

Research Paper

Impact of a multidimensional child cash grant programme on water, sanitation and hygiene in Nepal

Andre Renzaho, Stanley Chitekwe, Wen Chen, Sanjay Rijal, Thakur Dhakal, Ingrid R. Chikazaza and Pradiumna Dahal

ABSTRACT

The study evaluated the impact of a multidimensional child cash grant (CCG) programme on safe water, sanitation and hygiene (WASH) outcomes. The intervention district received a CCG providing 200 Nepalese Rupee per month for up to two children for poor families with children under five, a capacity building component for effective child sensitive social protection, and behaviour change activities in addition to existing standard social welfare services in the form of targeted resource transfers (TRTs) for eligible families. The control district received only TRTs for eligible families. Propensity scores were used in difference-in-differences models to compare the changes over time between the intervention and control groups. The intervention resulted in a 5.5% ($p < 0.01$), 46.6% ($p < 0.001$) and 42.2% ($p < 0.001$) percentage points reduction in the proportion of households reporting drinking water from unimproved sources, having unimproved sanitation facilities, and practising unsanitary disposal of children's faeces, respectively. However, the prevalence of households practising inadequate water treatment methods did not differ between the intervention and comparison districts. In order to achieve WASH coverage in Nepal, strategies to scale up the intervention need to consider a social protection programme embedding different financial incentive and integrated capacity mechanisms.

Key words | drinking-water sources, hygiene, Nepal, sanitation, social protection, WASH

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INTRODUCTION

A recent joint landmark report by the Sanitation and Hygiene Applied Research for Equity and the United Nations Children's Fund (UNICEF) examined the impact of water, sanitation and hygiene (WASH) on key health and social outcomes (Mills & Cumming 2016). The study looked at the impact of WASH in ten key health areas: diarrhoea, nutrition, complementary food hygiene, female psychosocial stress, violence, maternal and newborn health, menstrual hygiene management, school attendance, oral vaccine performance, and neglected tropical diseases.

The study found that WASH conditions pose a risk to the health of people in most low- and middle-income countries. Some of the key findings include the plausible influences of WASH on child growth and maternal and newborn health, the significant diarrhoeal disease burden attributable to poor WASH, and poor WASH facilities acting as a barrier to student attendance and enrolment.

While the estimation of the burden of disease attributable to exposure to inadequate WASH has varied considerably across studies, most recent estimates suggest

that overall inadequate WASH accounts for 1.5% of the total disease burden and 58% of diarrhoeal diseases; and 5.5% of the total disease burden among children under five years old (Prüss-Ustün *et al.* 2014). A total of 38 out of 188 countries have been found to have 5–16% of disability-adjusted life-years attributable to unsafe water, sanitation and handwashing (Forouzanfar *et al.* 2015). It has been estimated that improving access to adequate WASH leads to an approximate 20% reduction in childhood mortality (excluding China) as well as child diarrhoea (Günther & Fink 2011). Indeed, the role of improving WASH to address poor health was recognised in Target 7.C of the United Nations Millennium Development Goals (MDG) 7, committing to halve, by 2015, the proportion of people without sustainable access to safe and adequate WASH. In addition, the Sustainable Development Goals (SDGs) have set an agenda that explicitly outlines the need to ensure universal access to WASH (Goal 6) and social protection (Goal 1) (United Nations General Assembly 2015).

However, despite the impact of WASH on key health and social outcomes, social protection programmes have seldom included WASH indicators. Globally, social protection programmes have been recognised as an effective instrument to address vulnerability and life cycle risks in both humanitarian emergency and non-emergency situations (Devereux & Sabates-Wheeler 2004). Countries are implementing different types of social programmes in the form of conditional and unconditional cash transfers depending on contexts. The aim of the conditional cash transfer is to maximise the ‘substitution effect’ or ‘incentive effect’, which is the opportunity cost associated with investing in children’s human capital (Basinga *et al.* 2011; Hickey 2011; Kabeer *et al.* 2012; Evans & Popova 2017). Therefore, the conditional cash transfer has a social contract associated with it, geared towards enforcing behavioural change in beneficiary households, such as certain positive behaviours related to investing in children’s education, nutrition and healthcare or reducing household poverty, promoting human capital accumulation and improving overall well-being. The unconditional cash transfer’s objective is to maximise the ‘income effect’, which reflects the removing of liquidity constraints preventing households from undertaking investments in children’s human capital, reducing household poverty reduction, promoting human capital

accumulation, or improving overall well-being (Kabeer *et al.* 2012; Akee *et al.* 2013; Haushofer & Shapiro 2016). The ‘income effect’ represents the change in consumption resulting purely from the receipt of unconditional income increases or cash payments with no social contracts attached to them. It is often argued that unconditional cash transfers are empowering as they give recipients choices and dignity by allowing them to use the cash to meet their needs and priorities.

Social protection is one form of policy intervention that can improve WASH outcomes, especially in countries that experience multifaceted and complex public health challenges related to meeting key priorities enshrined in international development agendas. However, defining social protection remains a challenge and there is still no consensus on what constitutes ‘social protection’ due to varying and competing interests, objectives, and the focus of funding agencies and the intended beneficiaries of their programmes. Nevertheless, broadly speaking, social protection encompasses a variety of public and private social programmes and initiatives that ‘provide income or consumption transfers to the poor, protect the vulnerable against livelihood risks and enhance the social status and rights of the marginalised; with the overall objective of reducing the economic and social vulnerability of poor, vulnerable and marginalised groups’ (Devereux & Sabates-Wheeler 2004).

There are four categories of social protection programmes based on their functions (Devereux & Sabates-Wheeler 2004): protective function (e.g., guaranteeing relief from deprivation and recovery from shocks through social assistance to poor individuals or families unable to work and earn their livelihood); preventative function (e.g., focusing on averting deprivation through social insurance or social safety nets for economically vulnerable people through pensions, health insurance, maternity benefit and unemployment benefits, and informal mechanisms such as savings clubs and funeral societies); promotive function (e.g., focusing on enhancing income, income stabilisation, and consumption smoothing through microfinance; and capabilities through a range of livelihood-enhancing programmes such as school feeding programmes), and transformative function (e.g., upholding social equity and inclusion of socially marginalised groups such as people with disabilities,

victims of domestic violence or discrimination and abuses; or collective actions and legal or regulatory frameworks to promote empowerment and human rights).

