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## Background

Polyvictimisation (PV), or exposure to violence across multiple contexts, causes significant short- and long-term morbidity and even mortality among adolescents [1–3]. Research interest has grown in understanding the impact of multiple exposures to violence across a range of contexts including within the family and community, and from intimate partners and peers [4, 5]. Globally, rates of exposure to PV in adolescents vary considerably. In high-income countries, for example, estimates of PV range from 10 to 93% [5–10]. Rates of PV are generally higher in low- and middle-income countries (LMICs) [11], reaching almost 95% in one community-based sample in Cape Town, South Africa, for example [12].

A constellation of social vulnerabilities means that adolescents living in disadvantaged urban settings are at a particularly high risk for PV [12–15], and there are often very few social and health resources to counter these vulnerabilities [15, 16]. Victims of PV are at a considerably higher risk for poor mental health, as well as emotional, behavioural and developmental problems compared with those exposed to violence in a single context [17–19]. It has, however, not been clearly established whether the impact of PV on mental health varies by gender in these settings. The burden of PV and the associated mental health outcomes might be more profound for girls than boys, given high levels of sex-

checklist-civilian version used for diagnosing posttrau-



in Baltimore and Shanghai (41 to 48%). Negative perceptions of overall health status were notably more common in girls than boys in Baltimore (10.1 versus 4.1%) and Shanghai (16.8% against 5.2%). Treatment seeking for mental health concerns was infrequent (around 1% overall), irrespective of setting (Table 2).

The first part of this section presents the findings of the four mental health outcomes as a function of PV, separately for males and females (Tables 3 and 4). The second part sums the associations noted between these outcomes, and age and city (Tables 3 and 4).

For each outcome, the ORs increased for both genders as the number of types of victimisation increased (Tables 3 and 4). There were, however, differences in the magnitude of increase, and statistical significance, according to gender. Moreover, considerable differences were noted between effect sizes in unadjusted and adjusted models.

PV was strongly associated with negative perceptions of overall health for both boys and girls. Specifically, boys that experienced PV had 11.43 higher odds of having a negative perception of health than those who had never experienced violence (95%CI: 2.45-53.21), whereas these odds were 2.58 in girls with PV (95%CI: 1.62-4.12; Table 4).

Gender differences were also observed in the association between PV and the mental health outcome variables assessed. Independent of age and city of residence, girls that experienced PV had an increased odds of suicidal thoughts (aOR = 4.68; 95%CI: 2.29-9.54), posttraumatic stress (aOR = 4.53; 95%CI: 2.44-8.41) and depression (aOR = 2.65; 95%CI: 1.25-5.63), while the sizes of point estimates for these three associations were lower among boys. Depression was the only mental health outcome associated with PV in boys (aOR = 1.82; 95%CI = 1.00-3.33).

Several other findings in the multivariate analysis bear mention. Firstly, associations were detected between having one episode of victimisation and negative perceptions of health for boys (aOR = 7.90; 95%CI: 1.43-43.56) and suicidal thoughts for girls (aOR = 2.46; 95%CI: 1.17-5.18) compared to those who had never experienced violence. None of the estimated associations between having one episode of victimisation and the other outcomes were statistically significant, with the point estimates ranging from 0.85-1.41).

Secondly, city of residence was an important determinant of all outcomes assessed, independent of age and of having experienced victimisation. Negative perceptions of health were more common among boys in Johannesburg (aOR = 3.22; 95%CI: 1.63-6.36) and girls in Shanghai (aOR = 2.45; 95%CI: 1.33-4.52), than in Baltimore,

but less frequent in girls living in Ibadan (aOR = 0.31; 95%CI: 0.13-0.71). Most strikingly, however, being in Johannesburg, as opposed to in Baltimore, was associated with around a two-fold higher odds of all the mental health outcomes, aside from depression in boys. The converse was true of Delhi, where point estimates were the lowest for both genders.

Compared with Baltimore, girls in Ibadan had less posttraumatic stress, but more frequently had depression. Of note, the girls in Shanghai had 2.6 fold higher odds of suicidal thoughts than those in Baltimore (95%CI: 1.91-3.59), and also had higher odds of posttraumatic stress and depression. In Shanghai, aside from a 1.3 fold higher odds of suicidal thoughts in boys than in Baltimore, no significant differences were detected between boys in these two cities. Finally, age was associated with posttraumatic stress and depression for boys, where ORs of the condition rose with age.

