Associations between the Bolsa Familia conditional cash transfer programme and substance use disorder hospitalisations: a quasi-experimental study of the 100 Million Brazilian Cohort

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Summary

Background Although low socioeconomic status is a recognised risk factor for substance use disorders (SUDs), the potential of socioeconomic interventions, such as conditional cash transfer programmes, to mitigate this burden remains poorly explored. Our study investigated whether the Brazilian conditional cash transfer, the Bolsa Familia Program (BFP) was associated with reduced SUD hospitalisations (ie, both admission to and treatment within hospital).

Methods This quasi-experimental study used national administrative hospitalisation and BFP payroll records linked to the 100 Million Brazilian Cohort baseline from 2008 to 2015. We used Poisson regression models with inverse probability of treatment weighting, using the propensity score, to evaluate the association of the BFP with SUD hospitalisations.

Findings The study included 35 926 326 individuals registered at baseline from 2008 to 2015. BFP benefit was associated with a lower risk of SUD hospitalisations overall (incidence rate ratios [IRR] 0·83, 95% CI 0·81–0·85). BFP benefit was also associated with both a lower risk of alcohol-related hospitalisations (0·74, 0·71–0·77) and a lower risk of hospitalisations due to other substances except alcohol (0·89, 0·86–0·92). Both male and female beneficiaries had a lower risk of SUD hospitalisation compared with non-beneficiaries. We observed an increased gradient of protection against SUD hospitalisations among beneficiaries of the BFP as municipal deprivation increased. The reduction was 10% (IRR 0·90, 0·87–0·92) in less deprived municipalities and 41% (0·59, 0·49–0·71) in highly deprived municipalities.

Interpretation Receiving BFP benefit was associated with lower risk of SUD hospitalisation, implicating conditional cash transfers as a potential tool to respond to SUD-related issues in individuals experiencing poverty. This protective association could be mediated by alleviating poverty, fulfilling basic needs, improving socioeconomic status, enhancing health access, and promoting education.

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See **Comment** page e385

For the Portuguese translation of the abstract see **Online** for appendix 1

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Introduction

Substance use disorders (SUDs) cause a large worldwide morbidity and mortality burden, which has been increasing over the past decade.[1] In concordance with global trends, Brazil bears a high SUD burden, which poses challenges to the country's health system. In 2015, 2·3 million individuals between the ages of 12 years and 65 years met the Diagnostic and Statistical Manual of Mental Disorders criteria for alcohol dependence in the country, accounting for 1·5% of the general population.[2] Furthermore, 1·2 million individuals between the ages of 12 years and 65 years met the criteria for other substance dependencies (excluding alcohol and tobacco), constituting 0·8% of the general population.[2] Amid the various risk factors associated with SUDs—including individual, family, and environmental factors—low socioeconomic status, measured by low education level, low household income, poor housing conditions (eg, a lack of electricity and water supply), and area-based deprivation—have been described as risk factors for SUD development and exacerbation in high-income, middle-income, and low-income countries.[3,4] Despite this association, the potential of socioeconomic interventions, such as conditional cash transfer programmes to mitigate the SUD burden, remains poorly explored.

To the best of our knowledge, only three studies have examined the association between conditional cash transfers and SUD reduction, all of which have focused on specific populations. Two of these studies were on programmes based on narrow geographical ranges and young people: the You Puedo programme in

Research in context

Evidence before this study

In order to comprehensively assess the existing body of evidence on the association of conditional cash transfer programmes and substance use disorders (SUDs), encompassing aspects such as hospitalisation rates, we searched MEDLINE, PubMed, Scopus, Web of Science, Embase, APA PsycINFO, and Google Scholar, using the following terms: "cash transfer", "social protection", "conditional cash transfer programs", "poverty-alleviation", "income hardship", "poverty", "low socioeconomic status", "hospitalization", "psychiatric hospitalization", "inpatients", "psychiatric inpatient bed", "drug misuse", "drug dependence", "substance related disorder", "illicit drugs", and "drug overdose" from Jan 1, 2013, to June 30, 2023. 693 records were identified; however, only three studies specifically evaluated the association between conditional cash transfer and SUDs. These studies assessed conditional cash transfer programmes implemented within specific groups (ie, young people aged ≤21 years, and rural populations) at the local level (ie, two US cities and rural Mexico). The studies with young people were linked to cognitive rewards, based on the achievement of specific goals. All the studies showcased diminished self-reported substance use in the intervention group, compared with the control group. None of these studies accessed hospitalisation data or investigated the impact of the conditional cash transfer on individuals living in deprived areas.

