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Co-occurrence patterns of anxiety, depression and alcohol use disorders

■ **Abstract** Co-occurrence of anxiety and depressive symptoms with alcohol consumption/abuse was analyzed in a sample of 2,302 adults in Bahia, Brazil. A cross-sectional household survey collected self-reported information on social and personal health, as well as individual psychological status, with standardized techniques and trained examiners. Twelve-month prevalence was 15% for anxiety, 12% for depressive disorders and 7% for alcohol abuse/dependence. Symptom co-occurrence was more frequent for depression (94% of cases co-occurring with other diagnoses), followed by anxiety disorders (82%), and alcoholism (only 20%). There was a 74% proportion of anxiety symptoms among depressed, and a 61% proportion of depressed among anxiety sufferers. The combination of depression plus anxiety was the most prevalent in both gender groups, ranging from 17% for women to 5% for men. Comorbid combinations of alcoholism yielded low prevalences, the smallest (around 1%) being the triple combo alcoholism+anxiety+depression. Gender ratios increased substantially in the absence of comorbidity, reaching peaks in depression (F:M ratio = 13.8) and alcoholism (M:F ratio = 11.8). Set component analyses indicate strong overlapping of anxiety and depression and complementarity between depression and alcoholism, modulated by gender (women depressed, men alcoholic).

■ **Key words** comorbidity · anxiety · alcoholism · depression · depressive spectrum

Introduction

Widely used in research and practice in psychiatry and increasingly recognized as a common feature of the current mental health panorama, the umbrella term 'comorbidity' was introduced to characterize overlapping symptomatology, simultaneous psychopathology or multiple diagnosis of psychiatric disorders [29, 37, 48]. Psychiatric comorbidity has been considered mainly with regard to anxiety, mood disorders, and substance use disorders (particularly alcohol abuse or dependence) [14, 27, 28, 42].

In clinical settings, comorbid psychiatric disorders have been found to be particularly common among alcoholics. Although estimates of additional psychopathology differ according to instruments used to classify disorders, up to two-thirds of patients with alcohol dependence are likely to have a lifetime diagnosis of another psychiatric disorder [17]. Zilberman et al. [51] conducted a computerized search of health care databases to review gender differences in psychiatric comorbidity among individuals with substance use disorders and concluded that women with alcohol and other drug use disorders present higher rates of psychiatric comorbidity, particularly mood and anxiety disorders, than do men. Examining the links between alcoholism and depression, Vaillant [47] noted that clinical research would point to

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alcohol abuse as the "horse to the cart" of major depressive disorder. For Goldberg [21], categorical classification models across the whole range of mental disorders may create comorbidity since different diagnoses, such as depression and anxiety disorder, share a common core of minor symptoms. In this view, comorbidity is a kind of artifact, determined by over sampling of different disorders and, therefore, hypotheses of a common hereditary defect [29, 37] and of self-medication with alcohol [17, 42] should be discarded.

Aside from considering overlapping psychopathology as epiphenomena of nosological systems, alternative explanations have been proposed for comorbidity. Twin and family studies [29, 46] suggest shared familial risk factors for some specific subtypes of anxiety and depression. Cross-sectional data points to some overlap in anxiety and depression in the aggregate level, whereas longitudinal studies suggest that depression may be a complication of anxiety [38, 40, 49]. According to an international task force that examined evidence from epidemiological studies [37], the onset of anxiety disorders generally preceded that of depression.

Large-scale population studies that have focused comorbidity of depression or anxiety disorders with substance misuse – such as the Epidemiological Catchment Area [25], the National Comorbidity Survey [31], the OPCS National Psychiatric Morbidity Survey [20], the International Consortium in Psychiatric Epidemiology [39], the Australian National Survey of Mental Health and Well Being [6], the Netherlands Mental Health Survey and Incidence Study [19], the Zurich Cohort Study [11, 40], the US National Comorbidity Survey Replication [30] and the National Epidemiologic Survey on Alcohol and Related Conditions [16] – , found that comorbidity with affective disorders was generally greater for anxiety disorders than for alcoholism, while no major differences were found in patterns of comorbidity by depression subtype, gender or age group. Findings from recent longitudinal studies supported the notion that, instead of comorbidity, such co-occurrence conditions represent dimensions of a "soft bipolar spectrum" [32] or a "same underlying diathesis" [19] indicative of a "depressive spectrum" syndrome [9, 10, 12, 15, 32].

