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Research paper

## Experience of neighbourhood violence and mental distress in Brazilian favelas: a cross-sectional household survey



Marcelo Santos Cruz<sup>1</sup>, Eliana Sousa Silva<sup>2</sup>, Zivile Jakaite<sup>3</sup>, Miriam Krenzinger<sup>4</sup>, Leandro Valiati<sup>5</sup>, Dalcio Gonçalves<sup>2</sup>, Eduardo Ribeiro<sup>6</sup>, Paul Heritage<sup>7</sup>, Stefan Priebe<sup>3,\*</sup>

<sup>1</sup> Federal University of Rio de Janeiro, Institute of Psychiatry, Av. Venceslau Brás 71 fundos, Rio de Janeiro, Brazil, Zip code: 22290-140

<sup>2</sup> Redes da Maré. R. Sargento Silva Nunes 1012. Nova Holanda, Maré, Rio de Janeiro, Brazil. Zip code: 21044-242

<sup>3</sup> Queen Mary University of London, Unit for Social and Community Psychiatry. Newham Centre for Mental Health, London E13 8SP

<sup>4</sup> Federal University of Rio de Janeiro, School of Social Work. Av. Pasteur, 250, Urca, Rio de Janeiro, Brazil. Zip code: 22290-240

<sup>5</sup> University of Manchester. Institute of Cultural Practices. Department of Art History and Cultural Practices. Oxford Road, Manchester, M13 9PL

<sup>6</sup> Rio de Janeiro State University, Social Science Institute. Department of Sociology, Rua São Francisco Xavier, 524, Maracanã, Rio de Janeiro, Brazil, Zip code: 20550-900

<sup>7</sup> Queen Mary University of London, People's Palace Projects. c/o School of English and Drama, QMUL Mile End Road, London E1 4NS

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## ABSTRACT

**Background:** Living in informal settlements with extensive neighbourhood violence has been shown to be linked with poorer mental health. However, there is little evidence as to whether different levels of personal experiences and fears of neighbourhood violence within such settlements affect mental health. This study assessed such personal experiences and fears of residents in favelas in Brazil. We tested whether variations predict mental health symptoms and quality of life, and whether this is independent of the influence of sociodemographic characteristics and poverty.

**Methods:** In a population-based survey of adults living in a group of favelas in Rio de Janeiro, Brazil, we assessed: sociodemographic characteristics; extent of personal experiences and fear of neighbourhood violence; mental health symptoms on the Brief Symptom Inventory; and quality of life on the Manchester Short Assessment of Quality of Life. Univariate and multivariate regressions were fit to predict mental health symptoms and quality of life.

**Findings:** We interviewed 1,211 residents. Both more experiences of neighbourhood violence and more fear of violence predicted higher levels of mental health symptoms and poorer quality of life. In multivariate regression analyses, the associations remained significant after adjusting for the influence of other factors, in particular female gender, younger age, and marked poverty.

**Interpretation:** Even within a context in which the whole population can be exposed to violence and economic disadvantage, individual variations in the experiences of violence still make a significant difference for mental distress and quality of life. Policies to improve mental health and quality of life of residents in informal settlements need to address risk factors separately, most importantly the personal experiences of violence and poverty.

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**Antecedentes:** Viver em assentamentos informais, com ampla violência na vizinhança, parece estar associado a piores condições de saúde mental. No entanto, há poucas evidências de que, nestes locais, os diferentes níveis de experiências pessoais e o medo da violência na vizinhança afetem a saúde mental. Este estudo avaliou experiências pessoais e medos de moradores de favelas no Brasil. Testamos se tais variações predizem sintomas de saúde mental e qualidade de vida, e se isso é independente da influência das características sociodemográficas e da pobreza.

**Métodos:** Com base em um inquérito domiciliar de base populacional, realizado com adultos residentes em um grupo de favelas do Complexo da Maré, Rio de Janeiro, Brasil, foram observadas: características

\* Corresponding Author: Professor Stefan Priebe, Queen Mary University of London, Unit for Social and Community Psychiatry. Newham Centre for Mental Health, London E13 8SP, Tel: 0044-(0)20-75404210

E-mail addresses: [marcelosantoscruz@ipub.ufrj.br](mailto:marcelosantoscruz@ipub.ufrj.br) (M.S. Cruz), [eliana@redesdamare.org.br](mailto:eliana@redesdamare.org.br) (E.S. Silva), [zivile.jakaite@nhs.net](mailto:zivile.jakaite@nhs.net) (Z. Jakaite), [miriamufrj@gmail.com](mailto:miriamufrj@gmail.com) (M. Krenzinger), [leandro.valiati@manchester.ac.uk](mailto:leandro.valiati@manchester.ac.uk) (L. Valiati), [dalcio@redesdamare.org.br](mailto:dalcio@redesdamare.org.br) (D. Gonçalves), [eduardoribeiro@gmail.com](mailto:eduardoribeiro@gmail.com) (E. Ribeiro), [p.heritage@qmul.ac.uk](mailto:p.heritage@qmul.ac.uk) (P. Heritage), [s.priebe@qmul.ac.uk](mailto:s.priebe@qmul.ac.uk) (S. Priebe).

