UNDERSTANDING THE FACTORS THAT INFLUENCE THE PERFORMANCE OF INDIA'S COMMUNITY NUTRITION WORKERS: ANGANWADI WORKERS OF THE INTEGRATED CHILD DEVELOPMENT SERVICES SCHEME IN BIHAR

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I hereby declare that this thesis has not been and will not be submitted in whole or in part to another University for the award of any other degree

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SUMMARY

My PhD thesis is an enquiry into the factors that influence the performance of community nutrition workers known as *Anganwadi workers* (AWWs) employed by the Integrated Child Development Services (ICDS) scheme in the Indian state of Bihar.

My research question asks: *what factors influence the performance of AWWs and how does the addition of a technology augmented intervention influence AWW performance in the context of a state with a high burden of child undernutrition.* I use qualitative and quantitative methods to answer my research question. To explore the concept of performance in the AWW context, I developed a conceptual framework informed by a review of frameworks on the performance of community and facility-based health workers.

In my research I utilise the context of a pilot programme – the Bihar Child Support Programme – that introduced mobile phone technology as a job aid for the AWW, combined with a monetary incentive.

As part of the qualitative research, I conducted 30 semi-structured interviews with AWWs including 15 AWWs who received the mobile phone technology and monetary incentives intervention of the BCSP. I used a hybrid method of inductive and deductive thematic analysis to analyse the data.

In the quantitative research, I employed a Difference–in–Difference estimation strategy to assess the influence of the mobile phone technology and monetary incentives intervention on the uptake of ICDS services linked to the intervention.

I found a range of factors that impact on AWW performance. My research identified four new factors to add to the starting framework: family support, beneficiary and AWW service preferences, seasonal migration, and corruption.

The technology augmented intervention examined in this thesis would have been expected to be successful based on the existing frameworks for community and facility-based health worker performance. However, it had no positive impact on household level service delivery outcomes. One of the new factors identified in this thesis – beneficiary and AWW service preferences – is

the primary explanatory for this. The intervention sought to strengthen information-oriented nutrition services (weighing and counselling) but this was not a preference for either the beneficiaries (who prefer product-oriented services) or AWWs (who prefer education related services due to their self-identification as pre-school teachers) and as such did not lead to impact. This has implications for the understanding of the motivation and performance of AWWs and similar community health workers and the design of interventions aimed at improving their performance.

To my late grandmothers

Aachi Cheruvathoor (1919–2000)

Kunjamma Cheruvathoor (1918–2007)

Padmini Kadaliyil (1936–2015)

Rosa Panengadan (1922–1990)

Being the first-generation graduates and working women of my family, their life and work remain as the foundation of my academic journey

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I dedicate this thesis, which primarily portrays the lives of working women to the first-generation graduates and working women in my family–my late grandmothers– without them bravely pushing boundaries at home and outside, I would have struggled to be here today to present this thesis.

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List of figures and tables

List of abbreviations

ANC	Ante Natal Care
ANM	Auxiliary Nurse Midwife
ASHA	Accredited Social Health Activist
ATE	Average Treatment Effect
AWC	Anganwadi Centre
AWH	Anganwadi Helper
AWW	Anganwadi Worker
BBC	British Broadcasting Corporation
BCC	Behavioural Change Counselling
BCSP	Bihar Child Support Programme
BDO	Block Development Officer
BKMB	Bal Kuposhan Mukth Bihar (Child Undernutrition Free Bihar)
BMGF	Bill and Melinda Gates Foundation
BMI	Body Mass Index
BPL	Below Poverty Line
CARE	Cooperative for Assistance and Relief Everywhere
CBGA	Centre for Budget and Governance Accountability
CCT	Conditional Cash Transfer
CDPO	Child Development Project Officer
CHW	Community Health Worker
CMS	Centre for Media Studies
CPI	Communist Party of India
CPI (ML)	Communist Party of India (Marxist-Leninist)
DFID	Department for International Development
DID	Difference–in–Difference
DM	District Magistrate

DPO	District Programme Officer
FLW	Frontline Worker
FOCUS	Focus of Children Under Six
GoI	Government of India
HUNGaMA	Hunger and Malnutrition
ICDS	Integrated Child Development Services
IFA	Iron and Folic Acid
IFPRI	International Food Policy Research Institute
ITT	Intention to Treat
IYCF	Infant and Young Child Feeding
LATE	Local Average Treatment Effect
LS	Lady Supervisor
MCC	Maoist Communist Centre
MCH	Maternal and Child Health
MIS	Management Information System
MWCD	Ministry of Women and Child Development
NFHS	National Family Health Survey
NHM	National Health Mission
NIPCCD	National Institute of Public Cooperation and Child Development
NRC	Nutrition Rehabilitation Centre
NREGA	National Rural Employment Guarantee Act
PCA	Principal Component Analysis
PDS	Public Distribution System
PNC	Post Natal Care
PSM	Propensity Score Matching
PSU	Primary Sampling Unit
OBC	Other Backward Caste

OPM	Oxford Policy Management
POSHAN	Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India
RCT	Randomised Control Trial
RSOC	Rapid Survey on Children
SAM	Severe Acute Malnutrition
SC	Scheduled Caste
SD	Standard Deviation
SDP	State Domestic Product
SIM	Subscriber Identity Module
SMS	Short Message Service
SNP	Supplementary Nutrition Programme
ST	Scheduled Tribe
SWD	Social Welfare Department
TAM	Technology Acceptance Model
THR	Take Home Ration
TSO	Technical Support Officer
TTF	Task-Technology Fit
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
VHSND	Village Health Sanitation and Nutrition Day
WHO	World Health Organisation

