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10 **Cross-national comparisons and correlates of harms from the drinking of people with**  
11 **whom you work**

12

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72

### 73 **Abstract**

74 **Background:** While research in high-income countries (HIC) has established high costs  
75 associated with alcohol's harm to others (AHTO) in the workplace, scant attention has been  
76 paid to AHTO in the workplace in lower- or middle-income countries (LMIC). **Aim:** To  
77 compare estimates and predictors of alcohol's impacts upon co-workers among workers in 12  
78 countries. **Methods:** Cross-sectional surveys from 9,693 men and 8,606 women employed in  
79 Switzerland, Australia, the United States (US), Ireland, New Zealand, Chile, Nigeria, Lao  
80 PDR, Thailand, Vietnam, India and Sri Lanka. Five questions were asked about harms in the  
81 past year because of co-workers' drinking: had they (1) covered for another worker; (2)  
82 worked extra hours; (3) been involved in an accident or close call; or had their (4) own  
83 productivity been reduced; or (5) ability to do their job been affected? Logistic regression and  
84 meta-analyses were estimated with one or more harms (vs none) as the dependent variable,  
85 adjusting for age, sex, rurality of location and the respondent worker's own drinking.  
86 **Results:** Between 1% (New Zealand) and 16% (Thailand) of workers reported that they had  
87 been adversely affected by a co-worker's drinking in the previous year (with most countries  
88 in the 6-13% range). Smaller percentages (<1% to 12%) reported being in an accident or

89 close call due to others' drinking. Employed men were more likely to report harm from co-  
90 workers' drinking than employed women in all countries apart from the US, New Zealand  
91 and Vietnam, and own drinking pattern was associated with increased harm in five countries.  
92 Harms were distributed fairly equally across age and geographic regions. Harm from co-  
93 workers' drinking was less prevalent among men in HIC compared with LMIC.

94 **Conclusions:** Workforce impairment because of drinking extends beyond the drinker in a  
95 range of countries and impacts productivity and economic development, particularly affecting  
96 men in LMIC.

97

## 98 **Introduction**

99

### 100 *Drinking patterns among workers and at work*

101 In high-income and a few other countries there have been studies of drinking patterns  
102 and problems in employed populations (Silva et al., 2003). In recent decades, alcohol  
103 consumption by full-time workers, although not necessarily at work, has been common. In  
104 one survey, 55-69% of US workers aged 18-49 years employed in a variety of specified  
105 occupations reported drinking in the past year; heavy drinking was reported by 5-14% of  
106 workers surveyed (Zhang and Snizek, 2003). Drinking varies by occupation, with heavier  
107 drinking reported, in Australia, for example, in the hospitality, agriculture, mining, retail,  
108 transport and financial services industries (Pidd et al., 2011, Pidd, 2005). Data gathered in the  
109 US indicated that lawyers, nurses and other health care professionals, and workers in the  
110 mining, construction, and hospitality and food service industries, as well as entertainers and  
111 managers, were at higher risk of heavy drinking or alcohol-related problems (American  
112 Addictions Centre, 2019).

113 While drinking among the workforce is common, drinking at work and being  
114 intoxicated whilst working are less common. In general in the last forty years workplace  
115 safety regulations have tightened and heavy-drinking business lunches are less widespread,  
116 with norms for drinking at such lunches, for example, having shown a downward trend in the  
117 US (Greenfield and Room, 1997). Workplace testing for alcohol and other drug use during,  
118 for instance in the US, prior to and after working has also become more common in high-risk  
119 occupations and transport industries (Cunradi et al., 2005). Nevertheless, a substantial

120 proportion of Australians (8.7%) reported drinking alcohol at work in a 2007 survey (Pidd et  
121 al., 2011), and alcohol still plays a substantial role in work-related social events (Pidd, 2005).

122 Other factors may be correlated with drinking as well: for example, alcohol  
123 consumption in some countries (but not all) is higher in rural areas (Giang et al., 2013, Allan  
124 et al., 2012, Rehm et al., 2005). Consumption also varies by socio-economic factors within  
125 and between countries of differing affluence. There is some evidence that socio-economic  
126 differences operate differently in lower-and middle-income countries (LMIC) as compared  
127 with high-income countries (HIC), with lower-income respondents less able to afford to  
128 drink in LMIC (Huckle et al., 2018). Gender (male) and age (generally younger) are  
129 consistent predictors of heavy episodic drinking (Livingston et al., 2008) and potentially of  
130 associated injuries (Cherpitel et al., 2009). Particular occupational groups, as mentioned  
131 above, show patterns of heavier drinking (Hitz, 1973). These same factors may be associated  
132 with workplace injuries or impacts on work.

133

#### 134 *Alcohol's impact on work-related illness, injury and productivity*

135 Alcohol-related work injuries and incidents occur in the transport sector, factories,  
136 offices, retail and entertainment businesses, as well as in boardrooms and on farms in  
137 Australia (Roche et al., 2015). One in four industry accidents worldwide are estimated to be  
138 attributable to drugs and/or alcohol (Pidd, 2005). In Australia 16% of fatal workplace injuries  
139 tested for BAC levels involved workers who had BACs higher than zero (Hollo et al., 1993).  
140 In addition to workplace injuries, alcohol is responsible for substantial numbers of days  
141 missed due to heavy drinking. In the US, 38% of workers were absent for one or more days in  
142 the previous year. Of these days, 4.4% were attributed to the respondent's own drinking,  
143 with a further 5.5% attributed to someone else's drinking (Greenfield et al., 2016). In this  
144 study a clear association with drinking pattern was identified, with productivity losses  
145 greatest for the heaviest drinkers.

