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Do Conditional Cash Transfers Improve Antenatal Care Outcomes in Senegal? Combining Non-Experimental and Quasi-Experimental Evaluations

Frieda Vandeninden[1]* and Fabienne Fecher[2]

Abstract

Background

Experimental evaluations, such as randomised control trials, have become the gold standard for evaluating social programmes. The prerequisite measures that need to be in place at the project design phase in order for experimental evaluations to take place, however, are costly, time-consuming and involve survey data collection. They may also raise ethical issues when the social programme - for the sake of evaluation - denies benefits to some groups, like control groups. Consequently, the outcome of many programmes remains 'unevaluated'. Most commonly, governments or programme

[1] Université de Liège, B31 - Place des orateurs 3 - 4000 Liège – Belgium, f.vandeninden@uliege.be

[2] Université de Liège, B31 - Place des orateurs 3 - 4000 Liège – Belgium, ffecher@uliege.be

managers only track and monitor inputs (e.g. spending) and outputs (e.g. number of vaccines distributed). In this paper, we first conduct a non-experimental evaluation, using administrative data from social programme monitoring systems to infer a causal effect between programme and outcome. We then conduct a quasi-experimental evaluation of the CCT using available survey data (Demographic and Health Survey). The purpose of the analysis is to propose a low-cost and rapid evaluation using data that governments and/or programme managers have already collected. We apply this approach to Senegal, which introduced a pilot conditional cash transfer (CCT) programme in the Kaffrine region in 2015. The objective of the CCT was to boost demand among poor women for antenatal care. Vulnerable women were identified via a community targeting approach and a proxy-means test.

Methodology

We first used an original administrative dataset derived from antenatal consultation (ANC) registries of three health centres in the Kaffrine region, covering 681 pregnant women over a 13.5 month period in 2016 and 2017. By means of a regression analysis, we determined the demand drivers for ANC visits. In a second step, we used data from Demographic and Health Survey (DHS) datasets (2014 and 2017) to conduct a quasi-experimental evaluation, looking at the average level ANC between the treatment and control group, determined using a propensity score matching. Finally, we compared the results of the non-experimental and quasi-experimental analysis.

Results

The results of the non-experimental analysis reveal that the probability of high uptake of ANC is positively and significantly influenced by young maternal age and by the occurrence of at least one miscarriage event in the past. Overall, there was no significant difference in ANC consumption between CCT beneficiaries (vulnerable women targeted through community targeting) and non-beneficiaries. This result can be explained by either of two different hypotheses: (1) the CCT beneficiaries would have consumed fewer ANCs in the absence of a CCT, since the CCT reduced inequalities in ANC consumption between CCT beneficiaries and non-beneficiaries, or (2) there is no initial difference in ANC consumption between CCT beneficiaries and non-beneficiaries and thus the CCT does not increase consumption by CCT beneficiaries. The quasi-

experiment analysis shows that the average ANC of the treatment is significantly higher than for the control group, with 2.29 to 2.91 visits on average between the control and the matched treatment groups. This validates the first hypothesis, i.e. the CCT has increased the average ANC of beneficiaries. While the non-experimental approach did not allow to conclude on the impact of the CCT, the quasi-experimental approach revealed that the CCT significatively increase the numbers of antenatal consultations of beneficiaries.

Conclusions and policy implications

The combination of non-experimental and quasi-experimental evaluations has the potential to analyse the causal effects of a social policy in a cost-effective way, using combinations of existing information, such as administrative data and already-collected survey data. This approach revealed that the CCT in Senegal increased consumption of antenatal care services between beneficiaries and non-beneficiaries. CCTs appear to be an effective policy option to reduce inequalities in use of antenatal and maternal care services.

Keywords

Conditional Cash Transfers, Maternal and Child Health, Antenatal Consultation

1. Introduction

In early 2016, the Sustainable Development Goals (SDGs) of the 2030 Agenda were adopted, reflecting the recognition that poverty reduction must be supported by strategies that address education, health and social protection needs, while simultaneously tackling climate change and environmental protection (United Nations, 2015). Typically, social policies and programmes are implemented with the objective of changing outcomes and meeting some SDG targets, such as improving youth literacy, decreasing infant mortality, raising incomes or improving resilience against shocks. Evaluating whether programmes actually achieve their outcomes has become a central question in public policy today.

However, gauging the causal effect between a social programme and a social outcome is challenging. It requires designing a so-called impact evaluation, usually in the form of randomised control trials (also called experimental evaluations).[3] The core of any impact evaluation is to determine the causality of a programme by estimating a counterfactual; that is, what would have been the outcome for programme participants if they had not participated in the programme (Gertler et al., 2016)? In practice, impact evaluation requires comparing outcomes between the participants (treatment group) and a group that share identical characteristics but do not benefit from the programme (counterfactual or control group), and therefore collecting survey data on both groups (Heard et al. 2017).

Over the last decade, experimental evaluations have become a reference tool in social policy research. The 2019 Nobel Memorial Prize in Economics awarded to Abhijit Banerjee, Esther Duflo, and Michael Kremer for their experimental approach to alleviating global poverty, highlighted recognition of the importance of this method in the field of social policy.

Experimental evaluations are not without limitations, however, particularly in terms of cost and ethical considerations. Implementing impact evaluations requires collecting original survey data. The data collection process itself generates costs, both in terms of money and time (from hiring interviewers to the time needed to process and analyse the data). When financial resources are limited, policymakers may opt to invest more in people (increasing transfers and/or coverage) than in the evaluation method. Some situations also call for an urgent policy response that does not leave time for designing the experimental approach. Ethical concerns against experimental evaluation have also often been raised, since denying the control group the intervention benefits is controversial (Barnett and Camfield, 2016; White, 2013).

[3] Randomised control trials are a type of impact evaluation that involves a random assignment to the treatment and control groups. Quasi-experimental methods differ from experimental methods in that they do not use a randomised assignment. They usually imply methods such as Propensity Score Matching, Difference in Difference and Instrumental Variables. Non-experimental evaluations do not involve any control group. (see Gertler et al., 2016 for a discussion on the different impact evaluation methods).

The constraints and methodological requirements implied by impact evaluations often leave many programmes 'unevaluated'. Even though the number of impact evaluations worldwide is growing[4], outcomes of many social programmes are not directly measured. Policymakers most commonly focus on monitoring programme inputs (such as allocation of financial resources) and direct outputs (such as numbers of beneficiaries, number of vaccines distributed, etc.). This monitoring process leads to the constitution of administrative data; that is, data routinely collected as part of administering the programme (Gertler et al., 2016). However, administrative data alone do not allow programme outcomes to be evaluated and are therefore often underused.

This paper proposes an original method for exploiting administrative data and inferring outcome impact, making use of existing survey data. While impact evaluations imply associating the design of the programme with conducting an original survey, many countries (including low-income countries) have readily available survey data (such as Household Budget Data, Survey on Income and Living Conditions, Demographic Health Surveys, etc.) that offer a rich source of information on the socioeconomic characteristics of their population. Combining the analysis of existing survey data with programme administrative data is a potential way (given the type of data at hand) to measure impact at no additional cost.

More specifically, this paper first proposes a non-experimental evaluation of a conditional cash transfer (CCT) programme in Senegal, using administrative data. That programme aims to boost demand for antenatal care by vulnerable women and reduce regional inequalities in maternal health. The objective of our analysis is to evaluate the causal effects of the programme: did the number of antenatal consultations (ANCs) made by beneficiary women increase as a result of the cash transfer received? We use monitoring information on output, i.e. number of ANC visits, to construct a dependant variable (a score that depends on the number of visits and stage of pregnancy) in order to capture the programme's outcome.

[4] The Abdul Latif Jameel Poverty Action Lab has produced 1073 RCTs evaluations in the field of development and social policy, covering 90 countries (https://www.povertyactionlab.org/fr/evaluations).

Unlike experimental evaluations, the administrative dataset underlying our analysis did not include a control group. In fact, our dataset included post-intervention administrative data on CCT beneficiaries, vulnerable women selected based on socioeconomic characteristics through a community targeting method, and non-CCT beneficiaries. The administrative data allowed monitoring the numbers of consultations of the latter groups but did not include any information on a counterfactual group, i.e. vulnerable women with the same socioeconomic characteristics as beneficiary women, but who did not receive the CCT. To tackle the absence of a control group, we complemented our analysis by conducting a quasi-experimental analysis, looking at *ex-ante* ANC consumption behaviour by women with similar socioeconomic characteristics to CCT beneficiaries before and after the programme, using Demographic Health Survey (DHS) data. We used a Propensity Score Matching method to design a control group (based on DHS 2014) that have similar characteristics of CCT beneficiaries, i.e. the treatment group (based on DHS 2017, using eligibility criteria of the CCT).