Added value of this study

In contrast to previous investigations, we analysed a nationwide, population-based dataset that included more than 35 million individuals aged 5 years or older, over an 8-year period, resulting in—to our knowledge—the first large study evaluating the association between a conditional cash transfer programme and SUD hospitalisations worldwide. This study further advances knowledge in the field by investigating the association between a conditional cash transfer programme and SUD hospitalisations, including by SUD type, sex of the individual, and their municipal deprivation index. We identified that the Bolsa Familia Program (BFP) reduced SUD hospitalisation rates among its beneficiaries by 17%. The BFP was associated with lower hospitalisation rates, regardless of the SUD type, sex of the individual, or deprivation area index. An increased gradient of protection against SUD hospitalisations among beneficiaries of the BFP was observed as the municipal deprivation index increased. For instance, the reduction in SUD hospitalisations among beneficiaries of the BFP was 10% in municipalities with lower levels of deprivation and 41% in municipalities with high deprivation.

Implications of all the available evidence

Through its association of curbing SUD hospitalisation rates, the BFP not only enhances the wellbeing of its beneficiaries by preventing aggravation of their SUD, but also contributes to the alleviation of high-cost, preventable hospital admissions, thereby benefiting the overall health system. The BFP showed its major importance to priority groups for substance use prevention, such as individuals living in the most deprived contexts, highlighting substantial mediation in the reduction of health and social inequalities.

See Online for appendix 2

San Francisco (CA, USA), and a Family Rewards programme in New York City (NY, USA).[5,6] These programmes targeted young individuals and were built, for instance, on behavioural economic principles, with cash incentives contingent on health and educational achievements.[5,6] Both studies found decreased self-reported substance use associated with the programmes.[5,6] The only study from a low income to middle-income country was on Mexico's Oportunidades programme, focusing on specific rural populations.[7] Oportunidades transfers cash to families on low incomes, also conditionally on health and school attendance. None of these studies were population-based or accessed real-world hospitalisation (ie, admittance to and treatment within hospital) data. In Brazil, the Bolsa Familia Program (BFP) has been associated with reduced communicable and non-communicable diseases, including mental health-related outcomes, such as suicide.[8] Mental disorders, including SUDs, are well known to be socioeconomically patterned conditions, with low socioeconomic status playing a major role in mental health deterioration.[3,4,9] We hypothesised that among individuals on low incomes, the BFP would also emerge as a protective factor against SUD hospitalisation by improving beneficiaries' socioeconomic status through cash transfers (appendix 2 p 6). Additionally, we hypothesised that, since the BFP improves human capital through health and school attendance conditionalities, it could play a role in protecting beneficiaries from SUD hospitalisation. We theorised this because low education, as one of the measures of low socioeconomic status, is a well known risk factor for SUDs and people who use substances often face barriers to health care.[3,4,10] The BFP conditionalities act to enhance both factors (appendix 2 p 6). Despite these considerations, the association between the BFP and SUD hospitalisation remains unexplored. To our knowledge, this is the first time a large dataset (including hospitalisation records) has been used to test the hypothesis of whether the BFP is associated with a decrease in SUD hospitalisation rates, encompassing both alcohol and other substances; exploring sex differential associations; and investigating differential associations in deprived areas.

Methods

Study design and dataset source

This was a nationwide, population-based, quasi-experimental study in the 100 Million Brazilian Cohort.[11] The 100 Million Brazilian Cohort is a de-identified dataset

containing information on more than 100 million Brazilians, linking social and health-related administrative records.[11] For this study, the National Hospitalization Information System and BFP payroll database were linked to the Unified Social Program Registry (CadÚnico), which serves as the baseline for the 100 Million Brazilian Cohort.[11] The CadÚnico is a Brazilian Government system used to identify and register families on low incomes to grant various social benefits, such as Bolsa Familia.[11] The National Hospitalization Information System covers hospital admissions for 70% of Brazil's population under the Brazilian unified health system.[12] The BFP payroll database contains information on individuals registered on the BFP. The Centre for Data and Knowledge Integration for Health (CIDACS) links and stores these datasets, in accordance with Brazilian data protection laws and ethical regulations.[13] Detailed information on the linkage process has been published elsewhere and in appendix 2 (p 4).[13] The study protocol for investigating the BFP and its association with mental health outcomes has also been documented elsewhere.[14] We report this study according to the STROBE guidelines. We analysed data from individuals aged 5 years[14] or older, enrolled on the 100 Million Brazilian Cohort between Jan 1, 2008, and Dec 31, 2015 (figure). The Federal University of Bahia Institutional Ethics Review Board approved this study (CAAE 41695415.0.0000.5030).