146

#### 147 *Impacts from co-workers' drinking*

148 The majority of research on alcohol-related workplace harms has focused on self-reported  
149 drinking by, and drinking-related problems of, workers; however, the drinking of co-workers,  
150 bosses and others at work can have a range of impacts on other workers. For example,  
151 accidents where workers are intoxicated or hung over can injure others, and absenteeism and  
152 inefficient work practices can mean co-workers 'cover' for others, creating a burden for those

153 they work with, and diminishing overall productivity. Workers may also have to take time off  
154 work to take care of alcohol-related sickness of family members. A large number of people  
155 in the Australian Alcohol's Harm to Others (AHTO) survey, when asked, reported being  
156 negatively affected by their co-workers' drinking and working extra hours to cover for these  
157 drinkers (Dale and Livingston, 2010). These Australian findings indicated that the cost of co-  
158 workers' drinking to the Australian economy was an estimated AUD\$453 million annually.  
159 This was comparable to the cost estimated when drinkers were asked about their own  
160 absenteeism because of their drinking (Dale and Livingston, 2010).

161

### 162 *Research so far*

163 While we know that in general per capita consumption is higher and abstention rates  
164 are lower in HIC than in LMIC, for the same level of drinking the negative health  
165 consequences for people in less economically developed countries can be greater (World  
166 Health Organization, 2018). In HICs, a number of studies have focussed on alcohol-related  
167 work injuries, illnesses and absenteeism (Roman, 2002). However, in LMICs, very little  
168 attention has been paid to alcohol-related workplace harms in general, with even less focus  
169 turned to alcohol's harm to others in the workplace. In LMICs, small studies have identified  
170 harms from others' drinking in a range of occupational settings, including the trucking,  
171 hospitality (Obot et al., 2014) and sex work industries (Panchanadeswaran et al., 2008), and  
172 in farming families in rural India (a primary motivation of women's "anti-arack"  
173 movements) (Larsson, 2006). Given the vast majority of fatalities due to occupational injuries  
174 and illnesses are reported in Asia, including LMICs such as China, India and Vietnam (Wang  
175 et al., 2016), a large research knowledge gap is apparent. Moreover, given fewer resources in  
176 LMICs, there is less occupational injury-related research and related regulation and  
177 infrastructure support for increasing safety in LMIC workplaces (Sorensen et al., 2017). This  
178 research is intended to begin to fill the gap.

179

### 180 *Aims*

181 This study aims firstly to compare estimates and correlates of harms from co-workers'  
182 drinking in 12 countries, and secondly focuses on differences by country-level income when  
183 these countries are grouped into LMIC and HIC. The specific objectives of the study are to  
184 estimate and describe co-worker related harms, and correlates of these harms, from others'  
185 drinking for each country. The study seeks to provide evidence about which respondents are

186 more likely to experience harms from co-workers' drinking, specifically studying whether  
187 respondents who are male, younger, from rural areas and with heavier drinking patterns are at  
188 greater risk. The paper studies the correlates of harm from co-workers' drinking in each  
189 country and uses meta-analysis to produce a pooled estimate of harm for men and women  
190 overall and in LMIC and HIC separately.

191

## 192 **Materials and Methods**

### 193 *Data*

194 Country-level analyses: The study uses data from 12 countries involved in the Gender  
195 and Alcohol's Harm to Others (GENAHTO) project (<https://genahto.org/>) (Wilsnack et al.,  
196 2018): Switzerland, Australia, the United States, Ireland, New Zealand, Chile, Thailand, Sri  
197 Lanka, Nigeria, Vietnam, Lao People's Democratic Republic (Lao PDR) and India (listed in  
198 order of decreasing gross national income) (World Bank, 2015, WHO, 2014). All data are  
199 archived at the Centre for Alcohol Policy Research, La Trobe University. Only respondents  
200 aged 18-64 years who were employed are included in this analysis. Respondents who were  
201 unemployed, students and people primarily engaged in household duties were excluded.  
202 Recruited samples and the number of employed respondents are shown in Table 1.

203 The datasets used have been previously described in detail for Switzerland (Marmet  
204 and Gmel, 2017), Australia (Wilkinson et al., 2009), the US (Nayak et al., 2019), Ireland  
205 (Hope et al., 2015), New Zealand (Casswell et al., 2011) and for the remaining seven  
206 countries, as participants in a WHO-Thai Health collaborative project (Callinan et al., 2016).  
207 An overview of the methodology of the GENAHTO Project has also been published  
208 (Wilsnack et al., 2018). All studies were based on probability samples, with the majority  
209 national, and some from selected regions. Response rates varied from 35% in Australia to  
210 99% in Vietnam and Lao PDR (Laslett et al., 2017). The cooperation rate for the US sample  
211 was 60% (Kaplan et al., 2017). The Australian study's lower response rate reflected  
212 telephone sampling and interviewing; it slightly under-represented male, young and less  
213 educated persons in comparison with the Census (Wilkinson et al., 2009). The response rates  
214 in LMIC, on the other hand, were remarkably high, where survey burnout is uncommon, and  
215 in face-to-face surveys in general. This effect in LMIC may also reflect endorsement of  
216 participation in the study from trusted village health workers or heads of villages and  
217 adoption of a minimum of three call-back visits (Callinan et al., 2016).

218 HIC versus LMIC comparisons: The present study produces estimates of harm from  
219 co-workers' drinking stratified according to gross national income (GNI) per capita,  
220 determined by country-level indicators of 2015 per capita GNI (The World Bank, 2019a).  
221 High-income economies included countries whose 2015 GNI per capita was USD 12,476 or  
222 more (Chile: USD 14,340 – Switzerland: USD 85,780). LMIC economies (India: USD 1,600  
223 -- Thailand: USD 5,690) were countries whose 2015 GNI per capita was less than  
224 USD12,476 (World Bank, 2017).

225

#### 226 *Dependent variables/Outcome measures*

227 Respondents were asked the five questions: a) Have you covered for workers because  
228 of their drinking; b) Has your productivity been reduced because of their drinking; c) Has  
229 your ability to do your job been negatively affected because of their drinking; d) Were you  
230 involved in an accident or close call at work because of others' drinking; and e) Have you  
231 had to work extra hours because of others' drinking? In Australia, only the third, fourth and  
232 fifth questions were asked, and in New Zealand the fourth was omitted. A summary  
233 dichotomous (0,1) outcome measure was produced for reporting one or more of these harms  
234 from the drinking of co-workers [any work harm]. Responding workers who reported  
235 experiencing any of the items were categorised as 1. Respondents who reported no to all  
236 items were categorised as 0. Respondents in all countries (apart from Australia) who reported  
237 no to all items but who failed to respond on one item (n=60) were coded 0. Twenty-seven  
238 respondents who failed to respond on more than one of the work harm items, yet may have  
239 answered no to other items, (apart from seven Australian respondents who had one or more  
240 missing items) were coded missing for the "any work harm" variable. (In Australia, missing  
241 even one response constituted a third of their responses.) Given that we are creating a  
242 dichotomous any harm versus no harm variable this procedure was considered adequate.