The bulk of the evidence regarding this scientific question has been produced in developed Western countries. In this paper, we intend to test the comorbidity hypothesis in a different cultural setting, by considering the following questions: What are the patterns of co-occurrence of depression, anxiety and alcohol use symptoms in an urban setting of a developing country? Are these disorders associated as different nosological entities or as a dimension interaction of a same spectrum syndrome? What is the role of gender in such a complex panel of overlapping symptomatology? With this aim, we analyze prevalence data on anxiety and depressive symptoms and consumption, abuse and harmful use of alcohol, among adults in a representative population sample of Salvador, Bahia, Brazil.

Methods

Setting and sampling

Salvador (pop.: 2,556,013) is the capital city of the State of Bahia, the largest and most populated of Northeast Brazil. We used a 3-stage cluster random sampling strategy. In the first stage, contiguous census tracts sharing the same sociodemographic characteristics were merged in order to ensure a total of between 100 to 200 families in each. This produced a total of 108 survey areas (SA), which included 16,592 households and approximately 83,000 inhabitants, from where 37 SAs were randomly selected. In the second stage, a random systematic sampling of households was accomplished for each SA using a sampling interval of 10 homes. A total of 1,540 homes were visited, and heads of households were asked to provide information on age and gender of each resident as well as informed consent to participate in the study. At this stage, the refusal rate was 9.1%. In the third sampling stage, for each family that agreed to participate in the study, two adults (> 20 years of age), one male and one female (excluding pregnant women), were randomly selected. The final sample was composed by 2,306 adults from 1,258 families, living in 63 census tracts. It had more females (1,253) than males (1,053), with a refusal rate higher for men (5.9%) as compared to women (1.8%). The study protocol was approved by the Research Ethics Committee at the UFBA Instituto de Saúde Coletiva.

Data collection procedures

The field research team was composed of three health professionals and 10 trained lay interviewers (recruited from the neighborhoods included in the research). The lay interviewers located the households and completed a family information sheet for the collection of sociodemographic information on all residents identified and for scheduling visits for interviews and individual exams. Each interviewer was in charge of approximately 100 families. They were instructed to do the first visit during the lunch hour (when most household heads are at home), on weekends or evenings, up to three times before coding the unit as missing. Field supervisors (L.M., M.J.A.) monitored closely the data collection, re-visiting participating families at random to ensure quality control. The basic instrument of data collection was a modular questionnaire containing sociodemographic individual data. The family socioeconomic status and the head of household's occupation and schooling were taken as components for a 4-level social class scale. Race-ethnicity was assessed by an adapted skin-color scale, previously developed for population genetic studies in Bahia [35].

Outcome measures

Individual mental health status was assessed by the Psychosomatic-Anxiety-Depression (PSAD) subscale of the *Questionário de Morbidade Psiquiátrica de Adultos* (QMPA). The QMPA consists of a 44-item structured symptom-based instrument developed for case identification in psychiatric morbidity surveys and tested for validity and reliability in different research settings in Brazil [4, 5, 44, 45]. Validity tests demonstrated adequate sensitivity (89 to 93%), and specificity (72–98%), and low misclassification rates (6–12%) for the instrument. Reliability studies of the supporting diagnoses revealed a kappa of +0.88. It has since been largely employed for epidemiologic studies of mental disorders in Brazil [1–3, 44]. Andreoli et al. [5] analyzed the QMPA psychometric properties using principal component analysis and identified three of 10 components - anxiety, depression and alcoholism – that came out consistently in different research sites. These dimensions clustered around the same symp-

toms, with 12 items found to be the most reliable and stable for depression and anxiety, forming the basis of the PSAD/QMPA. Andreoli et al. [5] also observed that the PSAD/QMPA components reflected overall symptoms of anxiety and depression according to DSM-III-R criteria. Further analysis of the PSAD components showed that, although valid to detect minor psychological disturbances, these structures have only a regular capacity to predict clinical diagnoses of generalized anxiety disorder and major depression. The values of areas under the ROC curve for the models extracted by the components item analysis were: generalized anxiety (lifetime) = 0.69; generalized anxiety (12-month) = 0.71; depression (lifetime) = 0.66; depression (12-month) = 0.68 [4].