While the non-experimental approach alone does not allow to conclude on the impact of the CCT on antenatal consultations, the quasi-experimental approach shows that the CCT significantly increases the average number of antenatal visits, from 2.29 to 2.91 visits on average between the control and the matched treatment groups.

This research also contributes to the literature on the evaluation of maternal health cash transfer programs. Overall, most evaluations report positive and significant effects of the cash transfer on primary outcome, such as antenatal visits, skilled attendance at birth, delivery at a health facility, vaccination for mothers and appropriate birthweight, as reported in systematic reviews (Gaarder, Glassman and Todd 2010; Glassman, Duran and Fleisher 2013; Owusu-Addo, Renzaho and Smith 2018). Significant increase in the number of antenatal consultations have been found in Bangladesh, China, India, Indonesia, and Uruguay (respectively in Nguyen et al. 2012 ; Zhou et al. 2020 ; Lim et al. 2010; Alatas 2011; Amarante et al. 2012). Other studies found mixed results, such as no increase in prenatal care but increase in quality of prenatal care in Mexico and increase only in some regions (e.g. increase in urban area only (Barber and Gertler 2010)). Our paper contributes to the literature on evaluations of maternal health CCT,

and in particular CCT in Senegal. There is up to day no evaluation of this specific program.

The paper first provides an overview of maternal health context in Senegal and the design of the CCT under analysis (Section 2). Section 3 describes our administrative dataset and non-experimental methodology (including construction of the dependent variable, the ANC score). The results of the regression analysis are presented in Section 3.c. Given the mixed results of the non-experimental approach, Section 4 provides a quasi-experimental evaluation of the CCT using survey data and a matching technique to create comparable treatment and control groups. The concluding section is Section 5.

2. Contextualizing: Maternal Health in Senegal and CCT Programme Design

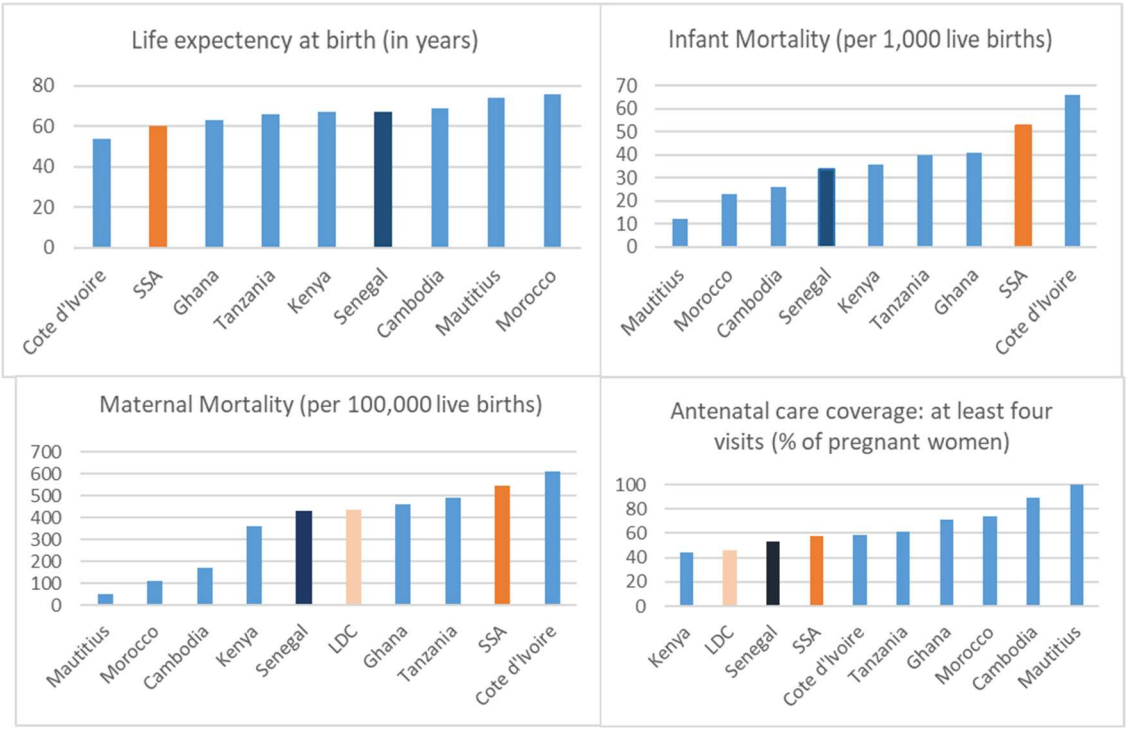
Senegal still faces many challenges in terms of human capital development. In 2017, the country scored poorly on UNDP's Human Development Index, ranking 164th out of 194 countries (Human Development Index, UNDP 2018).[5] While Senegal shows outstanding performance in some areas compared to others in the region (e.g. 92 percent of the population have access to safe water, 64 percent have access to electricity, and life expectancy is at 67 years old versus 60 region-wide), the country is lagging behind in education, nutrition and maternal health (World Bank 2018).

Maternal health requires urgent action in Senegal, with high maternal mortality and a low rate of antenatal consultations. The health sector shows very distinct patterns in the country with, on one hand, relatively good life expectancy and low infant mortality indicators, and on the other hand, large maternal mortality and low antenatal care coverage. Maternal mortality (430 per 100,000 births) is relatively high, close to the

[5] The Human Development Index (HDI) is a composite index focusing on three basic dimensions of human development: the ability to lead a long and healthy life, measured by life expectancy at birth; the ability to acquire knowledge, measured by mean and expected years of schooling and the ability to achieve a decent standard of living, measured by gross national income per capita (UNDP, 2018).

average of the Least Developed Countries (LDCs) (436 per 100,000 births). Maternal mortality is directly related to the low rate of births attended by professional staff as well as the low percentage of women who attend antenatal visits. The latter is particularly low in Senegal, with 53 percent of pregnant women attending four visits in 2016, versus 58 percent in the region (Figure 1).[6]

Figure 1. Maternal health indicators, Senegal and comparator countries (2016)



Source: Based on World Bank 2018 and UNICEF 2018

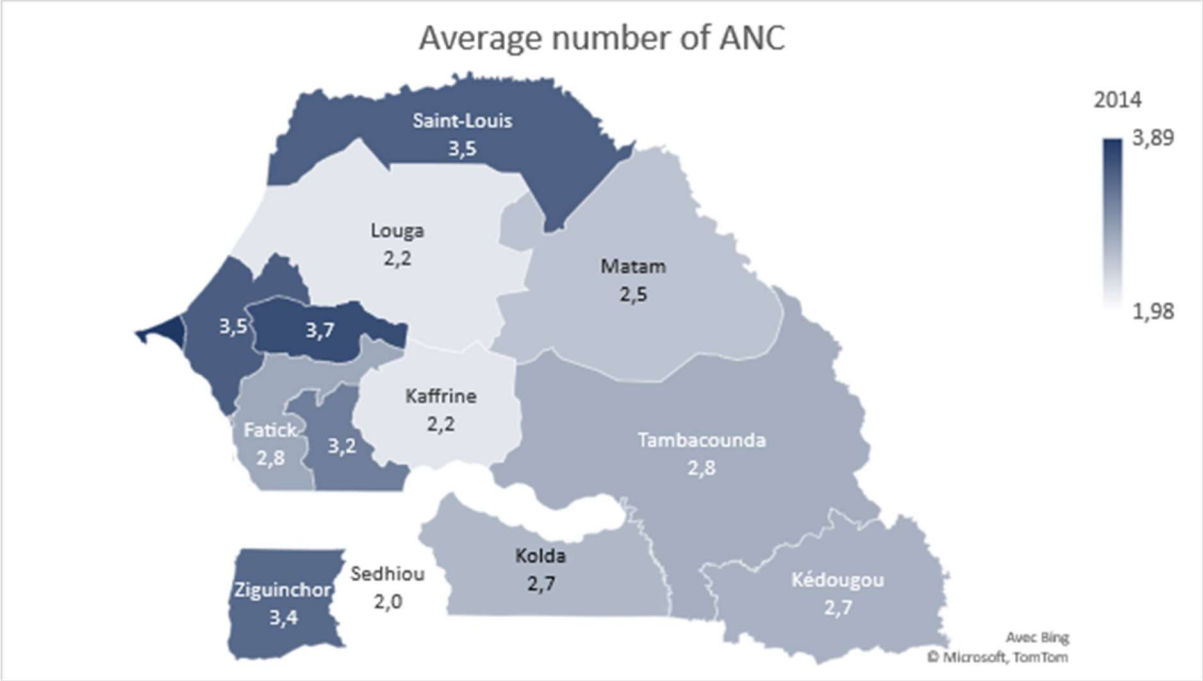
Note: SSA=Sub-Saharan Africa, LDC=Least Developed Countries

In this context, Senegal introduced a pilot conditional cash transfer (CCT) programme in 2015. The objective of the CCT was to stimulate demand for maternal health services, in particular antenatal consultations and births attended by skilled staff. The programme was implemented by the governmental unit in charge of fighting malnutrition in Senegal (Cellule de Lutte contre la Malnutrition - CLM) and benefitted from World Bank funding as part of its health and nutrition project that ended in 2020 (World Bank 2020).