243

#### 244 *Independent variables*

245 Respondents indicated whether they were male or female and their age at the time of  
246 interview. Ages were categorised into three groups: 18-29, 30-49 and 50-64 years.  
247 Respondents were classified as living in a *rural* or *non-rural location*. Rural areas were  
248 classified as "open country but not a farm", "on a farm" or "in a small city or town". A small



249 city or town constituted fewer than 60,000 people in Sweden, fewer than 20,000 people in the  
250 US and fewer than 50,000 people in all other countries.

251 To categorise drinking pattern, respondents were classified as abstainers, moderate  
252 drinkers or heavy episodic drinkers (HED). HED were those who said they consumed five or  
253 more drinks (about 60 gm of ethanol) on an occasion at least monthly in the last 12 months.  
254 Moderate drinkers were those who drank in the last year, but drank 5 or more on an occasion  
255 less than monthly, or always drank less than that. 151 Nigerian respondents missing a  
256 response on the drinking pattern variable were categorized into a fourth group to avoid a  
257 large proportion of the Nigerian sample being coded as missing. 359 Chilean respondents  
258 known to drink who were incorrectly skipped and not asked about their frequency of drinking  
259 60 g or more of alcohol on an occasion were also categorized as an additional group to  
260 prevent a large proportion of the Chilean sample being coded as missing for the drinking  
261 pattern variable.

262 *Weighting:* All country data were weighted to adjust for participants' probability of  
263 selection (based on the household's number of adults). Thailand, Sri Lanka, Lao PDR,  
264 Vietnam, Chile and Nigeria were additionally weighted by gender (based on male-female  
265 population proportions). Country-specific data were weighted to improve the  
266 representativeness of the sample, e.g., derived pre- and post-stratification weights were  
267 applied for Australian (Callinan et al., 2016) and US (Kaplan et al., 2017) data.

268

### 269 *Analytic approach*

270 The following analyses were undertaken:

#### 271 Country-level analyses

- 272 a. Descriptive statistics and confidence intervals using weighted data were generated for  
273 individual and combined measures of prevalence estimates of harm from co-workers'  
274 drinking per country.
- 275 b. Correlates of harm from co-workers' drinking in each country were identified using  
276 logistic regression, including each independent variable one at a time, and in a  
277 multivariable model, adjusting for gender, age, rurality and drinking status.

278

#### 279 HIC versus LMIC comparisons

- 280 c. Combining the data from all countries, pooled estimates of harm from co-workers'  
281 drinking for men and women were generated, with these effect estimates unadjusted

282 and adjusted for other factors to determine the size of this effect for men versus  
283 women.

284 d. Combining workers' data from all countries, an overall effect estimate of the  
285 increased risk of harm from co-workers' drinking associated with one's own drinking  
286 was calculated, unadjusted and adjusted for gender, age and rurality.

287 *Confidence intervals, statistical significance and statistical software:* Country prevalence and  
288 odds ratios are accompanied by 95% confidence intervals, with real country differences  
289 defined as non-overlapping confidence intervals (du Prel et al., 2009, Gardner and Altman,  
290 1986). All data analyses and construction of forest plots were completed using Stata version  
291 14.0 (Stata Corp., 2015).

292  
293 *Rationale for meta-analysis:* Because the 12 surveys are similar but still heterogeneous  
294 studies from vastly different countries, with differences in sampling, methodology and  
295 sample compositions, random effects meta-analyses were conducted (Huedo-Medina et al.,  
296 2006, Borenstein et al., 2007). The pooled estimates resulting from these analyses are  
297 interpreted as the mean estimates of the true varying effects across all studies. In the first  
298 meta-analysis, the DerSimonian-Laird method of two-stage inverse-variance random-effects  
299 meta-analysis (via the *ipdmetan* command using Stata 14.0 (Fisher, 2015)) was used to  
300 estimate the pooled proportion of respondents who reported harms from co-workers' drinking  
301 in the last 12 months, separately for men and women, pooled across 12 countries. Similarly,  
302 the likelihood of reporting harm from co-workers' drinking is presented by respondent  
303 drinking pattern. Country-level and pooled effect estimates and accompanying  $I^2$  statistics are  
304 presented as forest plots. The  $I^2$  statistic indicates the total variability in effect sizes due to  
305 heterogeneity across the studies;  $I^2$  values of 25%, 50%, and 75% indicate low, medium, and  
306 high heterogeneity.

307

## 308 **Results**

### 309 *Country-level findings*

310 Table 1 displays the unadjusted country-level findings. Employed men experienced  
311 significantly more harm from co-workers than employed women in Switzerland, Australia,  
312 Ireland, Chile, Thailand, Sri Lanka, Nigeria, Lao PDR and India, while in Switzerland, the  
313 US, Ireland, New Zealand and Vietnam differences were not significant. Overall, in the  
314 pooled analysis, employed men (12.3%; 95%CI 7.8%, 16.9%) reported more (but not

315 statistically significantly more) harm from co-workers' drinking than employed women  
316 (6.2%; 95%CI 4.3%, 8.1%). Seven per cent of respondents overall reported harms from co-  
317 workers' drinking.

318 [Insert Table 1 about here]

319 Table 2 provides more detail on the types of harms respondents reported experiencing  
320 from co-workers' drinking in each country. The most commonly reported harm from co-  
321 workers' drinking in six countries was having to cover for others because of their drinking,  
322 although Australia did not include this item. Reduced productivity and having to work extra  
323 hours because of co-workers' drinking were also reported relatively commonly as the most or  
324 second-most common reason respondents were affected by co-workers. Being involved in an  
325 accident or close call at work because of others' drinking was the least commonly reported  
326 impact of co-workers' drinking in the majority of countries, although the percentage of  
327 respondents who reported this measure of harm was remarkably high in India (11.7%), but  
328 also relatively high in Sri Lanka and Thailand.

