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Effectiveness of a conditional cash transfer programme on TB cure rate: a retrospective cohort study in Brazil

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Abstract

Background—Despite the efforts of the National Tuberculosis Programme, TB cure rates in Brazil are sub-optimal. The End TB Strategy for post-2015 identifies conditional cash transfer interventions as powerful tools to improve TB control indicators, including TB cure rate. This study aims to inform the new policy by evaluating the role of the Bolsa Familia Programme (BFP), one of the largest conditional cash transfer programmes in the world, on TB cure rates in Brazil.

Methods—We undertook a retrospective cohort study, based on an unprecedented record linkage of socioeconomic and health data, to compare cases of patients newly diagnosed with TB in 2010 receiving BFP cash benefits (n=5788) with those who did not (n=1467) during TB treatment. We used Poisson regression with robust variance to estimate the relative risks for TB cure adjusted for known confounders.

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Authors' contributions: AWT was in charge of the data procurement and data analysis and completed the first draft of the manuscript; DR and ZDO contributed to the data analysis and provided feedback on the subsequent drafts of the manuscript; DB contributed to the study design and helped with the interpretation of the study results, prepared the final the draft of the manuscript; ELNM, JSN and DCNB provided intellectual contribution to the manuscript and helped with the study findings interpretation; MNS conceived the study, led the various stages of the study development, supervised AWT's work and helped with the interpretation of the study findings. AWT is guarantor of the paper.

Competing interests: None declared.

Ethical approval: Ethical approval for the study was obtained by The Research Ethics Committee of the Institute of Center of Health Sciences of the Federal University of Espírito Santo [protocol number 242,831]. The confidentiality of patients with TB and individuals registered within CadUnico is under the responsibility of the Ministry of Health and the Ministry of Social Development. For the purpose of the data linkage, confidentiality was ensured by individual records (i.e. name and address) anonymization with Bloom filters, a procedure described by Schnell and colleagues.38

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Results—The cure rate among patients exposed to BFP during TB treatment was 82.1% (4752/5788), 5.2% higher than among those not exposed. This was confirmed after controlling for TB type, diabetes mellitus, HIV status and other relevant clinical and socioeconomic covariates (RR=1.07, 95% CI 1.04 to 1.11 for cure rates among BFP beneficiaries). This association seemed higher for patients not under directly observed treatment (RR=1.11; 95% CI 1.05 to 1.16).

Conclusions—Although further research is needed, this study suggests that conditional cash transfer programmes can contribute to improve TB cure rate in Brazil.

Keywords

Adherence; Conditional cash transfer; Social protection; Tuberculosis

Introduction

TB is the infectious disease that most emblematically shows an association with poverty and social exclusion,1–3 with cases consistently more concentrated in marginalized social groups.2,4 Brazil is considered a high TB-burden country (ranked 16th out of 22), with 71 000 new cases reported in 2013 and more than 4000 deaths per year.5 TB in Brazil is prevalent in degraded urban areas and it is typically associated with hunger, poor housing and sanitation, as well as other conditions such as alcohol and drug abuse, or immunosuppressive diseases such as HIV/AIDS.6 Since the end of the 1990s, Brazil has experienced a decline in TB incidence and mortality, but the cure rates are still below the threshold recommended by WHO (70.6% in 2012 vs recommended 85%) and the default rate remains high (10.5% in 2012).7

In 2011 the Brazilian Ministry of Health aligned with the other welfare agencies in order to develop concerted actions to address TB and other diseases of poverty through conditional cash transfer interventions able to enhance case detection and treatment access, prevention, social reintegration and physical rehabilitation.8 This strategy is in line with the recent post-2015 End TB strategy aiming for the integration of social protection interventions with the traditional biomedical response in order to strengthen TB control and accelerate its elimination,9,10 and it is coherent with the recent United Nations agenda for Sustainable Development.11

Conditional cash transfer programmes are widely popular social protection strategies aiming to move people out of extreme poverty and break the inter-generation transmission of poverty by improving material conditions and enhancing access to education and health services.12,13

Since 2003 Brazil has run the Bolsa Familia Programme (BFP), the national conditional cash transfer program aimed at enhancing the human capital of poor citizens through an increased utilization of public services and breaking the inter-generational transmission of poverty.14,15 With 13 million beneficiary families (nearly 50 million people) around the country, Bolsa Familia is today the largest conditional cash transfer programme in the world. Bolsa Familia targets extremely poor households earning between US$35–70 per person per month. Eligibility is assessed at federal level (by the Ministry of Development) to minimize