Variables

The BFP is a conditional cash transfer programme within the Brazilian social protection system and it has three axes:[15] (1) immediate cash transfers to alleviate poverty; (2) health and education conditionalities to continue receiving the income subsidy. For example, children aged 4–6 years must be enrolled in school and maintain a minimum 60% attendance record, whereas those aged 6–18 years must attend at least 75% of the time. Health-related conditionalities include attending health check-ups, staying up to date with vaccinations, monitoring prenatal care, and children's nutritional status; and (3) complementary actions to support adults' inclusion in the labour market. Detailed information about the programme is provided in appendix 2 (p 4). For this study, we used the same definition of BFP exposure used by Machado and colleagues.[8] We considered beneficiaries of the BFP as those who received the income subsidy within 6 months of their registration date on the cohort baseline. Non-beneficiaries were individuals who did not obtain benefit from the BFP within 6 months of enrolment or those who had never received the benefit.[8]

The primary outcomes were SUD hospitalisations, registered on the National Hospitalization Information System. SUDs were recorded as the primary cause of hospitalisation, according to the ICD-10 codes F10–19, which refers to mental and behavioural disorders due to psychoactive substance use.

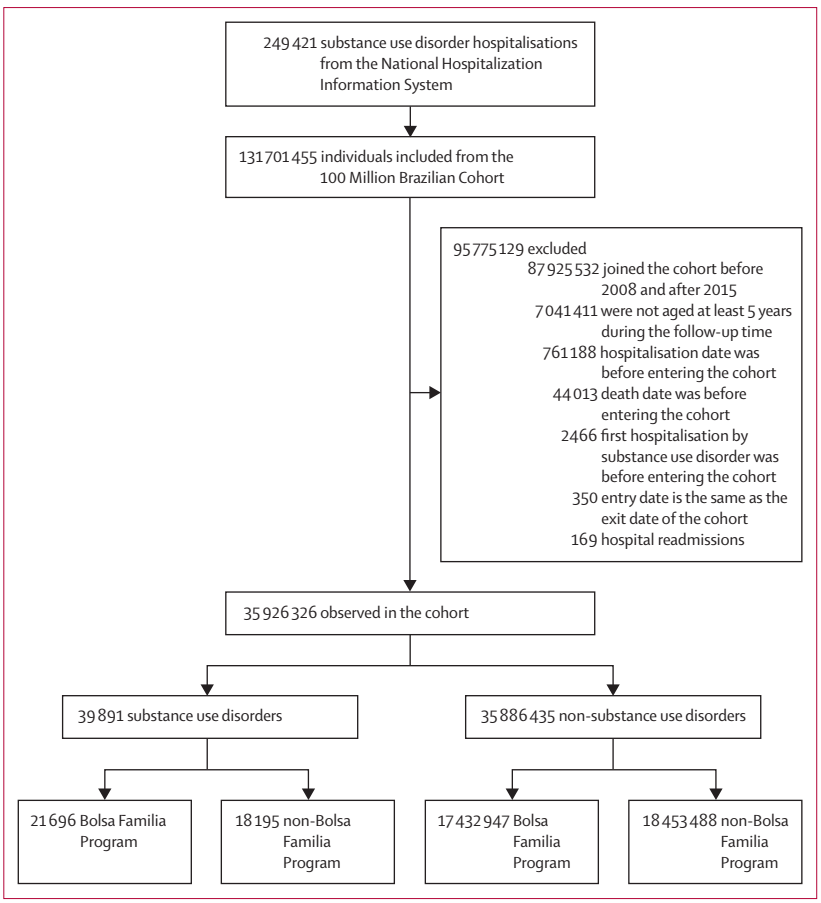

Figure: **Flowchart of the study population**

Baseline covariates included: age (ie, child [aged 5–12 years], adolescent [13–18 years], young adult [19–24 years], adult [aged 25–64 years], and older adults [aged ≥65 years]; age group definitions follow the National Institutes of Health and the National Library of Medicine);[16] sex (ie, male or female); education level (ie, have never attended school, have attended preschool, primary school, junior high school, high school, or college or university); unemployed (ie, yes or no); and area of residence (ie, urban or rural). We also included a composite variable that included information on poor housing conditions, such as adequate water supply, sanitation, electricity, housing materials, and waste disposal. The variable scores range from 0 to 5, where 0 indicates that none of these essential services are present, and 5 indicates they are all present.

