% qualified as ‘regular users’, having consumed at least 12 drinks in the past year.

When we examined HDLF and HDHF outcomes among the past-year regular users (RU), about 9% qualified as recent ‘heavy drinkers of lower frequency’ and about 20% qualified as ‘heavy drinkers of higher frequency’ (versus the complement of 71% non-HDLF/HDHF). Also conditioned on past-year RU, about 4%–8% qualified for these recently active DSM conditions: DSM-IV abuse (7.9%); DSM-IV dependence (3.9%); DSM-5 AUD (0.1%). In basic cross-tabulations, males were more likely than females to be past-year users, RU, and HDHF drinkers (all p<0.05), but were not more likely to qualify for DSM conditions (among RU).

Regarding the main focus on area-level NSD, with two exceptions [RU and HDLF], all alcohol outcomes were associated with NSD (p<0.05). NSD inverse associations were seen for past-year use and for non-heavy drinking among RU. Positive NSD associations were seen with higher frequency heavy drinking (HDHF) and with all three DSM conditions.

Among men who reported drinking in the past 12 months (62%), nearly 80% drank regularly. For women, 30% reported alcohol use in the previous year and among those around 60% consumed alcohol in a regular basis. There were also more men than women with heavy and frequent drinking patterns among regular users. Unexpectedly, such sex differences were no longer observed for non-heavy drinkers and heavy drinkers, DSM-IV abuse, DSM-IV dependence, and DSM-5 AUD.

For RU, there was a higher prevalence of heavy drinking patterns in younger cohorts than in the oldest cohort (55 years old and more). For example, about 25% of those aged 18–34 years drank in the HDHF pattern, whereas around 7% of those aged 55 or more engaged in those drinking patterns.

In Table 2, we compared men and women in terms of quantity and frequency of alcohol consumption, by drinking patterns. We note that men and women had the same modal frequency of consumption per week within each drinking pattern category (1–3 days a month for non-heavy drinkers, and 1–2 days a week for HDLF and HDHF). However, women surpassed men in the modal number of doses on a typical drinking day when drinking in heavy drinking patterns. For both HDLF men and women, and HDHF women, the median number of doses on a typical drinking day was 6. When drinking in the heavy and frequent pattern, men had the modal number of doses of 7.

**Correlates of recently active alcohol use, drinking patterns, and AUD for total sample, males and females**

**Neighborhood social deprivation level.** The bottom part of Table 3 shows covariate-adjusted NSD associations with past-year drinking and both forms of heavy drinking (p<0.05). Individuals in mid NSD neighborhoods are less likely to be past-year drinkers (p<0.05). Among RU, those in the mid to higher level NSD neighborhoods are more considerably likely to drink heavily (p<0.05). When we hold constant age and neighborhood social deprivation, the inverse association with low income that stands out such that regular drinkers of low education are under-represented among heavier drinkers at the low frequency level, and, under the same constraints, these drinkers with low education are neither over- nor under-represented among heavier frequent drinkers (p>0.05) (Table 3).

Table 4, bottom part, indicates the association for men with respect to NSD. It is possible to see statistically robust, but not exceptionally strong, covariate-adjusted NSD associations with DSM-IV alcohol dependence and with heavy drinking at high frequency. The pattern of estimates is such that the excess odds of these outcomes are found when the RU lives in a mid-range NSD neighborhood (p<0.05).

Table 5, bottom part, shows no covariate-adjusted NSD-dependence association for women, but it is noteworthy that women living in areas with lower NSD level are more likely to be
past-year drinkers (p<0.05). For ‘regular drinking’ outcome among women, no association was observed for NSD (p>0.05). Nevertheless, among RU, women in the higher level NSD neighborhoods are more substantially likely to qualify as cases of both forms of heavy drinking (p<0.05). In addition, when the RU lives in a mid NSD neighborhood, there also are excess odds of HFD (p<0.05). As for DSM-IV abuse, the covariate adjusted excess odds are seen for female RU living in the neighborhoods with higher levels of neighborhood social deprivation (p<0.05). 