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inclusion and exclusion errors and fraud episodes at municipal level.15 Depending on the household composition, the monthly cash benefits range from US$18 to a maximum of US $175 and are given under three conditions: 1. attendance at prenatal and postnatal monitoring sessions; 2. access to nutrition and vaccination monitoring for patients' children aged 0–7 years; 3. school attendance.15 All BFP beneficiaries must first be registered in the Unified Registry for Social Programmes (CadÚnico) of the Ministry of Social Development and Fight Against Hunger. The registry represents a unique database containing socioeconomic data of low-income households across the country. It also provides a census of all the households benefitting from any of the various social programmes provided by federal government, including BFP.16

The public health potential of BFP has been already investigated for several health indicators in Brazil17–19 and increasing evidence suggests there may also be a plausible effect on TB prevention, cure and support.20,21 Nonetheless, the actual impact of BFP on TB in Brazil remains largely unknown.

In this study we take advantage of an unprecedented record linkage between CadÚnico and the national TB notification system to contribute to filling this knowledge gap and specifically address the impact of BFP on TB cure rates in Brazil.

Materials and methods

This study used a retrospective cohort design. The cohort was obtained from an unprecedented record linkage of health and socioeconomic administrative datasets and respectively: 1. the TB notification database from the Ministry of Health included in the Notifiable Diseases Information System (SINAN); 2. CadÚnico, the socioeconomic database of from the Ministry of Social Development. CadÚnico is a database containing a wide range of demographic and socioeconomic information for approximately 80 million Brazilian citizens collected from 2001 to 2011. It is used to determine an individual's eligibility for social assistance or governmental programmes, including BFP.22

The population under study was represented by the new cases of TB diagnosed in the country during 2010 and recorded in the SINAN database, which were also registered in the CadÚnico database and included in the payroll of the BFP. A flow chart showing the process for the inclusion of individuals in our study population is shown in Figure 1.

For the record linkage we used a deterministic approach, using as matching variables name, date of birth and mother's name. The linkage was conducted by the National Secretariat of Income and Citizenship of the Ministry of Social Development. As shown in Figure 1, among the 71 660 cases of TB recorded in the SINAN database in 2010, 13.1% (n=9414) were also represented in the CadÚnico database and the BPF payroll and could thus be matched.

Among these records, we excluded 2159, comprising: 1. individuals without data on the date of treatment outcome (n=359) or first income transfer date informed (n=15); 2. individuals who were diagnosed with multidrug-resistant TB (MDR-TB) (n=25); 3. individuals for

whom there were observations with at least one missing value in one or more independent variables (n=1760) (Figure 1).

The exposed group encompassed patients newly diagnosed with TB who benefitted from BFP transfers during TB treatment. The unexposed group was composed of patients newly diagnosed with TB who were eligible for BFP benefits but only started to receive them after the end of treatment. These patients with TB had the same socioeconomic characteristics as TB patients benefitting from BFP transfers, but they were not included in the programme during their treatment due to a delayed registration in CadÚnico and random administrative delays in granting benefits, thus representing in principle as closely as possible a counterfactual group.

After assessing the completeness and consistency of the data, we characterised the study population in terms of clinical, epidemiological, demographic and socioeconomic profile. The variables of interest included age, ethnicity, TB type, diabetes mellitus, HIV status, directly observed treatment (DOT), number of rooms of the household, floor material, and household per capita income. These variables were categorized according to the median of the distribution in the study population or, when available, criteria described in the literature for their dichotomization. Patients with pending results on HIV screening (n=629) together with patients for whom HIV tests were not done (n=2293), were considered to have HIV comorbidity status as ‘unknown’ (total n=2922) (Table 1) and analyzed as a category on the multivariate analysis. Variables were presented as absolute and relative frequencies (proportions), means and standards deviations. Tests for differences in proportion and mean values were used (proportion difference test, chi square test and Wilcoxon rank-sum test) to evaluate differences between subpopulations.