[6] Increased from 47 percent in 2015.

The CCT was first piloted in the Kaffrine (Koungheul district) region, selected because it had experienced low maternal health indicators and high poverty rates. The average number of ANCs per pregnant women in Kaffrine was 2.2 in 2014, versus 3.2 nationally and 3.9 in Dakar (Map 1) and 63 percent of the Kaffrine population were poor (defined as those belonging to the bottom wealth quintile, World Bank 2020). The CCT was later extended further, into the Gossas district of the Fatick region and in the Sédhiou region. This is not covered by our analysis, however, given that our dataset was collected during a field trip to Kaffrine only.

Map 1. Average numbers of ANCs by region (2014)



Source: Authors' computations based on DHS 2014 (ANSD 2015)

The selection of potential CCT beneficiaries was the result of a community targeting exercise. Next to geographical targeting (focusing on most vulnerable districts), the selection of beneficiaries in intervention zones relied upon identification of poor households by the community. A targeting committee comprised of the Mayor, civil society representatives such as the community leader, priest or imam, village chief, school director and women was established in every commune of the intervention zone (in this case the nine communes in the Koungheul district) to identify the most vulnerable households (CLM 2016). The selection criteria were based on a proxy-means

test (PMT), following a list of proxies for poverty: type of habitation, numbers of meals a day, possession of livestock and durable goods (CLM 2014). Unlike many proxy-means test or other targeting method, there is not a defined formula that computes a PMT score and threshold against which households are ranked. Households are eligible if there are constrained is most of the proxies listed above.

During the 2015-2016 pilot, the selection process resulted in a list of 5,043 potential beneficiary households in Kaffrine. Once pregnant, each woman in the selected households needed to comply with the conditionalities in order to receive the cash transfer, that is, they needed to attend antenatal visits and have an assisted delivery in a health centre. Selected women were granted a beneficiary card, which tracked ANCs. The verification of conditionalities was enforced by community agents, once a month, cross-checking both health centre registers and beneficiary cards.

After verification of compliance with the conditions, women received 5,000 FCFA per ANC and 10,000 FCFA for giving birth in the health facility, hence a total of 30,000 FCFA if all conditions were fulfilled. The transfer amount had the potential to act as an incentive for making use of ANCs, as it represented a relatively fair share of the household consumption (average per capita monthly consumption by households in the two lowest quintiles estimated at 21,600 FCFA) and was in line with the transfer amounts of the national poverty programme *Bourse Familiale* (25,000 FCFA per trimester) (Ferré 2017). The payment was made after verification that all conditions had been met, and the cash was delivered directly by community agents to beneficiaries' homes.

Over the period April 2015 to end of March 2016, 37,575,000 FCFA were paid to beneficiaries in Kaffrine (Juquois 2019). Over the same period, 1,379 pregnant women were included in the programme, representing about 27 percent of the households selected (5,043 were identified). In total, more than 5,000 cash transfers were paid, based upon the number of ANCs per women in 2016 (CLM 2016). The project expended in 2017, covering 2,387 pregnant women at the end of 2018 (corresponding to 11,937 payments) (World Bank 2020). The remainder of the analysis focuses on the period 2016-2017, in the Kaffrine region.

3. Non-experimental approach: - Does the CCT Increase Uptake of ANCs?

This section examines the potential effect of the CCT on ANCs; i.e., is the CCT effective in increasing the number of ANCs among beneficiary women? The analysis relied on post-intervention administrative data, collected in three health centres in Kaffrine. Our objective was to use existing administrative data, collected for monitoring purposes, and to infer a causal effect between the CCT and the consumption of ANCs.

a. Methodology and data description

The quantitative analysis rests on data collected in three health facilities (*centres de santé*) in the Kaffrine region, through antenatal consultation (ANCs) registries. The registries contain a set of information on each pregnant woman who came to the centre for an ANC, therefore the dataset includes post-intervention data. Only pregnant women who had at least one antenatal consultation are therefore included in our dataset. Information on pregnant women who did not consult in the three health centres (whether eligible for the CCT or not) is consequently not included in the dataset. Hence, the analysis focuses on the number of ANCs (from 1 to the recommended 4) rather than use of the service itself.

We examine the difference in ANC outcomes between CCT beneficiaries (i.e. vulnerable women selected through the targeting process detailed in Section 2) and non-CCT beneficiaries. We then derive the determinants of higher probability of ANC using a regression analysis. Our analysis differs from standard impact evaluations, as no control group was available (that is, women with the same characteristics as beneficiaries but did not receive a CCT). Partly to overcome this limitation, trends in ANC consumption across quintile (proxies of characteristics of beneficiaries and non-beneficiaries) will be presented in Section 3.

The dataset originally comprised 681 women in total, with 280 from centre 1, 171 from centre 2 and 229 from centre 3. The data cleaning process resulted in a final dataset of 677 observations and a dozen variables.[7] Across the 677 women, 115 were CCT

[7] Five observations with missing or unreadable information on ANC were deleted.

beneficiaries. Data were collected in October 2017, and cover a period of approximately one year. Key variables in the study, notably, are the number of ANCs per woman (ranging from 1 to 4), the dates of each antenatal consultation (ANC) and women's eligibility for the CCT. Other variables of interest include age, number of children, number of pregnancies, health centre visited and the qualifications of the health care providers at each antenatal consultation. From the raw data, several additional explanatory variables were derived, such as number of miscarriages, rank of a woman's first ANC visit ('rank' = the point at which a visit took place, e.g. during the first, second, third or fourth segment of her pregnancy) and time interval between each consultation.

The main variable of interest in our analysis is the number of visits per woman – since the objective of the CCT was to incentivise women to consult four times during pregnancy. However, this variable could not be used as a dependent variable, since the sum of the numbers of visits does not take gestational age into consideration. As an example, a woman in early pregnancy at the end of our data collection period could only have attended only one ANC and thus the sum of her visits is not comparable with a woman whose entire pregnancy was covered by the dataset.

In order to evaluate the impact of the CCT on antenatal care, i.e. whether visits by beneficiaries were more frequent than those made by non-beneficiaries, we created a score that allowed comparing consumption of antenatal care services for different gestational ages, as detailed below, Section 3.b. This score serves as our dependent variable for the regression analysis.

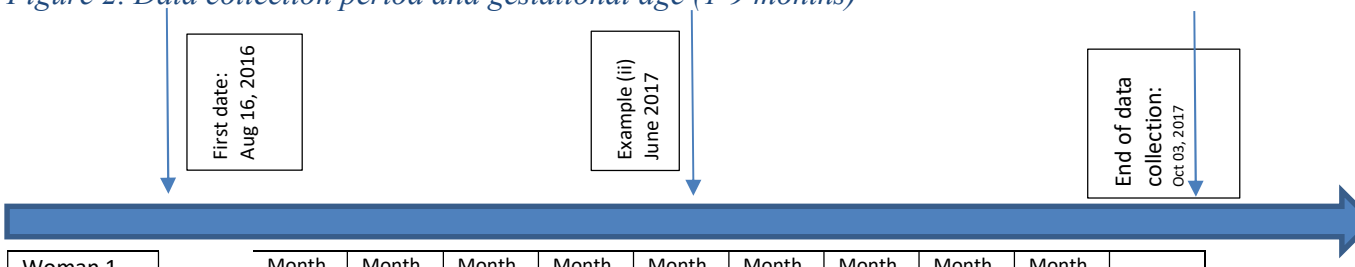
b. ANC score – the dependent variable

The registries followed pregnant women over 13.5 months, between August 16, 2016 and October 3, 2017. Only a few women had the possibility of completing the four ANCs throughout their pregnancy cycle, i.e. those pregnant before January 2017 (October minus 9 months). Any ANC visit after January 2017 led to different cases according to each woman's stage of pregnancy. Given the limited timeframe captured by our dataset, adjustments have to be made in order not to penalise women who made fewer than four ANCs as a result of the early stage of their pregnancy and the timing of the data collection.