Glossary of local terms

Adivasi	A term to denote a member of the tribal community
Bihar Bal Samarthan	Bihar Child Support Programme
Brahman	In the traditional Hindu caste system, a member of the first of the four Hindu castes
Chawal	Rice
Dal	Lentils
Dalit	A term to denote a member of the lower caste
Didi	Elder sister
Halwa	A semolina based sweet dish item in the Anganwadi centre menu
Jati	Caste
Kendra	Local Hindi term for Anganwadi centre, means 'centre'
Kshatriya	In the traditional Hindu caste system, a member of the second of the four Hindu castes
Khichdi	Rice and lentils based food item
Malikh	Owner
Mukhiya	Village Headman
Nashta-Pani	Local term to denote 'snacks and tea'
Panchayat Bhawan	A hall owned by the Gram Panchayat in a village
Paswan	One of the caste groups within the Scheduled Caste
Poshan Diwas	Village Health Sanitation and Nutrition Day
Rasia	A milk and semolina based sweet dish item in the Anganwadi centre menu
Ravidas	One of the caste groups within the Scheduled Caste
Sahaika	Helper, means 'a woman who helps'
Samudayik Bhawan	A community hall in a hamlet or a village
Sevika	Anganwadi worker, means 'a woman who serves'

Shudra	In the traditional Hindu caste system, a member of the fourth of the four Hindu castes
Tola	Hamlet
Vaishya	In the traditional Hindu caste system, a member of the third of the four Hindu castes
Varna	In Hinduism, any of the four Hindu castes (Brahman, Kshatriya, Vaishya, and Shudra)
Veda	Sacred Hindu texts

Chapter One: Introduction

This thesis is an enquiry into the factors that influence the performance of community nutrition workers known as *Anganwadi workers* (hereafter, AWWs) employed by the Integrated Child Development Services (hereafter, ICDS) scheme in the Indian state of Bihar. The ICDS and AWWs have a significant role in the context of the high burden of child undernutrition in India. Child undernutrition levels in India remain among the worst in the world (Raykar et al., 2015). The ICDS is the main government of India programme to address undernutrition. At the village level, AWWs provide significant maternal and child health and nutrition services to young children and mothers whilst also working as pre-school teachers. Hence, they cover the whole range of early childhood developmental stages from conception to pre-schooling. In the battle against child undernutrition, what constitutes an AWW's performance remains inadequately addressed. While existing branches of public health literature have examined in detail the factors that influence the performance of community and facility-based health workers, few studies have examined the performance of workers such as AWWs who perform health and nutrition activities along with broader early childhood developmental activities.

The Indian state of Bihar offers a unique empirical setting to study AWW performance because, being one of the states with the highest levels of child undernutrition, it has been demonstrating a steady commitment through various state-led interventions to improve AWW and ICDS performance. Making use of this opportunity to learn more about AWW performance, I structure this research around three distinct analytical chapters, which explore this topic using qualitative and quantitative methods.

The remainder of this introduction is organised as follows: section 1.1 describes the personal and academic motivation for this thesis; section 1.2 describes the geographic and programme contexts the thesis is situated in; section 1.3 outlines the overall analytical approach; and section 1.4 provides an overview of the thesis by connecting the research questions and chapters.