In the multivariate analysis the dependent variable was the treatment outcome (cure or not cure), and the main independent variable was receiving BFP cash transfers during the treatment period. Potential confounders were chosen based on the literature,2 on their association with the outcome and the exposure, and on data availability. Relative risks and their confidence intervals between exposure to the BPF cash transfer and TB cure rate were estimated through Poisson regression with robust variance model. In cohort studies, Poisson regression with robust variance is suitable to measure relative risk for binary outcomes.23 The model is robust to different regression specifications including logit, probit and linear regressions, as shown in Supplementary Table S1. We used likelihood ratio test to test for interaction between exposures and to test for linear trends. Data were analyzed with Stata v. 12 software (Stata Corp, College Station, Texas USA).

Results

After excluding missing information a total of 7255 individuals were included in study population. Among these, 5788 (79.8%) were patients with TB receiving BFP cash transfers during their treatment and 1467 (20.2%) were patients with TB, enrolled in BFP but receiving BFP cash transfers only after the end of treatment (Figure 1). The mean value of the benefit received monthly by the TB-affected households was US$55.60.

The demographic, clinical and socioeconomic profiles of the study population are outlined in Tables 1 and Table 2. Females and children aged less than 15 years were disproportionately represented in both the exposed and unexposed group. In both groups, half of the TB cases were head of the household (44.3% (3166/7152) and 58.7% (1091/1863) in the exposed and unexposed groups, respectively) (Supplementary Table S3). The exposed and unexposed groups were significantly different in terms of age, ethnicity, HIV status and diabetes mellitus (Table 1); however, these differences appeared random and no consistent pattern emerged in terms of risk factors distribution.

All the socioeconomic variables investigated were associated with the exposure to the BFP benefit. Compared to the unexposed group, patients with TB in the BFP exposed group were more likely to be illiterate, resident in rural areas, and living in households with less than four rooms and considered to be inadequate in terms of housing quality (Table 2).

The cure rate was 5.2% higher among the group of patients with TB patients exposed to the BFP compared to the unexposed group of patients with TB, respectively, 82.1% (4752/5788) versus 76.9% (1128/1467) (Table 1).

In the multivariable analysis, patients with TB who were exposed to BFP benefits were 7% more likely to be cured compared to the unexposed group of TB patients, after controlling for age, ethnicity, TB type, diabetes mellitus, HIV status, DOT, illiteracy, zone of residence, number of rooms and household floor material, and baseline household per capita income (Table 3).

As shown in Table 4, the association between BFP and TB cure rate was higher among cases under self-administered treatment compared to TB-patients under DOT even after controlling for potential confounding factors (5% vs 11% increase, respectively, among the DOT and the self-administered group).

Discussion

Through an unprecedented linkage of administrative socioeconomic and health data, this analysis seems to suggest that a conditional cash transfer programme may contribute to a 7% increase of TB cure rate in Brazil. This increase reaches 11% for patients with TB who were not enrolled into the Brazilian DOTS program.

This result should be considered as the minimum observable association, considering that the BFP is not meant to target TB-affected households specifically, but just households meeting socioeconomic eligibility criteria. The benefits are addressed to the female head of the household to improve maternal and child health in the household. Therefore, patient with TB in the household does not necessarily benefit fully nor directly from the BFP cash transfers. Furthermore, the patients with TB included in our analysis are not necessarily those most struggling to successfully complete TB treatment in Brazil or those who may benefit most from financial support (including homeless individuals, drug users and prisoners). It could be thus speculated that in such vulnerable TB-affected groups the potential of BFP may be potentially even bigger.

The larger association observed among patients with TB who were not enrolled into DOT should not be surprising: in Brazil patients with TB are enrolled into DOT only if they are judged to be able to complete their treatment. It could be argued that among those considered not eligible for DOT, the contribution of BFP is higher compared to those that can also benefit from the access to programmatic TB care. In other words, it could be that among those not even receiving TB standard of care (based on free diagnosis and treatment and DOTused to enhance treatment compliance), the role of social protection interventions may be proportionately higher.24