Income. Study of Tables 3, 4 and 5, column by column, discloses statistically independent inverse associations of past-year drinking with low to high-average income among total sample, with low-average income among both men and women, and with low income among men (but not women), where high income is the reference category (p<0.05). The only other statistically robust associations with income are seen in Tables 3’s and 4’s column on regular use among total sample and male past-year users and heavy drinking among male regular users, and in Table 5’s column on female past-year drinking. Here, it is the high-average income male drinkers who are less than the high income drinkers to be recently active regular users (p<0.05) and low income male regular users being more likely to drink heavily in a low frequency (p<0.05). As compared to high income women, the covariate-adjusted odds ratio shows that low-average income women are less likely to be past-year drinkers (p<0.05).

Education. Educational attainment is another individual-level SES indicator that shows no general strength as a correlate of alcohol outcomes with few exceptions. In the covariate-adjusted model for past-year drinking among women, it is the least well educated women who are under-represented, as compared to their better educated peers (p<0.05). Among women RU, low education is associated with excess odds of being an active alcohol dependence case (p<0.05). This is also observed for the total sample, which shows 2–3-fold excess odds of alcohol dependence and DSM-5 AUD among regular users with low education attainment as compared to their peers with higher education levels.

Education is not associated with past-year drinking among men, but it is associated with HDLF status among male RU. In Table 4 the most educated male RU have excess odds of low frequency heavy drinking (HDLF) (p<0.05). This last finding is also valid for the total sample (Table 3).

Employment status. Our third individual-level SES indicator is employment status, which seems to have more to do with the lower levels of drinking status [past-year drinking (total sample and male), RU among past-year drinkers (total sample, male and female), and HDLF among RU (female)]. The first column of Table 4 shows a 2-fold excess odds of past-year drinking among unemployed (and among currently employed) males, as compared to the formerly employed (p<0.05). The 2nd and third columns of Table 5 also highlight excess odds of alcohol outcomes among unemployed, here in comparison with the formerly employed and unpaid homemakers in the household: (1) among female past-year users, RU is associated with being unemployed (and also with being employed); (2) among female RU, these same employment status values are associated with our alcohol outcome called ‘heavy drinking of lower frequency’ (p<0.05). The only statistically robust employment status association involves DSM-5 AUD among total RU, which can be seen in the last column of Table 3, where there is an estimated 4-fold excess odds of AUD among RU who are unemployed as compared to formerly employed (p<0.05).

Marital status. As for marital status, there are no noteworthy associations with alcohol outcomes among males (Table 4). Among women and total sample, in a comparison with those who are married or cohabiting, it is the previously married who are modestly more likely to be past-year drinkers (p<0.05; Table 5, first column). Among the female RU, the never married are more likely to be cases of the alcohol-related disturbances in the form of DSM-IV abuse and DSM-5 AUD.

Discussion
With all the strengths of a transversal epidemiological survey of a representative sample of the adult general population living in the São Paulo Metropolitan Area, Brazil, this is the first Brazilian study to explore alcohol outcomes such as DSM-5 AUD in relation to suspected influences measured at both individual and neighborhood level areas and the associations of these outcomes with social position and possible socioeconomic inequalities. Overall, the main finding of note may be that regular alcohol users showing alcohol-related disturbances are generally more often found where area-level neighborhood characteristics reflect social disadvantage, even when important individual-level covariates have been held constant. More specifically, living in less deprived neighborhoods was associated with being a past-year alcohol drinker, while living in more deprived areas was associated with heavy drinking and some alcohol-related disturbances. As noted below, we would rather not offer a causal interpretation of this main finding. Nonetheless, it may be pertinent that those living in disadvantaged neighborhoods, with social exclusion and deprivation, might be most exposed to stress, less coping resources, high density of alcohol outlets. As such, the disadvantages experienced by residents of these neighborhoods extend beyond the indicators captured in our NSD assessment, which may influence heavy drinking [46] and the occurrence of alcohol related problems [45,47,61–63].

Other findings deserve to be highlighted as well, starting with a secondary focal point – namely, the individual-level SES indicators. Unemployed individuals often showed excess odds of alcohol-related disturbance (DSM-5 AUD), as compared to formerly employed or homemakers. In sex-specific analyses, female regular drinkers in the workforce were more likely to qualify for one of the forms of heavy drinking. Education associations also were noted, although not always with a consistently interpretable pattern.