The Brazilian Deprivation Index, developed by CIDACS (IBP-CIDACS) was included in the stratified analysis. IBP-CIDACS is an index that informs levels of material deprivation and socioeconomic status in a geographical area.[17] Using data from the 2010 Brazilian Population Census, this index combines the Z scores of three variables: the percentage of households with a per-capita income of

half the monthly minimum wage; the percentage of people aged 7 years and over who are illiterate; and the average percentage of people with inadequate access to water, sewage, waste collection, and no toilet or shower.[17] For this study, we considered the IBP-CIDACS at the municipal level, and categorised the Z scores into three categories: low (from 0 to 33·34), medium (from 33·35 to 66·67), and high deprivation (from 66·68 to 100).

Follow-up

For non-beneficiaries of the BFP, follow-up began on the CadÚnico registration date, or the 5-year anniversary, if registered on CadÚnico at younger than 5 years. The follow-up ended when any of the following reasons for censorship occurred: the individual's death by any cause; the individual became a beneficiary of the BFP; SUD hospitalisation occurred; or on Dec 31, 2015. For beneficiaries of the BFP, follow-up started once they began receiving benefit from the BFP (within 6 months of registration) and ended when any of the following reasons for censorship occurred: the individual's death by any cause; the individual stopped receiving benefit from the BFP; SUD hospitalisation occurred; or on Dec 31, 2015. The individual's person-year contribution was determined by subtracting the start date from the end of the follow-up period, expressed in years.

Statistical analysis

We ran a descriptive analysis of the original cohort's baseline characteristics, considering the categorical covariate absolute and relative frequencies, and continuous covariate mean and SD. The baseline characteristic imbalance between beneficiaries and non-beneficiaries of the BFP was evaluated using the standardised mean difference. In this analysis, standardised mean difference values equal to, or greater than, 0·2 were regarded as indicative of medium to large differences between the two groups.[18] The probability of receiving benefit from the BFP was estimated using the propensity score calculated from logistic regression, given the baseline socioeconomic and demographic characteristics: sex, age, education, unemployment status, area of residence, housing conditions, and cohort entry year. To estimate the probability of individuals receiving benefit from the BFP each month since the start of the follow-up, the final assigned weight was calculated by multiplying the cumulative weights over time—ie, we multiplied the weight in month t by 1 in the month t–1. Beneficiaries received weights equal to 1 and non-beneficiaries received weights equal to (1/ [1 – propensity score]). The propensity score associated with inverse probability of treatment weighting methods promotes the balance of baseline characteristics between the exposed and unexposed groups by weighting each participant by the inverse probability of receiving benefit from the BFP. We used Poisson regression models with follow-up time as an offset variable, and weighted observations using inverse probability of treatment weighting, using the propensity score to evaluate the association of the BFP with SUDs, as in previous studies.[8] We calculated the SUD hospitalisation incidence rates weighting by inverse probability of treatment weighting. Then, incidence rate ratios (IRRs) measured the association between the BFP and SUD hospitalisations.

The association between the BFP and SUD hospitalisations was estimated by SUDs overall and by types (alcohol use disorders and other SUDs [ie, cannabinoids, sedatives, or hypnotics, cocaine, opioids, multiple drug use, and use of other psychoactive substances]). Since the BFP benefit is preferentially transferred to female heads of households and the individuals on the lowest incomes in Brazil, we conducted a formal interaction analysis to assess the association between the BFP and SUD hospitalisations by subgroups according to sex and deprivation area incorporating an interaction term for each category of variable in the models to evaluate the statistical significance ($p<0·05$) of the interaction terms. Given the observed differences across subgroups, we proceeded with stratified Poisson regression models to assess the association of the BFP within each subgroup. As a robustness check, we conducted a Poisson regression model using the original cohort, both unadjusted and adjusted by the covariates used in the propensity score, and we included the BFP as an additional covariate. We also ran Poisson regression models using weighting methods, such as the stabilised inverse probability of treatment weighting and kernel weighting. The stabilised inverse probability of treatment weighting for individuals was calculated for those not exposed, using the formula (1–Pm) / (1–propensity score), and for exposed individuals using the formula Pm / propensity score, where Pm is the marginal probability of treatment in the population, and the propensity score is obtained from the logistic regression, adjusted for all variables. Finally, we ran the Poisson regression model using the BFP as a binary exposure without considering up to 6 months of delay to receive the benefit. In this analysis, all individuals were followed-up from their cohort entry date until one of the following censorship criteria occurred: SUD hospitalisation, death, or Dec 31, 2015, whichever came first.

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.

Results

Of 35 926 326 individuals within the cohort, 39 891 (0·1%) had a SUD hospitalisation, and 17 454 643 (48·6%) were beneficiaries of the BFP. The original cohort displayed demographic and socioeconomic baseline imbalances between beneficiaries and non-beneficiaries of the

Brazilian cash transfer programme for age, education level, and employment status (table 1). After applying inverse probability of treatment weighting, these characteristics became more balanced among beneficiaries and relative to non-beneficiaries (appendix 2 p 7).