The association that we observed between the BFP and TB cure rate is plausible. The BFP (and conditional cash transfers in general) is likely to affect the likelihood of TB cure mainly by acting on the individuals' health seeking behaviours20,25–27 and by improving individuals' response to treatment.3,28,29 In the first case it can be postulated that by having better access to health care services (upon which the transfer of cash is often conditional) people may be (albeit indirectly) better informed about diagnosis and treatment options as well as TB symptoms, and may be more inclined to access TB care services more promptly. In the second case, BFP is likely to boost individuals' response to TB treatment by enhancing the food security and nutritional status among the intervention beneficiaries, and thus the patients' immune competence. More recently, it has been demonstrated that cash transfer may improve TB treatment outcomes by mitigating the catastrophic costs imposed on TB-affected households.30 In this latter case, it can be imagined that by averting a further impoverishment of the household, cash transfers may increase people's resilience to TB and thus the likelihood of TB cure. This could happen by reducing both the risk of malnutrition and the psychosocial stress resulting from a further impoverishment of the household. Some of these postulated pathways are supported by literature on the BFP showing that in Brazil the program was able to reduce inequalities and household poverty and to increase food consumption and the availability of other goods.15,31

Our results are consistent with those found in other studies conducted in the Latin American region investigating the impact of financial incentives on TB cure rates. An operational assessment of a socioeconomic intervention (including conditional cash transfer) to enhance TB control in Peru, showed that the treatment success rate was 6% higher among patients benefitting from the cash support, when compared with the baseline.32 Similarly, in Ecuador an intervention based on a US$240 incentive to patients with MDR-TB for each month of adherence for 24 months showed that default rate was significantly lower among programme beneficiaries compared to pre-programme patients with MDR-TB after 1 year of implementation (26.7% vs 9.5%, $p<0.05$, respectively).33

The only other evidence available comes from South Africa and findings appear less encouraging: in a recent clustered randomized controlled trial assessing the impact of financial support on the outcome of patients with active TB, authors found a small, but non-significant increase in the treatment success rate among the intervention clinics.34 However, a subsequent process evaluation suggested that delayed benefits payment to patients, as well as poor fidelity to the trial protocol, could explain the results observed.35 Furthermore, the TB epidemic profile in South Africa may be too different to allow a more meaningful comparison with results achieved in Latin America.

Despite plausibility and consistency with the literature, causality cannot be claimed from our study and results should be interpreted with caution because of a number of limitations. First, we adopted a cohort study design comparing two groups that although both eligible for BFP appeared to be significantly different in terms of demographic and socioeconomic profile; these differences raise doubts about the effectiveness of the actual randomization procedure and thus the possible introduction of selection biases that may have affected our study findings. However, the choice of our comparison group (i.e. patients with TB who were enrolled in the BFP, but not yet receiving cash transfers while on treatment) appeared to be the only possible counterfactual group given the options available for the design of the impact evaluation (i.e. the BFP is a governmental program and benefits allocation cannot be manipulated for research purposes). Furthermore, we could not identify any obvious pattern in the distribution of risk factors, which indeed appeared to be random across the two groups. Also, these differences seemed quite modest in terms of percentages and perhaps significant mainly because of the very large sample size and the high number of variables under study. Finally, the adjustment in the regression model for these variables should have contributed to control at least partially for the observed differences. In conclusion, our counterfactual group is likely to be imperfect, but it was the most appropriate given the circumstances and seems unlikely to have introduced important selection biases.

Another limitation is that the study population included in this study represents only a quarter of the number of patients in Brazil newly diagnosed with TB. Representation of such a small proportion of patients could be due to the following reasons: 1. the low coverage of the BFP scheme of high-risk groups of individuals with TB (e.g. prisoners, indigenous people and homeless people), even though they do not represent the highest burden in absolute numbers of TB cases in the country; 2. the active search of poor and extremely poor families in the country, typically at high-risk for TB, started in 2011 only after the data analysis for this study was undertaken; 3. the typical target population for the BFP is mainly represented by women and children, which mismatches the profile of the majority of patients with TB in Brazil (i.e. young adult males); 4. the very low family income cut off adopted as inclusion criteria, which may exclude people still socially and financially vulnerable to being at risk for TB, yet who are above the cut off.

If this were the case, the observed association with cure rate may be different in the excluded TB cases. However, it could be argued that the actual result in these excluded groups may be similar if not higher than the one we observed.

The small proportion of linked patients with TB could be also imputed to the high specificity of the deterministic linkage approach we used. While this linkage strategy was appropriate for our study given the high discriminatory power of the algorithm used, it is still prone to low sensitivity. It is possible that this may have resulted in some true matches excluded from our analysis; however, these exclusion errors (mainly due to be misspelling of names in the administrative records) are likely to be random and, thus, unlikely to have introduced any relevant bias in our results.