As for our tertiary focal points, marital status was generally unrelated to alcohol outcomes among men, but among women, it was the previously married women who were more likely to be past-year drinkers; it was the never married women who were more likely to qualify as active cases of DSM-IV alcohol abuse and for DSM-5 AUD. It should not be surprising that adults age 18–34 were found to be over-represented among past-year drinkers. Among these young adults with at least 12 drinks in the past year, both forms of heavy drinking showed excess odds, relative to older RU, as did DSM-IV alcohol abuse (but not alcohol dependence nor DSM-5 AUD).

The results on prevalence estimates also may be of interest. These estimates reveal that although half of the sample is abstinent, nearly 30% of the past-year regular users drink in a heavy drinking pattern. It is particularly worrisome that, among heavy drinkers, two-thirds reports drinking in this pattern frequently - three or more times in a month period. Another important finding is the male-female convergence in the prevalence of heavy drinking pattern, reinforced by the observation that women are surpassing men in terms of estimated modal doses of alcohol consumption and women have reached men in terms of modal frequency of consumption in both heavy drinking patterns.
The phenomenon of convergence in Brazil seems to be more due to an increase in female consumption than a reduction in male drinking [64]. For past-year use and regular use, the male/female ratio is similar to what has usually been found in the literature, with men surpassing a group of high educated women who work outside home [65–67]. When considering only those who were past-year regular users the sex-specific prevalence estimates for drinking patterns and AUD did not differ appreciably.

We note that heavy drinking was a common drinking pattern, similar to what has been found in other recent Brazilian surveys [10,16,68–70]. This pattern is specifically frequent in young adults aged between 18–34 years, which exposes them to a range of risk behaviors with adverse short- and long-term consequences, from social and physical problems - such as hangovers or medical illnesses, unprotected sexual activity, alcohol-related car crashes and other unintentional injuries - to increased risk for AUD [16,20,71,72].

The 12-month prevalence of any DSM-IV AUD (alcohol abuse or dependence) among regular drinkers was 9.1%, which is slightly lower than reports from nationwide Brazilian studies probably due to methodological and sample differences [10,11] and greater than a national survey conducted in Australia with similar methods as ours (6%) [73]. Conversely, when the DSM-5 AUD criteria were considered, we found a prevalence of 8.1%, which is lower than other two recent studies examining the impact of the new DSM-5 criteria on the prevalence of AUD: 12.3% in US (among alcohol lifetime users) [74] and 9.7% in Australia (among regular users) [73].

It is possible to hypothesize that the changes in the constructs required for DSM-5 AUD diagnoses - namely the inclusion of craving and exclusion of legal problem’s criterion - could have reflected in the prevalence of AUD differentially across countries and cultures, for SPMA and US the impact was lighter than the one observed for Australia. Moreover, the new AUD DSM-5 criteria may have led the AUD prevalence to a more consistent estimate in our sample, considering that 15% of the positive cases for both DSM-IV AUD had concurrent onsets of abuse and dependence as showed in a previous SPMS report [9].

In Brazil, public health campaigns mainly target drinking driving and AUD. However, specific preventive strategies might be more targeted in relation to subgroups showing higher prevalence of “at risk” drinking, and those living in social disadvantaged situations. Other considerations note studied here are the current living circumstances and social support network of the individuals with harmful drinking practices. Of course, counter-balancing enthusiasm for these targeted interventions is evidence that often it is interventions working at both the individual and population levels (alcohol taxation, restrictions on alcohol availability) that prove to be the most effective policy options [3,75].

Study strengths and limitations

Our study has three important strengths. First of all, this project is based on data from a large, representative sample of adults residing in the metropolitan area of São Paulo. Secondly, it examines distinct alcohol outcomes using conditional prevalences and studies both the DSM-5 AUD and DSM-IV abuse and dependence, which were independently assessed by using the un gated approach described elsewhere. Thirdly, this study contributes to the recent theoretical discussion about effects on drinking patterns due to individual SES and neighborhood level deprivation.