The incidence rate of SUD hospitalisations among non-beneficiaries was 43·28 per 100 000 person-years (95% CI 42·40 to 44·18), whereas the incidence rate among beneficiaries was 35·97 per 100 000 person-years (35·49 to 36·47), which is a –16·89% difference (table 2). When stratified by SUD types, we observed lower incidence rate for both alcohol use disorder hospitalisations and for other SUDs (excluding alcohol) among beneficiaries compared with non-beneficiaries (–25·50% and –10·22%, respectively). We also observed a lower incidence rate of SUD hospitalisations among beneficiaries versus non-beneficiaries in males (–20·31%) and females (–10·82%) separately and in all levels of deprivation (table 2).

	Overall (n=35 926 326)	Non-Bolsa Familia Program (n=18 471 683)	Bolsa Familia Program (n=17 454 643)	Standardised mean difference
Substance use disorder hospitalisation (ie, treatment within hospital)	..	..	..	0·00773
Yes	39 891 (0·1%)	18 195 (0·1%)	21 696 (0·1%)	..
No	35 886 435 (99·9%)	18 453 488 (99·9%)	17 432 947 (99·9%)	..
Age	..	..	..	0·53604
Child (5–12 years)	13 901 351 (38·7%)	5 351 541 (29·0%)	8 549 810 (49·0%)	..
Adolescent (13–18 years)	2 677 408 (7·5%)	1 233 265 (6·7%)	1 444 143 (8·3%)	..
Young adult (19–24 years)	3 118 664 (8·7%)	1 608 987 (8·7%)	1 509 677 (8·6%)	..
Adult (25–64 years)	14 275 425 (39·7%)	8 489 933 (46·0%)	5 785 492 (33·1%)	..
Older adult (≥65 years)	1 953 478 (5·4%)	1 787 957 (9·7%)	165 521 (0·9%)	..
Sex	..	..	..	0·08114
Female	18 949 815 (52·7%)	10 106 381 (54·7%)	8 843 434 (50·7%)	..
Male	16 976 511 (47·3%)	8 365 302 (45·3%)	8 611 209 (49·3%)	..
Education level	..	..	..	0·37269
Never attended school	9 323 024 (26·0%)	3 784 013 (20·5%)	5 539 011 (31·7%)	..
Preschool	1 759 206 (4·9%)	769 175 (4·2%)	990 031 (5·7%)	..
Primary school	593 464 (1·7%)	295 228 (1·6%)	298 236 (1·7%)	..
Junior high school	15 583 639 (43·4%)	8 374 600 (45·3%)	7 209 039 (41·3%)	..
High school	6 372 803 (17·7%)	4 051 731 (21·9%)	2 321 072 (13·3%)	..
College or university	539 639 (1·5%)	461 545 (2·5%)	78 094 (0·4%)	..
Missing	1 754 551 (4·9%)	735 391 (4·0%)	1 019 160 (5·8%)	..
Unemployed	..	..	..	0·21912
No	8 633 239 (24·0%)	5 368 946 (29·1%)	3 264 293 (18·7%)	..
Yes	19 283 186 (53·7%)	9 744 132 (52·8%)	9 539 054 (54·7%)	..
Missing	8 009 901 (22·3%)	3 358 605 (18·2%)	46 512 296 (26·6%)	..
Area of residence	..	..	..	0·08535
Urban	29 227 504 (81·4%)	15 331 071 (83·0%)	13 896 433 (79·6%)	..
Rural	6 667 102 (18·6%)	3 131 670 (17·0%)	3 535 432 (20·3%)	..
Missing	31 720 (0·1%)	8942 (<0·1%)	22 778 (0·1%)	..
Housing conditions	4·05 (1·42)	4·19 (1·35)	3·90 (1·47)	0·20009
Year of registration	..	..	..	0·56395
2008	5 135 143 (14·3%)	2 572 121 (13·9%)	2 563 022 (14·7%)	..
2009	5 326 721 (14·8%)	1 566 195 (8·5%)	3 760 526 (21·5%)	..
2010	5 073 606 (14·1%)	2 227 776 (12·1%)	2 845 830 (16·3%)	..
2011	4 176 114 (11·6%)	1 672 941 (9·1%)	2 503 173 (14·3%)	..
2012	5 642 786 (15·7%)	3 426 490 (18·5%)	2 216 296 (12·7%)	..
2013	4 160 937 (11·6%)	2 450 717 (13·3%)	1 710 220 (9·8%)	..
2014	3 772 755 (10·5%)	2 676 299 (14·5%)	1 096 456 (6·3%)	..
2015	2 638 264 (7·3%)	1 879 144 (10·2%)	759 120 (4·3%)	..