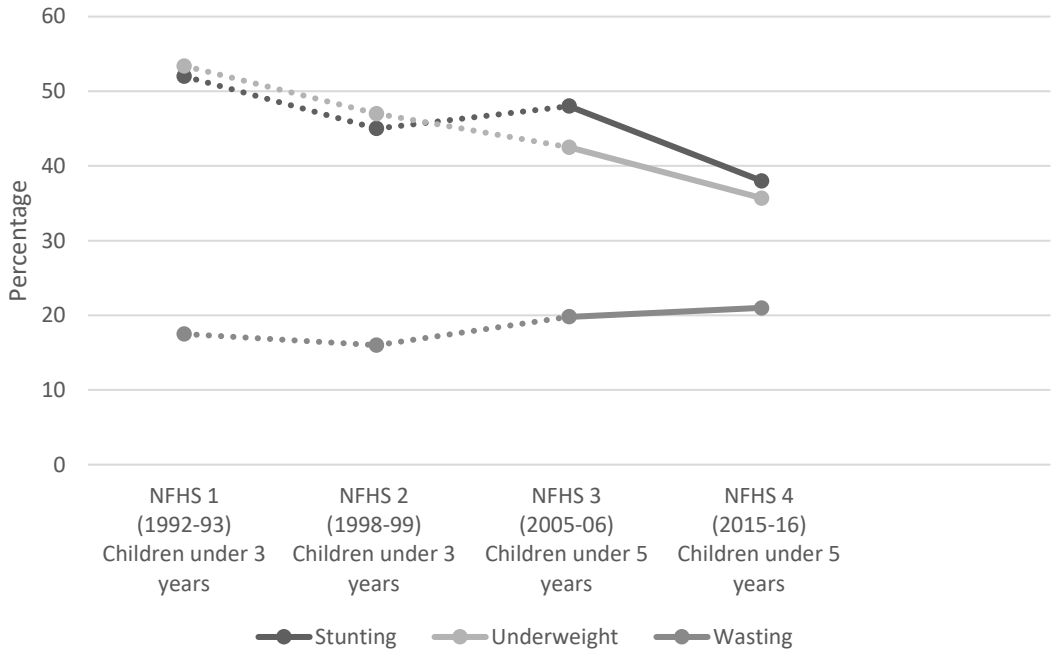
1.1 Personal and academic motivation

In the year 2006, the National Family Health Survey (known as NFHS–3) released its third round of findings on maternal and child health and nutrition levels in India. It revealed the persistent and deep crisis of undernutrition levels amongst under-five children in the country. Other than providing much-needed data, it also stirred discussions on the topic among central and state governments, the international and national nutrition community, the media, and undergraduate

students like me. Although my interest in the topic of child undernutrition started with reading the NFHS–3 fact sheets, it developed into an academic interest when I used the NFHS–3 raw datasets to study the determinants of child undernutrition in India for my Masters' dissertation.

Almost a decade after the NFHS–3, the fourth round (NFHS–4, 2015-16) also underlines India's high levels of child undernutrition. India is home to more than one-third of the world's stunted[1] children (IFPRI, 2016). In India, 40 million children under five are stunted (low height for age) and 17 million wasted (low weight for height) (Raykar et al., 2015). Figure 1 presents the trends in nutritional status from 1993 to 2016.

Figure 1 Trends in nutritional status in India 1993-2016



(Source: Author compiled from nutritional survey[2] reports)

[1] The majority of empirical work uses anthropometric indicators to understand the nutritional status of children. Nutritional deficits are identified by the prevalence of stunting, underweight, or wasting (defined using anthropometric Z scores compared to an international reference population calculated by the World Health Organisation (WHO)). Stunting is linear growth retardation and it captures chronic undernutrition - a failure to receive adequate nutrition over a long period or the presence of chronic/recurrent diarrhoea. Underweight is a measure of both acute and chronic undernutrition and captures seasonal variations in food intake or recent phases of illness. Wasting captures the thinness of children and indicates acute undernutrition. A child would be considered stunted when height-for- age is below -2 standard deviations (SD), underweight when weight- for- age is below -2 SD and wasted when weight-for-height is below -2SD with respect to the median of the reference population (WHO, 2010).

[2] Nutritional survey reports used for this graph are—(NFHS-3, 2007; NFHS-4, 2015; Rapid Survey on Children (RSOC), 2014)

Although the under-five stunting and underweight (low weight for age) rates of Indian children declined since 2006, they are at higher levels than those reported in other countries in the region which are considerably poorer (e.g. Bangladesh[3]).

Though evidence-based solutions to improve maternal and child nutrition are available, there is a lack of evidence on the best operational strategies to implement them (Menon et al., 2014). Community health programmes delivered through Community Health Workers (CHWs) have been shown to effectively deliver key maternal and child health and nutrition interventions at the community level in low and middle-income countries (Haines et al., 2007; Lewin et al., 2010). The performance of community health programmes delivered by CHWs is heavily influenced by individual CHW characteristics, programme, and contextual factors (Haines et al., 2007; Kok et al., 2014, 2015; Lehmann & Sanders, 2007; Rowe et al., 2005).

India has invested in efforts to reduce childhood undernutrition and improve maternal and child health through its two flagship CHW programmes— the ICDS scheme and National Health Mission (NHM). Together, these two programmes deliver all fourteen essential nutrition interventions[4] proved to improve maternal and child nutrition using two types of CHWs (Avula et al., 2013). The ICDS worker is AWW and the NHM worker is Accredited Social Health Activist (ASHA). In the wider public health literature, these two workers are considered as CHWs. However, in the Indian context the AWW has health and nutrition responsibilities and ASHAs have only health responsibilities (GoI MWCD, 2010; MWCD, 2017). Unlike the NHM, which only delivers health interventions through Accredited Social Health Activists (ASHAs), the ICDS delivers both health and nutrition interventions through its cadre of 1.34 million AWWs (MWCD, 2017).

In my career before this doctoral work, I conducted fieldwork on various social welfare policies in interior villages of Northern Indian states (Bihar, Chhattisgarh, Jharkhand, Rajasthan, and Uttar Pradesh) which have the highest rates of child undernutrition. Even when my fieldwork was not

[3] From 2006 to 2014, whilst the under 5 stunting prevalence in India declined from 48% to 39%, in Bangladesh it decreased from 43% to 36% (IFPRI, 2016).