sociodemográficas; a extensão das experiências pessoais de exposição à violência e o medo da violência na vizinhança; sintomas de saúde mental, a partir do Inventário de Sintomas Psicopatológicos (BSI); e qualidade de vida, a partir da escala Manchester Short Assessment of Quality of Life (MANSA). Regressões univariadas e multivariadas foram ajustadas para explicar variações nos sintomas de saúde mental e qualidade de vida.

**Resultados:** Entrevistamos 1.211 pessoas adultas residentes na Maré. Tanto maiores níveis de exposição a experiências de violência na vizinhança quanto mais medo dessa violência estiveram relacionados a piores níveis de saúde mental (maior número e intensidade de sintomas no BSI) e pior qualidade de vida. Nas análises de regressão multivariada, tais associações permaneceram significativas mesmo após controlarmos pela influência de outros fatores, em particular sexo (feminino), idade (mais jovem) e pobreza acentuada.

**Interpretação:** Mesmo em um contexto no qual toda a população pode estar exposta à violência e a desvantagens materiais e econômicas, as variações individuais nas experiências de violência ainda assim fazem diferença significativa nas condições de sofrimento mental e qualidade de vida. Políticas para melhorar a saúde mental e a qualidade de vida dos residentes de assentamentos informais, como as favelas, precisam abordar fatores de risco separadamente focando, principalmente, na redução da exposição a experiências pessoais de violência e da pobreza.

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## Research in context

### Evidence before this study

We searched for research studies on PubMed (up to June 20, 2021) which investigated the link between neighbourhood violence and mental distress or quality of life in informal urban settlements. The search terms included: 'neighbourhood violence, mental health'; 'neighbourhood violence, informal settlements'; 'violence, informal settlements'; 'community violence, informal settlements, quality of life'; 'violence, mental distress, informal settlement'. We were not able to find any studies which investigated the links between variations of neighbourhood violence within informal settlements and mental health. Some studies have been undertaken in general samples from low-income and middle-income countries (LMICs) which include people from informal settlements but do not primarily focus on such communities. The existing research suggests that living in an area with more neighbourhood violence is associated with higher levels of mental health symptoms.

### Added value of this study

This study interviewed a large random sample of residents within informal settlements and assessed variations in personal experiences and fears of violence as well as their associations with levels of symptoms and quality of life. The findings suggest that both personal experiences of neighbourhood violence and fear of it, influence levels of mental health symptoms and quality of life. This influence is in addition to the impact of sociodemographic characteristics, particularly poverty.

### Added value of this study

Implications of all the available evidence: Policies to reduce mental distress in informal settlements need to address distinct risk factors, most notably personal experiences and fear of violence, as well as poverty.

## 1. Introduction

More than 50% of the world's population resides in cities, with approximately one billion people in informal settlements [1]. Importantly, 90% of informal settlement dwellers live in low- and middle-income countries (LMICs), and these figures are estimated to increase exponentially in the next 25 years [2,3].

While there is no universal definition, informal settlements often include the following characteristics: (1) lack of security over tenure or occupancy; (2) lack of adequate services and infrastructure; and (3) failure to meet building and planning regulations [3]. A typical example of these deprived urban neighbourhoods are the favelas in Brazil, which are often ruled by armed criminal organisations with a limited role by state authorities. Extreme poverty is widespread and severe violence can occur frequently, including deaths by firearms most frequently as a result of police incursions.

People living in informal settlements across Latin America and elsewhere regularly experience high levels of neighbourhood violence as a result of drug trafficking, gang warfare and police actions, whilst at the same time being also exposed to other risk factors for poor mental health, in particular poverty [3]. Thus, identifying the factors associated with mental distress and reduced quality of life in such settings may have implications for policy priorities in public mental health.

Numerous studies demonstrate that the experience of violence can lead to mental distress and may negatively impact quality of life [4–7]. Most evidence refers to violence related to war and armed political conflicts [8–10], gender violence [11], violence against children or adolescents [12,13], violence against the elderly [14,15], and domestic violence [16]. Although sharing some similarities, neighbourhood violence is a specific form of violence that can dominate informal settlements.