Nepal provides an opportunity to test the effect of social protection WASH outcomes. Despite significant improvements in MDG 7 in Nepal, people living in rural areas and those from poor and marginalised ethnic groups are less likely to have access to improved water sources and sanitation facilities. However, the linkage between WASH and cash transfers is still emerging. Signs are that social protection programmes may, directly and indirectly, improve WASH outcomes by removing social and financial barriers and affecting behavioural changes, but this positive evidence is limited to only a few studies and varies in contexts (Case 2004; Miller *et al.* 2008; Perezniето *et al.* 2014; de Groot *et al.* 2017). Further studies are needed to better understand the programmatic approaches and contexts which directly and indirectly improve WASH outcomes.

The evaluations of cash transfers have mainly documented the non-contributory cash transfer programmes' intended and unintended impact on individuals and households, focusing on six outcome areas: monetary poverty; education; utilisation of health care services, dietary diversity and child undernutrition; savings, investment and production; employment; and empowerment (Honorati *et al.* 2015; Baird *et al.* 2016; Bastagli *et al.* 2016). It has been recognised that the impact of cash transfers on child health indicators will only be maximised if such programmes incorporate complementary interventions in other sectors, including WASH (Collins 2015). However, there is strong evidence that no one specific approach is most effective in promoting handwashing and sanitation behaviour change in low- and middle-income countries (De Buck *et al.* 2017). In order to meet the SDG targets, progressive elimination of inequalities in access to and the promotion of integrated approaches geared towards inducing behavioural changes in WASH programmes would need to be an important focus for the post-2015 agenda. This may require a multi-sectoral and multi-partner approach operating at various levels and bringing the government, non-government and civil society sector together for a common cause. Therefore, this study aimed to evaluate the impact of a child cash grant (CCG), augmented by capacity building for effective social protection and

behaviour change, and embedded within existing governments' targeted resource transfers (TRTs) for families on WASH outcomes. We hypothesised that an intervention that incorporates economic, capacity building and behavioural change will have a positive impact on main drinking-water sources, water treatment methods, access to sanitation facilities and disposal of children's faeces.

METHODS

Evaluation design and the intervention

The evaluation used a quasi-experimental design, the most appropriate design because randomisation was impractical and the study aimed at minimising threats to ecological validity, hence providing adequate avenues for testing the effectiveness of community-based interventions in real-world settings (Gray 2014). A repeat cross-sectional survey with measures taken pre- (October–December, 2009) and post-intervention (December 2014–February 2015) in the intervention community (Kalikot district) and the comparison community (Bajhang district) was undertaken.

The comparison district received government-funded TRTs for families. The TRTs included: senior citizens allowance for all persons aged 70+ (NRs 500/month (USD 1 = NRs 103)); single woman and widow allowance (NRs 500/month); disability allowance for all people with disabilities aged 16 years or older (NRs 1,000/month for total disability and NRs 300/month for partial disability); endangered ethnicities allowance (all household members receive NRs 500/month); and maternity incentive scheme for pregnant women (NRs 500 in Tarai, NRs 1,000 in Hills and NRs 1,500 in mountains as transportation costs plus NRs 300 provided to health professionals and NRs 1,000 reimbursement to facilities plus free delivery care).

The intervention district received the TRTs augmented with an economic, capacity building and behavioural change component (Figure 1). The economic component was in the form of a CCG programme introduced in the Government of Nepal's (GoN) 2009/2010 budget and a capacity building component for social protection. The CCG provides NRs 200 (~USD 1.93) per month for up to two children for families with children under five to complement existing