The form used in this study consisted of direct questions in the local idioms, covering the following symptom groups: (1) aggressiveness, (2) irritability, (3) sleep problems, (4) trembling, cold hands, (5) palpitations and heartburn, (6) ear-noise or "headbuzzing", (7) headaches, (8) fatigue and weakness in the legs, "nerves", (9) excessive concern with diseases or vague pain, (10) sadness and easy crying, (11) discouragement or negativism, and (12) social withdrawal. The first five items composed the anxiety dimension and the final four items were included in the depression component of the subscale. All symptoms referred to the past 12-month period. Answers were coded on to 4-point Likert scale (0-never, 1-rarely, 2-sometimes, 3-frequently).

Cases of anxiety disorders were defined as those subjects who scored > 18 in the PSAD/QMPA and who had reported as frequent or chronic complaint at least one symptom specific for anxiety disorders. Cases of Depression were defined as those subjects who scored >18 in the PSAD/QMPA and who had reported as frequent or chronic complaint at least one symptom specific for depressive disorders. Therefore, for someone to be diagnosed with anxiety or depressive disorders in the past year, he/she needed to have reported a major symptom specific for depression or anxiety disorders plus scoring in the upper quintile of the PSAD/QMPA scale. This approach to case definition is comparable to those used in several recent surveys on psychosocial health—e.g., the British National Psychiatric Morbidity Survey [26], the Alameda County Study [50], the ODIN Study [13], the Whitehall II Study [24].

QMPA sections regarding alcohol consumption—binge drinking, frequent drunkeness, daily drinking, and excessive drinking—were validated for screening alcohol abuse and dependence [5, 44]. The values of the areas under the ROC curve (using DIS diagnostic interviews as gold-standard) for alcohol abuse and dependence extracted by the principal components analysis were respectively 0.76 and 0.79, pointing to a reasonable performance of the instrument if used for population research purposes [5]. Alcohol consumption patterns were also surveyed through direct questions in the local idioms regarding: (a) frequency of consumption; (b) type of alcoholic beverage - beer, cachaça (Brazilian rum), whisky, cognac, wine; (c) intake amount. Abstemious was defined as those who declared never drinking alcohol. Cases of alcohol abuse/dependence were defined as subjects who reported daily high-intake of more than two units of beverage, with drunkenness, those who indicated binge drinking (at least once a week) plus episodes of drunkenness, and those who reported any use of alcoholic beverages but with frequent drunkenness (at least once a week), with acknowledged failure to stop drinking. High-intake was defined as more than two units (bottle/can/dose/cup) per day everyday. Binge drinking was defined as the consumption of eight or more drinks of wine, beer, or liquor at one sitting. All items referred to the past 12-month period including the current situation. The use of drinking patterns, graduated frequency of alcohol intake and case definition criteria for alcohol use disorders (abuse or dependence) are in keeping with current research [34, 36, 43, 41].

■ Statistical analysis

Prevalence rates and measures of association were estimated for each category of the hypothesized comorbidity variables. Considering the sampling design, separate analyses were conducted for each of the gender categories by estimating female:male (F:M) prevalence ratios. Odds-ratios (OR) were calculated for categories of covariables and, whenever indicated, with adjustments for confounding control through logistic regression. Adjusted odds-ratios were estimated by modeling only terms that reached statistical significance ($\alpha = 0.05$) in each specific group except for age, which was forced into all models. For the assessment of statistical significance, we used Mantel-Haenszel weighted chi-squares and Taylor-series confidence intervals (and, whenever indicated due to small size strata, Fisher's exact tests and Greenland-Robinson confidence limits). For data processing and statistical analysis, we used the software Minitab 1.3 and EpiInfo 2.3.1 for the estimation of summary measures of association. For comorbidity analyses, we calculated a direct Co-occurrence Index (CoI): CoI = (Co / D), where Co corresponds to the number of subjects affected by any disorder in co-occurrence with other disorders and D is the total number of cases of that disorder.

Results

In the sample, women were 11% more represented than men; middle age groups accounted for half of the sample, while 19% were older than 55 years of age. As seen in Table 1, a majority (65%) of the sample was currently married; and more women were widowed or divorced (16%) than men (4%). Half of the sample was migrants. The illiteracy rate was 8% and the majority (56%) of the sample had elementary education. Only 5% had college education. Women were less educated than men. Only 2% of the sample was classified as upper class; 13% was classified as middle class; and the majority (85%) was lower or working class. Regarding race-ethnicity, 62% self-identified as *morenos* or Mulattos and 21% as Blacks; Whites constituted 15% of the sample. Less than 3% declared some other racial ethnic identity.