Further and better designed studies will be essential to confirm our results; however, this is the first study investigating the role of a large governmental cash transfer scheme, thereby

allowing the formation of hypotheses about the actual potential of these highly popular programmes to influence TB control. As such, our study has the potential to be relevant to inform policy discussion in Brazil and internationally as it further suggests the public health potential of conditional cash transfers and contributes to our understanding of their role in TB control. Furthermore, our approach of using an unprecedented record linkage between administrative socioeconomic and health datasets, together with the use of natural and quasi natural experiments, are confirmed to be important and useful alternatives to lengthy, expensive and ethically sensitive randomized trials.24

In Brazil the response to addressing the need to enhance adherence to TB treatment has been mainly biomedical, with an emphasis on the decentralization of the disease control actions in primary care, the implementation of DOT and the adoption of treatment with fixed-dose combination.7 Nonetheless, cure rates in Brazil remain less than optimal.7 By showing a significant, and yet unintentional, association between implementing a conditional cash transfer programme and better TB cure rates, this study seems to reinforce the notion that the control of poverty-related diseases requires a more holistic approach based on intersectoral interventions able to address the social determinants of health, especially among the poorest groups.3

Conclusions

This study informs and supports the latest recommendations included in the WHO post-2015 End TB Strategy9 and reflects the vision underlying the Sustainable Development agenda calling for leadership beyond the health sector and greater coordination across sectors to achieve ambitious public health goals.36 Despite the favorable global political momentum and the recent Brazilian efforts to tackle TB inequalities among vulnerable groups, impact and operational evidence remains too fragmented26,27,37 to make conditional cash transfers an integral component of the national and international response to combating TB. Our results are encouraging, but we cannot still claim causality. Further, more rigorous impact and process evaluations are urgently needed to understand the effectiveness and cost-effectiveness of such an integrated approach in Brazil and beyond. Such an ambitious research agenda will require significant intellectual and financial investment from the TB scientific community, however no other option is currently available in order to meet the TB elimination target by 2030.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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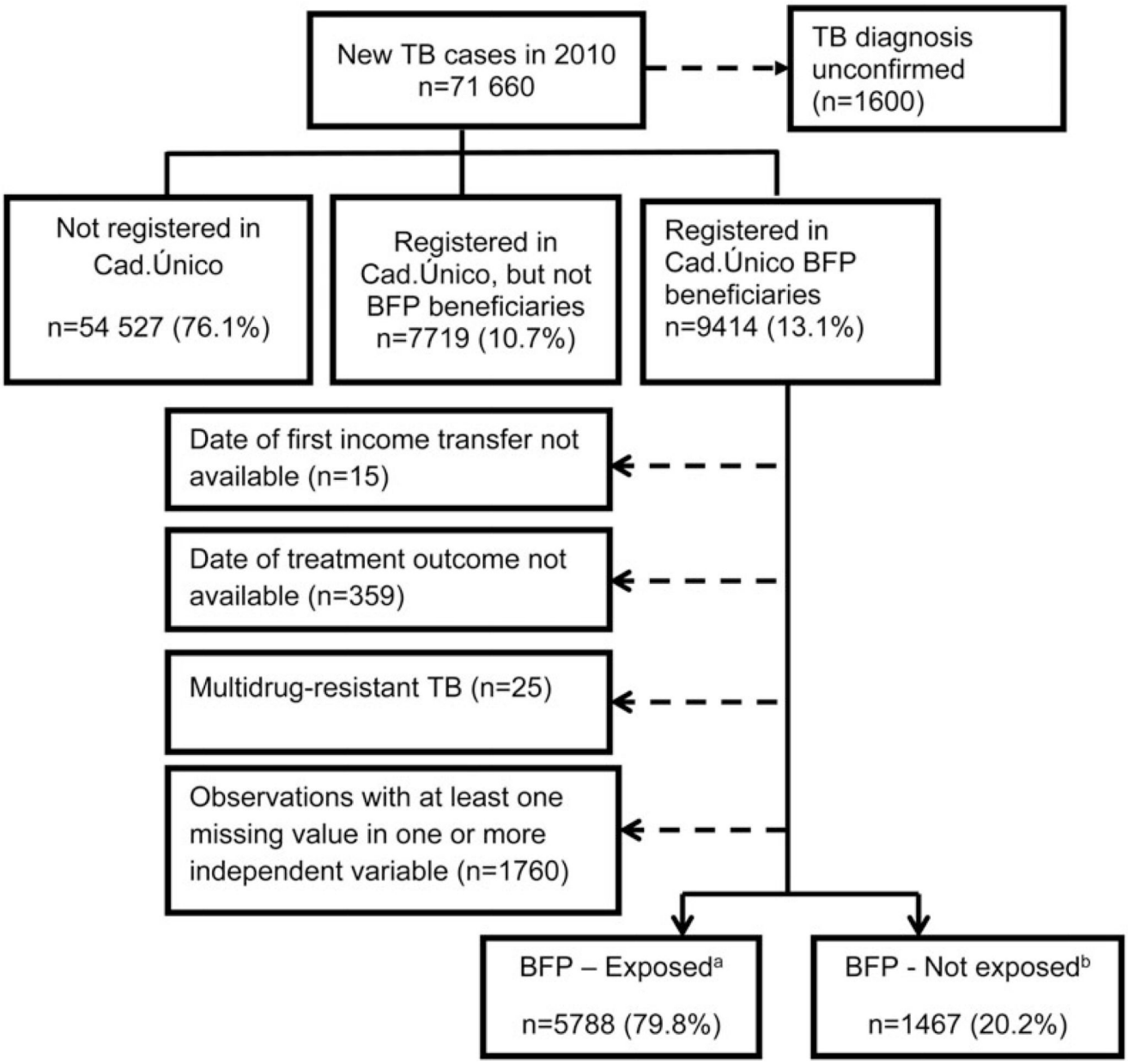