Additional variables available in the registries were used to derive a score that treat women equally according to the stage of their pregnancy. The registries also tracked the rank of the ANCs, i.e. if the women consulted during ANC1 (first to third month of pregnancy), ANC2 (fourth to sixth month), ANC3 (seventh to eighth months) or visited during ANC4 (at 9 months), as well as the calendar day of the visit.

In Figure 2, three different cases are illustrated: (i) The pregnancy of woman 1 is entirely covered and therefore trackable over the period covered by the dataset. In this case, the observed number of ANCs does not need to be adjusted and the possible number of ANCs given our period of data collection is 4; (ii) The second women comes for the first time to the health center in June 2017 for her ANC 1, but by the end of the data collection period, she is only 7 months pregnant and therefore not able to do her final ANC. In this case, her total possible number of ANCs is 3; (iii) Woman 3 was already pregnant when the data collection was initiated, and we can only track her ANCs from ANCs 2 to 4 but cannot know if she had her first consultation before the data collection period. In this case, we assume that she did go to her first consultation and her total possible number of visits over the period is 3.

Figure 2. Data collection period and gestational age (1-9 months)



Woman 1	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	
Woman 2				Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7
Woman 3	Month 5	Month 6	Month 7	Month 8	Month 9					

Source: Authors

Source: Authors

In order to account for each woman's stage of pregnancy, we thus estimated the numbers of months since the start of pregnancy using the date of each ANC (as captured in the registries) and computed the maximum possible number of ANCs. In other words, we tallied the number of ANCs that would have been possible over the period covered by our dataset given the calendar day of each visit and the ANC 'rank' In point of fact, the ANC rank gave us an indication of the stage of pregnancy (with some margin of error of max. 120 days, e.g. if ANC1 happened at the very beginning of pregnancy or at the end of the first trimester).

In order to take gestational age into account, we then derived a score by dividing the observed sum of ANCs by the number of possible ANCs (Annex 1 provides a detailed description on the estimation of the number of possible ANCs and the score). The score represents the level of ANCs with respect to the maximum number of times a woman could have consulted during the period covered in the dataset. Given the nature of the variables (two categorical variables from 1 to 4), the score has six categories, ranging from 0.25 to 1. Overall, 252 women (representing 37.22 percent of the sample) have a score of 1, i.e. given their stage of pregnancy/gestational age, the number of ANCs actually attended correspond to those they could possibly have attended (Table 1).

Table 1. ANC scores

Score ANC	0.25	0.333	0.5	0.667	0.75	1	Total
Total (percent)	8.57	2.66	23.34	10.78	17.43	37.22	100
Total (n)	58	18	158	73	118	252	677

Source: Authors' computation based on collected dataset

The average score offers additional insights into the relationship between the consultations and the explanatory variables. The descriptive analysis of the score (Table 2) shows a relationship between miscarriage and ANC -- the group with at least one miscarriage had a higher average score (average score of 0.75) than the one with no miscarriages (0.72). Similarly, a positive relationship was observed between age and

number of ANCs, with the youngest group scoring relatively high (0.82). The oldest group also showed a slightly higher average than the middle-aged group (0.74). The average score of centre 1 was smaller than the scores in centres 2 and 3 (0.70 versus 0.73 and 0.74 respectively). The average score between CCT beneficiaries and non-CCT beneficiary groups was relatively similar, though slightly smaller for beneficiaries (0.71 versus 0.72).

Table 2. Average ANC score and explanatory variables

Miscarriage	Average ANC score	Numbers of obs (n)
0	0,72	532
1	0,75	85
Age		
18 and less	0,82	37
18-22	0,72	193
23-27	0,70	182
28-31	0,71	156
32+	0,74	109
Health centre		
1	0,70	280
2	0,73	170
3	0,74	100
Staff performing the ANC1		
Midwife	0,91	230
Nurse	0,89	9
Nurse assistant	0,93	40
CCT		
0	0,72	552
1	0,71	115

Source: Authors' computation based on collected dataset

c. Regression Results

Descriptive statistics show some trends in consumption of ANCs but the impact of the conditional cash transfer on ANCs is unclear (similar average score for beneficiaries and non-beneficiaries). Nor do descriptive statistics allow us to draw a conclusion as to whether receiving a cash transfer influenced a mother's decision in favour of antenatal consultations. In what follows, we use a standard regression model to estimate the probability of having a high score (i.e. actual number of consultations equals potential number of consultations), controlling for several descriptive variables. Our dependant variable (that is, the score as constructed above) captured numbers of ANC visits. The model consequently estimates which variables impact the decision to go to more ANCs. In the first model (Model 1), we controlled for health centres (base category is centre 3), for receiving the CCT (dummy), for age category (with base category being between 18 and 31 years old), for number of pregnancies (continuous variable) and for miscarriages (dummy). In Model 2, we accounted for crossed effects between receiving the CCT and the health centre (Table 3).

Table 3. Regression analysis - results

Model 1				**Model 2**		
Variables	**Coeff.**	**SE**		**Variables**	**Coeff.**	**SE**
CCT (=0)	-0.025	0.026		CCT (=0)	-0.069*	0.042
Health centre (=3)				Health centre (=3)		
1	-0.048**	0.024		1	-0.064**	0.026
2	0.027	0.027		2	-0.032	0.029
				Health center*CCT		
				1 1	0.102*	0.060
				2 1	0.025	0.069
Age category (=18-31)				Age category (=18-31)		
<18	0.099**	0.045		<18	0.094**	0.046
>31	0.037	0.032		>31	0.039	0.032

Number of pregnancy	-0.008	0.005		Number of pregnancy	-0.008	0.005
Miscarriage (=0)	0.066**	0.031		Miscarriage (=0)	0.062**	0.031
Intercept	*0.767*	*0.025*			*0.777*	*0.026*
Observations	*661*				*661*	
R-squared	*0.025*				*0.029*	

*** and * indicate significance at 5% and 10% level*

Note: Coeff. stands for coefficient and SE for Standard Error

Source: Authors

In the first model, we see the absence of a significant relationship between the CCT and the ANCs. We therefore cannot conclude that CCT beneficiaries attend more ANCs than non-beneficiaries. Consulting in different centres affects the score, with centre 1 showing a significantly lower probability of high scores than centre 3. There is, however, no significant difference between centres 2 and 3. Women below 18 had a higher probability of performing ANCs than middle-aged women. The younger age category had the highest coefficient and is significant at 10%, while the number of pregnancies did not significantly affect the score. On the other hand, having had at least one miscarriage positively affected the likelihood of consulting more often (significant at 10%). Descriptive statistics indicate a potential centre effect on the score, i.e. the cash transfer may have an impact but only in specific centres (Table 2). In order to take these possible effects into account, we ran a regression model that took into account crossed effects between centres and CCTs.

In Model 2, we used the same specifications as in Model 1 and added a crossed effect between centres and the CCT, considering centre 3 as the baseline centre. In this case, the CCT negatively influenced the probability of a higher score (significant at 10%), indicating that centre 3 beneficiary women tended to consult less than the non-beneficiary group at centre 3. In fact, the coefficient of the CCT in turns captured the impact of the transfer but only for the baseline centre. The crossed effect showed a positive and significant relationship in centre 1: CCT beneficiaries in centre 1 had a higher probability of a high score than CCT beneficiaries in centre 3. There was,

however, no significant difference between centres 2 and 3, only between centres 1 and 3. While significant relationships of Model 1 held (having had a miscarriage at a young age increased the probability of a high score while consulting in centre 1 decreased the score), the crossed effects of Model 2 showed that the CCT had a negative impact only in centre 3 and that across all CCT beneficiaries, those in centre 1 had a higher score.

