

# A Prospective Analysis of the Interrelationship between Physical Intimate Partner Violence and Alcohol Use: A Post-Hoc Analysis of Young Women Involved in the Stepping Stones and Creating Futures Trial in South Africa

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## Abstract

Prospective studies assessing women's experience of intimate partner violence (IPV) and alcohol use have shown mixed results and all are from high-income countries. Using longitudinal data from young women in South Africa we assess whether changes in physical IPV impact alcohol use, and whether changes in alcohol use impact physical IPV experience. Post-hoc analysis of women aged 18–30 living in informal settlements in eThekweni Municipality, South Africa, involved in the Stepping Stones and Creating Futures trial,

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between September 2015 and October 2019, with data collected at baseline ( $n = 677$ ) and endline at 24 months ( $n = 545$ , 80.5% retention). At both timepoints, women were asked about their past year physical IPV experience and alcohol use. We estimated changes in physical IPV over time and whether this was associated with harmful alcohol use at endline. We then estimated changes in alcohol use over time, and whether this was associated with experience of past year physical IPV at endline. Women who experienced an increase in physical IPV over the study period were more likely to report harmful drinking at 24 months (aOR2.45, 95% CI 1.21–4.97). Similarly, women reporting increased alcohol use over time were more likely to report past year physical IPV at 24 months (aOR2.04, 95% CI 1.21–3.46). Among young women living in urban poverty those who experienced increasing physical violence from intimate partners were more likely to report increased and problematic alcohol use. Similarly, women reporting increasing alcohol use over 24 months were more likely to report physical IPV. However, there was no evidence that decreased alcohol use led to reductions in IPV, or that reduced IPV experience led to decreased alcohol use. Future research and interventions need to consider the reciprocal risks of physical IPV and alcohol use, with a focus on joint underlying drivers.

### **Keywords**

violence, alcohol, substance use, young people, informal settlements

### **Background**

Reducing harmful alcohol use and intimate partner violence (IPV) are both targets of the Sustainable Development Goals (SDG) (SDG 3.5 alcohol and SDG 5.2 IPV), as individually and together these have multiple negative impacts on health and development (Degenhardt et al., 2018; Ellsberg et al., 2008). In South Africa, high rates of both IPV and alcohol misuse have been reported (Davis et al., 2017; Machisa et al., 2011; Norman et al., 2010; Peltzer et al., 2011). This is particularly the case in urban informal settlements where overlapping factors of poverty, limited state support and engagement, sparse social networks, gender inequalities and generalised community violence have led to a particularly acute confluence of IPV and harmful alcohol use (Davis et al., 2017; Gibbs et al., 2018; Ndungu et al., 2020; Zembe et al., 2013). These two public health issues may have a syndemic relationship, whereby they overlap with one another, as well as being mutually reinforcing (Gilbert et al., 2015).

There is consistent evidence from high-income countries on the relationship between women's experience of IPV and subsequent increases in

alcohol use. A recent systematic review exploring the health impacts of IPV identified 10 longitudinal studies all showing positive relationships (Bacchus et al., 2018). Eight studies were from the USA and two further studies were from New Zealand (Bacchus et al., 2018). More recent research from high-income settings yielded similar findings. In Australia, a 9-year study found that women who experienced IPV by age 21 had significantly more alcohol use disorders, across a range of different forms of IPV during the follow-up period (Ahmadabadi et al., 2019).

There is mixed evidence on the impact of women's alcohol use as a potential driver of experience of IPV, and all prospective studies are from high-income countries. An early systematic review and meta-analysis on three prospective studies from high-income countries found a significant positive association between alcohol use and subsequent experience of IPV (Devries et al., 2014). A more recent meta-analysis found seven longitudinal studies and presented two meta-analyses, where alcohol was treated as either a continuous or binary exposure variable (Bacchus et al., 2018). These meta-analyses found that while alcohol was associated with an increase in experience of IPV, this association was not statistically significant (Bacchus et al., 2018). In low- and middle-income countries, some existing evidence shows a significant relationship between alcohol and IPV (Davis et al., 2017; Greene et al., 2017; Russell et al., 2014), but none of these analyses are prospective.