Figure 1.

Flow chart algorithm of inclusion in the study population. BFP: Bolsa Familia Programme. Data source: The Brazilian Ministry of Health's Notifiable Diseases Information System (SINAN) database; CadÚnico, the socioeconomic database of from the Ministry of Social Development; the BFP monthly payroll of the Brazilian Federal Bank. [a]Patients with TB enrolled on the BFP and receiving cash transfers while on treatment. [b]Patients with TB enrolled on the BFP but not receiving cash transfers while on treatment due to random administrative delays.

Table 1

Demographic and clinical characteristics of the study population according to the Bolsa Familia Programme (BFP) benefits exposure: Brazil, 2010

Demographic and clinical characteristics	Exposed during TB treatment	Not exposed during TB treatment	Total	% point difference	p-value
	n (%)	n (%)	n		
Total	5788 (100.0)	1467 (100.0)	7255		
Gender					
Female	2950 (51.0)	767 (52.3)	3717	|1.31|	NS
Male	2838 (49.0)	700 (47.7)	3638		
Age group, years					
<15	500 (8.6)	123 (8.4)	623	0.26	0.033
15–49	4423 (76.4)	1163 (79.3)	5586	–2.86	
≥50	865 (14.9)	181 (12.3)	1046	2.6	
Ethnicity					
Black	4085 (70.6)	995 (67.8)	5080	|2.75|	0.040
Other	1703 (29.4)	472 (32.1)	2175		
TB type					
Pulmonary	5051 (87.3)	1290 (87.9)	6341	|0.66|	NS
Extrapulmonary	737 (12.7)	177 (12.1)	914		
Comorbidity					
HIV					
Positive	373 (6.4)	116 (7.9)	489	–1.47	0.019
Negative	3044 (52.6)	800 (54.5)	3844	–1.94	
Unknown	2371 (41.0)	551 (37.6)	2922	3.4	
DM					
Yes	342 (5.9)	57 (3.9)	399	|2.02|	0.002
No	5446 (94.1)	1410 (96.1)	6856		
Alcoholism[a]					
Yes	640 (11.2)	171 (11.8)	811	|0.58|	NS
No	5072 (88.8)	1280 (88.2)	6352		
Outcome					
Cure	4752 (82.1)	1128 (76.9)	5880	|5.21|	<0.000
Not cure	1036 (17.9)	339 (23.1)	1375		

Data source: The Brazilian Ministry of Health's Notifiable Diseases Information System (SINAN) database; CadÚnico, the socioeconomic database of from the Ministry of Social Development; the BFP monthly payroll of the Brazilian Federal Bank.
DM: Diabetes mellitus; NS: not significant.

[a]Different total because data not included in final model.