[4] The 14 essential inputs for child nutrition are- Timely initiation of breast-feeding within one hour of birth; Exclusive breastfeeding during the first 6 months of life; Timely introduction of complementary foods at 6 months; Age-appropriate complementary feeding, adequate in terms of quality, quantity and frequency, for children ages 6-24 months; Prevention of anaemia; Safe handling of complementary foods and hygienic complementary feeding practices; Full immunisation; Reducing Vit A deficiency; Reducing burden of intestinal parasites; Prevention and treatment of diarrhoea; Timely and quality therapeutic feeding and care for all children with severe acute malnutrition; Improved food and nutrition intake for adolescent girls, particularly to prevent anaemia; Improved food and nutrient intake for adult women, including during pregnancy and lactation; Prevention and treatment of Malaria. The ICDS scheme has interventions to cover 12 out of 14 essential inputs listed above. Two essential inputs ICDS interventions don't cover are- Reducing burden of intestinal parasites and Prevention and treatment of Malaria. [Source: (Avula et al., 2013), Lancet Series on Maternal and Child Undernutrition (Bhutta et al., 2008); (Coalition for Sustainable Nutrition Secuirty, 2010; Scaling Up Nutrition Framework for Action, 2011)]

directly related to maternal and child health, I interacted with AWWs in villages as they had a prominent presence in a village. It is a common practice for journalists, government and non-governmental staff, social activists, and researchers like me to approach AWWs to inquire about the village population size, recent births and deaths, geographic boundaries, and to locate people in the villages. As a population data repository, a provider of integrated child development services, and a resident of the village, AWWs embodied the role of a representative of the welfare state and a fellow villager (Sreerekha, 2016). I was curious to see them deliver a programme mandate in a complex environment where the boundary between the personal and professional is often blurred.

Throughout my experience, I encountered Anganwadi Centres[5] (hereafter, AWCs) which varied in quality and AWWs who provided varied levels of support across villages, districts[6], and states. The majority of the studies that have examined the implementation of the ICDS confirm this observation. These studies on the ICDS suggest that, overall, it is performing sub-optimally. Implementation of services is often poor leading to low coverage[7] (Biswas & Verma, 2009; CBGA, 2011; Dasgupta et al., 2012; Drèze, 2006; FOCUS, 2006; HUNGaMA, 2011; Maity, 2016; Nayak & Saxena, 2006; NIPCCD, 2009a, 2009b; Planning Commission, 2011; Saxena & Srivastava, 2009; Sinha, 2006). Even though the available evidence suggests that the ICDS is not performing optimally especially in high burden undernutrition states, the reach of the overall ICDS platform is high as it has been documented to exist even in remote villages. Considering AWWs are responsible for the delivery of the ICDS services, their performance is critical for the overall programme performance (Biswas & Verma, 2009). However, the evidence base on what shapes AWW performance is limited. The evidence on the ICDS that is available primarily focuses on describing the shortfall in human resources management (especially workload, role clarity, supervision, and training) and resources and logistics (job aids, transport, supplies) but not the actual worker beyond her levels of skills and knowledge (Agarwal et al., 2015; Bhattacharji et al., 1986; Gujral et al., 1991; Maity, 2016; Planning Commission, 2011).

States in India have invested in initiatives to reduce the burden of child undernutrition. The Nutrition Mission led initiatives in Maharashtra has been reported as one such successful state-

[5] Buildings from which AWWs operate.
[6] A district is an administrative division of an Indian state.
[7] However, this performance is varied across India. For example, southern states like Tamil Nadu and Kerala have a history of well-equipped AWCs with educated AWWs, but states like Bihar have the least supported AWWs and most resource constrained AWCs (FOCUS, 2006; Maity, 2016; Nayak & Saxena, 2006; Planning Commission, 2011; Rajivan, 2006).

led initiative (IFPRI, 2014). The government of Bihar, with the input of key development partners[8], have initiated a series of projects to improve the implementation of the ICDS programme. Structural improvements to the AWC buildings, introducing an additional worker, providing cash transfers to beneficiaries, providing financial and non-financial incentives and building capacities of AWWs are some of the initiatives currently ongoing or recently completed. In 2013, I got the opportunity to be part of one these initiatives. As part of an organisation selected to design and evaluate a pilot maternal and child support programme utilising the ICDS platform, I interacted with several AWWs across Bihar.

The Bihar Child Support Programme (BCSP) is one of a range of government of Bihar initiated experiments to improve maternal and child nutrition with technical and financial assistance from the Department for International Development (DFID) (OPM, 2014). The BCSP was introduced by the Social Welfare Department (SWD) of the government of Bihar, in three administrative blocks[9] of Gaya district in Bihar[10]. The BCSP aimed to improve ICDS service delivery through demand and supply-side interventions[11]. The programme piloted a monthly maternal and child cash transfer as the demand-side intervention. As the supply-side intervention, it gave mobile phones to AWWs as a job aid to help them with real-time monitoring. It also provided monetary incentives to AWWs to encourage them to use the mobile phone technology. Although providing cash transfers to households is a widely studied social protection measure, programmes using the potential of mobile phone technology to improve health and nutrition service delivery is a relatively new area of research. A review of the evidence in the emerging fields of m-Health[12] and

[8] After the political change in 2005 Bihar started demonstrating more receptiveness to technical assistance and financial assistance from development partners. Since then, the nutrition landscape in Bihar has many players, but a few remain as key players. They are- United Nations International Children's Emergency Fund (UNICEF), Cooperative for Assistance and Relief Everywhere (CARE), Save the Children, British Broadcasting Corporation (BBC) Media Action, Bill and Melinda Gates Foundation (BMGF),and Department for International Development (DFID) etc. (Alive and Thrive, 2014). See Annexe B for a detailed description of donor engagement in Bihar.

[9] Administrative unit below district/sub-division covering 1,00,000 to 2,00,000 population.

[10] I worked for the programme as part of the organization Oxford Policy Management (OPM) that was hired to design, provide implementation support to, and evaluate the programme. I worked on the programme prior to its implementation as part of the inception and evaluation team leading the baseline data collection from January 2013 to August 2013.