Studies on the association of neighbourhood violence and mental health in LMICs have been conducted on larger populations and not focused on informal settlements. They have mostly used area-level violence data and not captured individual-level variations of experiences and fears of violence. This brings the risk of an ecological fallacy when data for whole populations are interpreted as reflecting how the personal experiences of individual residents influence their mental health. Thus, the questions remain as to whether the extent of personal experiences and fear of neighbourhood violence

olence of people living in informal settlements makes a difference to mental health and quality of life, and whether this influence is independent of the influence of other factors, in particular, marked poverty [17–22].

The dearth of evidence about factors influencing mental health in informal settlements such as favelas may be because conducting large representative studies in such contexts is very challenging. For instance, moving within informal settlements as an outsider can be difficult or even impossible and is associated with high risks to personal safety. Residents of informal settlements may also mistrust interviewers from research institutions. Through a partnership with a civil society organisation that is based within the favelas, we conducted a representative survey in the largest group of favelas in Brazil and assessed individual-level experiences and fears of neighbourhood violence. The study aimed to explore their association with mental health outcomes and quality of life, considering also the influence of other factors such as poverty.

## 2. Methods

### 2.1. Design

We conducted a large, population based cross-sectional survey of randomly selected adults living in 16 favelas in the area of Maré in Rio de Janeiro, Brazil. The study is part of the project “Building the barricades: Three interdisciplinary studies” (funded by the Economic and Social Research Council and Arts and Humanities Research Council in the United Kingdom, ES/S000720/1). Interviews were conducted from July 2019 to February 2020.

### 2.2. Setting

Maré is the largest conglomeration of favelas in Rio de Janeiro with more than 139,000 residents living in a low-quality housing. Three different armed criminal organisations control distinct territories, imposing their rules and impeding any normal police access. The regular police force enters the favelas only in heavily armed groups and war-like operations marked by intense armed clashes. In 2019, 39 police operations occurred in Maré, during which 34 residents were killed by firearms [23].

### 2.3. Sampling

The sampling frame was based on a Population Census produced by Redes da Maré, a collaborating civil society organisation based within Maré [24]. Over the past 25 years, Redes da Maré has collaborated with academic partners and initiated a range of support activities in the territory [23]. An inverse sampling procedure was applied to the Address Register, selecting the addresses to be visited, stratified by the geographical location in the three territories controlled by different gangs. However, addresses in the favelas are often not fixed and change frequently without regulation. If a selected address did not exist anymore, was not accessible, or had no permanent resident, a further address was selected. The residents to be interviewed in each household were selected by simple random sampling. If the selected person was absent, the household received up to two extra visits at different days and times to obtain the interview. If the selected resident could not be interviewed, interviewers continued with the next address in the random order of visits. The methodology has been detailed further in a published study protocol [25].

### 2.4. Participants

Participants were included if they were over 17 years of age and provided written informed consent. Excluded were people

who lacked capacity to consent, refused or withdrew consent, or had severe cognitive impairments impeding valid responses to the study instruments.

## 2.5. Measures and instruments

### 2.5.1. Sociodemographic data

Prior literature has documented mental health outcomes to be related to a range of different sociodemographic variables, including: age [26; gender 27]; marital status and living situation [28,29]; level of education [30]; ethnicity [31]; employment status [32]; household income, [33] with a monthly household income of less than the equivalent of US\$223 (exchange rate in February 2020) regarded as marked poverty; household size [34]; migration status [35]; and religious practice [36]. For this reason, we collected information regarding these variables using a structured questionnaire in order to account for their potential confounding effects.

### 2.5.2. Experience and fear of violence

Individuals' experiences of violence in the past 12 months and current fear of violence were assessed using a questionnaire which we specifically developed to capture the neighbourhood violence in favelas. It was based on two different sources: (1) data from the Bulletin “The Right to Public Security in Maré [23] and (2) questions from the Addiction Severity Index [37]. Questions were selected and modified in consultation with residents, social workers, and researchers in Maré, and finalised after 20 pilot interviews.

Five questions assessed the personal experience of neighbourhood violence, including witnessing people being beaten, assaulted, shot and killed, and having someone close shot or killed. The questions asked how many times in the last year the interviewee: 1) had had their house invaded by criminals or police; 2) had been caught in a crossfire; 3) had seen someone being beaten or assaulted; 4) had seen someone being shot or killed; and 5) had experienced someone close being killed or shot. The frequency of each experience was rated between 0 (never) and six (five or more times). Cronbach's alpha for the five questions was 0.636.

Fear of violence was assessed using nine questions that asked how often interviewees were afraid of: 1) being hit by a stray bullet; 2) someone close being hit by a stray bullet; 3) suffering physical or verbal aggression; 4) someone close suffering physical or verbal aggression; 5) economic loss or losing a job due to a violent situation; 6) being forced to engage in illegal activities; 7) someone close being forced to engage in illegal activities; 8) speaking about what you think or feel; and 9) going out. The participants were asked to respond on a 5-point Likert-type scale which ranged from 0 (never) to 4 (always). Cronbach's alpha for the 9 items was 0.863.