Table 2

Socioeconomic characteristics of the study population according to the Bolsa Familia Programme (BFP) benefits exposure: Brazil, 2010

Socioeconomic characteristics	Exposed during TB treatment	Not exposed during TB treatment	Total	% point difference	p-value
	n (%)	n (%)	n		
Total	5788 (100.0)	1467 (100.0)	7255		
Literacy					
Literate	4902 (84.7)	1291 (88.0)	6193	|3.31|	0.001
Illiterate	886 (15.3)	176 (12.0)	1062		
Household characteristics					
Zone					
Urban	4804 (83.0)	1290 (87.9)	6094	|4.93|	<0.000
Rural	984 (17.0)	177 (12.1)	1161		
Number of rooms					
4+	2249 (38.9)	469 (32.0)	2718	|6.89|	<0.000
<4	3539 (61.1)	998 (68.0)	4537		
Floor material[a]					
Appropriate	2469 (42.7)	940 (64.1)	3409	|21.43|	<0.000
Inappropriate	3319 (57.3)	527 (35.9)	3846		
Baseline household per capta income (US$)					
Mean	59.01	57.20	23.08	1.81	0.006
SD	52.04	53.05	20.74		

Data source: The Brazilian Ministry of Health's Notifiable Diseases Information System (SINAN) database; CadÚnico, the socioeconomic database of from the Ministry of Social Development; the BFP monthly payroll of the Brazilian Federal Bank.

[a]Dirt, rough wood and other non-specified material.

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Table 3

TB treatment outcome according to the Bolsa Familia Programme (BFP) cash transfer exposure: Brazil, 2010

Variables	Cure Adjusted RR (95% CI)
BPF cash transfer	1.07 (1.04 to 1.11)
Age group, years	
<15	1.0
15–50	0.94 (0.90 to 0.97)
≥50	0.95 (0.91 to 0.99)
Ethnicity: Black	0.95 (0.93 to 0.97)
DM comorbidity	0.99 (0.95 to 1.04)
HIV positive	0.78 (0.73 to 0.82)
HIV status unknown	0.92 (0.90 to 0.94)
Extrapulmonary TB	1.01 (0.97 to 1.04)
Self-administered treatment (not DOT)	0.88 (0.86 to 0.90)
Rural area	0.98 (0.96 to 1.02)
Number of rooms <4	1.00 (0.98 to 1.02)
Inappropriate floor material[a]	0.96 (0.94 to 0.99)
Baseline household monthly per capita income (before BFP) <US$20	0.97 (0.96 to 1.00)
Illiteracy	0.98 (0.95 to 0.99)
Total number of observations	7255

Data source: The Brazilian Ministry of Health's Notifiable Diseases Information System (SINAN) database; CadÚnico, the socioeconomic database of from the Ministry of Social Development; the BFP monthly payroll of the Brazilian Federal Bank. BFP: Bolsa Familia Programme; DM: Diabetes mellitus; RR: risk ratio.

[a]Dirt, rough wood and other non-specified material.

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Table 4

TB treatment outcome according to the Bolsa Familia Programme (BFP) cash transfer exposure stratified by DOT: Brazil, 2010

BFP income transfer	Cure n (%)	Not cure[a] n (%)	Total	RR (95% CI) Unadjusted	Adjusted[b]
DOT					
Exposed during TB treatment	2534 (87.1)	374 (12.9)	2908	1.04 (1.00 to 1.57)	1.05 (1.01 to 1.08)
Not exposed during TB treatment	581 (84.4)	107 (15.6)	688		
Total	3115 (86.6)	481 (13.4)	3596		
Self-administered treatment					
Exposed during TB treatment	2218 (77.0)	662 (23.0)	2880	1.10 (1.05 to 1.15)	1.11 (1.05 to 1.16)
Not exposed during TB treatment	547 (70.2)	232 (29.8)	779		
Total	2765 (75.6)	894 (24.4)	3659		

Data source: The Brazilian Ministry of Health's Notifiable Diseases Information System (SINAN) database; CadÚnico, the socioeconomic database of from the Ministry of Social Development; the BFP monthly payroll of the Brazilian Federal Bank.
BFP: Bolsa Familia Programme; DOT: directly observed treatment; RR; risk ratio.

[a] Lost to follow up, death and not evaluated (missing and transferred out).

[b] Adjusted for: age, ethnicity, TB type, diabetes mellitus, HIV status, directly observed treatment, illiteracy, zone of residence, number of rooms and household floor material, and baseline household per capita income.