Table 1 Sociodemographic profile of the sample (Salvador, Brazil, 2001)

Variables	Male		Female		Total	
	n	(%)	*n*	(%)	*n*	(%)
Marital status						
Never-married	292	(28.0)	271	(21.7)	563	(24.6)
Currently married	712	(68.2)	774	(62.0)	1486	(64.8)
Widowed	18	(1.7)	115	(9.2)	133	(5.8)
Separated/divorced	22	(2.1)	88	(7.1)	110	(4.8)
Migration						
Non-migrant	542	(51.5)	601	(48.0)	1143	(49.6)
Migrant	511	(48.5)	652	(52.0)	1163	(50.4)
Education						
College	49	(4.7)	62	(5.0)	111	(4.8)
High school	318	(30.4)	393	(31.5)	711	(31.0)
Elementary school	622	(59.5)	667	(53.5)	1289	(56.3)
Illiterate/read	56	(5.4)	124	(9.9)	180	(7.9)
Social class						
Upper	25	(2.4)	29	(2.3)	54	(2.4)
Middle	127	(12.2)	166	(13.4)	293	(12.9)
Lower/poor	887	(85.4)	1041	(84.2)	1928	(84.7)
Ethnic group						
White	145	(13.9)	194	(15.7)	339	(14.9)
Mulatto	669	(64.2)	746	(60.2)	1415	(62.0)
Black	210	(20.2)	261	(21.1)	471	(20.7)
Other	18	(1.7)	38	(3.1)	56	(2.5)
Total	1053	(100.0)	1253	(100.0)	2306	(100.0)

Table 2 Prevalence of anxiety disorders by substance use/abuse, according to gender (Salvador, Brazil, 2001)

Variables	n	(%)	Female Prev (%)	Male Prev (%)	F:M Ratio	Chi-square	Overall Prev (%)	Odds Ratio[a]	(95% CI)
Alcohol consumption									
Abstemious	938	(40.8)	18.1	7.2	2.51	***17.9	15.0	0.79	(0.58; 1.07)
Once a month	429	(18.7)	20.1	9.4	2.14	**8.97	15.6	0.96	(0.67; 1.37)
On weekends	805	(35.1)	24.7	5.1	4.84	***66.39	12.7	1.00	–
Daily	125	(5.4)	23.1	15.2	1.52	NS0.54	16.0	2.13	(1.21; 3.74)
Alcohol abuse									
Abstemious	938	(42.6)	18.1	7.2	2.51	***17.88	15.0	0.67	(0.45; 0.98)
Never	857	(38.9)	20.2	7.1	2.85	***31.31	13.5	0.78	(0.54; 1.15)
Sometimes	373	(17.0)	28.3	7.5	3.77	***28.31	13.4	1.00	–
Frequently	35	(1.6)	80.0	16.7	4.79	**8.99	25.7	2.86	(1.23; 6.66)
Total	2306	(100.0)	20.3	7.4	2.74	***76.82	14.4	–	–

* 0.05 > P > 0.005; ** 0.005 > P > 0.001; *** P < 0.001
NS Non-significant
a Adjusted for age, gender, social class, race-ethnicity

As seen in Table 2, the overall 12-month prevalence of anxiety disorders was 14%, 2.7 times more prevalent among females (20%) than among males (7%). Among self-reported abstemious, 15% had anxiety symptoms. Respondents who reported drinking alcohol daily showed the highest prevalence of anxiety (16%) as compared to other alcohol consumption subgroups. The contrast between this and the lowest prevalence (on weekends: 13%) yielded an adjusted OR of 2.1 (1.21; 3.74), statistically significant. Those who reported drinking but never abuse alcohol had the lowest prevalence of anxiety (13%) as compared to those who admit frequent drunkenness (26%), yielding an OR of 2.9 (1.23; 6.66).

The overall 12-month prevalence of depressive disorders was 12.5%, 3.1 times more prevalent among females (18%) than among males (6%). According to Table 3, differences in prevalence of depression among alcohol consumption subgroups (from 11% to 14%) were not statistically significant, except for the daily use group (OR = 1.96). Those who reported sometimes abusing alcohol had the lowest prevalence of depression (11%) as compared to those who admit frequent drunkenness (29%), yielding an OR of 4.10 (1.77; 9.46).