In spite of these strengths, some limitations should be considered. Despite the representativeness of our sample, it is restricted to residents of a large urbanized area, which precludes generalization of our findings to the general population living in rural settings of Brazil. Moreover, there was insufficient information to take race or ethnicity into account as covariate in the models because in the CIDI version questionaire used herein the question about ethnicity was only asked for respondents who self-identified as minorities (n = 156). Thus, this study cannot shed much light on sources of causal variation in drinking outcomes in Brazil as might involve linkages of race or ethnicity with neighborhood social deprivation and SES. Our survey measurements were not perfect and did not include constructs that belong in conceptual models of linkages between SES and alcohol outcomes (e.g., stress; social support buffers; access, availability, and cost of alcohol). As another aspect of measurement, lay interviewers with five days of training may not have the ability to make a refined assessment of alcohol related problems, although we note the generally favorable results on validity of the alcohol and other drug use disorders diagnoses, as assessed using clinical reappraisal study designs since the mid-1980s [51,76,77].

With a transversal epidemiological survey design, this project has a major limitation that tempers interpretation of its main finding on NSD and alcohol outcomes. As has been recognized for more than 80 years, individuals with alcohol problems may have selective migration toward neighborhoods at the higher NSD levels. Alternately, it is possible for these cases to be left behind as others without problems migrate upwardly and out to neighborhoods with lower NSD levels. Moreover, we cannot state whether these cases occurred as a consequence of disadvantageous social conditions (a social causation hypothesis) or whether the alcohol outcomes caused neglect and a worsening of social conditions (a social selection hypothesis), which are alternatives that have been most thoroughly discussed in psychiatric epidemiology and allied social sciences [74,78,79].

Future research of a prospective and longitudinal character can explore what might prove to be causal mechanisms that account for the otherwise heterogeneous patterns of association and male-female variations observed across alcohol outcomes in this study. For example, among RU, the AUD-unemployment association is possibly strong enough to rule out the possibility of a spurious association, but even so, the unemployment might cause AUD or it might be caused by AUD, among various alternative mechanisms. In future studies, it also should be possible to examine in detail the potential roles of social exclusion and deprivation as part of the underlying causal mechanisms.

Conclusions

In this study, we found an association between neighborhood socioeconomic deprivation with heavy drinking patterns and AUD. This project brings important contributions to the study of alcohol use patterns in Brazil where it is the first study to investigate area-level neighborhood socioeconomic deprivation (independent of household income and other SES indicators) in an effort to build evidence for public health alcohol policy development in this country. As noted above, access to alcohol may be a neglected component of NSD in the Brazilian area-level scaling approach, and we may find that higher NSD are those in which alcohol outlets are largely concentrated (as has been found elsewhere; [80–82]). If this also is the case in Brazil, one important policy measure would be reduce the number of outlets that sell...
alcohol in these neighborhoods; another measure might be an increase in taxes on alcohol, with revenues directed toward future projects to improve alcohol prevention and treatment in our country. The implementation of such policies has proved successful in other countries [3,7], and we are hopeful that these epidemiological findings may help guide future directions for public health work along these lines, not only in Brazil but also more globally.

Supporting Information

Table S1  Neighborhood Social Deprivation (NSD) level distribution of the total sample, men and women. Data from the São Paulo Megacity Mental Health Survey (SPMHS), Brazil, 2005–2007.

References

1. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, et al. (2012) A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380: 2224–2260.

2. UN (2011) Prevention and control of non-communucable diseases - Report of the Secretary-General A/66/183. United Nations.

3. WHO (2010) Global strategy to reduce the harmful use of alcohol. Geneva: World Health Organization.

4. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Trearattanamong Y, et al. (2009) Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet 373: 2223–2233.

5. Rehm J, Room R, Monteiro M, Gmel G, Graham K, et al. (2004) Alcohol use. In: M Escaith AL, A Rodgers, CJL Murray, editor. Comparative quantification of health risks Global and regional burden of disease attributable to selected major risk factors. Geneva: WHO. 959–1108.

6. Shield KD, Rylen M, Gmel G, Kehoe-Chan TA, Rehm J (2013) Global alcohol exposure estimates by country, territory and region for 2005–a contribution to the Comparative Risk Assessment for the 2010 Global Burden of Disease Study. Addiction 108: 912–922.