Changing the baseline health centre for crossed effect (see Annex 2) validated the findings of Model 2, i.e. 1) there was no significant difference with respect to centre 2. In all cases, receiving the transfer in centre 2 versus centre 1, or in centre 2 versus centre 3 was not significant, 2) looking at each health centre separately (beneficiaries versus non beneficiaries), the CCT significantly affected the score only in centre 3 (negatively), while it affected the score positively in centre 1 but not significantly (p-value: 0.44), 3) looking at the overall group of beneficiaries, receiving the CCT in centre 1 significantly increased the probability of a high score by 0.102 p.p. Additionally, several tests and robustness checks (see annex 3 for a probit model performed only on the 283 women for whom pregnancy was entirely covered over the data collection period) confirmed the above finding. Adding other variables, such as staff qualifications and the rank of the first ANC did not add any explanatory power and was not significant.

Overall, there is an absence of a positive and significant relationship between the CCT and the numbers of ANC. However, we cannot conclude that the CCT has no effect on beneficiaries, given the different characteristics of groups of beneficiaries – vulnerable women selected through proxy-means-test (PMT) targeting – and non-beneficiaries. Beneficiaries are supposedly more likely to have increase their level of ANCs, as stated in the objective of the programme. The absence of significant effects of the CCT can thus be explained by one of the two different hypotheses: (1) the CCT beneficiaries would have consumed less ANC in the absence of CCT. The latter reduces inequalities in ANC consumption between CCT beneficiaries and non-beneficiaries, or (2) there is no initial difference in ANC consumption between CCT beneficiaries and non-beneficiaries and the CCT does not increase the consumption by CCT beneficiaries.

The next section further analyses ANC consumption using a Demographic Health Survey data analysis, with the objective of validating either hypothesis 1 or 2. More

specifically, it looks at ANC consumption pre-CCT and post-CCT (before the pilot was introduced in late 2015) , with a specific focus on the Kaffrine region.

4. Discussion: Can a quasi-experimental approach supplement the nonexperimental approach?

The non-experimental analysis does not show statistically significant impact of the CCT. Next to the absence of significative causal effect, the analysis compared two groups of women (CCT beneficiaries and non-beneficiaries) with potentially different characteristics. These two groups, in fact, most likely differ in terms of socioeconomic characteristics that could influence both the eligibility to the CCT and the decision on the number of ANC. The beneficiaries were selected through a PMT targeting process, with the objective of focusing on women living in poor households. The selection committees based their decisions on a series of poverty proxies, including the type of habitation and ownership of livestock and durable goods (Section 2 describes the targeting process). Because of the selection process, it can be expected that beneficiaries are overall more vulnerable than non-beneficiaries. The administrative dataset therefore does not include any counterfactual, that is, women who shared similar characteristics as CCT beneficiaries but did not receive a CCT. This section proposes a quasi-experimental evaluation of the CCT, by designing a control group that shares similar characteristics with the CCT beneficiaries.

In order to evaluate the causal impact of the CCT on ANCs, and in the absence of a counterfactual, one option would have been to compare ANC consumption for the group of beneficiaries before and after the CCT. However, the administrative data, i.e. a list of indicators tracked in the health centre registries, did not allow monitoring ANC consumption by women across their pregnancies. Surveying beneficiaries regarding their consumption of antenatal care might have captured the missing information but would have entailed high costs. Rather, the approach of this paper was to make use of readily available information to illustrate how programmes can be evaluated at a low cost. Given the limitations of the collected administrative dataset, another option is to use survey data to create a control group, including women that share similar characteristics with CCT beneficiaries, but did not benefit from the program.

We use a Propensity Score Matching (PSM) method to design a control group and evaluate the impact of the CCT. The purpose of the PSM is to credibly determine the causal effect of the program by identifying a group of non-beneficiaries (counterfactual or control group) that are statistically comparable to CCT beneficiaries (de Hoop et al. 2020). We used DHS data to determine the treatment and control groups.[8] Both groups include observations from Kaffrine region only, and focus on women who delivered at least one child over the year.

The treatment group is determined using 2017 DHS data (as the CCT run in the Kaffrine region from 2015 to 2018), by replicating the eligibility conditions of the targeting process (described in section 2).[9] More specifically, the treatment group is first drawn using a variable from DHS that identifies households that reported receiving a cash transfer. As this participatory variable does not clearly indicate if the cash transfer received is the CCT under study, other variables were used to refine the treatment group (see Handa et al. 2012 and Stoeffler et al. 2016 for successful examples of simulations of programs entitlements using survey data). The set of observable variables selected is similar to those used in the PMT selection process of beneficiaries, and includes type of house (floor, roof, wall), household's commodity (including TV), and livestock (see Table 4 for the list of variables used to simulate CCT eligibility). A woman is determined as CCT eligible if she receives at least one cash transfer, and if she is deprived in at least 5 of the 7 dimensions of table 4. In 2017, 142 women delivered at least one child in Kaffrine. Simulation of the eligibility criteria of the PMT and the condition on declaring receiving a cash transfer in the survey resulted in a treatment group of 77 observations.

Table 4: List of variables used to determine CCT eligibility

Variables	*Definitions*
Receive_anyCT	is =1 if declare receiving a cash transfer from national/international source

[8] The outcomes we wanted to measure drove the survey choice: details on consumption of antenatal care services are only available in the DHS survey

[9] Another option would have been to use the collected dataset to form the treatment group but the limited numbers of socio-economic characteristics (include only age, number of children and miscarriage along the information on the different ANC) in the dataset jeopardize the PSM with non-beneficiary women.

Roof_pov	dummy variable that accounts for precarious material for roof (=1 if roof is made of natural material such as leaf, mood, bambo or zinc; =0 if roof is made of wood, tuiles, ciment or other elaborated material)
Floor_pov	dummy variable that accounts for precarious material for floor (=1 if roof is made of natural material such as soil, sand, dung, palm, bamboo, cement and =0 if floor is made of parquet, wood, vinyl, tiles or carpet)
Toilet_pov	dummy variable that show poor toilet conditions (=1 if no facility/bush/filed, pit latrine with flush, ventilated pit laterine, open pit laterine (no flush) ; =0 if toilet with flush to septic tank, pit laterine with flush and traditional laterine)
No_electricity	is = 1 if no electicity
Cow_pov	is = 1 if less than 5 animals
Goat_pov	is = 1 if less than 5 animals
Sheep_pov	is = 1 if less than 5 animals

Source: Authors based on DHS questionnaires

As the program was piloted from 2015 on, the control group draws from DHS data in 2014. The 2014 dataset included 59 women in Kaffrine region, who delivered at least one child during the preceding year.[10] In 2014, no woman declared benefiting for any cash transfer. Table 5 summarizes descriptive statistics for eligibility variables in the treatment group, distinguishing between CCT-eligible women and non-eligible women, and the control group. It shows that all women in the CCT eligible group (treatment group) receive a cash transfer. Only few women in the non-eligible group receive a cash transfer (25 percent), as they were not considered as CCT eligible because they did not fit the eligibility criteria of the PMT. The mean values of the variable used to determine eligibility are significantly lower in the non-eligible group compared to the CCT eligible (column B-C in Table 5), indicating lower chance of participation if a woman is not deprived in any of the dimensions used to replicate the PMT. The group of women in 2014 also shows some statistically significant differences with the CCT eligible group but to a lesser extend (statistically significant difference only for poor toilet conditions, less cow and sheep).

Table 5: Sample mean and comparisons for variables determining CCT eligibility.

	Women 2014 (A)	*2017 non-eligible (B)*	*2017 CCT eligible (C)*	*B-C**	*A-C**
receive_anyCT	0	0,25	1	-0,75***	.
roof_pov	1	0,91	1	-0,09***	.

[10] The overall sample size of DHS data increased over time. It included 40,723 observations in 2014 versus 78,950 in 2018. The control group is therefore smaller due to survey design.

floor_pov	0,95	0,89	0,99	-0,09**	-0,38
toilet_pov	0,51	0,72	0,86	-0,13**	-0,35***
no_electricity	0,81	0,6	0,79	-0,19**	0,021
cow_pov	0,83	0,77	0,97	-0,2***	-0,14***
goat_pov	0,57	0,60	0,81	-0,21***	-0,23***
sheep_pov	0,85	0,71	0,90	-0,188***	-0,09
# Obvervations	59	65	77	136	142

*Two-sample test of proportions for dichotomous variables. *p < 0.1; ** p < 0.05; ***p < 0.01.