329 [Insert Table 2 about here]

330 A higher percentage of men were employed than women in all countries, with quite  
331 diverse levels of reported employment among women. The percentage of women not  
332 reporting employment was low in Australia (10.5%), around 20-30% in Switzerland, NZ,  
333 Thailand, Nigeria, Vietnam, Lao PDR, and 31-40% in US, Ireland and Chile; over two-thirds  
334 of women reported not being employed in the paid workforce in Sri Lanka (72%) and India  
335 (67%) (See Table 1).

336

### 337 *Unadjusted analyses*

338 Table 3 compares odds ratios for demographic and drinking status subpopulations on  
339 the rate of occurrence of any of the harms. As noted earlier from Table 2, among those in the  
340 workforce, women were significantly less likely to report harm from co-workers' drinking in  
341 the majority of countries.

342 Respondents in the oldest age group were generally less likely to report harm from co-  
343 workers' drinking than those in the youngest age group, although this was statistically  
344 significant only in Thailand, Vietnam, Lao PDR and India. Comparison of the youngest age  
345 group and the mid-aged group revealed inconsistent results across countries, with the younger  
346 group significantly less likely to report harm than 30-49 year olds in Switzerland, Chile,  
347 Nigeria and India, yet significantly more likely to report experiencing harm in Thailand and

348 Sri Lanka. The findings regarding rurality were mixed, with respondents from rural areas  
349 significantly more likely to report harm in Sri Lanka and less likely to do so in Lao PDR, but  
350 with the results in other countries showing no significant rural-urban differences.

351 Respondents who were HED were more likely than abstainers to report harm from co-  
352 workers' drinking in Chile, Thailand, Sri Lanka, Lao PDR and India. Moderate drinking was  
353 also associated with greater odds of harm from co-workers' drinking compared to abstainers  
354 in Chile, Thailand, Sri Lanka and India.

355

#### 356 *Adjusted (multivariable) findings*

357 In five countries -- Switzerland, Australia, New Zealand, the US and Ireland (all HIC)  
358 -- harms from co-workers' drinking were fairly evenly spread in the employed population,  
359 with no adjusted odds ratios significant apart from gender in Australia and Ireland and age in  
360 Switzerland.

361 Other correlates aside from gender were identified for harms from co-workers'  
362 drinking but few consistent patterns were identified. Respondents aged 50-65 in Thailand,  
363 Lao PDR and Sri Lanka, and 30-49 in Sri Lanka were less likely than those aged 18-29 to  
364 report harm from co-workers' drinking. In Switzerland, Chile and Nigeria the mid-aged  
365 groups were more likely to report harm from co-workers' drinking than the youngest age  
366 group. Rural workers in Sri Lanka were more likely than non-rural workers to and rural  
367 workers from Lao PDR less likely to report harm from co-workers' drinking.

368 The adjusted results show that those who were themselves HED and moderate  
369 drinkers were much more likely than abstainers to have suffered harm from co-workers'  
370 drinking in Chile, Thailand, Sri Lanka and particularly in India.

371 [Insert Table 3 about here]

372

#### 373 *Analysing results across all countries*

374 In pooled meta-analyses across nine countries (not shown here), adjusting for the  
375 factors in the regression models in Table 3, effect estimates for gender and HED were  
376 separately estimated. Men were more likely than women to report harms from co-workers'  
377 drinking (OR = 0.62, 95%CI = 0.53, 0.72, I<sup>2</sup> = 0.0%), consistent with the unadjusted results  
378 presented in Table 1. Furthermore, HED were significantly more likely to report harms from  
379 co-workers' drinking than abstainers (OR = 2.10, 95%CI = 1.36, 3.25, I<sup>2</sup> = 77.3%), as were  
380 moderate drinkers (OR = 1.69, 95%CI = 1.13, 2.50, I<sup>2</sup> = 74.0%).

381

382 *Differences between high-income and low- and middle- income countries: a meta-analysis*

383 In a second meta-analysis undertaken to formally test differences in harm from co-  
384 workers' drinking between LMICs and HICs, although men from LMIC were generally more  
385 likely to report harm from co-workers' drinking than men in HIC, this was not significant.  
386 Women in HIC were less likely to report harm than women in LMIC, although the difference  
387 was smaller and the rates less consistent within HICs and LMICs. With Chile and Nigeria as  
388 exceptions, Figure 1 breaks down into a split between LMIC and HIC countries: men report  
389 much more harm than women from others' drinking in LMICs, while men and women report  
390 harm from co-workers more evenly and at lower levels in HICs.

391

392 [Insert Figure 1a and 1b about here]

393

#### 394 **Discussion**

395 The finding that 7.0% of employed respondents reported some harm from others'  
396 drinking in the past 12 months, underscores the externalities of others' drinking, in this case  
397 co-workers' drinking, and suggests that harm from others' drinking in the workplace may not  
398 be fully acknowledged in current statistics, which have tended to focus on absenteeism and  
399 harms reported only by the drinking worker. Where these harms have been estimated in the  
400 past (e.g., Australia), the costs associated with others' drinking have been nearly equal to  
401 those already incurred by the respondent's own drinking (Laslett et al., 2010), although there  
402 is probably some overlap between the two costs.

403 In general, high income-countries reported a much lower prevalence of harms from  
404 co-workers' drinking, with the exception of Ireland and Chile. This is consistent with  
405 evidence that industrial injuries and illnesses are higher in LMICs (Wang et al., 2016) and  
406 that workplace policies and regulations are less likely to be in place and, if in place, enforced  
407 (Sorensen et al., 2017). Chile is the lowest income country in the HICs, with an income level  
408 more similar to Thailand than to New Zealand. It was only recently classified as a HIC by the  
409 World Bank in 2012. Inconsistent with the LMIC pattern were Nigeria and Lao PDR –  
410 respondents in these countries reported lower levels of harm from co-workers' drinking  
411 among the employed population than respondents in other LMICs.