[11] The terms *demand* and *supply* are commonly used in economic theory. In the BCSP context a demand-side intervention is defined as an intervention that aimed at the beneficiary/household. Supply-side interventions are considered as those piloted to improve government systems, in this case especially the AWW and AWC.

[12] The terms m-Health and m-Nutrition are used to denote interventions that use mobile phones in health and nutrition system functioning including the delivery of health and nutrition surveillance (Labrique et al., 2013).

m-Nutrition confirms this observation (Agarwal et al. 2015, Barun et. al 2013, and Labrique et.al 2013).

Considering AWWs continue to work in low-resource settings with a high burden of child undernutrition, the current evidence on the ICDS does not shed light on how they negotiate existing limitations and emerging opportunities (e.g. use of monetarily incentivised mobile phone technology) in those settings. Understanding how AWWs negotiate with existing limitations and emerging opportunities offered by technology is a significant step towards understanding their performance. The question of what constitutes AWW performance and how various factors including new technology influence it needs to be adequately understood to intensify AWWs' battle against child undernutrition, especially in the context of a state like Bihar. At this juncture, I found my motivation taking the shape of an academic quest asking a pertinent question inadequately answered in the literature –*what factors influence the performance of AWWs and how does the addition of a technology augmented intervention influence AWW performance in the context of a state with a high burden of child undernutrition?*

1.2 Understanding the context: Bihar and the ICDS

This thesis is situated in the geographic context of a high burden child undernutrition state, Bihar, and the programme context of one of the world's largest CHW programmes, the ICDS, to study the performance of AWWs. Within the Bihar–ICDS context, it also utilises the context of a pilot programme, the BCSP as an empirical site to answer specific research questions. In this section, I introduce key features of the geographic (Bihar) and programme (the ICDS) contexts to lay a foundation to situate the overall significance and contributions of this thesis. I describe in detail my empirical site of the BCSP in Chapter 3.

Geographical[13] context: Bihar

The state of Bihar[14], situated in the fertile Gangetic plain, possesses a rich range of natural resources (e.g. coal, steel) (Ministry of Finance Central Bureau of Statistics, 2016). However, it has long been at the bottom of India's poverty rankings and is a consistently poor performer in social development indicators (UNDP, 2011; World Bank, 2005). It has been characterised as embodying the interface of an old and new India – a feudal agrarian society and a fast-growing newly globalised economy (Singh & Stern, 2014). As a feudal society, it

[13] Geographical maps of Bihar and Gaya are given in Annex A.
[14] From 1947 to 2000 it was undivided Bihar. Later it was divided as Bihar and Jharkhand (Bhattacharya, 2017).

historically preserved traditional social biases that lead to caste[15] and class conflicts, especially caste conflicts between upper and lower caste Hindus (Bhatia, 2005; Gajrani, 2004; Sharma et al., 2012). The social fabric of Bihar has long been governed by caste-based patronage politics, corruption, and bad governance. In the period 1990 to 2005, Bihar faced intensified deterioration in growth and development due to the excessive patronage political practices leading to state incapacity in planning and day-to-day governance (Mathew & Moore, 2011).

The district of Gaya is a popular tourist destination due to its religious significance in Buddhism and Hinduism. Bodhgaya, a part of the Gaya district, houses the famous Maha Bodhi temple where it is believed by Buddhists that Buddha found enlightenment. It is a hub of Buddhist monasteries and occupies a significant space in religious tourism. In Hinduism, Gaya is a significant place for rituals related to the salvation of ancestors. Although Gaya is the second highest district contributor of the State Domestic Product (SDP) through small-scale industries and religious tourism, a significant proportion of the population live with low standards of living, and pockets of it experience extreme poverty (Ministry of Finance Central Bureau of Statistics, 2016; NFHS-4, 2015).

Since, 2005, with new political leadership[16], the state of Bihar has been demonstrating efforts to change its reputation by investing in improving economic growth, infrastructure, social welfare programmes, law and order, and state governance (Singh & Stern, 2014). Although the state witnessed increased economic growth and infrastructure development in the last decade, the returns to reforms in governance have been low, especially the improvement of social welfare programmes. The state did achieve commendable improvements in the performance of the Public Distribution System[17] (PDS) and education initiatives, but reducing child undernutrition and improving maternal and child health remains a challenge (Drèze & Khera, 2013; NFHS-4, 2015).

From 2006 to 2014, all states in India showed a decline in stunting of children below five years. However, Bihar is one of the three Indian states[18] which had a high rate of under-five stunting in

[15] A box on caste (Box 1) in Bihar is presented on page 15.