Source: Authors' computations based on DHS 2014 and 2017

Table 6 shows the mean value of the number of antenatal consultations for each group. There is no statistically significant difference between the mean ANC of CCT eligible women versus non-eligible in 2017, which is in line with the results of the non-experimental analysis (Section 3.c). In turns, the average number of ANC in 2014 is significantly lower (2.39 ANC) compared to the average ANC of beneficiary women (3.09 ANC). However, it is not possible to distinguish eligible women from non-eligible ones in 2014. In fact, the CCT was not implemented at the time, and therefore no women in 2014 declared receiving a cash transfer. To infer the causality of the CCT, we need to compare the average ANC levels of the CCT eligible (2017) with the ANC levels of women before the CCT (2014) that share similar characteristics with CCT beneficiaries.

Table 6: Mean of outcome variable (ANC) for comparison groups

Variables	*Women in (2014) (A)*	*2017 non-eligible (B)*	*2017 CCT eligible (C)*	*B-C*[1]	*A-C*[1]
ANC	2.39	3.12	3.09	-0.03	-0.70***
Observation	59	65	77	142	136

[1]Two-sample unpaired t-test, with.*p < 0.1; ** p < 0.05; ***p < 0.01.

Source: Authors' computations based on DHS 2014 and 2017

We employed a matching method based on the observable characteristics of CCT eligible women to create a comparable sample in 2014.[11] Propensity Score Matching (PSM) is a widely used method to estimate causal effect of social policy programs (see Caliendo and Kopeinig 2008). It aims to compare individuals who receive a program with similar individuals who did not receive it. Our propensity scores are constructed using a participation equation, based on a Probit model in this case, with CCT eligibility as the dependent variable (CCT_eligible=1 if the woman is eligible). Each member of the treatment group (CCT_eligible=1) is matched to one member of the comparison group (women in 2014), using the nearest neighbour matching method. The control group therefore includes women from 2014 that match observable characteristics of the CCT eligible women in 2017 (treatment group) (Iacus, King, and Porro 2011).

The list of observable characteristics is assumed exogenous to the eligibility criteria (summarized in Table 4 above) and unlikely to be influenced by the CCT (Sabates et al. 2021).[12] Table 7 reports the determinants of eligibility for both group (CCT eligible=1 in 2017 and =0 in 2014) before matching. The probability of being eligible increases with age (ranging from 17 to 44 years old) and number of miscarriages (not significantly for the latter) while it decreases with the number of children and level of education. Female-headed household have an increased probability of being eligible, as well as those declaring working. The wealth index also shows significant difference between eligible and non-eligible, potentially depicting increase in overall wellbeing across the years. Polygamous households have less probability of being eligible than monogamous households. Given the large number of statistically significant differences between eligible and non-eligible women, applying a PSM technique is indicated.

Table 7. Determinant of eligibility

CCT eligible	*Coef.*	*Std. Err.*
age	0,11**	0,05

[11] Another possibility would be to create a control group looking at other regions than Kaffrine. However, this approach risks to mislead the impact of the CCT on antenatal consultations, as women in other regions may benefit from other initiatives and programs that potentially increase their ANC consumptions.

[12] The characteristics that were not included (because they are unobservable and not included in the survey) are supposed not to affect ANC level and/or do not differ between participants and non-participants

miscarriage	0,19	0,38
childrenborn	-0,25**	0,11
education	-1,21**	0,49
sex_head	0,33	0,36
know_ovary_cycle	-0,01	0,07
radio	-0,06	0,20
work	0,48*	0,27
wealth_index	-0,44**	0,22
number_of_otherwife	-0,56**	0,21
literacy	0,98**	0,39
water	-0,07***	0,02
_cons	-0,28	1,03
Observation	129	
Pseudo R2	0.2548	
Log likelihood	-54.06	

*p < 0.1; ** p < 0.05; ***p < 0.01.

Source: Authors' computations based on DHS 2014 and 2017

We use the commonly used nearest neighbour matching (NN) method with no replacement (as the number of CCT eligible women is larger than the number of women in the control group, the "no-replacement" option considers that the unit matched cannot be match with another unit of the control group).[13] Table 8 reports the average treatment effect on the treated (ATT), which is computed by taking the average of the difference between the ANC of each treated unit and the ANC of the matched control unit. The ATT value shows that receiving the CCT increases the average level of ANC (2.91 ANC on average, with a difference of 0.618 with non-beneficiaries). Tests on the balancing properties of covariates and area of common support were made to confirm the quality on the match (following Dohmwirth and Liu 2020, see appendix 4), showing the absence of significant differences between the two groups after the match and a fair overlap between them. Further statistical test (Two-sample t test with equal variances) on the mean ANC between the treatment and the control group after the match show that the mean of the control group is significantly lower (p value=0.009) that the mean ANC of the treatment group.

[13] Off the 129 observations for both year, 19 were discarded from the treated group because no women with similar characteristics were found in the control group. The matching process resulted in a sample size of 110 observations (with 55 observations in both group).

Table 8. ATT of the CCT on average level of ANC

	CCT beneficiaires (after matching)	Control group (after matching)	Difference in outcome	S.E	
ATT	2,91**	2,29	0,618***	0.259	

** Average treatment effect on the treated is significant at the $p < 0.05$ level (p=0.026)

*** Difference in means significant at the $p < 0.05$ level (p=0.009)

The results of the quasi-experimental approach to evaluate the impact of the CCT show that the latter significantly increased the average number of antenatal visits (from 2.29 to 2.91 visits on average between the control and the matched treatment groups). While the non-experimental analysis shows an absence of statistical difference between the level of ANC of CCT beneficiaries and non-beneficiaries, it was comparing women with potentially different characteristics. As compared to the non-experimental analysis (section 3), which found no statistically significant effect of the CCT, taking into account the differences in characteristics between beneficiaries and non-beneficiaries using PSM method reveals a statistically significant positive impact of the program.

5. Conclusions

In the development field, it is crucial to know what works and what does not. Impact evaluations have become the norm for distinguishing what works from what does not. However, designing such evaluations has a cost. In a world of tight budget constraints, where social policy often needs to be activated promptly, there is a need for rapid and low-cost evaluations. We propose using data already collected by governments and/or programme managers to try to infer a causal impact between a programme and its outcome.

More specifically, our objective was to propose applying non-experimental and quasi-experimental evaluations to a CCT programme in Senegal, looking at whether it has an impact on the demand for ANC by beneficiaries. In the absence of a counterfactual (a group of women with the same characteristics as beneficiaries but who are not enrolled in the programme), we first compared consumption of ANC services by beneficiary and non-beneficiary women using an original dataset containing post-intervention

administrative data. The data were collected in the Kaffrine region, covering the period August 2016 and October 2017 and comprising 681 pregnant women.

The administrative dataset offered some data on outputs (observed number of ANC by individual and rank of ANC) that were used to construct a score. The latter reflected how many ANCs a woman made with respect to those she could have made, given the stage of her pregnancy – thus controlling for gestational age. The regression analysis revealed that the probability of having a high ANC score is significantly and positively associated with the following characteristics: (1) women below 18 have a higher probability of making ANC visits than middle-aged women, (2) maternal history of at least one miscarriage positively affected the probability of consulting more, (3) the scores varied by consulting centre, with centre 1 showing a significantly lower probability of a high score than centre 3, but with no significant difference between centres 2 and 3, and (4) there was no significant relationship between the CCT and the ANCs. Adding crossed effects between centres and the CCT (Model 2) showed that the CCT had a negative impact in centre 3 only and that across all CCT beneficiaries, those in centre 1 had a higher score.

Our results indicate that during the period covered (2016-2017), there was no statistical difference in ANC consumption between CCT beneficiaries and non-CCT beneficiaries. The lack of impact of the CCT on the number of ANCs can be explained by one of two hypotheses: (1) the CCT beneficiaries (targeted through a PMT method) would have consumed fewer ANCs in the absence of a CCT, suggesting that the CCT increases ANC consumption between CCT beneficiaries and non-beneficiaries; or (2) there is no initial difference in ANC consumption between CCT beneficiaries and non-beneficiaries and the CCT has no effect on, i.e. does not increase, consumption by CCT beneficiaries.

In order to determine which hypothesis holds, and in the absence of a counterfactual in the administrative dataset, we conducted a quasi-experimental evaluation. Using already collected data at hand, we analysed trends in ANC using DHS data from 2014 (before the CCT) and 2017 (after CCT). Focusing on the Kaffrine region, we designed a control group (from 2014 sample) that share similar characteristics with CCT beneficiaries (from 2017 sample) using a PSM method. The results of the quasi-experimental analysis

showed that the CCT significantly increased the average number of ANC of beneficiaries compared to non-beneficiaries. In fact, the average level of ANC for the treatment group was 2.91 versus 2.29 for the control group.