412 All countries reported relatively low rates of occupational "accidents" and close calls  
413 due to others' drinking in the previous 12 months, with all countries except India reporting

414 rates below 5%. However, even rates between 2 and 5% (reported in 5 LMICs) are  
415 substantially higher than rates under or around 1% found in all of the HICs in this study. The  
416 prevalence of accidents and near-misses in LMICs of between 2.2% and 4.9% (as high as  
417 11.7% in India) is worrying. Including all negative effects from co-workers' drinking  
418 measured in this study, these comparisons are even more stark, with 7-22% of respondents in  
419 most LMIC countries reporting one or more harms from co-workers' drinking in the previous  
420 year. In South-East Asian countries like India, Thailand and Vietnam, the likely impact on  
421 LMIC co-workers is of particular concern, as these countries are viewed as key emerging  
422 markets by the alcohol industry, since increasing alcohol consumption is forecast (Babor et  
423 al., 2010).

424 Turning to factors that indicated working respondents were at higher odds of harm  
425 from co-workers' drinking, gender (unadjusted) was a consistent marker of risk across almost  
426 all countries, with men generally at twice or more the odds of harm than women in the  
427 majority of countries. The meta-analysis of workers' harms from co-workers' drinking  
428 provides an important estimate of the harms experienced by employed men and women from  
429 a small number of HIC and LMIC countries. Overall, four percent of women and 11 per cent  
430 of men reported harms from co-workers' drinking, with men significantly more likely to  
431 report these harms than women. Men's greater likelihood of experiencing harms from co-  
432 workers' drinking (possibly with the exception of men in the US) probably reflects at least in  
433 part that they are likely to associate more with co-workers who are men and who drink more.

434 This is consistent with the gendered drinking patterns identified previously (Wilsnack  
435 et al., 2009), and may be due to management decisions where there is some degree of gender  
436 separation in the workplace in LMICs: men may be more likely to be asked to cover for other  
437 men they work with (also true for women but less likely to occur because women drink less).  
438 Cultures in male-dominated workplaces (which can sometimes be more physical and more  
439 risky, e.g., construction and mining) have traditionally been associated with heavy drinking  
440 (Bacharach et al., 1994, Sonnenstuhl, 1996). Types of men's and women's work and the  
441 typical workplace culture may be more gendered across some countries than others (Dong et  
442 al., 2015, Bureau of Labour Statistics, 2017, Cui et al., 2015). Gender employment equity  
443 differs a lot across countries (The World Bank, 2019b) and might affect exposure to harm in  
444 general and in particular occupations. Indeed, because men comprise a larger proportion of  
445 the formal workforce, and tend to be the drinkers and heavy drinkers, they are likely to be at  
446 greater odds of co-worker harms, as in almost all countries in our study.

447 While employed persons of both genders are selectively targeted by advertising and  
448 marketing strategies, analyses of alcohol industry campaigns indicate that these campaigns  
449 often seek to reinforce traditional masculine drinking patterns, sometimes in association with  
450 workplace settings or work-related gatherings. These marketing campaigns may also seek to  
451 increase drinking in masculine work-related groups (Duff, 2003), potentially increasing the  
452 odds of harm in these settings for men. Currently it appears to be LMIC men who are at  
453 greater risk here, although women may also be at risk from these drinking men when they  
454 return home (Callinan et al., 2018). Women may be at more risk in the future if the alcohol  
455 industry continues to target underdeveloped markets.

456 Contrary to expectations, the youngest age group in this study was not always the  
457 group most likely to experience harm from co-workers' drinking. Generally, the oldest group  
458 was less likely to experience harm from co-workers' drinking than the youngest group, with  
459 less difference identified between the mid and youngest age groups. However, in Thailand,  
460 Vietnam, Lao PDR, and India younger workers did seem to be at greater risk of harm from  
461 coworkers' drinking. This is consistent with evidence from Canada, for example, where it  
462 was found that young people may be more likely to be employed in riskier occupations, and  
463 that their inexperience may increase the risk they are exposed to (Breslin et al., 2007).  
464 However, we cannot determine from our data whether young people were employed in riskier  
465 occupations as that level of detail on occupation was not collected in the survey. It may also  
466 be the case that younger people work in occupations where there is a culture of heavier  
467 drinking (e.g., hospitality industry), and these occupations may not necessarily be more  
468 dangerous. It is important to remember that the harms to coworkers studied in this survey  
469 include harms related to covering for someone as well as risk of injury, so it is not only in  
470 more dangerous occupations where respondents are at greater risk. However, findings  
471 showing that middle- and older-aged males are at similar risk in some countries are consistent  
472 with the findings of Wilsnack and colleagues (Wilsnack et al., 2009), who found drinking  
473 patterns, particularly problematic drinking patterns, in some countries were not established  
474 until somewhat later in life.

475 HEDs, compared to abstainers, were more likely to report harm from co-workers'  
476 drinking, and this was significant in the majority of LMICs, including Thailand, Sri Lanka  
477 and India (and for Lao PDR when the results are unadjusted). In HIC, apart from Chile  
478 (which has the lowest GNI of all the HICs in this study), there was no evidence of differences

479 in reported harms from co-workers' drinking by drinking pattern. Interpreting this fairly  
480 consistent pattern needs to keep in mind that in HICs the levels of harm were much lower and  
481 the prevalence of drinking much higher, diminishing the size of the baseline abstaining group  
482 and reducing the power to detect differences.

483

#### 484 *Limitations*

485 Outcome variable: The outcome – harm from a coworker's drinking – is the  
486 subjective assessment of the respondent. This variable may under-report harms from a co-  
487 worker's drinking, as the work colleagues may not know or be told why their co-worker is  
488 absent. However, often a colleague may be told about heavy drinking sessions, and also will  
489 know whether a co-worker is a heavy drinker in general (either through direct observation or  
490 conversations). When this person is absent -- perhaps especially on a Monday – reasonable  
491 assumptions may be made regarding the absence. While likely to produce conservative  
492 estimates, these questions are arguably no less likely to be valid than self-reports of  
493 individuals about their own drinking. This may also be the case for hung-over people who  
494 attend work and may cause an accident, or perhaps just go home 'sick' early.