## Discussion

We primarily aimed to explore whether there are gender differences in the association between PV and mental health outcomes among urban disadvantaged adolescents in five cities. In this regard, we demonstrate that whilst past-year PV is remarkably common in adolescents in all five cities, affecting around three quarters of adolescents in four of the five cities, its effects on mental and physical health vary, and differ by gender. PV was strongly associated with negative perceptions of overall health for both boys and girls, but the effect sizes tended to be higher for boys than girls. By contrast, girls that experienced PV had an increased likelihood of suicidal thoughts, posttraumatic stress and depression, while for boys these associations were not significant in adjusted analyses. The point estimates of associations between PV and the mental health outcomes were lower among the boys and not significant aside from depression. We also illustrated clearly that city of residence is an important determinant of all associations studied, even independent of whether boys or girls experienced victimisation.

Most previous studies involved data from one site only and report on single types of victimisation, making it difficult to compare our results to those of others. Where differences are observed between studies, these may also be accounted for by variations in the definition of exposure and outcomes. Nevertheless, our findings are broadly consistent with that of an Italian study among university students, which concluded that PV was associated with a high risk of depression, panic attacks, heavy alcohol use, eating problems, suicidal ideation and attempts, and a negative perception of overall health [4]. Other studies in high-income countries [20] and LMICs [17] have also found that adolescent girls who experienced violence





## Conclusions

In conclusion, this study sheds some light on the role of gender in the intersections between PV and mental health among adolescents in five urban disadvantaged settings. The results show that PV is associated with the mental health outcomes for girls, and poor self-rated health and depression for the boys. Girls who have experienced PV require specific targeting with services that address posttraumatic stress and depression. Overall, the findings highlight the dire need for interventions that reduce violence exposure and improve safety in these settings. For instance, there is evidence from Uganda, which shows the potential to reduce violence by focussing on social mobilisation [38]. It is also possible to modify violence outcomes within programmatic time frames when interventions are delivered at a structural level [39]. mHealth interventions for adolescents show much promise, such as

the rapidly expanding Circle of Six smartphone application which addresses gender-based violence [27]. Historically, intervention systems address specific forms of violence in general - for example, IPV support, family violence support etc., but rarely consider the overlap between these [16].

This study highlights the need to shift this approach to one which understands and addresses the interacting



## Additional files

**Additional file 1: Table S1.** [Download additional file 1](#) (36 kb)

**Additional file 2: Table S2.** [Download additional file 2](#) (32 kb)

**Additional file 3: Table S3.** [Download additional file 3](#) (35 kb)

**Abstract**

Background: The prevalence of *Salmonella* infections in humans and animals is increasing worldwide. The aim of this study was to identify the genetic diversity of *Salmonella* strains isolated from humans and animals in the region of the Tigris and Euphrates rivers in Iraq.

**Methods:** A total of 100 *Salmonella* strains were isolated from humans and animals in the region of the Tigris and Euphrates rivers in Iraq. The strains were identified by conventional methods and confirmed by PCR. The genetic diversity of the strains was determined by pulsed-field gel electrophoresis (PFGE) using the *Salmonella* enterica phage type (SEPT) scheme.

**Results:** The results showed that the majority of the strains were of the *Salmonella* enterica serotype Enteritidis (SEPT) phage type. The genetic diversity of the strains was determined by PFGE using the SEPT scheme. The results showed that the majority of the strains were of the SEPT phage type. The genetic diversity of the strains was determined by PFGE using the SEPT scheme.

**Conclusion:** The results of this study indicate that the majority of the *Salmonella* strains isolated from humans and animals in the region of the Tigris and Euphrates rivers in Iraq are of the SEPT phage type.

**Keywords:** *Salmonella*, SEPT, PFGE, Tigris and Euphrates rivers, Iraq

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**1** *Salmonella* enterica serotype Enteritidis (SEPT) phage type. **2** *Salmonella* enterica serotype Enteritidis (SEPT) phage type. **3 *Salmonella* enterica serotype Enteritidis (SEPT) phage type. **4 *Salmonella* enterica serotype Enteritidis (SEPT) phage type. **5** *Salmonella* enterica serotype Enteritidis (SEPT) phage type. **6** *Salmonella* enterica serotype Enteritidis (SEPT) phage type. **7** *Salmonella* enterica serotype Enteritidis (SEPT) phage type.****

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