While the non-experimental analysis alone did not allow to assess the impact of the CCT, the quasi-experimental approach allowed to conclude on a significative and positive effect of the programme. The absence of a counterfactual in the administrative dataset was overcame using a matching method applied to survey data before and after the implementation of the CCT. The comparison of the average level of ANC between the control group (that is women from the 2014 survey, with similar characteristics than CCT beneficiaries) and the treatment group (CCT beneficiaries, from 2017 survey) showed a positive and significant effect of the CCT. The quasi-experimental analysis supplements the non-experimental analysis: the absence of statistically significant effect in the latter is a consequence of the ability of the CCT to bring back ANC level of beneficiaries (more vulnerable women) to the one of non-beneficiaries.

1. List of abbreviations

ANCs Antenatal Consultations
CCT Conditional Cash Transfer
DHS Demographic Health Survey
HDI Human Development Index
LDC Least Developed Countries
MICS Multiple Indicator Cluster Surveys
PFSN Projet de Financement de la Santé et de la Nutrition (Financing Project on Health and Nutrition)
PMT Proxy-Means Test
PSM Propensity Score Matching
SDGs Sustainable Development Goals
UNDP United Nations Development Programme
UNICEF United Nations Children's Fund

Declarations

Data availability statement

The dataset used in the quantitative analysis was collected in October 2017, by Oriane Bodson, researcher (Université de Liège) under the "Effi-Santé" project funded through the ARC grant for Concerted Research Actions, financed by the French Community of Belgium (Wallonia-Brussels Federation). The overall project, including the CCT evaluation, benefitted from the approval of the following ethics committee: Comité National d'Ethique pour la Recherche en Santé du Sénégal (sous l'autorisation administrative N°0284 MSAS/DPRS/DR), approved in March 2016. The approval was renewed for 2017-2018. Data is available on request.

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Authors' contributions

FV participated in the drafting of the paper and analysed/interpreted the DHS and original datasets, providing substance for the analysis of ANC trends and determining ANC consumption in the Kaffrine region and applied a PSM method to the survey data. FF was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

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References

Agence Nationale de la Statistique et de la Démographie (ANSD). 2015. Sénégal : Enquête Démographique et de Santé Continue (EDS-Continue) en 2014. Dakar,

Sénégal. Accessed from https://dhsprogram.com (authorization granted in 2019).

Agence Nationale de la Statistique et de la Démographie (ANSD). 2016. Sénégal : Enquête Démographique et de Santé Continue (EDS-Continue) en 2015,. Dakar, Sénégal Accessed from https://dhsprogram.com (authorization granted in 2019).

Agence Nationale de la Statistique et de la Démographie (ANSD). 2017. Sénégal: Enquête Démographique et de Santé Continue (EDS-Continue) en 2016.. Dakar, Sénégal. Accessed from https://dhsprogram.com (authorization granted in 2019).

Agence Nationale de la Statistique et de la Démographie (ANSD). 2018. Sénégal : Enquête Démographique et de Santé Continue (EDS-Continue) en 2017. Dakar, Sénégal. Accessed from https://dhsprogram.com (authorization granted in 2019).

Alatas, V. 2011. *Program Keluarga Harapan: Main Findings from the Impact Evaluation of Indonesia's Pilot Household Conditional Cash Transfer Program*. Jakarta: World Bank. Available from: http://documents1.worldbank.org/curated/en/589171468266179965/pdf/725060WP00PUBL0luation0Report0FINAL.pdf

Amarante, V., M. Manacorda, E. Miguel, and A. Vigorito. 2012. "Do Cash Transfers Improve Birth Outcomes? Evidence from Matched Vital Statistics, Program, and Social Security Data. " Working Paper 17690, National Bureau of Economic Research, Cambridge, MA.

Barber, S. and P. J. Gertler. 2010. "Empowering Women: How Mexico's Conditional Cash Transfer Programme Raised Prenatal Care Quality and Birth Weight." *Journal of Development Effectiveness* 2 (1): 51–73. doi: 10.1080/19439341003592630.

Barnett, C. and L. Camfield. 2016. "Ethics in evaluation." *Journal of Development Effectiveness* 8 (4): 528-534. doi:10.1080/19439342.2016.1244554.

Caliendo, M., and S. Kopeinig. 2008. "Some Practical Guidance for the Implementation of Propensity Score Matching." Journal of Economic Surveys 22 (1): 31–72. doi:10.1111/j.1467-6419.2007.00527.x.

Cellule de Lutte contre la Malnutrition (CLM). 2014. “Manuel de processus - Financement basé sur les résultats ciblant la demande de soins maternels. ” Sénégal: Primature.

Cellule de Lutte contre la Malnutrition (CLM). 2016. “Rapport sur la mise en œuvre du pre-pilote financement base sur les résultats - volet demande de soins maternels. ” Sénégal: Primature.

Dohmwirth, C. and Z. Liu. 2020. “Does cooperative membership matter for women’s empowerment? Evidence from South Indian dairy producers.” *Journal of Development Effectiveness*, *12*(2), 133-150. doi: 10.1080/19439342.2020.1758749

de Hoop, T., S. Fallon, F.M. Yunus, S. Munrat, S.P. Jolly, F. Sehrin, B. Aktar, R.B.A. Ghani, and J. Sennett. 2020. “Mothers’ education and the effectiveness of nutrition programmes: evidence from a matched cross-sectional study in rural Bangladesh.” *Journal of Development Effectiveness*, 12(4), 279-297. doi: 10.1080/19439342.2020.1828998

Ferré, C. 2017. “Results of the baseline survey : national family scholarship program (PNBSF) : Senegal - Résultats de l’enquête de ligne de reference : Programme National de Bourses Sociales Familiales (PNBSF) (French).” Washington, D.C. : World Bank Group. Available from : http://documents1.worldbank.org/curated/en/296901510833342709/pdf/121426-2017-06-Baseline-Report-PNBSF-FINAL.pdf

Gaarder M. M., A. Glassman, and J. E. Todd. 2010. “Conditional Cash Transfers and Health: Unpacking the Causal Chain.” *Journal of Development Effectiveness* 2 (1): 6–50. Doi: 10.1080/19439341003646188.

Gertler, P. J., S. Martinez, P. Premand, L. B. Rawlings, and C. M. J. Vermeersch. 2016. *Impact Evaluation in Practice. 2nd Ed*. Washington, DC: Inter-American Development Bank and World Bank. doi:10.1596/978-1-4648-0779-4.

Glassman, A., D. Duran, L. Fleisher, D. Singer, R. Sturke, G. Angeles, J. Charles, B. Emrey, J. Gleason, W. Mwebsa, K. Saldana, K. Yarrow, and M. Koblinsky. 2013. “Impact of Conditional Cash Transfers on Maternal and Newborn Health.” *Journal of health, population, and nutrition* 31(4 Suppl 2): S48–S66.

Handa, S., C. Huang, N. Hypher, C. Teixeira, F. V. Soares and B. Davis. 2012. “Targeting Effectiveness of Social Cash Transfer Programmes in Three African

Countries." *Journal of Development Effectiveness* 4 (1): 78-108. doi:10.1080/19439342.2011.641994.

Heard, K., E. O'Toole, R. Naimpally, and L. Bressler. 2017. "*Real-world challenges to randomization and their solution*s." Boston, MA: Abdul Latif Jameel Poverty Action Lab. Available from: https://www.povertyactionlab.org/sites/default/files/research-resources/2017.04.14-Real-World-Challenges-to-Randomization-and-Their-Solutions.pdf

Iacus, S. M., G. King, and G. Porro. 2012. "Causal inference without balance checking: Coarsened exact matching". *Political analysis*, 20(1), 1-24.

Juquois, M. 2019. *Disclosable Version of the ISR - Senegal Health Nutrition Financing - P129472 - Sequence No : 10.* Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/360801555189579926/Disclosable-Version-of-the-ISR-Senegal-Health-Nutrition-Financing-P129472-Sequence-No-10

Lim, S. S., L. Dandona, J. A. Hoisington, S. L. James, M. C. Hogan., and E. Gakidou. 2010. "India's Janani Suraksha Yojana, a Conditional Cash Transfer Programme to Increase Births in Health Facilities: An Impact Evaluation." *The Lancet* 375 (9730): 2009–23.