In low- and middle-income countries, patterns of alcohol use, and the relationships between alcohol use and IPV, may differ from high-income countries. In some settings, alcohol use among women is limited, and this may be particularly true where social norms look unfavourably on young women's drinking (Hlomani-Nyawasha et al., 2020; Sommer et al., 2019). Additionally, it may be that women tend to consume alcohol only if male partners are paying, given the high levels of poverty and reliance on men for survival (Zembe et al., 2013). Many low- and middle-income countries have high rates of community violence, and thus high prevalence unresolved trauma (McDonald & Richmond, 2008; Mmari et al., 2014), which may increase background rates of substance use, and thereby dilute or wash out any relationship between alcohol with IPV. It is therefore critical to expand the global evidence base on the relationships between alcohol and IPV to lower- and middle-income countries.

There has been substantial research on the inter-relationship between alcohol and IPV in South Africa. Broadly, South Africa has high rates of alcohol related harm, with the cost of alcohol harm estimated at 10–12% of Gross Domestic Product (GDP) (Matzopoulos et al., 2014). Many cross-sectional studies have highlighted the association between alcohol and women's experiences of violence (Minnis et al., 2015; Ndungu et al., 2020; Pitpitan et al., 2013; Selin et al., 2019). Qualitative studies have emphasised how the centrality of informal drinking establishments (*shebeens*) in shaping the

relationship between alcohol and IPV (Wojcicki, 2002; Zembe et al., 2013), as well as how alcohol becomes embedded in everyday conflict in intimate relationships (Backe et al., 2021), and how these experiences are patterned by broader issues of poverty, and gendered expectations in relationships (Zembe et al., 2013).

To address the paucity of research on the temporal relationship between women's use alcohol and experience of IPV outside high-income countries, we conducted a post-hoc longitudinal analysis of data collected as part of a cluster randomised controlled trial of the Stepping Stones and Creating Futures programme in urban informal settlements in South Africa (Gibbs et al., 2017). The primary aim of the main trial was to assess the effectiveness of the intervention in preventing IPV over a 24-month follow-up (Gibbs et al., 2020); alcohol use was included as a secondary outcome. The intervention did not impact either outcome for women. In the analyses presented here, we first examine whether changes in women's experience of past-year physical IPV between baseline and endline has an effect on alcohol use at endline. Second, we look at whether changes in women's alcohol use between baseline and endline impacted their experience of physical IPV in the past 12 months as reported at endline.

## Methods

### *Study Setting and Design*

Data were collected as part of a cluster randomised control trial evaluating the impact of the Stepping Stones and Creating Futures intervention on young women's experiences of intimate partner violence, gender attitudes, substance use and livelihoods in urban informal settlements (Gibbs et al., 2020). The trial was implemented in 34 clusters in informal settlements in the eThekweni Municipality, South Africa, and details have been published elsewhere (Gibbs et al., 2017). Studies demonstrate high and strongly correlated rates of IPV and substance use in these communities (Gibbs et al., 2018; Ndungu et al., 2020).

Study participants at baseline were women aged 18 to 30, normally resident in the selected clusters, not in formal work and not studying full-time and able to communicate in English, isiZulu or isiXhosa. Questionnaires covered socio-demographics, experiences of IPV, gender attitudes, mental health, alcohol and drug use and livelihoods. They were self-administered using an app-created by Mobenzi, within in-built logic and range checks, on a cell-phone lent to participants for data collection. Participants could complete the survey in English, isiZulu or isiXhosa, and trained female interviewers were available to support participants if needed. Baseline data were collected from September 2015–2016, with those in the intervention group receiving the intervention immediately. We traced participants approximately 24 months

post-baseline, using information they provided, and re-administered the questionnaire. Further study details are available elsewhere (Gibbs et al., 2017).

## **Ethics Approval and Consent to Participate**

The study received ethical approval from the South African Medical Research Council's Ethics Committee and the Biomedical Research Ethics Committee at the University of KwaZulu-Natal. All participants provided written informed consent prior to participation, and local community leadership provided letters of support.