7. Rehm J, Monteiro M (2005) Alcohol consumption and burden of disease in the Americas: implications for alcohol policy. Rev Panam Salud Publica 15: 1–7.

8. Caetano R, Mills B, Pinsky I, Zaleski M, Lanarjena R (2012) The distribution of alcohol consumption and the prevention paradox in Brazil. Addiction 107: 60–66.

9. Silveira CM, Viana MG, Sui ER, de Andrade AG, Anthony JC, et al. (2011) Sociodemographic correlates of transitions from alcohol use to disorders and remission in the Sao Paulo megacity mental health survey, Brazil. Alcohol Alcohol 46: 324–332.

10. Laranjeira R, Pinsky I, Zaleski M, Caetano R (2010) Alcohol use patterns among Brazilian adults. Rev Bras Psiquiatr 32: 231–241.

11. Fonseca AM, Galhuriz JCF, Noto AR, Carlini ELA (2010) Comparison between two household surveys on psychotropic drug use in Brazil 2001 and 2004. Ciência & Saúde Coletiva 15: 663–670.

12. Sanchez ZM, Santos MG, Pereira AP, Nappo SA, Carlini EA, et al. (2013) Childhood Alcohol Use May Predict Adolescent Binge Drinking: A Multivariate Analysis among Adolescents in Brazil. J Pediatr 163: 363–368.

13. Galhuriz JCF, Carlini EA (2007) Use of alcohol among the inhabitants of the 107 largest cities in Brazil: 2001. Braz J Med Biol Res 40: 367–375.

14. Kore-Correia F, Tucci AM, Hegedus AM, Trinca LA, de Oliveira JB, et al. (2008) Drinking patterns between men and women in two distinct Brazilian communities. Rev Bras Psiquiatr 30: 235–242.

15. Kore-Correia F, Hegedus AM, Sanches AF, Trinca LA, Kore-Pontes LRS, et al. (2005) Differences in drinking patterns between men and women in Brazil. In: Room BSOR, editor. Alcohol, gender and drinking problems: perspectives from low and middle income countries. Geneva: World Health Organization. pp. 49–61.

16. Silveira CM, Wang YP, Andrade AG, Andrade LH (2007) Differences in drinking patterns between men and women in Brazil. In: Room BSOR, editor. Alcohol, gender and drinking problems: perspectives from low and middle income countries. Geneva: World Health Organization. pp. 49–61.

17. Rehm J, Klotsche J, Patra J (2007) Comparative quantification of alcohol exposure as risk factor for global burden of disease. Int J Methods Psychiatr Res 16: 66–76.

18. WHO (2011) Global status report on alcohol and health. Geneva: World Health Organization.

19. Silveira CM, Sui ER, Wang YP, Viana MG, Andrade AG, et al. (2012) Gender differences in drinking patterns and alcohol-related problems in a community sample in Sao Paulo, Brazil. Clinics (Sao Paulo) 67: 205–212.

20. Almeida-Filho N, Lessa I, Magalhães L, Araújo MJ, Aquino E, et al. (2004) Alcohol drinking patterns by gender, ethnicity, and social class in Bahia, Brazil. Rev Saude Publica 38: 45–54.

21. Barros MB, Betega NJ, Dalgalarrondo P, Marin-Leon L, de Oliveira HB (2007) Prevalence of alcohol abuse and associated factors in a population-based study. Rev Saude Publica 41: 502–509.

22. Castro DS, Sanchez ZM, Zaleski M, Alves HN, Pinsky I, et al. (2012) Sociodemographic characteristics associated with binge drinking among Brazilians. Drug Alcohol Depend 126: 272–276.

23. Mendoza-Sassi RA, Beria JU (2003) Prevalence of alcohol use disorders and associated factors: a population-based study using AUDIT in southern Brazil. Addiction 98: 799–804.

24. Moreira LB, Fuchs FD, Moraes RS, Bredermeier M, Cárdeno S, et al. (1996) Alcoholic beverage consumption and associated factors in Porto Alegre, a southern Brazilian city: a population-based survey. J Stud Alcohol 57: 253–259.