The gender ratio was reversed for alcoholism, 6 times more prevalent among men (13%) than among women (2%); with an overall prevalence of 7%. As seen in Table 4, this male to female ratio was statistically significant for all strata of the hypothesized comorbid variables. There was evidence of low comorbidity between alcoholism and anxiety or depressive disorders (prevalence of alcoholism around 9% among anxiety and depressed, compared to 6.5%; non-significant differences) but this finding is modified by gender. Men with depressive disorders were the most vulnerable for alcoholism (prevalence = 29%) while women without anxiety or depression formed the most protected subgroup (prevalence less than 2%, PR = 0.07). Data suggest strong comorbidity between anxiety and depressive disorders, with a 93% prevalence of anxiety symptoms among depressed (adjusted OR = 421.61), and an 81% proportion of depressed subjects among anxiety sufferers (adjusted OR = 418.36). Interestingly enough, there was no significant female:male ratio for anxiety among depressed nor for depression in the anxiety subgroup.

Figure 1 presents a set component analysis of co-occurrence of depression, anxiety and alcoholism.

Table 3 Prevalence of depression by substance use/abuse, according to gender (Salvador, Brazil, 2001)

Variables	n	(%)	Female Prev (%)	Male Prev (%)	F:M Ratio	Chi-square	Overall Prev (%)	Odds Ratio[a]	(95% CI)
Alcohol consumption									
Abstemious	938	(40.8)	16.3	5.3	3.08	***20.28	13.2	0.80	(0.59; 1.11)
Once a month	429	(18.7)	18.5	7.8	2.37	**9.94	14.0	0.98	(0.68; 1.43)
On weekends	805	(35.1)	21.8	3.9	5.59	***63.8	10.8	1.00	–
Daily	125	(5.4)	7.7	13.4	0.57	NS0.34	12.8	1.96	(1.06; 3.66)
Alcohol abuse									
Abstemious	938	(45.6)	16.3	5.3	3.07	*** 20.28	13.2	0.67	(0.44; 1.00)
Never	857	(38.9)	17.6	6.0	2.93	***28.03	11.7	0.76	(0.50; 1.13)
Sometimes	373	(16.9)	25.5	5.6	4.55	***29.93	11.3	1.00	–
Frequently	35	(1.6)	80.0	20.0	4.00	*7.56	28.6	4.10	(1.77;9.46)
Total	2306	(100.0)	18.1	5.9	3.07	***78.05	12.5	–	–

* 0.05 > P > 0.005; ** 0.005 > P > 0.001; *** P < 0.001
NS Non-significant
a Adjusted for age, gender, social class, race-ethnicity

Table 4 Comorbidity of alcoholism, anxiety and depressive disorders, according to gender (Salvador, Brazil, 2001)

| Prevalence	n	(%)	Female Prev (%)	Male Prev (%)	F:M Ratio	Chi-square	Overall Prev (%)	Odds Ratio[a]	(95% CI)
Alcoholism on									
Anxiety disorders	332	(14.4)	23.1	4.7	1/4.91	***24.45	9.0	2.66	(1.68; 4.22)
Absent	1974	(85.6)	11.8	1.4	1/8.43	***87.28	6.5	1.00	–
Alcoholism on									
Depressive disorders	289	(12.5)	29.0	4.4	1/6.59	***83.76	9.7	3.08	(1.90; 4.98)
Absent	2017	(87.5)	11.6	1.6	1/7.25	***33.76	6.5	1.00	–
Anxiety disorders on									
Depressive disorders	289	(12.5)	73.1	83.9	1.15	*4.10	93.4	421.61	(245.45;724.20)
Absent	2017	(87.5)	0.5	1.4	2.80	*4.60	3.1	1.00	–
Depressive disorders on									
Anxiety disorders	332	(14.4)	92.0	94.0	1.02	NS0.29	81.3	418.36	(244.14;716.90)
Absent	1974	(85.6)	2.1	4.0	1.90	*5.96	1.0	1.00	–
Alcoholism (overall)	2306	(100.0)	12.6	2.1	1/6.00	***99.30	6.9	–	–

* $0.05 > P > 0.005$; ** $0.005 > P > 0.001$; *** $P < 0.001$. NS Non-significant. [a] Adjusted for age, gender, social class, race-ethnicity.

Depression had overall the highest Co-occurrence Index (CoI = 0.939), or 94% of cases co-occurring with other diagnoses, followed by anxiety disorders (CoI = 0.825). Alcoholism showed the smallest overall Co-occurrence Index (CoI = 0.201). Graphically confirming the analysis above, co-occurrence was higher for depression with anxiety, respectively CoI = 0.844 (for anxiety among depressed) and CoI = 0.735 (for depression among anxiety sufferers). None of the comorbid combinations of alcoholism reached CoI values above 0.10.