## **Measures**

Past year alcohol use at both baseline and endline was assessed using the Alcohol Use Disorders Identification Test (AUDIT), which comprises of 10 questions assessing alcohol consumption, binge drinking and alcohol dependency (Saunders et al., 1993). AUDIT has been widely used in South Africa (Dunkle et al., 2004; Jewkes et al., 2006). Item responses were summed with higher scores indicating greater alcohol use (range 0–40, Cronbach  $\alpha = 0.77$  at both baseline and 24 months). To generate a prevalence of potentially harmful alcohol use, we coded women scoring 8 points or higher as having harmful use of alcohol (Saunders et al., 1993).

Past year physical IPV was assessed using five items (see Table 1) slightly modified from the WHO's Women's Health and Domestic Violence study (Garcia-Moreno et al., 2006), which has been widely used and revised in South Africa (Dunkle et al., 2004; Jewkes et al., 2006). Responses to all items were: 'never', 'once', 'few' or 'many'. The potential range of scores was 0–

**Table 1.** Items Used to Assess Past Year Intimate Partner Violence Experience.

- 1) In the past 12 months how many times has a current or previous husband or boyfriend ever slapped you or thrown something at you which could hurt you?
- 2) In the past 12 months how many times has a current or previous husband or boyfriend ever pushed or shoved you?
- 3) In the past 12 months how many times has a current or previous husband or boyfriend ever hit you with a fist or with something else which could hurt you?
- 4) In the past 12 months, how many times has a current or previous husband or boyfriend ever kicked, dragged, beaten, choked or burnt you?
- 5) In the past 12 months, how many times has a current or previous husband or boyfriend ever threatened to use or actually used a gun, knife or other weapon against you?

Response options were: 'Never', 'once', 'a few times', 'many times'

15. To generate a binary variable of past year physical IPV experience, we coded any woman reporting ‘once’, ‘few’ or ‘many’ on one or more items, as having experienced physical IPV.

We assessed a range of co-variables. Age in years was treated as a continuous variable. Relationship status was assessed as ‘married or living together’, ‘boyfriend but not living together’ or ‘no relationship’. Education was coded as either completed secondary school (matric) or not. Food insecurity was assessed using three items of the Household Hunger Scale (Deitchler et al., 2010), and recoded into little or none, moderate or severe. A single item assessed whether a person had worked in the past 3 months.

Gender attitudes were assessed using 20 items modified from the Gender Equitable Men’s Scale (Pulerwitz & Barker, 2008), with a Likert response. Scores were summed, with higher scores indicate more inequitable attitudes (range 0–60,  $\alpha = 0.86$  at baseline). We assessed male partner’s controlling behaviour using a modified sexual relationship power scale (Pulerwitz et al., 2000), comprising eight items, with higher scores indicative of being controlled more (range 0–24,  $\alpha = 0.75$ ). Women’s mental health was assessed using the Centre for Epidemiological Studies Depression (CES-D) scale, 20-item version, to capture past week depressive symptoms (range 0–60,  $\alpha = 0.88$ ), with higher scores indicating more depressive symptoms. A score  $>20$  was used to indicate possible depression (Radloff, 1977). Past week post-traumatic stress symptoms were measured using 16 items comprising the Harvard Trauma Questionnaire (Mollica et al., 1992) (range 0–48,  $\alpha = 0.92$ ), and we calculated the mean score across all 16 items for each individual. Individuals who had mean scores of  $>2.5$  were classed as indicative of potential post-traumatic stress disorder (PTSD) (Mollica et al., 1992). We also assessed other forms of IPV women may have experienced in the past year, specifically emotional, economic and sexual IPV, all drawing on the WHO’s scales used in the Health and Domestic Violence study (Garcia-Moreno et al., 2006), although our primary analysis remained on the association between alcohol use and physical IPV.