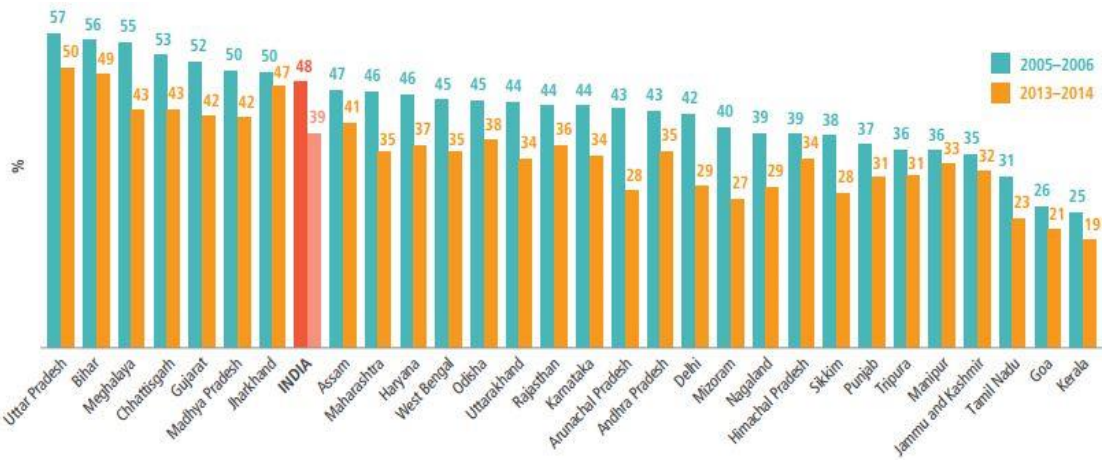
[16] After a period of rule by Rashtriya Janta Dal (RJD) leaders Lalu Prasad Yadav and Rabri Devi and a short period of the president of India's rule, Nitish Kumar (Janta Dal United) came to power for a second term in 2005. He remained as the chief minister until May 2014. Although he stepped down as the chief minister for less than a year, he got re-elected as the chief minister by the legislatives and later in the 2015 state elections.

[17] PDS is in India is a chain of government run ration shops that distributes subsidised food (wheat, rice, sugar etc.) to different beneficiary groups in the local catchment area.

[18] Uttar Pradesh and Jharkhand are the other two states that showed slow declines in under five stunting from 2006 to 2014 (IFPRI, 2015).

2006 but which had only slow improvement (see Figure 2). Still half (48.3%) of the children below age five years are underweight and more than a quarter (27.1%) are wasted in Bihar (NFHS-4, 2015).

Figure 2 Stunting rates 2005-06 and 2013-14 in 29 Indian states



(Source: (IFPRI, 2015)

Therefore, despite the intensified efforts to improve maternal and child health by improving basic measures (e.g. filling up the vacant AWW posts, investing in the physical infrastructure of the AWCs, sanctioning more AWCs and converging the ICDS and NHM activities at the village level) and state-initiated interventions[19] (e.g. innovative pilots using technology, additional workers, team based goals and incentives, cash transfers, women self-help groups, and food fortification) the state is yet to see a significant benefit of these efforts in the form of a substantial reduction in child undernutrition[20]. Although my doctoral study utilises the empirical context of one of these state-initiated maternal and child cash transfer interventions, it is primarily aimed at contributing towards a richer understanding of preferred human resource management strategies to improve the service delivery of national health and nutrition programmes using community health workers, and thus contribute to the government of Bihar's goals to reduce malnutrition among young children.

Programmatic context: the ICDS

The ICDS was started in 1975 as a pilot in 33 administrative blocks. It began universalisation (i.e. scaled up across all districts in all states) following several Supreme Court orders since 2001 (Kapil, 2002). Table 5 shows the ICDS expansion since its inception in 1975 regarding

[19] A detailed list of recently completed and ongoing state-initiatives in health and nutrition service delivery is given in Annex B.
[20] Undernutrition measured as stunting, underweight, and wasting of children below 5 years of age.

the number of AWCs, AWWs, and beneficiaries (women and children). In the four decades of the ICDS programme, the number of AWWs increased from 4,891 to 1.34 million.

Table 1 The ICDS since 1975: the increase in workforce and beneficiaries[21]

Category	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000	2000-2005	2005-2010	2015-
Overall coverage	Targeted	Targeted	Targeted	Targeted	Targeted	Universal	Universal	Universal
Number of ICDS projects sanctioned	33	174	1,130	2,236	3,397	4,200	5,671	7,075
Number of ICDS projects fully operational	NA	NA	784	1,617	2,872	4,348	5,422	7,072
Number of AWWs	4,891	24,302	91,755	1,79,733	2,70,126	5,04,129	6,92,831	13,46,186
Number of SNP women beneficiaries	NA	NA	11,12,420	2,053	33,66,312	57,03,191	81,05,009	1,93,33,605
Number of SNP children beneficiaries	NA	NA	50,63,890	10,733	1,56,64,934	2,80,76,473	4,03,37,104	8,28,99,424

***SNP:** Supplementary Nutrition Programme

Traditionally the ICDS comprised of six services – preschool education, supplementary nutrition, immunisation, health-check-ups, nutritional health education, and referral services (GoI MWCD, 2010). However, with the introduction of ASHAs as part of the NHM programme from 2006, the activities AWWs perform within the broad service category have evolved (Bhatia, 2014). In the current context, an AWW delivers the following services–

1. Preschool education for 3-6-year-old children
2. SNP
    i. Hot Cooked Meal (HCM): daily lunch for 3–6-year-old children
    ii. Take Home Ration (THR): monthly dry rations to pregnant and lactating women and 6-36-month-old children
3. Health and nutrition counselling (individual and group)
4. Preparation for monthly Village Health Sanitation and Nutrition Day (VHSND) to facilitate immunisation and weight monitoring of children and pregnant women in coordination with ASHAs and Auxiliary Nurse Midwives (ANMs)
5. Identification and referral of Severely and Acutely Malnourished (SAM) children

[21] Source: author compiled from the ICDS website (MWCD, 2017).