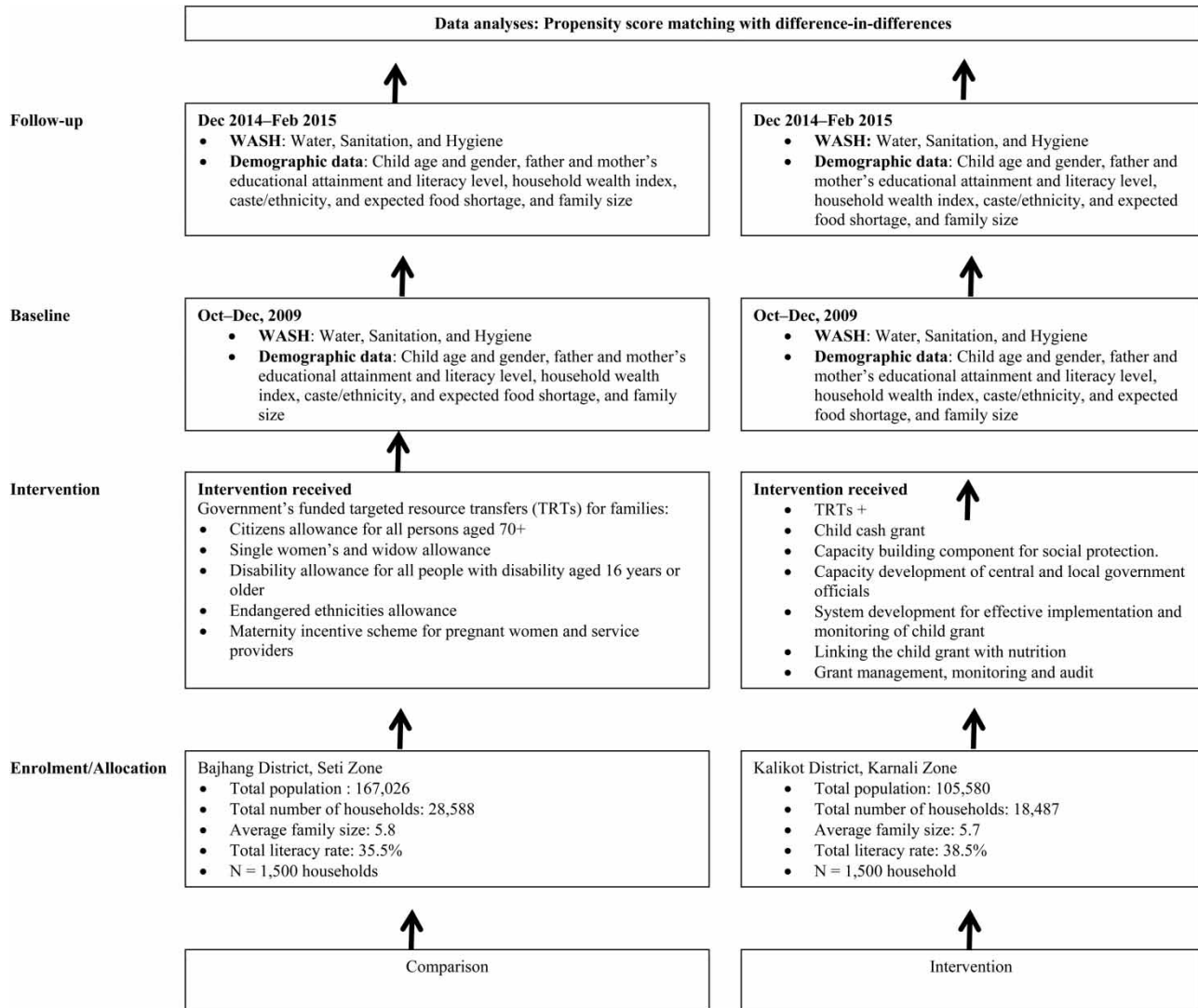


Figure 1 | Flow diagram detailing the intervention implementation plan and data collection phases.

social protection schemes for senior citizens, single women, endangered communities and people with disabilities. The GoN’s CCG is an unconditional cash transfer scheme in which allowances are provided to all eligible households. The capacity building component supporting the CCG was implemented by a United Nations Children’s Fund (UNICEF)/Nepal partnership programme partly funded by the Asian Development Bank through the Japan Fund for Poverty Reduction. The capacity building component had four major components: (1) capacity development of central and local government officials; (2) system development for effective implementation and monitoring of child grant; (3)

linking the child grant with nutrition; and (4) grant management, monitoring and audit. The Ministry of Federal Affairs and Local Development (the main executing agency) was responsible for the system development component and the Asia Development Bank, together with the Ministry of Federal Affairs and Local Development and the Ministry of Health and Population, were responsible for the grant management component. The behavioural change component focused on linking the CCG with nutrition, and was implemented by UNICEF and supported by the GoN (Ministry of Federal Affairs and Local Development and Ministry of Health and Population).

The economic, capacity building and behavioural change activities were integrated into key strategies underpinning the intervention (Appendix, Table A1, available with the online version of this paper). These were:

- (1) capacity building to enhance the capacity of local bodies in the project districts to deliver the child grant, through orientations for Village Development Committee (VDC) leaders, Traditional Healers and mothers/caretakers, and capacity-building for health workers and Female Community Health Volunteers (FCHVs) and VDC secretaries;
- (2) enhancing networking between local bodies, health facilities and communities in the project districts to improve child nutrition;
- (3) social behaviour change communication on child nutrition including the provision of nutrition-related counselling services;
- (4) awareness raising for timely birth registration to identify all eligible households about the availability of the CCG;
- (5) assisting mothers and others caring for children to identify the best possible locally available food and encouraging them to use the CCG for nutritious foods and the improvement of the nutritional status of children;
- (6) improving the knowledge and skills of CCG beneficiaries in the areas of infant and young child feeding (IYCF) practices, hygiene, sanitation, and other key behaviours linked to child nutrition.

Sampling strategy

The surveys were conducted using a two-stage cluster sampling method. The first stage involved identifying clusters (wards) within each district to be included in the study. All wards in each district were listed separately in alphabetical order by VDC. Using the 2011 population census data for each ward (cluster), a cumulative population for all wards was computed. From this cumulative list, the required number of clusters in each district was determined using the probability proportional to size sampling method.

In the second stage, households within the selected clusters were identified for inclusion in the study. A list of households in each selected ward was constructed with the help of the local leaders and UNICEF staff. From the

list, a household was selected using a systematic sampling approach. Only households with at least one child under 60 months of age were eligible for the study. The sampling interval (X) was determined by dividing the total number of households in each ward with the expected sample size, and the first household to be surveyed was randomly selected by choosing a number between 1 and X. For each selected household, mothers/caretakers of children under five years of age volunteered to take part in the surveys, and the interview occurred outside the home, away from other household members. If the selected household was not inhabited, or there was no one at home, the closest neighbouring household was used for the survey. We sampled approximately 30 households per cluster in each selected district at baseline and endline surveys. For clusters where the number of households was less than 25, the selected ward and its adjoining neighbour were merged and treated as a single cluster. In households with more than one child, only one child was randomly selected for enumeration. An equal sample size of 750 households at baseline and 750 at follow-up was obtained in the intervention as well as the comparison area. This sample size was adequate to show a 10% effect size of households with access to improved sanitation facilities (27% in the comparison vs. 37% in the intervention group) and drinking-water from improved sources (68% in the comparison vs. 78% in the intervention group) (WHO & UNICEF 2014), with more than 80% power and 5% significance level (two-sided test), a design effect of 2 and 5% sampling error. The sample size allowed for a 10% non-response rate. The sample size was adequately powered to model associations between outcome and intervention, adjusted for demographics and other variables. The study was approved by the Nepal Health Research Council Ethical Review Board (approval No. 2071-12-18; Reg No. 29/2015).

Evaluation variables

Dependent variables

The evaluation considered whether or not a district was exposed to the intervention. Outcome variables were WASH indicators, generated according to the World

Health Organization's guidelines (World Health Organization 2006). Indicators included the following.