25. Primo NLNP, Stein AT (2004) Prevalência do abuso e da dependência de álcool em Rio Grande (RS): um estudo transversal de base populacional. Rev Psiquiatr Rio Gd Sul 26: 290–296.

26. Almeida-Filho N, Lessa I, Magalhães L, Araújo MJ, Aquino E, et al. (2005) Social inequality and alcohol consumption-abuse in Bahia, Brazil–interactions of gender, ethnicity and social class. Soc Psychiatry Psychiatr Epidemiol 40: 214–222.

27. Laranjeira R, Pinsky I, Zaleski M, Caetano R (2010) Alcohol use patterns among Brazilian adults. Rev Bras Psiquiatr 32: 231–241.

28. Rehm J, Monteiro M (2005) Alcohol consumption and burden of disease in the Americas: implications for alcohol policy. Rev Panam Salud Publica 15: 1–7.

29. Room R (2005) Stigma, social inequality and alcohol and drug use. Drug Alcohol Rev 24: 143–155.

30. Dzurova D, Spilkova J, Pikhart H (2010) Social inequalities in alcohol consumption in the Czech Republic: a multilevel analysis. Health Place 16: 590–597.

31. Bloomfield K, Grittner U, Kramer S, Gmel G (2006) Social inequalities in alcohol consumption and alcohol-related problems in the study countries of the EU concertation action ‘Gender, Culture and Alcohol Problems: A Multi-national Study’. Alcohol Alcohol Suppl 41: 286–36.

32. Bloomfield K, Grittner U, Kramer S, Gmel G (2006) Social inequalities in alcohol consumption and alcohol-related problems in the study countries of the EU concertation action ‘Gender, Culture and Alcohol Problems: A Multi-national Study’. Alcohol Alcohol Suppl 41: 286–36.

33. Room R (2005) Stigma, social inequality and alcohol and drug use. Drug Alcohol Rev 24: 143–155.

34. Greenfield TK, Midlang LT, Rogers JD (2000) A 10-year national trend study of alcohol consumption, 1984–1995: is the period of declining drinking over? Am J Public Health 90: 47–52.

35. Midlang LT, Clark WB (1994) The demographic distribution of US drinking patterns in 1990: description and trends from 1984. Am J Public Health 84: 1218–1222.

36. Henningsson T, Lundberg I, Diderichsen F, Allebeck P (1998) Explanations of social class differences in alcoholism among young men. Soc Sci Med 47: 1399–1405.

37. Mahyuta S, Bobak M, Kruilovitch S, Nikitin Y, Marmot M (2004) Trends in alcohol intake by education and marital status in urban population in Russia between the mid 1980s and the mid 1990s. Alcohol Alcohol 39: 64–69.

38. Marmot M (1997) Inequality, deprivation and alcohol use. Addiction 92 Suppl 1: S13–20.

39. Bloomfield K (2000) Alcohol Consumption and Alcohol Problems Among Women in European Countries. Subst Abus 21: 223–229.

40. Matheson PJ, White HT, Moomedien R, Drew JR, Glazier RH (2012) Drinking in context: the influence of gender and neighbourhood deprivation on alcohol consumption. J Epidemiol Community Health 66: e4.

41. Mulia N, Kerker-Jaffe KJ (2012) Interactive influences of neighborhood and individual socioeconomic status on alcohol consumption and problems. Alcohol Alcohol 47: 178–186.

42. Galea S, Ahern J, Tracy M, Rudenstine S, Vlahov D (2007) Education inequality and use of cigarettes, alcohol, and marijuana. Drug Alcohol Depend 90 Suppl 1: S4–13.

Author Contributions

Conceived and designed the experiments: CMS ERS LHA. Performed the experiments: CMS ERS LPS AK LHA. Analyzed the data: CMS ERS JCA LPS SSM LHA. Wrote the paper: CMS ERS JCA LPS AGA YPW SSM LHA. Created databank: LHA MCV.
43. Galea S, Ahern J, Tracy M, Vlahov D (2007) Neighborhood income and income distribution and the use of cigarettes, alcohol, and marijuana. Am J Prev Med 32: S195–202.