### Statistical Analysis

We first described the baseline characteristics of the retained cohort at both timepoints, using  $n$ ’s and percentages or means and standard deviations as appropriate. We assess difference between timepoints using chi-squared tests, or t-tests, as appropriate. We then assessed loss-to-follow-up (LTFU) of the whole baseline sample, with those retained at 24 months, using chi-squared tests and t-tests to assess potential difference, on all outcomes and co-variables. At endline, a software issue on some cellphones meant that not all women completed the AUDIT scale. To address this, we compared those retained at

endline who completed the scale to those who did not, on both baseline and endline characteristics, reporting *n*'s and percentages or means and standard deviations, with chi-squared tests and t-tests as necessary.

We then assessed the association between changes in physical IPV scores between baseline and endline and harmful alcohol use at endline. We calculated the change in IPV scores over time as endline physical IPV score minus baseline physical IPV score, recoded into a three-level variable: 0) no change in physical IPV scores (difference in scores equal to zero); 1) decrease in physical IPV scores (difference <0); and 3) Increase in physical IPV scores (difference >0).

We described the women in terms of their allocation to each IPV change group and the proportion reporting harmful alcohol use at baseline and endline. We then modelled the association between change in experience of IPV over time and harmful alcohol use at endline, using generalized estimating equations with a binomial link function for the binary outcome. We used an individual-level analysis, adjusted for the clustered nature of the sampling as per the original trial (Gibbs et al., 2020). In Model 1, we assessed the association between change in physical IPV score (as a three-level variable), and harmful alcohol use at 24 months, adjusting for age, IPV score at baseline, harmful alcohol use at baseline, and assignment to intervention or control arm. In Model 2, we additionally adjusted for depression score at baseline and change in depression score between baseline and endline. In all models we reported odds ratios, ninety-five percent confidence intervals (95% CI) and *p*-values. We assessed multicollinearity in all models and found none.

We then assessed the impact of changing alcohol use between baseline and endline on experience of physical IPV at endline. We calculated change in alcohol scores through endline AUDIT score minus baseline AUDIT score. We then recoded this into a three-level variable: 0) no change in AUDIT score (difference in scores equal to zero), (1) a decrease in AUDIT (difference <0), and (2) increase in AUDIT scores (difference >0). Past year physical IPV at endline was treated as a binary variable.

We then described the women in terms of their allocation into their group of alcohol change scores (none, decrease, and increase) with the proportion who experienced past year physical IPV and harmful alcohol use at baseline and endline. We then modelled the association between changes in AUDIT score as a categorical variable and its association with past year physical IPV (as a binary variable) at endline (Model 1). Modelling reflected the approach described above. In Model 2, we adjusted for relationship control as a baseline and change variable, as well as depression. We assessed multicollinearity in all models and found none.

We checked the robustness of the findings through multiple sensitivity analyses. First, given the missing data on alcohol use at 24 months, we performed multiple imputation for all models described above. Both the

imputation and estimation models adjusted for the variables included in the initial complete case analysis above and factors associated with missing alcohol data. Second, we re-ran all analyses changing how we modelled the outcome and main exposure variable. Specifically, to assess the impact of changing physical IPV experience on alcohol use, we assessed alcohol change as a continuous variable, and then physical IPV as a continuous variable. We also repeated these analyses looking at alcohol as the dependent variable and physical IPV as the outcome variable, treating variables in the same way.

## Results

At baseline, 677 women were enrolled in the study, with overall retention of 80.5% ( $n = 545$ ) at 24 months. The 545 women who provided data at both timepoints, had a mean age 24.0 years at baseline, two-thirds (67.3%) had a current relationship, but did not live with their partner and a fifth (18.2%) reported no current relationship (Table 2). Half reported moderate food insecurity and nearly a third (30.5%) severe food insecurity, while only a quarter (25.1%) had worked in the past month. Three-quarters (77.6%) reported past year emotional IPV experience, half reported past year economic IPV experience and 28.1% past year sexual IPV experience. Nearly half (44.6%) scored with likely depression on the CES-D, and a fifth (19.6%) scored with potential PTSD. At baseline over half (58.5%) reported past year physical IPV and a quarter (23.9%) past year problem alcohol use. At 24 months, there were only slight changes, with slightly improving food insecurity (from severe to moderate), an increase in past month work, a borderline increase in economic IPV experience and an increase in depressive symptoms.