Nguyen H. T., L. Hatt, M. Islam, N. L. Sloan, J. Chowdhury, J. O. Schmidt, A. Hossain, and H. Wang. 2012. "Encouraging Maternal Health Service Utilization: An Evaluation of the Bangladesh Voucher Program." *Social Science and Medicine* 74 (7): 989–96.

Owusu-Addo, E., A. M. Renzaho, and B. J. Smith. 2018. "The Impact of Cash Transfers on Social Determinants of Health and Health Inequalities in Sub-Saharan Africa: a Systematic Review." *Health Policy Plan* 33: 675–96. doi:10.1093/heapol/czy020.

Sabates, R., P. Rose, B. Alcott, and M. Delprato. 2021. "Assessing cost-effectiveness with equity of a programme targeting marginalised girls in secondary schools in Tanzania." *Journal of Development Effectiveness*, *13*(1), 28-46. doi: 10.1080/19439342.2020.1844782

Stoeffler, Q., Mills, B. and del Ninno, C. 2016. "Reaching the Poor: Cash Transfer Program Targeting in Cameroon," *World Development* 83(C): 244-263.

UNICEF. 2018. “Progress for Every Child in the SDG Era.” Available from: https://uni.cf/sdgfullreport

United Nation. 2015. “Transforming our World: The 2030 Agenda for Sustainable Development.” New York, NY. Resolution Adopted by the UN General Assembly. 25 September 2015. Available from: https://sustainabledevelopment.un.org

United Nations Development Program (UNDP). 2018. “Human Development Indices and Indicators: 2018 Statistical Update.” Available from: http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf

White, H. 2013. “An Introduction to the Use of Randomised Control Trials to Evaluate Development Interventions.” *Journal of Development Effectiveness* 5 (1): 30-49. doi:10.1080/19439342.2013.764652.

World Bank. 2018. “Senegal - Systematic Country Diagnostic.” Washington, D.C. : World Bank Group. Available from: http://documents.worldbank.org/curated/en/336611539873310474/Senegal-Systematic-Country-Diagnostic

World Bank. 2020. “Senegal - Health Nutrition Financing Project - Implementation Completion and Results Report.” Washington, D.C. : World Bank Group. Available from: http://documents.worldbank.org/curated/en/169851584393359384/Senegal-Health-Nutrition-Financing-Project

Zhou, H., Y. Wu, C. Liu, C. Sun, Y. Shi, L. Zhang, A. Medina, and S. Rozelle. 2020. “Conditional Cash Transfers, Uptake of Maternal and Child Health Services, and Health Outcomes in Western Rural China.” *BMC Public Health* 20: 1-17. doi:10.1186/s12889-020-08996-9.

Annex 1. Estimation of the number of possible ANC and score construction

The number of possible ANCs was estimated in several steps: (i) we computed the time interval between the last observed ANC and the date of the data collection in the three health centres, (ii) according to the rank of the latest ANC (first, second, third, fourth) and (iii) we compared the time interval with the numbers of days that were theoretically possible between each ANC, as depicted in Table 1. As a matter of fact, we know that the first ANC took place in months 1 to 3, ANC 2 between months 4 and 6, ANC 3 between months 7 and 8 and ANC 4 at 9 months. Therefore, if the last ANC was ANC 1, we considered that only 1 ANC could have been performed - if the time elapsed was less than 120 days (3 months) with respect to the data collection. If higher than 120 days, it could have been feasible for the woman to have attended ANC 2, etc. If the last ANC had been performed in rank 4, the maximum possible number of ANCs is automatically 4 (only three women came for the first time for ANC4, and in all cases, they could have made four ANC visits given the date of the consultations and the starting date of the data collection).

Table A.1. Construction of ANC score – estimation period for possible number of ANCs given time interval between last ANC and end of data collection

	number of possible ANCs	more than (…) days	Less (…) days
if last ANC 1	1		120
	2	120	150
	3	150	210
	4	210	405
if last ANC 2	2		110
	3	110	150
	4	150	348
if last ANC 3	3		60
	4	60	

Source: Authors

The rank of the last ANC is not necessarily related with the actual number of ANC, as a woman can have consulted only once, but in ANC 3 (between 7 and 8 months). In fact, the proportion of woman who came in ANC 1 the last time (did not come subsequently) is only 10.34 percent, while 28.95 percent of women did only one ANC (irrespectively of the rank). Among those 28.95 percent, 15.81 percent came the last time in ANC 2, 2.36 percent in ANC 3 and 0,44 percent in ANC 4. Similarly, while only 13.29 percent of the sample did four ANCs, 33.68 percent came the last time during ANC 4 (i.e. at 9 months pregnant) (Table A.2).

Table A.2. Rank of last ANC and number of ANCs

		Number of ANCs					
Last ANC		1	2	3	4	Total (percent)	Total (n)
	1	10.34	0	0	0	10.34	70
	2	15.81	11.67	0	0	27.47	186
	3	2.36	17.73	8.42	0	28.51	193
	4	0.44	4.58	15.36	13.29	33.68	228
	Total (percent)	28.95	33.97	23.78	13.29	100	
	Total (n)	196	230	161	90		677

Source: Authors' computation based on collected dataset

Annex 2. Regression results with additional crossed effects

Table A.3. Crossed effects models, Model 3 (base= health centre 1) and Model 4 (base= health centre 2)

	Model 3		Model 4	
Variables	Coeff.	SE.	Coeff.	SE.
Health centre (=1)			**Health centre (=2)**	
2	0,033	0,027	1	-0,033
3	0,064**	0,026	3	0,032

CCT (=0)	0,033	0,043	CCT (=0)	-0,043
Health centre#CCT			Health centre#CCT	
2 1	-0,076	0,070	1 1	0,076
3 1	-0,102*	0,060	3 1	-0,025
Age category (=18-31)			Age category (=18-31)	
<18	0,094**	0,046	<18	0,094**
>31	0,039	0,032	>31	0,039
Number of pregnancy	-0,008	0,005	Number of pregnancy	-0,008
Miscarriage (=0)	0,062**	0,031	Miscarriage (=0)	0,062**
Intercept	0,712	0,025	Intercept	0.7447919

*** and * indicate significance at 5% and 10% level*

Note: Coeff. Stands for coefficient and SE for Standard Error

Source: Authors' computation based on collected dataset

Annex 3. Robustness test

We look only at the women whose pregnancy is covered entirely by the period, i.e. those with the maximum number of ANC possible =4. The numbers of observations therefore drops from 661 to 283. We use the sum of ANC (not our score) as a dependent variable of a Probit Model (Model 4) to test whether we have the same result (and that the construction of our score do not influence the results). Again, the CCT decreases overall score, centre 3 performs better than centre 1 (not significate with centre 2), being young and having had one or more miscarriage increase the probability to do more ANCs.

Table A.4. Model 4, with crossed effect (base= health centre 2)

Variables	Coeff.	SE.
CCT (=0)	-0,58**	0,27
Health centre (=1)		
2	0,437	0,293
3	0,565**	0,264

Age category (=18-31)		
<18	1,111*	0,567
>31	0,216	0,301
Miscarriage (=0)	0,692**	0,350
Pseudo R	0.20	
Observation	283	

*** and * indicate significance at 5% and 10% level*

Note: Coeff. Stands for coefficient and SE for Standard Error

Source: Authors' computation based on collected dataset

Annex 4. PSM tests

Tables A5 reports the tests on matching quality after pairwise estimation of PSM indicate. It shows no significant difference between control and treatment groups after matching (except for the access to water).

Table A5. Balancing properties of covariates in treated and control group (comparison group 1).

	Mean			*t-test*	
Variable	Treated	Control	%bias	t	p>|t|
age	26	26	-0,6	-0,03	0,976
miscarriage	0,10909	0,10909	0	0	1.000
childrenborn	4	4	-7	-0,36	0,72
education	0,16364	0,27273	-23,5	-1,2	0,232
sex_head	1	1	5,1	0,28	0,784
know_ovary_cycle	3	3,6	-6,9	-0,34	0,731
radio	1	2	-10,8	-0,55	0,581
work	0,49091	0,32727	33,6	1,75	0,082
wealth_index	1	1	-19,5	-1,05	0,297
number_of_otherwife	0,34545	0,50909	-25,8	-1,31	0,192

literacy	0,2	0,29091	-14	-0,82	0,412
water	14.727	17.673	-41,2	-2,15	0,034*

PS R2=0.121

Tests on the overlap assumption (Figures A1) show that the propensity scores of the treatment group mostly fall into the scope of the controlled observations' propensity scores.

Figures A1. Area of common support