### 2.5.3. Mental Health Symptoms and Quality of Life

Our outcomes included the assessment of mental health symptoms and quality of life. The level of mental health symptoms was assessed by the Global Severity Index (GSI) which reflects the mean of 53 self-rated items on the Brief Symptom Inventory (BSI) [38,39]. Respondents were asked to rate to what extent they were distressed by a range of different mental health-related symptoms within the last 7 days on a scale from 0 (not at all) to 4 (extremely distressed).

Participants rated their quality of life on the Manchester Short Assessment of Quality of Life (MANSA) [40]. The MANSA includes 12 questions about satisfaction with different life domains, rated from 1 (extremely dissatisfied) to 7 (extremely satisfied). The mean score is used as measure of subjective quality of life.

## 2.6. Procedures

All interviewers were selected from informal settlements in Rio de Janeiro, had previous experience of working in Maré, and were trained in administering the questionnaires. Interviews were organised by local residents working for Redes da Maré.

Once researchers had randomly selected an interviewee, they explained the purpose and content of the study, and obtained written informed consent. Interviews were carried out at the participants' homes, ensuring a place with privacy as far as possible. Data were collected directly on portable electronic devices. The study was approved by the Brazilian National Commission for Research Ethics (CAAE: 01944918.2.0000.5263).

## 2.7. Analysis

Descriptive statistics in a form of means and standard deviations or proportions were used to present all assessed data.

In further analyses, sociodemographic characteristics as well as the experience and fear of violence were regarded as predictor variables, with mental distress and quality of life as outcome variables. To show the actual differences in outcomes for different scores of predictor variables, we first presented mean scores of outcomes for categorical predictors and Pearson's  $r$  for continuous predictors.

We then fitted univariate regression models (Table 2). We were interested in the main effects of experience and fear of neighbourhood violence. To ensure that the effects were robust to confounding effects of sociodemographic variables, we fitted two multivariate regression models in which only predictor variables with relevant univariate associations (with  $p < 0.10$ ) were included.

Potential multicollinearity between predictor variables was assessed using the variance inflation factor statistics (VIF). No variable had a VIF value greater than 2.

For the analyses, we used IBM SPSS software, version 20, and the toolboxes 'Descriptive Statistics', 'General Linear Model', 'Regression' and 'Scale'.

## 2.8. Role of the Funding Source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

## 3. Results

### 3.1. Sample Characteristics

Through inverse sampling, a total of 3,136 addresses were selected from the census data. Of them, 1,497 addresses were non-existent, not accessible, not residential, or unoccupied. In 14 households no adult present met the inclusion criteria; 169 households refused to participate. In 213 households the selected interviewee was absent on all visits, and in 32 households the selected interviewee refused participation. In total, 1,211 participants were interviewed, which is a response rate of 73.9% of potential interviewees in households that could be identified and accessed with at least one resident. On average, 2.9 (SD=1.4) residents lived in each household. The characteristics of the sample are shown in Table 1.

About 50% of interviewees lived without a partner, 46.2% had not completed elementary school education, 44.1% were without employment, and 35.6% lived in a household with a total monthly income equivalent to about US\$223 or less, reflecting marked poverty.

### 3.2. Experience and fear of violence

Experiences and fear of violence are shown in Tables 2 and 3.

**Table 1**  
Sociodemographic profile of participants interviewed in the Household Survey

Age (Mean, SD)	43.7	17.0
Gender (N, %)		
Female	743	61.4
Male	468	38.6
Ethnicity (N, %)		
White	382	31.9
Black and Non-white	814	68.1
Education (N, %)		
Less than Elementary School	558	46.2
Complete Elementary School	650	53.8
Work situation (N, %)		
Unemployed	534	44.1
Employed	676	56.9
Household income (N, %)		
Up to US\$232 monthly	396	35.6
More than US\$223 monthly	716	64.4
Living with partner (N, %)		
Yes	601	49.6
No	610	50.4
Household Size (Mean, SD)	3.0	1.5
Born in Maré (N, %)		
Yes	407	33.6
No	804	66.4
Religious practice (N, %)		
Yes	890	73.7
No	318	26.3

N = 1,211

The mean score for the questionnaire assessing the experiences of violence was 2.65 (SD=4.15). During the past 12 months, a substantial number of interviewees had experienced different types of violence at least once: 33.6% were caught in crossfire; 21.1% experienced someone close being shot or killed; 19.8% saw someone being beaten or assaulted; 14.2% saw someone being shot or killed, and 11.5% had their house invaded by criminals or police.