- Main sources of drinking-water: Main drinking-water source was classified into 'improved' sources of drinking-water (piped water into dwelling; piped water to yard/plot; public tap or standpipe; tube well or borehole; protected dug well; protected spring; bottled water; and rainwater) and 'unimproved' sources of drinking-water (unprotected spring; unprotected dug well; cart with small tank/drum; tanker-truck; and surface water).
- Water treatment method: Water treatment was classified into 'adequate' water treatment methods (boiling; adding bleach/chlorine; using a water filter such as ceramic; sand; composite; and solar disinfection) and 'inadequate' water treatment methods (straining it through a cloth or letting it stand and settle).
- Sanitation facilities: Sanitation facility was classified as 'improved' sanitation facilities (flush toilet; piped sewer system; a septic tank; a flush/pour flush to pit latrine; a ventilated improved pit; a pit latrine with slab; and a composting toilet) and 'unimproved' sanitation facilities (a flush/pour flush to elsewhere; a pit latrine without slab; bucket/containers; a hanging toilet or hanging latrine; and bush/field or no facilities).
- Disposal of children's faeces: Disposal of children's faeces was classified into 'sanitary disposal of children's faeces' (child used toilet/latrine; put/rinsed faeces into the toilet or latrine or buried the faeces) and 'unsanitary disposal of children's faeces' (put/rinsed faeces into drain or ditch; faeces thrown into the garbage or faeces left or buried in the open).

Independent variables

Available evidence suggests that educated parents adopt better and superior hygiene standards than those who are less educated (Aslam & Kingdon 2012). Women are disproportionately affected by lack of access to WASH as a result of a combination of biological and cultural factors (Jansz & Wilbur 2013). At the household level, family size has been shown to be significantly associated with WASH outcomes (Joshi & Amadi 2013). Therefore, assessed socio-demographic factors were paternal and maternal literacy (illiterate = can't read at all and literate = can read), paternal and maternal

educational attainment (primary or less; secondary level; and intermediate or higher), child age (from the child's birth records/certificates) and gender, and family size.

Statistical tests

Data were analysed using STATA version 14 (StataCorp, College Station, TX, USA). Descriptive statistics were used to summarise key variables. Given the cross-sectional nature of the repeated surveys, propensity scores (PS) were used in difference-in-differences (DiD) models to compare the changes over time between the intervention and comparison groups (Baser 2006; Caliendo & Kopeinig 2008; Mayne et al. 2015). In the absence of randomisation, DiD models and propensity scores are two methods considered as strong alternative non-experimental study design options (Stuart 2010; Austin 2010a; Stuart et al. 2014). Combining them provides an even better estimate of an intervention impact or a causal treatment effect. PS permit the design and analysis of observational studies (nonrandomised) through mimicking some of the particular aspects of a randomised controlled trial by constructing matched sets with similar distributions of the covariates between intervention and control participants (Stuart 2010; Austin 2010a).

Although there exist multiple matching methods with varying levels of model improvements associated with them, authors often fail to report different models they assessed and tend to only summarise the best model that fits their data (Baser 2006; Caliendo & Kopeinig 2008; Harder et al. 2010). Therefore, our analysis compared three matching algorithms: nearest-neighbour matching, kernel matching and radius matching (Baser 2006; Caliendo & Kopeinig 2008). We applied the nearest neighbour matching model, where a household from the control district was chosen as a matching partner for a household in the intervention district that was closest in terms of propensity scores. Caliendo & Kopeinig (2008) note that, when the closest neighbour is far away, the nearest neighbour matching model runs the risk of bad matches. They propose imposing a tolerance level on the maximum propensity score distance, and in our case, we applied a radius matching with a caliper (propensity range) of 0.02 (i.e., a household from the comparison district was chosen as a matching partner for an intervention household that lay within the propensity

range). For example, if a household in the intervention district had a propensity score of 0.559, with our caliper value set at 0.02, households in the comparison district with propensity scores in the 0.539–0.579 range were selected as matches. While there are no guidelines governing the choice of the caliper value, recently, Austin (2016) conducted a series of Monte Carlo simulations to determine the optimal caliper width and concluded that calipers of width equal to 0.02 or 0.03 have superior performance for estimating intervention effects. In kernel matching, a weighted composite of households in the comparison district was used to create a match for each household in the intervention, where comparison households were weighted by their distance in propensity score from intervention households within a bandwidth or a range of the propensity score. For this study we used a bandwidth of 0.06 (propensity score -0.06 to propensity score $+0.06$), a value which has been shown to optimise the trade-off between variance and bias (Heckman *et al.* 1997; Garrido *et al.* 2014).

A logit model was used to estimate programme participation (probability of being or not being in the intervention) as a function of household size, father and mother's education, father and mother's literacy level, child age and child gender. We then used the predicted values from logit to generate propensity score for all households in the intervention and comparison group. The balance check was used to evaluate the effectiveness of the matching method and the covariate balance was satisfactory. The standardised bias for each covariate was further examined to confirm covariate balance, and standardised biases of less than 25% were considered a good balance between the groups (Harder *et al.* 2010). To address the variability of estimated programme effect (Austin & Small 2014), bootstrap methods were used by drawing bootstrap samples from the matched pairs in the propensity-score-matched sample. This method results in improved estimates of the standard error (Austin & Small 2014). In all cases $p < 0.05$ was considered to be statistically significant.

RESULTS

Summary statistics of the matching variables and estimates of logit regression models for stage 1 of propensity score

matching are summarised in Table 1. Coefficients of four out of the seven covariates (child age and gender, and mother's educational attainment and literacy level) were statistically indistinguishable from zero. That is, sample households in the intervention and comparison districts did not differ on these variables. However, being in the intervention was significantly associated with larger household size, and lower educational attainment but higher literacy level among fathers (e.g., it is worth noting that in most low- and middle-income countries there is a weak correlation between educational attainment and literacy (Smith-Greenaway 2015)). The fact that sample households in the intervention district had larger families and more highly literate fathers than the comparison districts meant that balancing covariates to achieve similarities in their distribution was a necessity. It is worth noting that the level of literacy and educational attainment improved significantly for women, which is in line with the improving school enrolment among Nepalese women over the last decades (Acharya 2015).