495 A sensitivity analysis was undertaken on the outcome variable measuring one or more  
496 harms from co-workers. This analysis (presented in a supplementary appendix) compared an  
497 outcome variable that used the full five items with variables that used only four and three  
498 items. Although the outcome variable derived differently across countries was validated (See  
499 Supplemental Tables A1 and A2), the odds ratios determined in the logistic regression may  
500 be identifying slightly different conceptual links between predictors and outcomes.  
501 Nevertheless, identifying the correlates of harm from co-workers' drinking in each country  
502 and studying outcomes in HIC and LMIC was useful and comparisons across countries  
503 should be interpreted with caution.

504 Underestimation: The proportion of Australian and New Zealand respondents who  
505 experienced one or more harms from co-workers' drinking has been underestimated because  
506 these countries' surveys included three and four, respectively, of the five harm items included  
507 in this analysis. Moreover, in Australia only those respondents who identified that they were  
508 employed and who had answered affirmatively an earlier question about whether they had  
509 been negatively affected by heavy drinking co-workers were asked these questions. In New  
510 Zealand, respondents were asked to list people who had negatively affected them because of



511 their drinking. Only if they listed (unprompted) a co-worker would they have been asked  
512 these further questions. In Switzerland, US and Ireland before completing specific harm  
513 items, respondents had to answer yes to “Any problems with colleagues/boss due to their  
514 drinking”, and in Nigeria, India, Sri Lanka, Thailand, Vietnam and Lao PDR respondents had  
515 to first respond that they worked with others to be asked questions about harms from their co-  
516 workers’ drinking. These procedures will have resulted in some underestimation of  
517 respondents who might have reported harms from co-workers’ drinking if they had been  
518 prompted by the specific items or if they had been harmed by co-workers who were less than  
519 heavy drinkers.

520 Attribution of harm to alcohol: In places like India where a minority of men drink and  
521 when they do, drink a lot, the abstaining others often have strong negative opinions about  
522 drinking. This anti-drinking bias may affect the tendency to find fault with immoderately (or  
523 even moderately) drinking co-workers.

524 Selection bias: It is important that this paper is not interpreted as a definitive  
525 comparison of HIC versus LMIC as only a small number of countries were selected and this  
526 selection was not done randomly on the basis of specified income levels. Yet the findings do  
527 begin to highlight that harm from coworkers’ drinking is a problem common across many  
528 countries, and one that appears to be a somewhat greater problem in the LMICs versus the  
529 HICs in this study.

530 Additional questionnaire items, for example, on sexual harassment due to a co-  
531 worker’s drinking, should be added to future surveys. The absence of such questions may  
532 explain in part why women were less likely to report harms from co-workers’ drinking. Type  
533 of occupation, organisational size, part-time work, and casual and seasonal work are all likely  
534 to impact upon the exposure of respondents to potentially heavy-drinking coworkers. This  
535 study was part of a broader harm to others study and as such could not provide detailed  
536 information on all domains of life affected by others’ drinking. Future studies should more  
537 consistently measure part-time work and type of occupation. Nevertheless, this study  
538 suggests gender and country-level income differences in harms from co-workers’ drinking  
539 and begins to highlight the extent of the problem cross-nationally.

540 The  $I^2$  values in Figures 1a and 1b showed a high level of heterogeneity and indicate  
541 between-studies variability (not the same as sampling error). While the confidence intervals  
542 around these estimates are relatively tight, these values should not be interpreted as measures

543 of global prevalence. Finally, the data are cross-sectional and therefore cannot be used to  
544 attribute causality.

545

## 546 **Conclusion**

547 This study estimates the prevalence of harms from co-workers' drinking in each of  
548 the countries studied. Male workers were more at likely to experience harm than female  
549 workers overall. Although these results were based on only a small number of countries,  
550 workers in middle- and lower-income countries appeared to be more at risk than workers in  
551 higher-income countries in the study.

552 More stringent alcohol-related regulations, enforcing alcohol-free workplaces,  
553 providing supports and treatment (termed Employee Assistance Programs in the US) for  
554 workers who drink in heavy episodic ways (Carson and Balkin, 1992) and their colleagues  
555 within workplaces in LMIC may make workplaces safer for drinkers themselves and their co-  
556 workers. Strategies that address heavy drinking cultures associated with workplaces should  
557 also be considered. Whether prevention strategies are effective should be evaluated as  
558 programs to reduce harm from co-workers are introduced.

559

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732 Figure Legend

733 Figure 1a Proportion of employed men in high-income countries and in low- and middle-  
734 income countries who experienced any harm from co-workers' drinking in the last 12  
735 months.

736 Any harm from co-workers' drinking was derived from three items for the Australian sample  
737 and four items for the New Zealand sample (compared to five items used for each of the  
738 remaining 10 countries); Overall estimates are pooled across country-level estimates via the

739 DerSimonian-Laird method of two-stage inverse-variance random-effects meta-analysis  
740 using individual participant data; Weights of the contribution of country-level estimates to  
741 pooled estimates are represented by the relative area of the corresponding grey square.

742

743 Figure 1b Proportion of employed women in high-income countries and in low- and middle-  
744 income countries who experienced any harm from co-workers' drinking in the last 12  
745 months.

746 Any harm from co-workers' drinking was derived from three items for the Australian sample  
747 and four items for the New Zealand sample (compared to five items used for each of the  
748 remaining 10 countries); Overall estimates are pooled across country-level estimates via the  
749 DerSimonian-Laird method of two-stage inverse-variance random-effects meta-analysis  
750 using individual participant data; Weights of the contribution of country-level estimates to  
751 pooled estimates are represented by the relative area of the corresponding grey square.