Regarding fear of violence, the mean score for the questionnaire was 15.21 (SD=9.99). At least to some extent, i.e. between rarely and always, 78.7% feared getting hit by a stray bullet; 83.3% that someone close would get hit by a stray bullet; 50.4% suffering physical or verbal aggression; 63.0% that someone close would suffer physical or verbal aggression; 49.4% economic loss or losing their job due to some violent situation; 32.8% being forced to engage in illegal activities; 53.3% that someone close would be forced to engage in illegal activities; 50.7% feared speaking about their thoughts and feelings; and 32.1% feared going out.

### 3.3. Outcomes: Mental health symptoms and quality of life

The mean score for mental health symptoms as assessed by the GSI was 0.597 (SD= 0.525) and subjective quality of life on the MANSA was 4.71 (SD=0.82). The internal consistency (Cronbach's alpha) were 0.945 for the BSI and 0.742 for the MANSA. GSI and MANSA were negatively correlated (Pearson's  $r = -0.371$ ).

#### 3.3.1. Predictor models

**3.3.1.1. Mental Health Symptoms.** The univariate and multivariate models predicting mental health symptoms are shown in Table 4.

In univariate analyses, being younger, female, unemployed, migrant to Maré, having experienced and fearing neighbourhood violence, living within a larger household, living without a partner, and having lower income were each separately significantly linked with higher symptom levels.

In the multivariate model, being younger, female, unemployed, having experienced and fearing neighbourhood violence, and having a lower income were all significantly associated with higher

**Table 2**  
The frequency of violence-related experiences reported by participants in the last 12 months

Type of violence experienced	Number of times participants reported experiencing violence in the last 12 months N (%)						
	NEVER	ONE	TWO	THREE	FOUR	FIVE	FIVE OR MORE
House invasion by criminals or the police force (N=1,203)	1065(87.9)	69(5.7)	38(3.1)	7(0.6)	7(0.6)	6(0.5)	11(0.9)
Being caught in the crossfire of a shooting (N=1,202)	797(65.8)	111(9.2)	85(7.0)	66(5.5)	30(2.5)	45(3.7)	68(5.6)
Seeing someone being beaten or assaulted (N=1,196)	959(79.2)	87(7.2)	48(4.0)	33(2.7)	14(1.2)	25(2.1)	30(2.5)
Seeing someone being shot, killed, or murdered (N=1,197)	1027(84.8)	79(6.5)	37(3.1)	21(1.7)	3(0.2)	14(1.2)	16(1.3)
Someone close being shot or killed (N=1,199)	946(78.1)	132(10.9)	31(2.6)	29(2.4)	10(0.8)	23(1.9)	28(2.3)

**Table 3**  
The frequency of fear related to violence reported by the participants in the last 12 months

Situations in Maré reported as reasons for fear	Number of times participants reported experiencing fear related to violence in the last 12 months				
	Never N(%)	Rarely N(%)	A few times N(%)	Often N(%)	Always N(%)
Feeling afraid of being hit by a stray bullet (N=1201)	248(20.5)	102(8.4)	163(13.5)	141(11.6)	547(45.2)
Feeling afraid that someone close will get hit by a stray bullet (N=1194)	185(15.3)	72(5.9)	153(12.6)	169(14.0)	615(50.8)
Feeling afraid of suffering physical or verbal aggression (N=1199)	588(48.6)	99(8.2)	132(10.9)	78(6.4)	302(24.9)
Feeling afraid that someone close will suffer physical or verbal aggression (N=1199)	427(35.3)	88(7.3)	153(12.6)	140(11.6)	382(31.5)
Experiencing an economic or material loss due to a violent situation (N =1195)	597(49.3)	68(5.6)	146(12.1)	119(9.8)	265(21.9)
Having to engage in illegal activities (N=1191)	793(65.5)	57(4.7)	80(6.6)	68(5.6)	193(15.9)
Feeling afraid that someone close to you will be forced to engage in illegal activities (N=1184)	540(44.6)	71(5.9)	128(10.6)	128(10.6)	317(26.2)
Feeling afraid to speak about what you think or feel (N=1193)	578(47.7)	67(5.5)	182(15.0)	124(10.2)	242(20.0)
Feeling afraid to go outside (N=1196)	807(66.6)	73(6.0)	168(13.9)	58(4.8)	90(7.4)