44. Pollack CE, Cahnin C, Ahn D, Winkleby M (2005) Neighborhood deprivation and alcohol consumption: does the availability of alcohol play a role? Int J Epidemiol 34: 772–780.

45. Karriker-Jaffe KJ, Zemore SE, Mula N, Jones-Webb R, Bond J, et al. (2012) Neighborhood disadvantage and adult alcohol outcomes: differential risk by race and gender. J Stud Alcohol Drugs 73: 865–873.

46. Stimpson JP, Ju H, Raja MA, Eschbach K (2007) Neighborhood deprivation and health risk behaviors in NHANES III. Am J Health Behav 31: 215–222.

47. Jones-Webb R, Snowden L, Herd D, Short B, Hamann P (1997) Alcohol-related problems among black, Hispanic and white men: the contribution of neighborhood poverty. J Stud Alcohol 58: 339–345.

48. Viana MC, Teixeira MG, Beraldi F, Bassani Ide S, Andrade LH (2009) Sao Paulo Megacity Mental Health Survey – a population-based epidemiological study of psychiatric morbidity in the Sao Paulo metropolitan area: aims, design and field implementation. Rev Bras Psiquiatr 31: 375–386.

49. IBGE (2001) Censo demográfico populacional do ano 2000. Instituto Brasileiro de Geografia e Estatística.

50. Kish L, Frankel MR (1970) Balanced Repeated Replications for Standard Errors. J Amer Stat Assoc 65: 1071–1094.

51. Haro JM, Arbabzadeh-Bouchez S, Brugha TS, de Girolamo G, Guyer ME, et al. (2006) Concordance of the Composite International Diagnostic Interview Version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World Mental Health surveys. Int J Methods Psychiatr Res 15: 167–180.

52. Kessler RC, Ustun TB (2004) The World Mental Health (WMH) Survey Initiative Version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). Int J Methods Psychiatr Res 13: 93–121.

53. Esan O, Makanjuola V, Oladeji B, Gureje O (2013) Determinants of transition across the spectrum of alcohol use and misuse in Nigeria. Alcohol 47: 249–255.

54. Abdin E, Subramaniam M, Vaingankar JA, Chong SA (2014) The role of sociodemographic factors in the risk of transition from alcohol use to disorders and remission in singapore. Alcohol Alcohol 49: 103–106.

55. Tsutidh M, ten Have M, van den Brink W, Vollebergh W, de Graaf R (2012) The role of conduct disorder in the association between ADHD and alcohol use (disorder). Results from the Netherlands Mental Health Survey and Incidence Study-2. Drug Alcohol Depend 123: 115–121.

56. Degenhardt L, Bohnert KM, Anthony JC (2007) Case ascertainment of alcohol dependence in general population surveys: ‘gated’ versus ‘ungated’ approaches. Int J Methods Psychiatr Res 16: 111–123.

57. Degenhardt L, Chan WT, Sampson N, Kessler RC, Anthony JC, et al. (2008) Toward a global view of alcohol, tobacco, cannabis, and cocaine use: findings from the WHO World Mental Health Surveys. PLoS Med 5: e141.

58. Heeringa SG, West BT, Berglund PA (2010) Preparation for complex sample survey data analysis. Applied Survey Data Analysis. 91–116.

59. Harrel Jr FE (2001) Regression Modeling Strategies. With Applications to Linear Models, Logistic Regression, and Survival Analysis. New York: Springer-Verlag.

60. Wolter KM (1985) Introduction to variance estimation. New York, NY: Springer-Verlag.

61. Chuang YC, Li YS, Wu YH, Chao HJ (2007) A multilevel analysis of neighborhood poverty. J Stud Alcohol 58: 539–545.

62. Tuithof M, ten Have M, van den Brink W, Vollebergh W, de Graaf R (2012) Gender difference in heavy alcohol use: a general population survey (The Genacis Project) of Sao Paulo City, Brazil. Contemp Drug Problems 34: 427–444.

63. Jordanov L, Fulker MS, Strasser J, Castanares CV, Rehm J, et al. (2010) The role of conduct disorder in the association between ADHD and alcohol use (disorder). Results from the Netherlands Mental Health Survey and Incidence Study-2. Drug Alcohol Depend 123: 115–121.