Therefore, in theory, an AWW provides a varied set of services. She provides food to children and mothers, provides non-formal pre-school teaching, counsels mothers individually and as a group, facilitates age-appropriate immunisation, and provides nutrition surveillance such as weighing and referral of SAM children. The monthly VHSND is a platform to deliver a set of health services primarily for women and children and an opportunity for the two village-level CHWs (AWW and ASHA) to coordinate under the leadership of the facility based health worker, ANM. An AWW provides the physical space at the AWC to hold a monthly VHNSD where the ANM provides immunisation, health check-ups, and Ante-Natal Care (ANC), which means that an AWW is not directly responsible for two out of six of traditional ICDS services. However, she is still responsible for monitoring of age-appropriate immunisation for every child and weighing of pregnant women as part of the ANC check-ups within her catchment area (GoI MWCD, 2010, 2010, 2011).

Each population segment of 1000 is entitled to have an AWC managed by an AWW who is assisted by an Anganwadi Helper (AWH) in cooking and cleaning. An AWW works from the AWC, which is usually a physical structure with one or two rooms. The AWC functions either in ICDS owned buildings or any other government buildings or rented premises. The AWCs are expected to have facilities for clean drinking water, sanitation, and cooking as well as medicines (such as oral rehydration salts, de-worming tablets, etc.). It is also expected that a well-functioning AWC will have teaching aids, health and nutrition counselling posters, seating facilities for children, weighing machines, and growth charts. Moreover, a clean environment fostering childcare should be provided (GoI MWCD, 2010, 2010, 2011). Apart from district-level Nutritional Rehabilitation Centre (NRC) attached to primary health care facilities to treat SAM children, the AWC is the only provider of public nutrition services. However, many studies have pointed out that a high proportion of AWCs across the country suffer from the absence of basic facilities like clean drinking water or sanitation (Dasgupta et al., 2012; FOCUS, 2006; HUNGaMA, 2011; Maity, 2016; Planning Commission, 2011).

The ICDS is a human resource intensive public programme, with 35-50% of its budget spent on AWWs (Biswas & Verma, 2009). The ICDS recognises AWWs as 'honorary workers' from the local community who have come forward to render their services, on a part-time basis, in child care and development (GoI MWCD, 2010). Thus, they are paid a fixed honorarium per month. In Bihar, an AWW and an AWH are paid up to Rs. 3000 ($45)[22] and Rs. 1500

[22] All conversions mentioned in this thesis used the forex rates on 28th Feb 2017 from https://www.oanda.com/currency/converter.

($22.5) respectively depending on their educational qualifications (SWD, 2015a). Different states provide a top-up to the minimum honorarium amount. For example, the South Indian state Kerala gives Rs. 5000 as the monthly honorarium (GoI MWCD, 2015). In most of the states, AWWs and AWHs are contractual labourers with temporary job status (i.e. they do not have the permanent employee status that entitles them to a minimum wage salary or pension or other government employee benefits). Only the state of Tamil Nadu and Union Territory Puducherry have recognised AWWs as government employees (GoI MWCD, 2015).

The minimum education qualification to become an AWW is ten years of education in Bihar. AWWs are expected to work four to six hours per day for six days a week. AWWs are supervised by Lady Supervisors (LS). Each LS supervises 20-30 centres. They are based at the administrative block headquarters and are supposed to visit AWCs on a regular basis. The LSs support AWWs by helping them solve their daily operational issues, reporting their difficulties to higher officials, making sure they have supplies for the month and monitoring their work. The Child Development Project Officers (CDPOs) posted at the block level (covering a population of 100,000- 250,000) provide the next line of management support (GoI MWCD, 2010, 2011).

1.3 Overarching analytical approach

This thesis is situated within the fields of public health and nutrition. Overall, I follow a mixed methodology combining qualitative and quantitative methods to answer my research question, simultaneously engaging with public health frameworks on worker performance and seeking to draw lessons for policy.

My central research question asks: *what factors influence the performance of AWWs and how does the addition of a technology augmented intervention influence AWW performance in the context of a state with a high burden of child undernutrition?*

To conceptually and empirically explore the concept of performance in the AWW context, I define AWW performance as *'AWWs making services accessible with required quality (i.e. fidelity to guidelines)'*. I derived the conceptual framework on AWW performance from reviewing the relevant public health literature. It envisages that individual, programmatic, community, and organisational factors act as determinants of AWW performance at the AWW level (discussed in Chapter 2). I define the monetarily incentivised mobile phone technology intervention as an augmentation in programme factors because the literature identifies monetary incentives within the broader category of incentives and mobile phones within the category of job aids and both are classified as programme factors.

Based on the development of the conceptual framework, I refined my central research question into two sub-questions RQ1 and RQ2. The primary aim of this thesis is to understand factors that influence AWW performance, especially after a technology augmented intervention has been implemented to improve AWW performance. Each of the research questions specifically focuses on filling identified research gaps in the public health literature (discussed in Chapter 2). Separating the questions allowed me to explore and examine specific areas of performance identified in the conceptual framework in depth. The nature of the research questions led me to choose suitable research methods to answer them. I use qualitative methods to answer RQ1 and combine qualitative and quantitative methods to answer RQ 2. Table 2 provides an overview of research questions, aims, methodology and chapter categorisation of this thesis.