Figure 2 demonstrate graphically the different co-occurrence profiles by gender. Among females, depression had the highest Co-occurrence Index (CoI = 0.938), or 94% of cases co-occurring with other diagnoses, mostly anxiety (present in 89% of depressed cases), followed by anxiety disorders (CoI = 0.856) and alcoholism (CoI = 0.461). Noteworthy is the absence of co-occurrence of alcoholism and depression among women as well as the very low levels of common psychopathology with the other conditions for both gender. Almost all cases of male

depression are comorbid with other conditions (CoI = 0.952), mostly anxiety (in 80% of the cases). Anxiety disorders also reached a very high overall Co-occurrence Index (0.756). Despite being the most prevalent condition (13%) in the male subgroup, alcoholism had the lowest overall Co-occurrence Index (0.150).

Table 5 summarizes the analysis of comorbidity between anxiety, depression and alcoholism, stratified by gender. The comorbid combination of depression plus anxiety was the most frequent in both gender
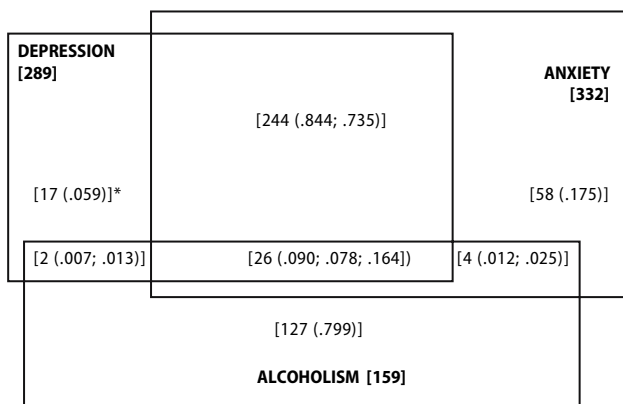
* [number of cases (CoI, respectively for depression, anxiety, alcoholism)]
Obs.: areas are not proportional to rates.

Fig. 1 Set components of comorbidity combinations of depression, anxiety and alcoholism
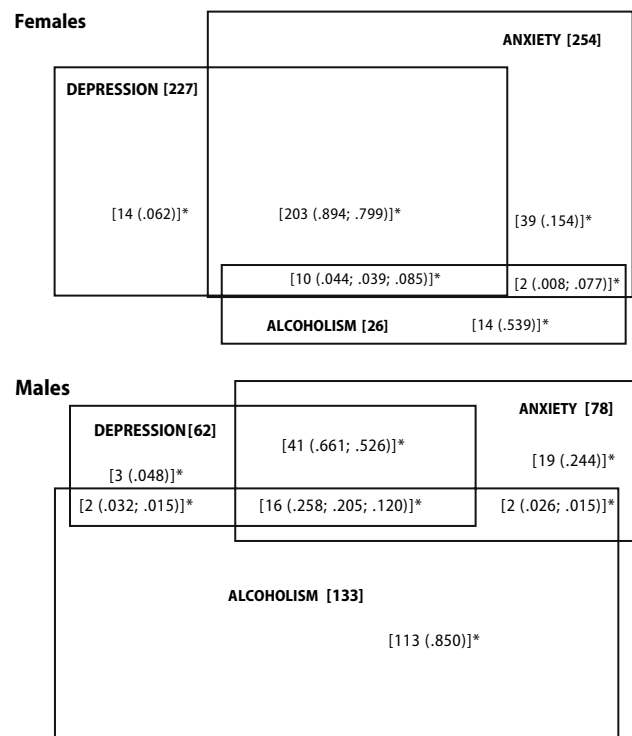
* [number of cases (CoI, respectively for depression, anxiety, alcoholism)]
Obs.: areas are not proportional to rates.