**Table 4**  
Bivariate analyses, univariable and multivariable regressions for Mental Health (GSI/BSI)

	Bivariate analysis			Univariable Regressions			Multivariable Regression <sup>b</sup>				
	Statistics	n		Coef.	95% CI	p-value	Coef.	95% CI	p-value		
Age (Pearson's r, n)	-0.218	1,193		-0.007	-0.009	-0.005	<0.0001	-0.006	-0.008	-0.004	<0.0001
Gender (Mean, SD, n)											
Female	0.68	0.55	735	0 <sup>a</sup>				0 <sup>a</sup>			
Male	0.46	0.44	458	-0.226	-0.286	-0.166	<0.0001	-0.183	-0.244	-0.122	<0.0001
Ethnicity (Mean, SD, n)											
White	0.60	0.53	374	0 <sup>a</sup>							
Black and Non-white	0.60	0.53	805	0.004	-0.061	0.069	0.903				
Education (Mean, SD, n)											
Less than Primary School	0.57	0.50	545	0 <sup>a</sup>				0 <sup>a</sup>			
Complete Primary School	0.62	0.54	645	0.058	-0.002	0.118	0.059	-0.031	-0.099	0.037	0.38
Work situation (Mean, SD, n)											
Unemployed	0.66	0.56	524	0 <sup>a</sup>				0 <sup>a</sup>			
Employed	0.55	0.49	668	-0.114	-0.174	-0.055	0.00018	-0.066	-0.128	-0.003	0.040
Household income (Mean, SD, n)											
Up to US\$232 monthly	0.70	0.58	390	0 <sup>a</sup>				0 <sup>a</sup>			
More than US\$223 monthly	0.53	0.48	706	-0.167	-0.232	-0.103	<0.0001	-0.105	-0.173	-0.037	0.0025
Living with partner (Mean, SD, n)											
Yes	0.55	0.50	594	-0.089	-0.149	-0.030	0.0033	-0.048	-0.111	0.014	0.13
No	0.64	0.55	599	0 <sup>a</sup>				0 <sup>a</sup>			
Household Size (Pearson's r, n)	0.090		1,191	0.033	0.012	0.054	0.0018	0.003	-0.021	0.027	0.79
Born in Maré											
Yes	0.65	0.54	403	0.076	0.013	0.139	0.017	-0.024	-0.088	0.041	0.47
No	0.57	0.52	790	0 <sup>a</sup>				0 <sup>a</sup>			
Religious practice (Mean, SD, n)											
Yes	0.60	0.53	876	0.017	-0.051	0.085	0.62				
No	0.58	0.52	315	0 <sup>a</sup>							
Experience of violence (Pearson's r, n)	0.210		1,186	0.027	0.020	0.034	<0.0001	0.019	0.011	0.026	<0.0001
Fear of violence (Pearson's r, n)	0.262		1,189	0.014	0.011	0.017	<0.0001	0.081	0.053	0.108	<0.0001

a. This parameter is set to zero because it is redundant. b. Model fitted to 1.004 observations.

symptom scores. Both experience and fear of neighbourhood violence remained being highly significant predictors after adjusting for the effect of sociodemographic variables.

In a post-hoc sensitivity analysis, we explored whether the predictive model would change when repeated with only participants who did not display symptoms above a clinical threshold. Out of

the whole sample, 63 participants had GSI scores of 1.65 or higher, which is the suggested cut-off point for clinical relevance [41]. When those participants were excluded, the model was largely unaltered with all statistically significant predictor variables remaining significant and a slightly higher overall explained variance (Supplementary table 1).