Estimates of standardised bias are reported in the last column of Table 2. The standardised bias for each covariate was calculated to assess the balance of the study's covariates between the intervention and comparison districts and the similarity of their distributions. The study's covariates had an after matching standardised bias less than 25%, suggesting that all included covariates had similar distribution. The mean of standardised bias was lowest for household size, child age and gender, mother's educational attainment and literacy level, and father's literacy level; but highest (still less than 25%) for father's educational attainment. Therefore, there is little variance between women in terms of educational attainment and literacy level in the intervention and comparison districts at baseline and follow-up measurements. In contrast, men's educational attainment varies significantly across districts, hence the need to ensure this covariate is balanced prior to being entered in the regression model.

Water and sanitation

Estimates from the radius matching models were comparable to those from the Kernel matching models, but slightly higher than those from neighbour matching models. An estimate with a negative sign means that the

Table 1 | Characteristic of participants at baseline and follow-up; and estimate of programme participation

Matching variables	Intervention				Comparison				Programme participation: logit model			
	Baseline		Follow-up		Baseline		Follow-up		Coefficient	95%CI	p-Value	
	N	%	N	%	N	%	N	%				
People per household (%)	750		750		750		750					
4 people or less		13.5		21.20		11.33		15.33	0.41	0.19	0.63	0.000
5–8 people		64.8		65.20		64.80		60.53	0.20	0.03	0.36	0.018
9 people or above		21.7		13.60		23.87		24.13	Ref			
Child's age in months (SD)	750	28.6 (15.4)	750	28.4 (15.7)	750	26.8 (15.4)	750	28.1 (15.5)	0.00	0.00	0.01	0.169
Child's gender (%)	750		750		750		750					
Girl		44.8		43.6		41.3		43.7	Ref			
Boy		55.2		56.4		58.7		56.3	−0.08	−0.22	0.05	0.224
Father's education	750		750		750		750					
Intermediate or higher		2.1		16.8		5.6		25.9	Ref			
Secondary level		50.1		31.5		50.9		34.8	−0.12	−0.35	0.11	0.310
Primary or less		47.7		51.7		43.5		39.3	0.44	0.16	0.71	0.002
Mother's education	750		750		750		750					
Intermediate or higher		0.5		8.4		1.1		12.4	Ref			
Secondary level		10.1		12.5		14.3		12.5	−0.25	−0.60	0.11	0.175
Primary or less		89.3		79.1		84.7		75.1	0.13	−0.12	0.38	0.294
Father's literacy	750		750		750		750					
Illiterate		46.3		24.4		43.2		14.0	Ref			
Literate		53.7		75.6		56.8		86.0	0.26	0.04	0.47	0.022
Mother's literacy	750		750		750		750					
Illiterate		85.3		45.3		82.0		39.7	Ref			
Literate		14.7		54.7		18.0		60.3	0.05	−0.13	0.24	0.576

intervention had a positive impact by reducing the rate of unhealthy WASH indicators. That is, the Kernel matching model found that the intervention resulted in a 5.5% ($p < 0.01$), 46.6% ($p < 0.001$) and 42.2% ($p < 0.001$) percentage points reduction in the proportion of households reporting drinking water from unimproved sources, having unimproved sanitation facilities and practising unsanitary disposal of children's faeces, respectively (Table 3). Similarly, estimates from the radius models suggest that the intervention resulted in a 5.2% ($p < 0.01$), 46.0% ($p < 0.001$) and 43.1% ($p < 0.001$) percentage points reduction in the proportion of households reporting drinking water from unimproved sources, having unimproved sanitation facilities and practising unsanitary disposal of children's faeces, respectively. In contrast, the percentage points

reduction associated with the intervention's impact from the neighbour matching models were 4.1% ($p < 0.05$), 34.9% ($p < 0.001$) and 38.0% ($p < 0.001$) for households reporting drinking water from unimproved sources, having unimproved sanitation facilities and practising unsanitary disposal of children's faeces, respectively. However, estimates from the three matching models suggest that the intervention had no effect on drinking-water treatment methods.

DISCUSSION

This is the first ever study to examine the impact of multi-sectoral and multi-partner approaches operating at various

Table 2 | Evaluation of standardised differences in matched sample

Matching variables	Intervention		Comparison		%bias
	Unmatched	Matched	Unmatched	Matched	
People per household (%)					
4 people or less	16.4	11.4	13.3	13.6	-6.1
5-8 people	64.2	62.5	62.7	63.2	-1.4
9 people or above	19.4	26.0	24.0	23.2	6.9
Child's age in months (SD)	28.4	26.2	27.4	27.6	-9.0
Child's gender (%)					
Girl	44.4	39.3	42.5	42.8	-7.1
Boy	55.6	60.7	57.5	57.2	7.1
Father's education					
Intermediate or higher	13.0	18.8	15.7	15.4	9.9
Secondary level	35.3	53.4	42.9	42.4	22.6
Primary or less	51.4	27.7	41.4	42.2	-20.2
Mother's education					
Intermediate or higher	4.5	7.0	6.7	5.8	4.4
Secondary level	11.0	15.4	13.4	13.2	6.4
Primary or less	84.5	77.8	79.9	81.0	-8.2
Father's literacy					
Illiterate	32.6	26.1	28.6	29.2	-6.6
Literate	67.4	73.9	71.4	70.8	6.6
Mother's literacy					
Illiterate	63.4	59.7	60.9	61.6	-3.9
Literate	36.6	40.3	39.1	38.4	3.9

levels for the effectiveness of social protection programmes on WASH outcomes in Nepal. While social protection programmes have been widely recognised as a key instrument in tackling child malnutrition, their impact on WASH remains poorly documented, making the contextualisation of our findings within the broader context a daunting task. Nevertheless, we hypothesised that an intervention that incorporates economic, capacity building and behavioural change would be associated with a positive impact on main drinking-water sources, water treatment methods, access to sanitation facilities and sanitary disposal of children's faeces. Our hypotheses were predominantly confirmed. We found that the intervention had a positive impact on drinking-water sources, access to sanitation facilities and sanitary disposal of children faeces but no impact on water treatment methods.