Fig. 2 Set components of co-occurrence of depression, anxiety disorders and alcoholism by gender (A, females; B, males)

Table 5 Prevalence of co-occurring combinations of depression, anxiety disorders and alcoholism according to gender (Salvador, Brazil, 2001)

Comorbidity combinations	Women		Men		Female:Male		Total	
	n	(%)	n	(%)	Ratio	Chi-square	n	(%)
Anxiety (all cases)	254	20.3	78	7.4	2.74	***76.82	332	14.4
Depression (all cases)	227	18.1	62	5.9	3.07	***78.05	289	12.5
Alcoholism (all cases)	26	2.1	133	12.6	1/5.88	***99.31	159	6.9
Depression + anxiety	213	17.0	57	5.4	3.14	***74.30	270	11.7
Alcoholism + anxiety	12	1.0	18	1.7	1/1.69	NS2.52	30	1.3
Alcoholism + depression	10	0.8	18	1.7	1/2.13	*3.96	28	1.2
Alcoholism + anxiety + depression	10	0.8	16	1.5	1/1.89	NS2.67	26	1.1
Anxiety only	39	3.1	19	1.8	1.72	*6.36	58	2.5
Depression only	14	1.1	3	0.3	3.93	*5.42	17	0.7
Alcoholism only	14	1.1	113	10.7	1/10.00	*101.62	127	5.5
Depression or anxiety	278	22.2	99	9.4	2.36	***70.82	377	16.3
Alcoholism or anxiety	278	22.2	209	19.8	1.12	**14.35	487	21.1
Alcoholism or depression	253	20.2	193	18.3	1.10	**10.24	446	19.3
Alcoholism or anxiety or depression	292	23.3	212	20.1	1.16	**13.12	504	21.8
Total	1253	(100.0)	1053	(100.0)	–	–	2306	(100.0)

* $0.05 > P > 0.005$; ** $0.005 > P > 0.001$; *** $P < 0.001$. NS Non-significant

groups, ranging from 17% for women to 5% for men. Comorbid combinations of alcoholism yielded low prevalences, the smallest (around 1%) being the triple combo alcoholism+anxiety+depression. Gender ratios varied across the different comorbidity combinations following the overall pattern: anxiety and depression higher for females and alcoholism for males. Such ratios increased substantially in the absence of comorbidity, reaching peaks in depression only (female:male ratio = 3.9) and alcoholism only (male:female ratio = 9.7). Noteworthy is the reduction of significance levels on gender ratios for comorbidity with alcoholism, due to small numbers. The analysis of non-overlapping diagnoses is also shown in Table 5. Prevalences of two-by-two combinations of the analyzed outcomes vary between 9% and 20% for males, while they remain stable over 20% for females. Taken together, anxiety/depression/alcoholism yields an overall prevalence of 23%.

Discussion

The study data suggest strong comorbidity between anxiety and depressive disorders. On the other hand, there was weak evidence of comorbidity of depression or anxiety with alcohol consumption subgroups given that only one tenth of those who had anxiety or depressive disorders were diagnosed as alcoholic. Nevertheless, self-reported drinkers that admit frequent drunkenness had the highest prevalence of depression and anxiety disorders. As far as alcoholism is concerned, anxious or depressed men were the most vulnerable while women without anxiety or depressive disorders formed the most protected subgroup. Despite large variations due to group size and psychopathology, gender ratios were statistically significant for all but five strata (daily drinkers, alcohol abusers and depressed, anxious subgroups) of comorbid variables. These ratios are smaller than the

ones estimated by Brazilian epidemiologic studies from the eighties [4, 44], but they are comparable to those found in more recent surveys [1–3, 18]. Only the male:female ratio found in our study for alcohol use disorders is higher than those estimated in North-American and European surveys (with estimated ratios of around 2:1) [23, 30, 31, 36].

The co-occurrence combination depression+anxiety was the most frequent overall and in both gender groups while comorbid combinations of alcoholism had low prevalence in general. Depression and anxiety disorders reached high co-occurrence indices, as compared to alcoholism. Among females, all comorbid conditions yielded large co-occurrence indices. Among men, alcoholism showed the highest prevalence but the lowest co-occurrence index. Almost all cases of male depression were comorbid, with anxiety and alcoholism or either both. Gender ratios followed a general pattern across the different co-occurrence combinations: anxiety and depression higher for females and alcoholism for males. Noteworthy is the finding that such ratios increased substantially in the absence of comorbidity but virtually disappeared when considering the set combinations of anxiety/alcoholism, depression/alcoholism and anxiety/depression/alcoholism.