Data are n (%) or mean (SD).

Table 1: **Baseline characteristics**

	Bolsa Familia Program			Non-Bolsa Familia Program			% difference*
	Incidence per 100 000 (95% CI)	Failures (n)	Person-years at risk	Incidence per 100 000 (95% CI)	Failures (n)	Person-years at risk	
Overall substance use disorder hospitalisations	35·97 (35·49 to 36·47)	20 636	57 354 957	43·28 (42·40 to 44·18)	13 416·3	30 996 363	–16·89
By type of substance use							
Alcohol use disorders	16·21 (15·84 to 16·59)	7154	44 130 201	21·76 (21·17 to 22·39)	6743·5	30 976 459	–25·50
Other substance use disorder (except alcohol)	19·32 (18·96 to 19·68)	11 079	57 329 484	21·52 (20·89 to 22·18)	6670·0	30 981 643	–10·22
By sex							
Female	15·33 (14·84 to 15·85)	3548	23 131 186	17·19 (16·35 to 18·08)	2713·5	15 783 244	–10·82
Male	57·16 (56·15 to 58·19)	12 017	21 022 606	71·73 (70·16 to 73·35)	10 895·3	15 188 264	–20·31
By deprivation area (Brazilian Deprivation Index)							
Low deprivation	49·32 (48·49 to 50·16)	13 291	26 948 317	54·64 (53·45 to 55·87)	11 435·5	20 926 721	–9·73
Medium deprivation	15·25 (14·58 to 15·95)	1890	12 392 061	23·91 (22·43 to 25·53)	1824·5	7 627 468	–36·21
High deprivation	7·97 (7·22 to 8·82)	384	4 813 414	13·39 (11·60 to 15·54)	357 104·0	2 665 658	–40·47

*% difference=([Bolsa Familia Program rate – non-Bolsa Familia Program rate] / non-Bolsa Familia Program rate) × 100%.

Table 2: **Substance use disorder hospitalisation incidence rate weighting with inverse probability of treatment weighting among Bolsa Familia Program beneficiaries and non-beneficiaries, overall and stratified by substance use disorder overall and specific causes, sex, and deprivation area index**

After applying inverse probability of treatment weighting to the Poisson regression model, receipt of the BFP was associated with a 17% reduction in SUD hospitalisations (IRR 0·83, 95% CI 0·81–0·85; table 3). We found similar point estimates for the association between the BFP and decreased SUD hospitalisations in all the robustness analyses, including when considering the BFP as a binary exposure without up to 6 months of delay to receive the benefit (appendix 2 p 7). The characteristics of the excluded individuals during the analysis due to missing values in propensity score covariates or negative follow-up by beneficiaries and non-beneficiaries are shown in appendix 2 (p 8). The interaction terms showed statistical significance ($p<0·05$), indicating that there is a significant difference in the association of the BFP in the different subgroups analysed by sex and deprivation area (appendix 2 p 9). We identified that beneficiaries had lower risk of hospitalisation than non-beneficiaries, irrespective of SUD type, sex, and deprivation area index. Among male beneficiaries, the BFP was associated with a 21% decrease in the risk of SUD hospitalisations (IRR 0·79, 95% CI 0·77–0·81), whereas the reduction was 11% (0·89, 0·84–0·94) for female beneficiaries (table 4). We observed an increased gradient of protection against SUD hospitalisations among beneficiaries as the municipal deprivation index increased (table 4). For instance, the reduction in SUD hospitalisations among beneficiaries was 10% in those living in municipalities with lower levels of deprivation (IRR 0·90, 95% CI 0·87–0·92), whereas the reduction was 41% in those in municipalities with high deprivation (0·59, 0·49–0·71; table 4).

Discussion

Receipt of BFP financial aid was associated with reduced SUD hospitalisations versus non-receipt of this aid in this population-based, quasi-experimental study. We found a protective association between the BFP and SUD hospitalisation irrespective of the substance used to cause the hospitalisation, and irrespective of sex. A stronger protective association was observed among individuals who lived in the most deprived municipalities compared with those living in the least deprived municipalities, possibly indicating the particular value of the BFP in reducing health and social inequalities in socioeconomically disadvantaged environments. To our knowledge, this is the first population-based study using real-world linked records to explore the association of a conditional cash transfer on SUD hospitalisations. As we hypothesised (appendix 2 p 6), a protective association of the BFP on SUD hospitalisations could be explained by the following factors: first, financial difficulties are associated with an increased risk of developing and exacerbating SUDs.[3,19] The BFP alleviates financial stress by providing direct income subsidies to families on low incomes which, in turn, could decrease the substance use associated with these stressors. Second, the BFP improves human capital through its health and school conditionalities, which could serve as protective factors against SUD hospitalisations since low education