64. WHO (2005) Alcohol, gender and drinking problems: perspectives from low and middle income countries. Geneva: World Health Organization.

65. Neve RJ, Drop MJ, Lemmens PH, Swinkels H (1996) Gender differences in drinking behaviour in the Netherlands: convergence or stability? Addiction 91: 360–370.

66. Holmila M, Raitasalo K (2005) Gender differences in drinking: why do they still exist? Addiction 100: 1763–1769.

67. Wilsnack SC (2005) Honouring Ladek Kubicka: an introduction to the symposium. Addiction 100: 1760–1762.

68. Lima MC, Kerr-Corrêa F, Rehm J (2013). Alcohol consumption pattern and Coronary Heart Disease risk in Metropolitan Sao Paulo: analyses of GENACIS Project. Rev Bras Epidemiol 16: 89–97.

69. Lima MC, Kerr-Corrêa F, Tucci AM, Simão MO, Oliveira JR, et al. (2007) Gender difference in heavy alcohol use: a general population survey (The Genacis Project) of São Paulo City, Brazil. Contemp Drug Problems 34: 427–444.

70. Guzmánz VV, Florindo AA, Stopa SR, César CLG, Barros MBA, et al. (2010) Consumption abusive and dependência de alcohol em população adulta no Estado de São Paulo, Brasil. Revista Brasileira de Epidemiologia 13: 314–325.

71. Bromet EJ, Gluzman SF, Paniotto VI, Webb CP, Tintle NL, et al. (2005) Epidemiology of psychiatric and alcohol disorders in Ukraine: findings from the Ukraine World Mental Health survey. Soc Psychiatry Psychiatr Epidemiol 40: 681–690.

72. Kim JH, Lee S, Chow J, Lau J, Tsang A, et al. (2008) Prevalence and the factors associated with binge drinking, alcohol abuse, and alcohol dependence: a population-based study of Chinese adults in Hong Kong. Alcohol Alcohol 43: 360–370.

73. Mewton L, Slade T, McBride O, Groves R, Teesson M (2011) An evaluation of the proposed DSM-5 alcohol use disorder criteria using Australian national data. Addiction 106: 941–950.

74. Agrawal A, Heath AC, Lysyj MT (2011) DSM-IV to DSM-5: the impact of proposed revisions on diagnosis of alcohol use disorders. Addiction 106: 1935–1943.

75. Anderson P, Chisholm D, Fuhr DC (2009) Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. Lancet 373: 2234–2246.

76. Anthony JC, Folstein M, Romanskij AF, Von Korff MR, Nestadt GR, et al. (1985) Comparison of the lay Diagnostic Interview Schedule and a standardized psychiatric diagnosis. Experience in eastern Baltimore. Arch Gen Psychiatry 42: 667–675.

77. Wittchen HU (1994) Reliability and validity studies of the WHO-Composite International Diagnostic Interview (CIDI): a critical review. J Psychiatr Res 28: 57–84.

78. Johnson JG, Cohen P, Dohrenwend BP, Link BG, Brook JS (1999) A longitudinal investigation of social causation and social selection processes involved in the association between socioeconomic status and psychiatric disorders. J Abnorm Psychol 108: 490–499.

79. Dohrenwend BP, Levine I, Shroff PE, Schwartz S, Naveh G, et al. (1992) Socioeconomic status and psychiatric disorders: the causation-selection issue. Science 253: 946–952.

80. Gruenewald PJ (2007) The spatial ecology of alcohol problems: niche theory and assortative drinking. Addiction 102: 870–878.

81. MacCulloch E, Gruenewald PJ, Ponicki WR, Remer L (2013) Varying impacts of alcohol outlet densities on violent assaults: explaining differences across neighborhoods. J Stud Alcohol Drugs 74: 50–58.

82. Toomey TL, Erickson DJ, Carlin BP, Leun KM, Quick HS, et al. (2012) The association between density of alcohol establishments and violent crime within urban neighborhoods. Alcohol Clin Exp Res 36: 1468–1473.