Supplementary Table 1 shows LTFU in the overall sample. Baseline characteristics associated with LTFU were being in the intervention group, being married or living with partner and higher mean relationship control scores. Supplementary Table 2 shows baseline and endline factors associated with missing data on the AUDIT score data at 24 months. Baseline characteristics associated with this were greater food insecurity, problem drinking and probable depression and PTSD. Endline characteristics associated with missing alcohol data were greater food insecurity, probable depression, PTSD and higher mean scores of controlling behaviour and we tested these as potential confounders, including in models those which impacted on the outcome models.



**Table 2.** Socio-Demographics and Prevalence of IPV at Baseline and 24 m.

	Baseline (N = 545)		24m (N = 545)		p-Value
	n/mean	sd/%	n/mean	sd/%	
Intervention group					
Control	285	52.3			
Intervention	260	47.7			
Age (mean)	24.0	3.6	26.2	3.7	
Relationship status					0.515
Married or living together	79	14.5	84	15.4	
Not living together	367	67.3	376	69.0	
No current relationship	99	18.2	85	15.6	
Household food insecurity					0.001
Little or no insecurity	106	19.5	119	21.8	
Moderate insecurity	273	50.1	314	57.6	
Severe insecurity	166	30.5	112	20.6	
Worked in past 3 months	137	25.1	235	43.1	<0.001
Past year physical IPV	319	58.5	289	53.0	0.067
Past year sexual IPV	153	28.1	187	34.3	0.026
Past year emotional IPV	423	77.6	412	75.6	0.431
Past year economic IPV	283	51.9	331	60.7	0.003
Past year any IPV	475	87.1	472	86.6	0.788
Problem drinking	130	23.9	117	24.2 <sup>a</sup>	0.904
Severe symptoms of depression	243	44.6	277	50.8	0.039
Severe symptoms of PTSD	108	19.8	122	22.4	0.291
Relationship control score (mean)	10.1	4.3	9.7	4.6	0.146
Gender attitude score (mean)	25.3	9.5	21.8	9.6	<0.001

<sup>a</sup>denominator is  $n = 484$  (missing data,  $n = 61$ , 11.2%).

### *Changes in Physical Intimate Partner Violence as a Driver of Harmful Alcohol Use*

Table 3 shows patterns of change in physical IPV scores between the two timepoints. Overall, 29.5% reported no change in past year IPV scores, just over a third (38.0%) reported a decrease and a third (32.5%) reported an increase in past year IPV scores.

Among those reporting no change in IPV scores, only a tenth (11.2%) reported past year IPV and 8.1% harmful alcohol use at baseline, and there was no change in this at 24 months. In the group with decreasing physical IPV, there was overall a reduction in median physical IPV scores from 5 to 0 points, with a mean change of  $-3.9$  points. Baseline IPV experience was reported by



all and a third (34.8%) reported harmful alcohol use at baseline. At 24 months among those reporting a decrease in IPV scores, just under half (45.4%) reported past year IPV, and a quarter (28.7%) harmful alcohol use. In the group reporting increasing IPV scores, the median physical IPV score rose from 1 to 5 points (mean change +4.2 points), with half (53.1%) reporting IPV and a quarter (25.4%) harmful alcohol use at baseline. At endline, all in the increasing IPV group reported past year IPV and a third (32.2%) harmful alcohol use. Supplementary tables report these for depression and controlling behaviours as well (Supplemental Table 3).

Adjusted models examining the impact of changes in physical IPV scores on likelihood of harmful alcohol use at 24 months (Table 4) show a consistent pattern whereby those with increasing physical IPV scores over time have a greater likelihood of reporting harmful alcohol at endline. In Model 1, the effect size is aOR = 2.73 (1.37–5.47). In Model 2, the association is slightly attenuated (aOR = 2.45 (1.21–4.97), and additionally, shows that a one-point increase in depressive symptoms increases the likelihood of harmful alcohol use at endline (aOR 1.03; 1.01–1.04). The imputed analyses for both models show similar, but slightly reduced, effect sizes.