	N	Estimated incidence rate ratio (95% CI) from a Poisson regression model	p value
Inverse probability of treatment weighting	30 556 848	0·83 (0·81–0·85)	<0·0001
Unadjusted	35 002 823	0·93 (0·91–0·95)	<0·0001
Adjusted	25 805 305	0·97 (0·95–0·99)	<0·0001
Stabilised inverse probability of treatment weighting	25 805 305	0·93 (0·91–0·95)	<0·0001
Kernel weighting	25 805 219	0·83 (0·81–0·85)	<0·0001

Table 3: **Incidence rate ratio of substance use disorder hospitalisations among beneficiaries of the Bolsa Familia Program compared with non-beneficiaries in the original and weighted cohorts**

	N	Incidence rate ratio (95% CI)	p value
ICD-10 specific causes			
Alcohol use disorders	25 789 737	0·74 (0·71–0·77)	<0·0001
Other substance use disorders (except alcohol)	30 538 974	0·89 (0·86–0·92)	<0·0001
Stratified by sex			
Female	13 851 726	0·89 (0·84–0·94)	<0·0001
Male	11 953 579	0·79 (0·77–0·81)	<0·0001
Stratified by deprivation area (IBP-CIDACS)			
Low deprivation	17 056 504	0·90 (0·87–0·92)	<0·0001
Medium deprivation	6 559 288	0·63 (0·58–0·68)	<0·0001
High deprivation	2 189 513	0·59 (0·49–0·71)	<0·0001

IBP-CIDACS=the Brazilian Deprivation Index, developed by the Centre for Data and Knowledge Integration for Health.

Table 4: **Incidence rate ratio of substance use disorder hospitalisations weighting with inverse probability of treatment weighting by specific causes and stratified by sex and deprivation area index among beneficiaries of the Bolsa Familia Program compared with non-beneficiaries**

level—as one component in measuring low socioeconomic status—has been associated with alcohol-related hospitalisations.[3] Beyond that, while people living with SUDs—especially those also experiencing poverty—often encounter barriers to accessing health care.[10] Families who are beneficiaries of the BFP show increased access to primary health care.[20] In Brazil, primary health care offers SUD screening, group therapy, brief interventions, and harm reduction practices. In addition, primary health care can refer severe cases for outpatient and inpatient mental health care, facilitating access to high-complexity care when needed. Finally, beneficiaries in the BFP are afforded the opportunity to engage in complementary initiatives, such as actions that foster adult integration into the labour force. According to a study conducted by Santos and colleagues,[21] beneficiaries of the BFP had a 7–10% lower chance of dropping out of their formal jobs than non-beneficiaries, which contributes to the household income and financial stress alleviation.

The BFP was associated with a lower risk of hospitalisation due to SUD, irrespective of sex. One possible explanation for this protective effect is that the BFP supports the entire family, fostering care and positively impacting all members.[22] Receiving a stable monthly income can help alleviate the stress of meeting basic needs, such as food, other household expenses, and clothing for children. Reducing financial stress could, in turn, lead to a decrease of substance use,[19] benefiting both women and men in the household.

Our findings have relevant implications for SUD policies and practices. First, the BFP introduces a promising and innovative dimension to SUD prevention strategies, since most well known interventions to reduce the SUD burden are centred on pharmacological and behavioural change interventions focused on social skill development.[23] Second, preventing hospitalisation among beneficiaries of the BFP could lead to better health outcomes, since alcohol-use disorder hospitalisation, for instance, has been associated with prospective risk of death.[24] Third, the BFP appears to be cost-effective for health systems, especially in low-resource settings, since the investment made with cash transfers to families on low incomes could be beneficial by reducing the high cost of preventable hospitalisations. Fourth, our findings show the importance of considering cross-sector programmes that not only include social and financial support, but also health-care and educational assistance, when considering a decrease in SUD-related issues. One of the study's strengths is the use of linked socio-demographic, health, and social data records. It allowed us to apply propensity scores to identify individuals with similar characteristics differing only by participation in the BFP, providing a non-beneficiary control group. Creating a robust study design was crucial, since conducting a primary randomised controlled trial could be unfeasible or unethical. It would mean denying the benefit from the BFP to families on low incomes, and thus its proven social and health-related benefits. Moreover, our study was at the population level instead of being limited to a specific group as in previous studies.[5,6] Also, using countrywide hospitalisation records as the primary outcome measure represents a substantial improvement over the self-reporting method used to measure substance use in previous studies.[5,6] Hospitalisation records offer a more objective assessment, mitigating potential issues of under-reporting, memory, and social desirability bias, commonly associated with self-reporting methods.[25]