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**Table 1: Sample composition and prevalence of harm to respondents from co-workers' drinking in ten societies.**

Country	Year of data collection	Response rate	Sample	Number of respondents	Per cent not employed	Any harm from drinking of co-workers [1+ harms] in population % (95%CI)	Number of employed respondents <sup>a</sup>	Any harm (1+) from drinking co-workers among those employed, % (95%CI)
Switzerland	2012/16	51.4/45.0	Men	1457	16.3	3.2 (2.1, 4.8)	1147	3.8 (2.5, 5.7)
			Women	1813	27.1	1.3 (0.7, 2.3)	1270	1.8 (1.0, 3.1)
			Total	3270	21.7	2.2 (1.6, 3.1)	2417	2.9 (2.0, 4.0)
Australia	2008	35.2	Men	889	5.6	5.4 (4.0, 7.2) <sup>c</sup>	852	5.7 (4.3, 7.7) <sup>b</sup>
			Women	1300	10.5	2.6 (1.8, 3.8) <sup>c</sup>	1181	2.9 (2.0, 4.3) <sup>b</sup>
			Total	2189	8.1	4.0 (3.1, 5.0) <sup>c</sup>	2033	4.3 (3.4, 5.5) <sup>b</sup>
US	2015	60.0 <sup>c</sup>	Men	801	24.2	3.5 (2.1, 5.7)	580	4.6 (2.8, 7.5)
			Women	1026	35.9	3.4 (2.0, 5.6)	623	5.3 (3.2, 8.7)
			Total	1827	30.8	3.4 (2.4, 4.9)	1203	4.9 (3.4, 7.0)
Ireland	2015		Men	782	27.1	7.9 (6.1, 10.3)	563	10.9 (8.4, 14.0)
			Women	826	35.9	4.1 (2.9, 5.9)	515	6.4 (4.5, 9.1)
			Total	1608	31.7	6.0 (4.8, 7.4)	1078	8.7 (7.1, 10.7)

New Zealand	2008/09	64.0	Men	950	14.7	1.2 (0.6, 2.3) b,d	823	1.4 (0.7, 2.7) b,d
			Women	1459	25.3	0.7 (0.4, 1.3) b,d	1065	1.0 (0.5, 1.8) b,d
			Total	2409	20.4	0.9 (0.6, 1.5) b,d	1888	1.2 (0.7, 1.9) b,d
Chile	2012/13	71.8	Men	653	14.2	17.8 (14.8, 21.3)	565	20.5 (17.1, 14.5)
			Women	741	36.2	7.5 (5.6, 9.9)	482	11.3 (8.5, 14.9)
			Total	1394	25.3	12.6 (10.8, 14.7)	1047	16.6 (14.2, 19.2)
Thailand	2012/13	94.2	Men	643	8.4	24.3 (20.8, 28.2)	593	26.4 (22.5, 30.6)
			Women	928	22.8	8.7 (6.7, 11.2)	731	11.0 (8.5, 14.1)
			Total	1571	15.8	16.3 (14.2, 18.6)	1324	19.1 (16.8, 21.8)
Sri Lanka	2013/14	93.0	Men	1091	15.1	22.1 (19.5, 25.0)	915	26.0 (22.9, 29.3)
			Women	1172	72.3	3.2 (2.3, 4.5)	329	11.5 (8.2,

								15.9)
			Total	2263	44.9	12.3 (10.8, 13.9)	1244	22.2 (19.7, 24.9)
Nigeria	2012/13	99.0 <sup>e</sup>	Men	1355	10.3	2.8 (1.9, 4.3)	1227	3.2 (2.1, 4.8)
			Women	861	23.1	1.0 (0.5, 2.0)	705	1.3 (0.7, 2.6)
			Total	2216	16.7	1.9 (1.4, 2.7)	1932	2.3 (1.6, 3.3)
Vietnam	2012/13	99.2	Men	719	5.3	11.8 (9.5, 14.6)	683	21.5 (10.0, 15.4)
			Women	719	24.4	7.5 (5.7, 9.8)	551	9.5 (7.2, 12.5)
			Total	1438	15.0	9.6 (8.1, 11.4)	1234	11.1 (9.4, 13.2)
Lao PDR	2013	99.0	Men	504	13.4	8.9 (6.4, 12.2)	448	10.3 (7.4, 14.0)
			Women	708	21.1	3.3 (2.1, 5.2)	567	4.2 (2.6, 6.6)
			Total	1212	17.2	6.1 (4.7, 8.0)	1015	7.4 (5.6, 9.6)
India	2013/14	97.0	Men	1517	15.4	20.8 (18.8, 23.1)	1297	24.6 (22.2, 27.1)
			Women	1711	66.5	5.0 (4.0, 6.2)	587	12.3 (9.8, 15.5)
			Total	3228	40.6	13.1 (11.9, 14.4)	1884	21.2 (19.3, 23.2)

All countries	Men	11361	14.4	10.7 (6.8, 14.5) <sup>b,d,f</sup> [I <sup>2</sup> = 98.3%]	9693	12.3 (7.8, 16.9) <sup>b,d,f</sup> [I <sup>2</sup> = 98.4%]
	Women	13264	35.2	3.8 (2.6, 5.0) <sup>b,d,f</sup> [I <sup>2</sup> = 93.8%]	8606	6.2 (4.3, 8.1) <sup>b,d,f</sup> [I <sup>2</sup> = 94.8%]
	Total	24625	25.0	7.1 (5.5, 8.8) <sup>b,d,f</sup> [I <sup>2</sup> = 97.7%]	18299	9.3 (7.1, 11.5) <sup>b,d,f</sup> [I <sup>2</sup> = 97.7%]

<sup>a</sup> excluding unemployed, students and people engaged in house duties; <sup>b</sup> In Australian and NZ the any harm from co-workers' drinking variable was derived from three items for the Australian sample and four items for the New Zealand sample (compared to five items used for each of the remaining 10 countries) <sup>c</sup> a co-operation rate was published in the US; <sup>d</sup> NZ respondents were not asked about specific items unless they identified a co-worker unprompted; <sup>e</sup> In Nigeria a response rate of 99% was reported among households where someone was home, but random selection was not followed within the household; <sup>f</sup> overall estimates are pooled across country-level estimates via the DerSimonian-Laird method of two-stage inverse-variance random-effects meta-analysis using individual participant data

**Table 2: Percentage of employed respondents aged 18-64 that experienced harms from co-workers' drinking in ten societies**