**Table 4.** Effect of Change in Physical IPV Experience on Problem Drinking at 24 months.

	Change from Baseline to 24 months	Complete Case Analysis (N = 484)		Multiple Imputation Analysis (N = 545)	
		aOR (95% CI)	p-Value	aOR (95% CI)	p-Value
Model 1	No change in physical IPV	Ref		Ref	
	Decrease in physical IPV	1.36 (0.67–2.78)	0.394	1.41 (0.69–2.91)	0.345
	Increase in physical IPV	2.73 (1.37–5.47)	0.004	2.54 (1.30–4.96)	0.007
Model 2	No change in physical IPV experience	Ref			
	Decrease in physical IPV experience	1.44 (0.70–2.94)	0.321	1.50 (0.72–3.13)	0.273
	Increase in physical IPV experience	2.45 (1.21–4.97)	0.013	2.27 (1.15–4.48)	0.019
	1 unit increase in depression score	1.03 (1.01–1.04)	0.006	1.03 (1.00–1.05)	0.029

Model 1: Adjusted for intervention arm, age at baseline, physical IPV at baseline and baseline problem drinking.

Model 2: Adjusted for intervention arm, age at baseline, physical IPV at baseline and baseline problem drinking, plus baseline depression score and change in depression score.

**Table 5.** Effect of Change in Alcohol Use on Physical IPV Experience at 24 months.

Change from Baseline to 24 months		Complete Case Analysis (N = 484)		Multiple Imputation Analysis (N = 545)	
		aOR (95% CI)	p-value	aOR (95% CI)	p-value
Model 1	No change in AUDIT score	Ref		Ref	
	Decrease in AUDIT score	0.76 (0.38–1.49)	0.422	0.75 (0.39–1.43)	0.404
	Increase in AUDIT score	1.87 (1.10–3.15)	0.02	1.87 (1.13–3.07)	0.014
Model 2	No change in AUDIT score	Ref		Ref	
	Decrease in AUDIT score	0.84 (0.41–1.73)	0.639	0.84 (0.43–1.65)	0.608
	Increase in AUDIT score	2.04 (1.21–3.46)	0.008	1.98 (1.18–3.34)	0.010
	1 unit increase in depression score	1.03 (1.00–1.05)	0.019	1.17 (1.12–1.22)	<0.001
	1 unit increase in relationship control score	1.18 (1.13–1.24)	<0.001	1.03 (1.01–1.05)	0.003

Model 1: Adjusted for intervention arm, age at baseline, baseline physical IPV score and baseline AUDIT score.

Model 2: Adjusted for intervention arm, age at baseline, baseline physical IPV score and baseline AUDIT score, plus baseline depression score, relationship control score, change in depression score and change relationship score.

### *Changes in Alcohol Use as a Driver of Past Year Physical Intimate Partner Violence*

Assessing the relationship between changes in AUDIT scores and subsequent IPV experience, there was about a third split between those reporting no change, those reporting decreases, and those reporting increases in AUDIT scores over time (Table 3). Among those with no change in AUDIT scores, just under half (44.9%) reported past year physical IPV, and only reported 3% ( $n = 5$ ) reported harmful alcohol use at baseline, with similar percentages at endline. In the group with reducing AUDIT scores, median AUDIT scores declined from 7 points to 1 point (mean change  $-6.3$  AUDIT points), and two-thirds (67.3%) reported past year physical IPV, and half (48.7%) harmful alcohol use at baseline. In the decreasing AUDIT score group at endline, past year IPV experience had declined to a half (53.3%) and harmful alcohol use to 16%. In the group where AUDIT scores increased, median AUDIT scores changed from 2 to 9 (mean increase  $+6.3$  points). At baseline just under two-thirds (62.3%) reported past year physical IPV, and a fifth (18.0%) harmful

alcohol use, while IPV remained similar at endline (63.9%), a much larger percentage (52.7%) reported harmful alcohol use.