The limitations of this study include—firstly—structural barriers, such as a scarcity of hospital beds in some areas (ie, rural areas and the north and northeast regions of Brazil), and sociocultural barriers, such as the fear of suffering stigma and prejudice during health visits, which could have contributed to under-reporting of SUD hospitalisations. Second, although numerous

initiatives have been implemented to enhance the accuracy of diagnoses in Brazil, the misclassification of an SUD diagnosis could still exist, since clinical presentation of SUDs can mirror the symptoms of other medical conditions. Third, our study refers to severe SUDs that require hospitalisation, thus it cannot be extrapolated to other SUD presentations. Fourth, beneficiaries in isolated or rural areas could potentially struggle to meet education and health conditionalities due to distant or unavailable schools and primary health-care units in the area. However, this possible limitation to education and health-care access might not be relevant for most individuals, since the Government must also ensure the provision of health and education services enabling beneficiaries to comply with the conditionalities. Indeed, in Brazil, school attendance among young people aged between 4 and 17 years was more than 90% in 2022.[26] Moreover, Brazil health policy privileges high coverage of primary health care among the most vulnerable populations to achieve equity.[27] Beyond that, families that do not meet the programme's conditionalities can face gradual sanctions, which could lead to their exclusion from the programme in rare and extreme cases. However, no sanctions are applied if the municipality is shown not to have provided health and education services or provided them inconsistently.[28] Fifth, residual confounding is possible due to the inherent limitation of administrative data, which have a restricted covariate set and were not designed for scientific purposes. Thus, we could be failing to control for some SUD-related unobservable confounders, such as physical and other mental comorbidities, onset and duration of substance use, experience of prejudice due to substance use, and previous use of health services. To minimise the possible effect of uncontrolled confounding, we conducted subgroup analysis by sex, which could account for variations in substance use patterns and by municipal-level deprivation, and for differences in access to previous health-care services. Finally, our study mostly considered individuals residing in households,[29] so the findings should not be generalised to individuals living with SUDs and experiencing homelessness, or living in shelters.

In conclusion, alleviating financial pressure, fulfilling basic needs, improving socioeconomic status, promoting health access, and encouraging educational attainment could all mediate the protective association of the BFP against SUD hospitalisations. Further studies are needed to evaluate whether similar findings will be found in countries at different income levels and to test possible mechanisms. Policy makers in countries with similar income disparities to Brazil, where SUDs pose substantial burdens and societal consequences, should consider investing in conditional cash transfer programmes similar to the BFP. In addition, public health professionals should routinely include the referral of patients with SUDs who are experiencing economic hardship to economic assistance programmes. These actions could help prevent SUD aggravation and the need for hospitalisation. These integrated efforts promise to curb SUD hospitalisation rates and foster societal wellbeing and more equitable and healthier societies.

See Online for appendix 3

For the **Centro de Integração de Dados e Conhecimentos para Saúde website** see https://cidacs.bahia.fiocruz.br/

Contributors

LT and DBM contributed to the study conception and design. EF and FA had full access to the raw data, verified the data, and take responsibility for data integrity and the accuracy of the analyses. EF and FA performed data processing and formal analysis. Not all authors had access to the raw data. For ethical and regulatory reasons, data access is provided through a virtual private network for authorised researchers, with restricted access to the analysis environment, which is secured by strict access controls and protocols. EF, DBM, FA, VP, and MLB contributed to the method. LT contributed to writing the original draft, and all authors contributed to reviewing and editing the final manuscript. DBM contributed to funding acquisition. All authors read and approved the final manuscript and were responsible for the decision to submit the manuscript for publication. LT had the final responsibility to submit the manuscript.

Equitable partnership declaration

The authors of this paper have submitted an equitable partnership declaration (appendix 3). This statement allows researchers to describe how their work engages with researchers, communities, and environments in the countries of study. This statement is part of *The Lancet Global Health*'s broader goal to decolonise global health.

Declaration of interests

We declare no competing interests.

Data sharing

All data supporting the findings presented here were obtained from Centro de Integração de Dados e Conhecimentos para Saúde. Restrictions apply to the availability of these data. However, the institutional data curation team can make the data available upon reasonable request, provided all ethical and legal requirements are met. Information on how to apply to access the data can be found at the Centro de Integração de Dados e Conhecimentos para Saúde website.

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