Families in the intervention area received NRs 200 (~UDS 1.93) per month for up to two children for families with children under five to complement existing social protection schemes for senior citizens, single women, endangered communities and people with disabilities. Indeed, the positive correlation between low socio-economic status and poor WASH outcomes is well established. [Blakely *et al.* \(2005\)](#) estimated that improving the economic situation of all people living on <US\$ 2.00 per day to living on US\$ 2.00 or more per day would prevent 51% of the risk of exposure to unimproved water and/or sanitation. Data from South Africa suggest that households receiving cash transfers have better access to sanitation facilities than those without benefits ([Case 2004](#)). [Perezniето *et al.* \(2014\)](#) found that the proportion of households experiencing fewer difficulties in paying for

Table 3 | Programme impact on household WASH outcomes

	Baseline		Endline		Matched dataset: matching algorithms								
	Comparison N = 750	Intervention N = 750	Comparison N = 750	Intervention N = 750	Kernel		Nearest neighbour		Radius ⁱ				
					ADD ^a	95%CI ^b	ADD ^a	95%CI ^b	ADD ^a	95%CI ^b			
Unimproved sources of drinking-water	11.1	32	18.4	15.7	-5.5#	-8.3	-2.6	-4.1*	-7.6	-0.7	-5.2#	-6.4	-2.0
Inadequate water treatment method	99.3	96.4	93.1	96.9	0.3	-1.8	1.8	-0.1	-1.9	0.9	0.3	-0.9	1.7
Unimproved sanitation facilities	95.2	94.1	7.1	21.7	-44.6 [^]	-47.4	-40.0	-34.9 [^]	-40.9	-29.4	-46.0 [^]	-47.8	-43.0
Unsanitary disposal of children's faeces	88.4	82.3	31.6	25.5	-42.2 [^]	-46.5	-38.7	-38.0 [^]	-40.3	-34.8	-43.1 [^]	-46.7	-39.6

ADD, adjusted difference-in-differences.

^aAdjusted for father and mother's educational attainment and literacy level, child age and gender, and family size; weighted with bootstrapping.^bBias-corrected.ⁱRadius = 0.02.* $p < 0.05$; # $p < 0.01$; [^] $p < 0.001$.

safe drinking-water was significantly higher among families receiving cash transfers than those in the comparison group. Our findings on the positive intervention's impact on sanitary disposal of children faeces suggest that child-sensitive social protection programmes, complemented by health education programmes, can improve hygiene behaviours. Data from Malawi suggest that beneficiary households receiving conditional cash transfers have better hygiene behaviours than those in the comparison group (Miller *et al.* 2008).

Most of the studies showing the impact of social protection on WASH outcomes are primarily conditional cash transfers. It is hypothesised that cash-based interventions provided in WASH programmes can achieve outcomes in all three areas: water supply, sanitation and hygiene (Tilley & Günther 2016; UNHCR 2016). Tilley & Günther (2016) reported high participation and high acceptance rate of conditional cash transfer as an incentive for toilet use. They examined the impact of conditional cash transfer on toilet use in South Africa and found that cash incentives were sufficient to overcome any issues that may exist with regard to the use of urine-diverting dry toilets, and thus are a useful tool for increasing toilet use.

However, the CCG in Nepal was an unconditional cash transfer programme. Therefore, the unconditionality of the cash transfer in Nepal could explain the lack of the intervention's effect on water treatment methods. Nevertheless, there are a number of limitations that need to be taken into account when interpreting our findings. The lack of random assignment into intervention groups means that the comparison and intervention groups were non-equivalent. Our design sought to maximise the trade-off between experimental control and ecological validity. Given that randomisation was impractical, the quasi-experimental design was the most appropriate design and provided adequate avenues for testing the effectiveness of community-based interventions in real-world settings (Gray 2014). Because the intervention did not involve random assignment, its acceptability to the broader society was high. In order to reduce threats to external validity, a number of measures were implemented. Potential confounding factors were controlled in the regression models depicting the intervention's impact. We reduced the risk of contamination by having a buffer zone (Figure 2). The