**Table 5**  
Bivariate analysis and Univariable and Multivariable regressions SQOL- MANSÁ

	Bivariate analysis			Univariable Regressions				Multivariable Regression <sup>b</sup>			
			N	Coef.	95% CI		p-value	Coef.	95% CI		p-value
Age (Pearson's r, n)	0.149		1,197	0.007	0.004	0.010	<0.0001	0.003	-0.001	0.006	0.12
Gender (Mean, SD, n)											
Female	4.61	0.81	735	0 <sup>a</sup>				0 <sup>a</sup>			
Male	4.88	0.81	462	0.263	0.168	0.357	<0.0001	0.190	0.092	0.288	0.00015
Ethnicity (Mean, SD, n)											
White	4.72	0.83	376	0 <sup>a</sup>							
Black and Non-white	4.71	0.82	806	-0.014	-0.114	0.087	0.79				
Education (Mean, SD, n)											
Less than Primary School	4.82	0.88	548	0 <sup>a</sup>				0 <sup>a</sup>			
Complete Primary School	4.63	0.75	646	-0.184	-0.276	-0.091	0.00011	-0.131	-0.240	-0.022	0.018
Work situation (Mean, SD, n)											
Unemployed	4.64	0.84	529	0 <sup>a</sup>				0 <sup>a</sup>			
Employed	4.78	0.80	667	0.142	0.049	0.235	0.0029	0.050	-0.051	0.150	0.33
Household income (Mean, SD, n)											
Up to US\$223 monthly	4.52	0.86	394	0 <sup>a</sup>				0 <sup>a</sup>			
More than US\$223 monthly	4.83	0.78	706	0.302	0.203	0.402	<0.0001	0.261	0.152	0.370	<0.0001
Living with partner (Mean, SD, n)											
Yes	4.80	0.78	594	0.172	0.080	0.265	0.00027	0.116	0.016	0.217	0.023
No	4.63	0.85	603	0 <sup>a</sup>				0 <sup>a</sup>			
Household Size (Pearson's r, n)	-0.069		1,195	-0.040	-0.072	-0.007	0.016	-0.027	-0.065	0.011	0.17
Born in Maré											
Yes	4.63	0.87	405	-0.128	-0.226	-0.029	0.0108	-0.031	-0.135	0.073	0.55
No	4.76	0.79	792	0 <sup>a</sup>				0 <sup>a</sup>			
Religious practice (Mean, SD, n)											
Yes	4.73	0.84	878	0.037	-0.068	0.143	0.49				
No	4.69	0.77	317	0 <sup>a</sup>							
Exposure of violence (Pearson's r, n)	-0.129		1,193	-0.026	-0.037	-0.014	<0.0001	-0.016	-0.027	-0.004	0.0085
Fear of violence (Pearson's r, n)	-0.229		1,196	-0.019	-0.023	-0.014	<0.0001	-0.120	-0.165	-0.076	<0.0001

This parameter is set to zero because it is redundant. b. Model fitted to 1.004 observation

3.3.1.2. *Quality of Life.* The univariate and multivariate models predicting quality of life are presented in Table 5.

After adjusting for the influence of sociodemographic variables in multivariate analyses, the coefficients on experience and fear of violence both remained significant. In addition, being female, educated to less than primary school level, having low income, and living without a partner were also associated with poorer quality of life.

In a further post-hoc analysis we tested interaction effects of experiences of violence and fear of violence in predicting the two dependent variables. None of these effects were statistically significant.

## 4. Discussion

### 4.1. Main findings

This is the first large representative mental health survey in a group of favelas in Brazil, a typical example of informal settlements in LMICs with high levels of violence and poverty, and shows that people with more personal experience and fear of violence have higher levels of mental health symptoms and poorer quality of life. The associations are independent of and in addition to the influence of sociodemographic characteristics, marked poverty in particular, which also predict less favourable outcomes. The results suggest that, even within a context in which the whole population can be exposed to violence and economic disadvantage, individual variations in experiences of violence still make a significant difference to mental distress and quality of life.

### 4.2. Strengths and Limitations

To our knowledge, this is one of the first studies to explore the associations between the experiences of neighbourhood violence

and mental distress in the context of informal urban settlements. The study consisted of a large sample size and the response rate of 73.9% personally interviewed residents is good, particularly given the challenging context. We used established and well-validated methods for assessing mental health symptoms and quality of life [38,40] and developed questions for measuring experiences and fear of violence in collaboration with local stakeholders to ensure relevance to the context. The data were collected by trained and supervised researchers who had lived or worked in favelas before, which made it possible to conduct individual interviews locally and to complete the study despite repeated interruptions due to violence during police actions. Moreover, the current study explored both direct and indirect experiences of neighbourhood violence and its association with mental health symptoms, providing a more comprehensive understanding of the topic. Finally, sensitivity analysis excluding participants with clinically relevant symptom levels showed that the identified associations were not driven by a relatively small proportion of participants with high symptom scores.

However, the study also has some limitations. First, there was no objective documentation of the violence that interviewees had actually experienced. All data were based on self-reports which can be influenced by memory and response biases. Second, whilst the response rate in identified households with at least one resident was good, a large number of households were reported as not accessible: if some of those households actually still existed and had residents, this would lower the response rate. Third, there was a bias in the availability of selected people for the interviews. As a result, there is a higher percentage of women in our sample (61.4%) than in the census data (51.3%), and the sample, although randomly selected, may not be fully representative in other characteristics either. Finally, the study was conducted in a large group of favelas in Rio de Janeiro. Throughout the world, informal settlements are extremely heterogeneous and levels of violence may

vary. Thus, caution should be used when generalising the results of the current study to other communities [3].