Country	Number of employed respondents <sup>a</sup>	Covered for workers because of their drinking,	Has your productivity been reduced because	Ability to do your job been negatively	Involved in an accident or close call at work	Have you had to work extra hours because of others'
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		% (95%CI)	of their drinking, % (95%CI)	affected because of their drinking, % (95%CI)	because of others' drinking, % (95%CI)	drinking, % (95%CI)
Switzerland	2417	1.3 (0.8, 2.1)	1.6 (1.0, 2.5)	0.9 (0.5, 1.6)	0.4 (0.2, 1.0)	1.3 (0.8, 2.2)
Australia	2033	n/a	n/a	3.3 (2.5, 4.3)	0.5 (0.3, 0.9)	2.8 (2.1, 3.8)
US	1203	3.5 (2.2, 5.4)	2.9 (1.8, 4.7)	3.4 (2.2, 5.2)	0.9 (0.4, 2.1)	3.5 (2.2, 5.4)
Ireland	1078	7.2 (5.6, 9.0)	7.3 (5.8, 9.2)	5.9 (4.5, 7.6)	0.8 (0.4, 1.6)	5.3 (4.0, 6.9)
New Zealand	1888	0.7 (0.4, 1.3)	1.0 (0.6, 1.7)	n/a	0.0 (0.0, 0.3) <sup>b</sup>	0.6 (0.3, 1.1)
Chile	1047	11.3 (9.3, 13.6)	7.6 (6.0, 9.6)	6.8 (5.3, 8.7)	1.4 (0.8, 2.5)	9.0 (7.2, 11.1)
Thailand	1324	12.1 (10.2, 14.3)	11.0 (9.2, 13.1)	7.5 (6.0, 9.3)	3.9 (2.8, 5.3)	6.6 (5.2, 8.4)
Sri Lanka	1244	13.9 (11.8, 16.2)	11.8 (10.0, 14.0)	10.9 (9.1, 13.0)	4.9 (3.7, 6.4)	12.6 (10.6, 14.8)
Nigeria	1932	1.4 (0.9, 2.2)	0.9 (0.5, 1.5)	0.7 (0.4, 1.3)	0.4 (0.2, 1.0)	1.5 (1.0, 2.3)
Vietnam	1234	6.9 (5.5, 8.5)	6.5 (5.2, 8.1)	3.9 (2.9, 5.1)	2.2 (1.4, 3.3)	2.7 (1.9, 3.8)
Lao PDR	1015	5.1 (3.7, 7.0)	4.2 (2.9, 6.0)	4.1 (2.9, 5.9)	2.2 (1.3, 3.7)	2.0 (1.2, 3.2)
India	1884	12.5 (11.0, 14.2)	11.6 (10.2, 13.2)	14.9 (13.3, 16.7)	11.7 (10.2, 13.3)	14.0 (12.4, 15.7)

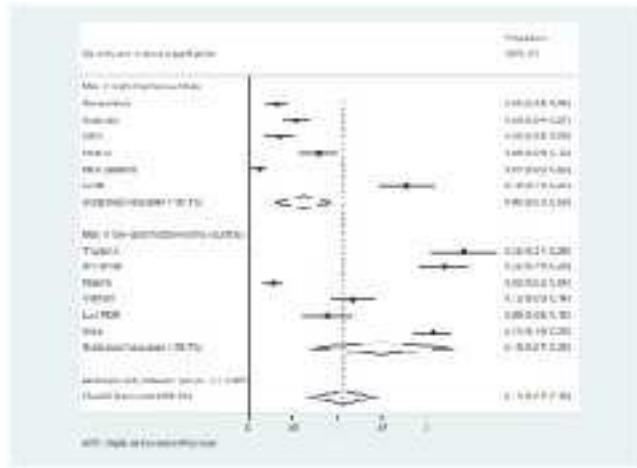
N = 18,299; <sup>a</sup>excluding unemployed, students and people engaged in house duties; n/a: no equivalent item in country-level survey; <sup>b</sup>NZ respondents were not asked about specific items unless they identified a co-worker unprompted.

**Table 3: Characteristics of employed respondents harmed by co-workers' drinking: odds ratios by gender, age group, residence (rural/non-rural), respondent's (R's) drinking status**

		Switzerland	Australia	US	Ireland	New Zealand	Chile	Thailand	Sri Lanka	Nigeria	Vietnam	Lao PDR	India	
Bivariate	Gender (vs. Male)	Female	0.46*	0.50**	1.16	0.56*	0.67	0.49***	0.34***	0.37***	0.42*	0.74	0.38**	0.43***
	Age (vs. 18-29)	30-49	2.67*	1.26	0.82	1.15	1.25	1.53*	0.62*	0.61*	2.90*	0.69	0.52	1.51**
		50-64	1.17	0.50	0.70	0.58	0.35	1.19	0.35***	0.66	1.82	0.52*	0.41*	1.71**
	Residence (vs. Rural)	Not rural	n/a	0.78	0.34	0.92	2.30	1.51	0.92	0.64*	0.85	0.67	2.32*	0.95
	Drinking status (vs. Abstainer)	Moderate	0.82	0.82	1.01	1.09	1.51	2.21*	2.00**	2.03***	1.88	1.35	1.73	6.60***
		HED	1.28	1.40	0.82	1.28	1.48	2.03**	5.39***	5.03***	1.79	1.60	3.18*	6.39***
Multivariate	Gender (vs. Male)	Female	0.48*	0.54*	1.00	0.55*	0.67	0.54**	0.50**	0.72	0.45	0.88	0.40**	0.73
	Age (vs. 18-29)	30-49	2.77*	1.34	0.74	1.14	1.23	1.62*	0.68	0.54**	2.82	0.69	0.52	1.18
		50-65	1.27	0.54	0.62	0.57	0.34	1.60	0.42**	0.54*	1.64	0.53	0.36*	1.26
	Residence (vs. Rural)	Not rural	n/a	0.76	0.29	0.85	2.19	1.62	0.92	0.61*	0.90	0.73	2.27*	0.86
	Drinking status (vs. Abstainer)	Moderate	0.76	0.85	1.36	1.20	1.65	2.27*	1.58*	1.76*	1.43	1.26	1.34	6.19***
		HED	1.13	1.21	1.04	1.14	1.35	1.95*	3.40***	4.43***	1.13	1.39	1.79	5.88***

N = 18,299; \*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$ ; n/a: no equivalent item in country-level survey

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