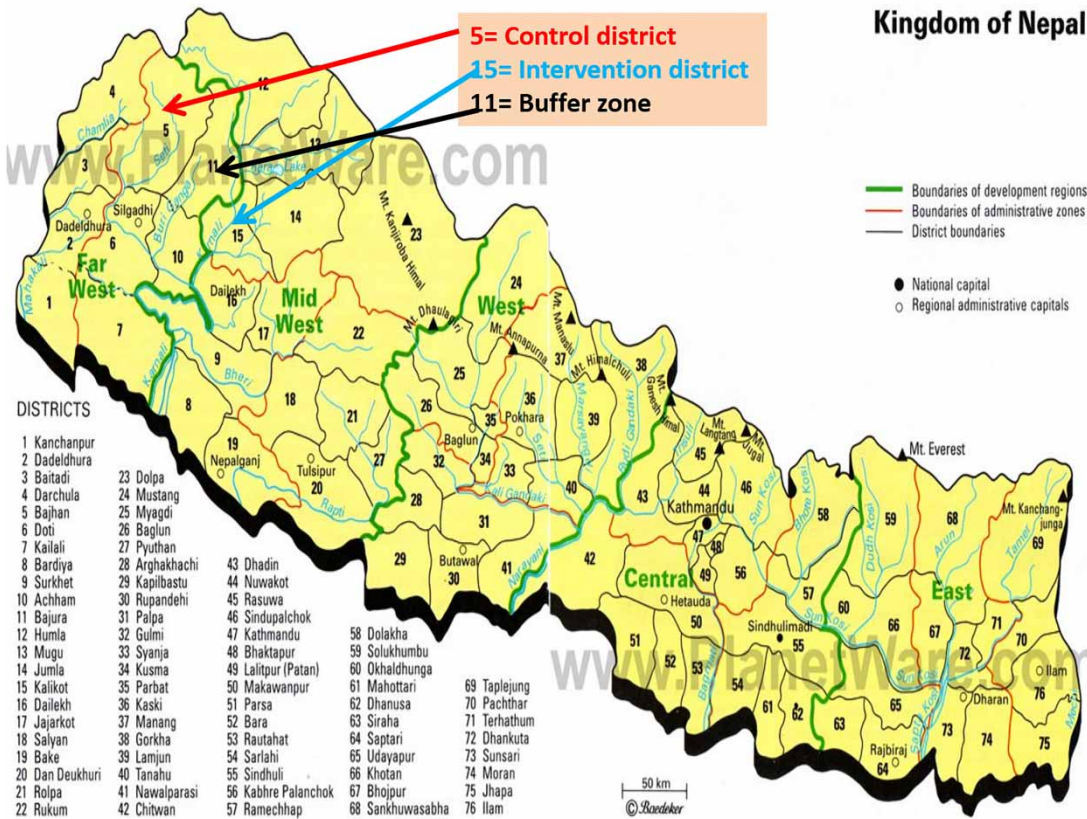


Figure 2 | Intervention, comparison and buffer districts. *Source:* Extracted from Planet Ware, provided as a free map download at <http://www.planetware.com/map/nepal-nepal-districts-map-nep-nep046.htm>.

comparison community (Bajhang District) is in Seti Zone in the Far-Western Development Region. In contrast, the intervention community (Kalikot District) is in Karnali Zone in the Mid-Western Development Region. The two districts were chosen because of their similar socio-demographic, economic and child malnutrition profile, but the distance between them acted as a buffer zone, hence minimising the risk of contamination. The intervention was embedded within existing universal social transfer programmes, thus ensuring continuity of participation and preventing the disruption in disbursements. The implementation of the intervention involved too many stakeholders with differing expectations and competing objectives, which might have hampered the effective implementation of the project. This challenge was overcome by having a clear role and responsibilities and a focal coordinating committee overseen by the government of Nepal.

CONCLUSION AND POLICY DIRECTION

Our study is the first, to our knowledge, to evaluate an unconditional child-sensitive social protection programme, augmented by capacity building for effective social protection and embedded within existing universal social transfer programmes. A CCG embedded in a programme that incorporates economic, capacity building and behavioural change strategies was found to have a positive impact on drinking-water sources, access to sanitation facilities and sanitary disposal of children's faeces, but no impact on drinking-water treatment methods. In order to achieve sanitation coverage in Nepal, a social protection programme embedding different financial incentive mechanisms and augmented by capacity building and behavioural change may be required. Sanitation-based incentives could feasibly be integrated into existing governments' TRTs for families to improve water treatment methods.

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REFERENCES

- Acharya, S. 2015 *Gender, Jobs and Education Prospects and Realities in Nepal*. UNESCO, Kathmandu.
- Akee, R., Simeonova, E., Copeland, W., Angold, A. & Costello, E. J. 2013 Young adult obesity and household income: effects of unconditional cash transfers. *American Economic Journal: Applied Economics* 5 (2), 1–28.
- Aslam, M. & Kingdon, G. G. 2012 Parental education and child health – understanding the pathways of impact in Pakistan. *World Development* 40 (10), 2014–2032.
- Austin, P. C. 2011a An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research* 46 (3), 399–424.
- Austin, P. C. 2011b Optimal caliper widths for propensity-score matching when estimating differences in means and differences in proportions in observational studies. *Pharmaceutical Statistics* 10 (2), 150–161.
- Austin, P. C. & Small, D. S. 2014 The use of bootstrapping when using propensity-score matching without replacement: a simulation study. *Statistics in Medicine* 33 (24), 4306–4319.
- Baird, S., McIntosh, C. & Ozler, B. 2016 *When the Money Runs out: do Cash Transfers Have Sustained Effects on Human Capital Accumulation?* Policy Research Working Paper 7901, World Bank Group, Washington, DC.
- Baser, O. 2006 Too much ado about propensity score models? Comparing methods of propensity score matching. *Value in Health* 9 (6), 377–385.
- Basinga, P., Gertler, P. J., Binagwaho, A., Soucat, A. L., Sturdy, J. & Vermeersch, C. M. 2011 Effect on maternal and child health services in Rwanda of payment to primary health-care providers for performance: an impact evaluation. *The Lancet* 377 (9775), 1421–1428.
- Bastagli, F., Hagen-Zanker, J., Harman, L., Sturge, G., Barca, V., Schmidt, T. & Pellerano, L. 2016 *Cash Transfers: What Does the Evidence Say? A Rigorous Review of Impacts and the Role of Design and Implementation Features*. Overseas Development Institute, London.
- Blakely, T., Hales, S., Kieft, C., Wilson, N. & Woodward, A. 2005 The global distribution of risk factors by poverty level. *Bulletin of the World Health Organization* 83 (2), 118–126.
- Caliendo, M. & Kopeinig, S. 2008 Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys* 22 (1), 31–72.
- Case, A. 2004 Does money protect health status? Evidence from South African pensions. In: *Perspectives on the Economics of Aging* (D. A. Wise, ed.). University of Chicago Press, Chicago, IL.
- Collins, O. 2015 *Social Cash Transfers and Children's Outcomes: A Review of Evidence From Africa*. UNICEF Eastern and Southern African Regional Office. Available at: https://www.unicef.org/esaro/Social_Cash_Transfer_Publication_ESARO_December_2015.pdf (accessed 21 September 2017).
- De Buck, E., Van Remoortel, H., Hannes, K., Govender, T., Naidoo, S., Avau, B., Musekiwa, A., Lutje, V., Cargo, M. & Mosler, H.-J. 2017 Approaches to promote handwashing and sanitation behaviour change in low-and middle income countries: a mixed method systematic review. *Campbell Systematic Reviews* 7, 1–447.
- de Groot, R., Palermo, T., Handa, S., Ragno, L. P. & Peterman, A. 2017 Cash transfers and child nutrition: pathways and impacts. *Development Policy Review* 35, 621–643.
- Devereux, S. & Sabates-Wheeler, R. 2004 *Transformative Social Protection*. IDS Working Paper 232. Institute of Development Studies, Brighton.
- Evans, D. K. & Popova, A. 2017 Cash transfers and temptation goods. *Economic Development and Cultural Change* 65 (2), 189–221.
- Forouzanfar, M. H., Alexander, L., Anderson, H. R., Bachman, V. F., Biryukov, S., Brauer, M., Burnett, R., Casey, D., Coates, M. M. & Cohen, A. 2015 Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet* 386 (10010), 2287–2323.
- Garrido, M. M., Kelley, A. S., Paris, J., Roza, K., Meier, D. E., Morrison, R. S. & Aldridge, M. D. 2014 Methods for constructing and assessing propensity scores. *Health Services Research* 49 (5), 1701–1720.
- Gray, D. E. 2014 *Doing Research in the Real World*. Sage, London.
- Günther, I. & Fink, G. 2011 *Water and Sanitation to Reduce Child Mortality: The Impact and Cost of Water and Sanitation Infrastructure*. Development Economics Prospects Group, World Bank, Zurich, Switzerland.
- Harder, V. S., Stuart, E. A. & Anthony, J. C. 2010 Propensity score techniques and the assessment of measured covariate balance to test causal associations in psychological research. *Psychological Methods* 15 (3), 234–249.
- Haushofer, J. & Shapiro, J. 2016 The short-term impact of unconditional cash transfers to the poor: experimental evidence from Kenya. *The Quarterly Journal of Economics* 131 (4), 1973–2042.
- Heckman, J. J., Ichimura, H. & Todd, P. E. 1997 Matching as an econometric evaluation estimator: evidence from evaluating