#### 4.3. Comparison with the literature

The characteristics of the interviewees in this survey are similar to those found in a recent census of the same favelas. Experiences of violence were frequent. For instance, more than one third of the participants reported having been caught in the crossfire of a shooting, almost one fifth had seen someone being beaten, and the same proportion witnessed someone close being killed or shot. This frequency of experiences of violence appears to be much higher than in the general population in Brazil [42], but similar to levels documented by other studies investigating violence in the context of poverty [43]. These high levels of violence, comparable to our findings, were also associated with fear, anxiety, sadness, anger, insecurity, and other kinds of mental distress [43,44]. Personal experiences and fear of violence were associated, but the correlation was weak, and both experiences and fear independently predicted higher levels of mental health symptoms and poorer quality of life. Furthermore, they are worth assessing as separate relevant factors for mental distress in research and possibly clinical practice.

In addition to personal experiences and fear of violence, several sociodemographic characteristics were identified as predictors of higher levels of mental health symptoms and poorer quality of life. The results such as the higher levels of mental distress are largely in line with previous research [45]. Marked poverty, living without a partner, and unemployment have been shown to be linked with more mental health symptoms and worse quality of life [28,29,32,46], whilst findings on gender differences in quality of life and the influence of age on mental distress and quality of life have been inconsistent [27,47–51].

The main finding of the current study showed that people with more personal experience and fear of violence have higher levels of mental distress and poorer quality of life even after controlling for a range of sociodemographic variables, including poverty. These findings add to the evidence of other population-based studies from LMICs on violence and mental health. For instance, Al-loush and Bloem [17] reported that levels of perceived neighbourhood violence in South Africa were strongly associated with depressive symptoms as well as an increased risk of developing depression. Additionally, other loosely similar studies have also documented associations between exposure to violence and the prevalence of mental health disorders [18,19,21,22,44]. However, these studies did not primarily focus on people living in informal settlements in which neighbourhood violence may differ from other contexts or explore individual-level experiences of community violence.

The findings are similar to results from studies in high-income countries showing a link between neighbourhood violence and poorer mental health [4,52–56]. Some of these studies suggested that experiences of neighbourhood violence at an individual level are more important for mental health outcomes than official crime rates which do not seem to have much impact [52,53]. However, the above studies were conducted in a context that is very different from the informal settlement that our study focused on.

Living in an informal settlement like the favelas with high overall levels of neighbourhood violence does not seem to lead to an overall adjustment or habituation to increased violence, or to a situation where generalised fears make individual differences in experiences irrelevant. Indeed, differences in experiences of violence in informal settlements demonstrate an association with mental distress and quality of life similar to that reported in other contexts. Personal experience of more neighbourhood violence seems to increase mental health symptoms, even if the general level of

violence is already high. At the same time, only 63 participants (5.3%) showed symptoms above a clinically relevant level which may point towards an overall high resilience in this population.

#### 4.4. Implications

The results of the current study may be of interest to policy makers or governments with rapidly urbanising areas and informal settlements, particularly in LMICs which may not have the economic means to relocate those living in informal settlements. The findings demonstrate that policies to improve mental health and quality of life of residents in informal settlements need to separately address multiple risk factors. Although poverty and violence are interrelated, the impact of the experience of violence seems to be separate from and add to the impact of marked poverty. Therefore, different strategies and policies may be required to address these factors in informal settlements.

For clinical practice, it might be important to know that mental health symptoms are not just driven by the overall violence level of a residential area and the threat of violence experienced by all residents in an informal settlement, but that individual differences still matter, and that fear of violence is not fully explained by personal experiences.

The study also demonstrates that collaborations with organisations based within informal settlements make it possible to conduct large surveys which entail individual interviews about sensitive topics such as personal experiences of violence and mental health. Future research should explore the link between the experiences of neighbourhood violence and mental distress from a longitudinal perspective and develop and test strategies to reduce violence as well as strengthen the resilience of the population experiencing violence.

#### 4.5. Conclusion

Neighbourhood violence is a serious social issue which affects a large proportion of the population worldwide, particularly people living in informal settlements. Individual differences in experiences and fears of violence are linked with mental health symptoms and quality of life of residents in a conglomerate of favelas in Brazil – a typical example of informal settlements where levels of neighbourhood violence are high. The impact of violence on mental health and quality of life is in addition to the influence of other factors, in particular, marked poverty.

#### Contributors

MSC, ESS, DMG, PH and SP designed the study. PH generated the grant that funded the study. MSC, ESS, MKA, LV, DMG and PH were in charge of the study implementation, data collection and researcher supervision. ESS, MKA, LV, DMG and PH established and maintained the collaboration with Redes da Maré. DMG and SP guided the methodological and analytical approach. ED conducted all statistical analyses. MSC, ZJ and SP drafted the first version of the manuscript and conducted the literature review for the background; all of the authors contributed towards further revisions of the manuscript by ZJ and SP, and approved the final version of it.

#### Data Sharing Statement

Data will be made available upon a reasonable request from the authors.

#### Declaration of interests

The authors have no conflicts of interest to disclose.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.lana.2021.100067.

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