In regression models only increases in AUDIT scores were associated with significant change in past year IPV experience (Table 5), whereby an increase was seen with increased likelihood of past year IPV (Model 1 aOR1.87, 1.10 to 3.15; Model 2 aOR2.04, 1.21 to 3.46). In Model 2, a 1 unit increase in depressive symptoms was associated with an increase IPV experience at endline (aOR1.03, 1.00 to 1.05) and a 1 unit increase in relationship control scores was similarly associated with increased IPV experience (aOR1.18, 1.13 to 1.24). In imputed models, there was no change for Model 1, and in Model 2, the effect size for depressive symptoms increased, while decreasing for relationship control.

Supplementary analyses (Supplemental Tables 4 and 5) confirm the primary analyses. In all these models the same relationships are demonstrated.

## Discussion

In a sample of young women living in urban informal settlements in eThekweni Municipality, South Africa, facing multiple overlapping challenges of poverty, high levels of background violence and limited social and state support, there was a clear and consistent finding whereby women who experienced increasing amounts of physical violence from partners over time were more likely to subsequently report greater harmful alcohol use, and similarly, women reporting increasing alcohol use over time were more likely to report past year physical IPV at endline. There was no evidence that decreases in alcohol use were associated with reductions in physical IPV, or that reduced IPV experience led to decreased alcohol use.

Our analysis strongly supports the finding from high-income countries that women's experience of physical IPV is a driver of their subsequent alcohol use (Bacchus et al., 2018; Devries et al., 2014), and extends the evidence base through locating this in urban informal settlements in South Africa. In urban informal settlements, access to social support, psychosocial care and health care in general is limited, as are availability and use of legal strategies to deal with violence in relationships. As such, it is highly likely that increased alcohol use in response to increasing IPV experience is a form of self-medication (Hawn et al., 2020; Kaysen et al., 2007). IPV experience is strongly associated with worse mental health outcomes, including depression and post-traumatic stress (Bacchus et al., 2018; Devries et al., 2013), and there is clear evidence that alcohol is often used to self-medicate for these unresolved mental health issues where formal care is unavailable (Hawn et al., 2020; Kaysen et al., 2007). This hypothesis, around self-medication, gains support from our analyses: when we included depressive symptoms in the model, the overall association between physical IPV increasing and alcohol

use was clearly attenuated, although it remained significant. It is important that alcohol use and poor mental health are acknowledged to have similar underlying drivers, and that interventions actively address this. Similarly, interventions to address IPV, and especially those that support survivors and/or seek to prevent recurrence of IPV, should recognize the importance of addressing alcohol use and depression.

In this analysis there was also evidence that where women increased their alcohol use, they were more likely to experience physical IPV. Global evidence on this point has been varied, with prospective studies from high-income countries showing mixed outcomes (Bacchus et al., 2018; Devries et al., 2014), and current evidence from low- and middle-income countries being cross-sectional only. The potential pathways through which increasing alcohol use may increase women's experience of IPV may include increased arguments with a partner, either because women's alcohol use breaks social norms on women's behaviour (Wechsberg et al., 2013) or because alcohol use increases disinhibition (Babor et al., 1983). In the UK, studies on couples' use of substances and violence highlighted the importance of arguments about access to substances (though more often hard drugs) as a driver of violence (Gilchrist et al., 2019). Other analyses (Martino et al., 2005) have demonstrated a reciprocal relationship between violence and alcohol use, and it may be that in this cohort, young women's increasing alcohol use and IPV experience tracked closely together, and we cannot clearly disentangle the exact relationship between these two.

There was no evidence that decreasing experience of physical IPV reduced alcohol use, or that reductions in alcohol use reduced subsequent IPV experience. The reason for the lack of association is unclear. For both physical IPV and alcohol use, the proportion of women in this study who reported a decrease was similar to, or greater than, the proportion reporting an increase, so it is unlikely to be a question of simple statistical power. It may be that there are other factors which jointly impact on both that were not meaningfully changing during this time period, for instance, food insecurity or generalized experiences of community level-violence and trauma. It may also be that the impact of decreasing IPV and/or alcohol on the cycles of reciprocal causality has a reduced effect size compared to the increases we did observe, or that any benefits of reduced IPV/alcohol only appear over a longer time horizon than our 24 months of follow-up. Additional research with longer follow-up and a greater number of observations will be needed to unpack these questions.