We must acknowledge some limitations of the study methodology, particularly related to potential sampling bias and misclassification bias of the outcome variables and to the cross-sectional character of our research design. First, there is a particular selection bias that should be considered in discussing our survey findings. The field assessment team randomly chose two adults (a man and a woman) from each family. This could have biased our results especially on alcohol use in families as the substance use or misuse might not be independent for each other person involved in the survey. In this case, the main implication is not statistical but rather psychosocial, namely the possibility that alcohol abuse of a husband

may trigger anxiety/depression symptomatology in other family members.

Secondly, our choice of collapsing categories of alcohol abuse and alcohol consumption into one single outcome measure was justified by operational reasons regarding the immediate research objectives. Particularly concerning the QMPA performance, selected contents were partially equivalent to clinical diagnostic criteria of abuse and dependence of alcohol as classified by DSM-III-R and DSM-IV criteria; of four items of the alcoholism section, two—weekly drunkenness and excessive drinking—may be related to pathological drinking, which is essential for the diagnosis of alcohol use disorders [5, 44]. Indeed, standardized nosological systems (e.g., DSM and ICD series), have replaced the heterogeneity of categories and typologies that defined diagnostic psychiatric research in the past. Despite recent efforts of convergence between both systems, inconsistencies still hold, particularly for classification of substance use, abuse and dependence as syndromes or full-status diagnostic categories [22].

Third, our goal was not to produce high-precision epidemiologic estimates of alcoholism, depression and anxiety disorders as clinical pictures, but rather to provide a comprehensive account of selected research questions about comorbidity phenomena. For that aim, data concerning dimensional aspects of depression and anxiety symptoms and the alcohol-related QMPA items combined with graduated frequency of alcohol consumption seemed to have composed a useful field instrument.

For many years, it has been suggested that depression and anxiety may be better characterized on a common dimensional approach [8, 21]. Goldberg [21] proposed that such an approach would provide a more accurate representation of the interaction of depression and anxiety symptoms as well as a better characterization of their distribution of severity. However, cross-sectional dimensional data also have major limitations because symptom inventories assess mostly the current state and do not incorporate key critical characteristics such as disease history, disability, subjective distress and diagnostic contexts. By and large, data from longitudinal investigations of both anxiety and depression has supported dimensional approaches to classification of psychiatric syndromes [7, 8, 33].

Except for the gender patterns, which may reflect differences in the cultural role of women in Northeast Brazil, our data are in line with findings from recent population studies conducted in North America. The National Comorbidity Survey Replication (NCS-R) found that 72% of respondents with lifetime major depression also met the criteria for at least another DSM-IV disorder, including 59% with anxiety disorder and 24% with substance use disorder [30], without a clear distribution by gender. The Canadian Community Health Survey [36] estimated a preva-

lence of 32% of alcoholism among depressed as compared to 9.5% for persons without depression, regardless of gender. Data from the National Epidemiologic Survey on Alcohol and Related Conditions [16] suggest that greater comorbidity between mood and anxiety disorders and substance use among women may reflect more psychopathology among women than men.

However, instead of comorbidity, or presence of concurrent diagnoses in the same case, overlapping of depressive and anxiety symptoms may be better interpreted as representing the initial phase of a "depressive spectrum" syndrome [9, 10, 12, 15], which is, for women, clinically expressed by depressive symptoms and, for males, manifested as alcohol addictive behavior. Deeper exploration of models and mechanisms of symptom co-occurrence requires study designs beyond the scope of conventional clinical and epidemiological research, as well as synthetic, interdisciplinary strategies to investigating the complexity of mental health-disease processes. Further research with biochemical and cognitive markers might help identify, cross-culturally and underneath divergent clinical features, common co-occurrence patterns of specific disorders such as the ones studied here, relevant for the advancement of nosological and psychopathological knowledge in the mental health field.

Conclusions

(a) Overall, symptom co-occurrence was far more frequent for depression (94% of cases co-occurring with other diagnoses), followed by anxiety disorders (82%), than for alcoholism (only 20% with other diagnoses).

(b) The combination of depression plus anxiety was the most prevalent in both gender groups, ranging from 17% for women to 5% for men.

(c) Comorbid combinations of alcoholism yielded low prevalences, the smallest (around 1%) being the triple combo alcoholism+anxiety+depression.

(d) Gender ratios increased substantially in the absence of comorbidity, reaching peaks in depression (F:M ratio = 13.8) and alcoholism (M:F ratio = 11.8).

(e) Contrasting to strong overlapping of depression and anxiety symptomatology, set component analyses indicate an almost clear-cut complementarity between depression and alcoholism, modulated by gender (women depressed, men alcoholic).

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