- a job training programme. *The Review of Economic Studies* **64** (4), 605–654.
- Hickey, S. 2011 *The politics of social protection: what do we get from a 'social contract' approach?* *Canadian Journal of Development Studies/Revue canadienne d'études du développement* **32** (4), 426–438.
- Honorati, M., Gentilini, U. & Yemtsov, R. G. 2015 *The State of Social Safety Nets 2015*. World Bank Group, Washington, DC.
- Jansz, S. & Wilbur, J. 2013 *Women and WASH: Water, Sanitation and Hygiene for Women's Rights and Gender Equality*. WaterAid, London.
- Joshi, A. & Amadi, C. 2013 *Impact of water, sanitation, and hygiene interventions on improving health outcomes among school children*. *Journal of Environmental and Public Health* **2013**, 1–10.
- Kabeer, N., Piza, C. & Taylor, L. 2012 *What are the Economic Impacts of Conditional Cash Transfer Programmes? A Systematic Review of the Evidence*. EPPI-Centre, Social Science Research Unit, Institute of Education, University of London, London.
- Mayne, S. L., Lee, B. K. & Auchincloss, A. H. 2015 *Evaluating propensity score methods in a quasi-experimental study of the impact of menu-labeling*. *PLoS One* **10** (12), e0144962.
- Miller, C., Tsoka, M. & Reichert, K. 2008 *Impact Evaluation Report. External Evaluation of the Mchinji Social Cash Transfer Pilot*. Center for International Health and Development, Boston University, Boston, MA. Available at: https://www.unicef.org/malawi/MLW_resources_impactsocialcashtrf.pdf (accessed 12 September 2017).
- Mills, J. & Cumming, O. 2016 *The Impact of Water, Sanitation, and Hygiene on Key Health and Social Outcomes: A Review of Evidence*. Sanitation and Hygiene Applied Research for Equity (SHARE) and UNICEF, London and New York.
- Pereznieto, P., Jones, N., Hamad, B. A. & Shaheen, M. 2014 *Effects of the Palestinian National Cash Transfer Programme on Children and Adolescents: A Mixed Methods Analysis*. ODI report. Available at: <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8936.pdf> (accessed 10 September 2017).
- Prüss-Ustün, A., Bartram, J., Clasen, T., Colford, J. M., Cumming, O., Curtis, V., Bonjour, S., Dangour, A. D., De France, J. & Fewtrell, L. 2014 *Burden of disease from inadequate water, sanitation and hygiene in low-and middle-income settings: a retrospective analysis of data from 145 countries*. *Tropical Medicine & International Health* **19** (8), 894–905.
- Smith-Greenaway, E. 2015 *Educational attainment and adult literacy: a descriptive account of 31 Sub-Saharan Africa countries*. *Demographic Research* **33**, 1015–1034.
- Stuart, E. A. 2010 *Matching methods for causal inference: a review and a look forward*. *Statistical Science* **25** (1), 1–21.
- Stuart, E. A., Huskamp, H. A., Duckworth, K., Simmons, J., Song, Z., Chernew, M. E. & Barry, C. L. 2014 *Using propensity scores in difference-in-differences models to estimate the effects of a policy change*. *Health Services and Outcomes Research Methodology* **14** (4), 166–182.
- Tilley, E. & Günther, I. 2016 *The impact of conditional cash transfer on toilet use in eThekweni, South Africa*. *Sustainability* **8** (10), 1070.
- UNHCR 2016 *Cash Based Interventions for WASH Programmes in Refugee Settings*. Available at: <http://www.unhcr.org/59fc35bd7.pdf> (accessed 12 February 2018).
- United Nations General Assembly 2015 *Transforming our World: the 2030 Agenda for Sustainable Development*. United Nations, New York. Available at: <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf> (accessed 2 January 2017).
- WHO & UNICEF 2014 *Nepal: Sanitation, Drinking-Water and Hygiene Status Overview*. Available at: http://www.who.int/water_sanitation_health/glaas/2014/nepal-10-nov.pdf (accessed 1 August 2017).
- World Health Organization 2006 *Core Questions on Drinking-Water and Sanitation for Household Surveys*. World Health Organization, Geneva.

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