In both analyses, increasing depressive symptoms were associated with increased likelihood of physical IPV experience and harmful alcohol use at endline. While studies in high- and low-income settings have previously described the prospective association between depression and IPV experience (Devries et al., 2013; Tsai et al., 2016), there remains limited prospective evidence about the impact of depression on women's experience of IPV and

women's alcohol use in low-income settings. Without adequate treatment and support for depression, alcohol may become a form of self-medication, particularly in contexts of ongoing trauma, often starting from early childhood.

This study has several limitations. The population self-selected into an intervention trial, and is thus not representative of the general population; however, it is unclear how this would affect associations. Furthermore, the population consisted entirely of young women who all self-identified as 'Black', and we assumed heterosexual relationships, thus limiting generalization further. All measures were self-reported, and this could have led to under-reporting of either IPV or alcohol use, which would likely attenuate the association between the two. In addition, we did not ask about male partners' alcohol consumption at either timepoint; this is strongly associated with women's IPV experience and women's alcohol use, and should be included as a potential confounder in future research. While we modelled changes in both physical IPV and alcohol use, we could not model these as reciprocal relationships. In addition, as the two timepoints were approximately 24 months apart, there could have been changes at 12 months not captured in our measures (which were both past 12 months). It is unclear how this would have affected our analysis. There was missing data at 24 months on a primary outcome – alcohol use – caused by faults in cellphone software, which was associated with potential drivers of alcohol use. To address this limitation, we used multiple imputation to verify the main analysis, which showed consistency in the relationships. We also modelled the relationships in multiple ways, and these too showed the same associations as in our primary analysis. We also only examined the associations between alcohol and physical IPV, rather than multiple forms of IPV, as we wished to disentangle this specific relationship and there remains little clarity on how to model multiple different forms of often overlapping IPV experience simultaneously.

## **Conclusion**

Our analysis has several important implications for effective interventions to address alcohol use and IPV experience among young women living in challenging contexts. First, efficacious interventions need to address alcohol use and IPV simultaneously, given that they clearly exacerbate one another. Second, reflecting other recent analyses on effective IPV prevention (Kerr-Wilson et al., 2020), our analysis suggests addressing alcohol and IPV together, is unlikely to be successful without also addressing other shared underlying causes of these two issues. While many effective alcohol reduction and IPV prevention interventions are strongly focussed on addressing poor mental health (Murray et al., 2020), poverty is also an

important driver of both alcohol use and IPV experience and deserves attention (Lund et al., 2010). As such, in low-income settings, addressing multiple drivers of alcohol use and IPV, including structural drivers, is critical for an effective response. Third, women's alcohol use often occurs with male partners (Greene et al., 2017), and it may be that women are more vulnerable to violence when drinking with partners (Wechsberg et al., 2013). There is some evidence that interventions addressing alcohol and IPV have stronger outcomes when they work with couples, rather than individual women (Minnis et al., 2015). In this population of young women in urban informal settlements, the concept of 'couple' may not resonate with their lived experiences, particularly as women do not often reside with male partners (Gibbs et al., 2018). Developing effective ways of working with couples on the interlinked issues of alcohol reduction and violence remains an important priority, but given the complex relationships young women often had (Willan et al., 2019), also how to address these issues for individuals. Fourth, the separation between IPV prevention and response strategies is not clear cut, with many prevention interventions preventing ongoing violence in relationships (Chatterji et al., 2020), and requiring significant focus on the residual traumas of violence manifested in alcohol use, and concurrent depression, needing to be a focus of interventions in highly traumatized populations. Broadly, therefore, addressing the interlinked issues of alcohol use and experience of IPV among young women with multiple overlapping risk factors needs to address the shared risk factors, as well as these two issues directly if they are likely to be successful.

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### **Author Contributions**

AG, KD, and EC conceptualised the analysis jointly. EC led data analysis, with supervision by AG and KD. AG wrote the first draft of the manuscript. EC and KD contributed sections of the manuscript. All authors agreed the interpretation and suitability for publication.

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## Supplemental Material

Supplemental material for this article is available online.

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