Table 2 Overall analytical approach

Research question		Research aims	Methodology	Chapters
Central question	*What* factors influence the performance of AWWs and *how* does the addition of a technology augmented intervention influence AWW performance in the context of a state with a high burden of child undernutrition?		Mixed	4,5, 6, and 7
Sub-question RQ 1	*What* are the individual, programmatic, community, and organisational factors that influence AWW performance?	Understanding the factors influencing AWW performance	Qualitative	4
Sub-question RQ 2	*How* and *why* does a change to the programmatic factors (mobile phone technology and monetary incentives bundle) influence AWW performance?	Understanding how and why the monetarily incentivised mobile phone technology intervention influences the uptake of ICDS services linked to the intervention	Quantitative	5
		Understanding how and why the monetarily incentivised mobile phone technology intervention influences AWW performance	Qualitative	6

I conducted qualitative fieldwork that informs two different chapters with separate objectives. The two objectives were–1) understand what and how individual, programmatic, community and organisational factors influence AWW performance and 2) understand how and why the technology augmented intervention with a monetary incentive component influences AWW performance. I also conducted quantitative analysis to examine the influence of the technology augmented intervention's influence on the household uptake of services. In Chapter 3, I provide a detailed discussion of the rationale for combining qualitative and quantitative methods.

1.4 Structure of the thesis

Overall this thesis comprises of three background chapters and four analytical chapters. I now describe the overview of each of the constituent chapters of my thesis.

Chapter Two: Conceptual review and conceptual framework

The next chapter provides an analytical summary of the empirical and conceptual evidence available on the performance of AWWs, and of community and facility-based health workers across the world. In doing so, the chapter highlights the empirical and conceptual research gap in understanding AWW performance within the ICDS literature and lays out key lessons from the existing public health literature on conceptualising performance of workers such as AWWs. It also introduces the emerging fields of m-Health and m-Nutrition and the relevance of studying the influence of mobile phone technology and monetary incentives on the performance of workers such as AWWs. Finally, the chapter discusses how I used the lessons from the conceptual review as the point of departure in developing a conceptual framework on AWW performance.

Chapter Three: Empirical context and methodology

In Chapter 3, I describe the BCSP empirical context, discuss my motivation to conduct qualitative and quantitative research and my approach in combining them, outline the qualitative methods including selection of participants, data collection, and data analysis, and provides a brief overview of the quantitative data and estimation strategy.

Chapter Four: Individual, programmatic, community, and organisational factors that influence Anganwadi Workers' performance

In Chapter 4, I present findings from my qualitative research that explored the individual, programmatic, community, and organisational factors influence AWW performance. The chapter aims to present a deeper understanding of an AWW's lived experiences, feelings, and emotions as a village woman and as a programme worker. It briefly recaps the concepts and methods used in the research, presents the findings, discusses the implications of the findings, and concludes with a summary of conclusions.

Chapter Five: Effect of the mobile phone technology and monetary incentives by Anganwadi Workers on the household uptake of ICDS services

Chapter 5 presents the findings of my quantitative research. In the chapter, I present the quantitative analysis I undertook to examine the influence of the monetarily incentivised mobile phone technology intervention on the household uptake of ICDS services linked to the

intervention. The chapter also describes the quantitative data and the empirical strategy used in the analysis.

Chapter Six: Anganwadi Workers' perceptions and experiences in using the mobile phone technology and monetary incentives intervention

In Chapter 6, I present the findings of my qualitative research that aims to understand the influence of the intervention on AWW performance by exploring AWWs' perceptions and experiences. In the chapter, I also provide a recap of the concepts and methods, and discuss the analytical framework used in the analysis.

Chapter Seven: Discussion and conclusion

Chapter 7 brings together the findings from earlier analytical chapters (Chapters 4, 5 and 6) to demonstrate how they present a coherent narrative on AWW performance. I discuss specifically how the overall findings make significant contributions towards the conceptual and empirical strands of knowledge on the performance of workers such as the AWWs. Moreover, I discuss the implications of the thesis findings for policy and practice at the national and state contexts. I also reflect on the overall doctoral thesis limitations and end the thesis with a concluding discussion.

Box 1 Caste in Bihar

Caste (in Hindi *Jati*) denotes an endogamous kinship group of the individual Hindu. *Jatis* generally have distinctive traditional occupations (e.g. priest, administrator, barber, milkmen, porters etc.). In a village, there will be individual households belonging to different *jatis*. In typical Bihari villages, different *jatis* reside in different locations within a village. Broad differences of race, religion, culture and language tend to be geographical in nature; the different *jatis* coexist in the same locality (Blair, 1972). Over a region, for example in an entire linguistic area, there are often a number of *jatis* of the same name. These *jatis* form an analytical category that can be denoted as a 'caste group' or 'caste cluster' (Blair, 1972)

The caste groups are roughly categorised in terms on the *varna* system. This classifies Hindu society into four categories- *Brahmans* (Priests), *Kshatriyas* (Warriors), *Vaishyas* (Merchants) and *Shudras* (Workers). The first three classes are known as 'twice born' *varnas*, since they by tradition undergo the religious initiation ceremony of 'rebirth', and in strict orthodoxy they are allowed to hear the sacred texts of *vedas* (Blair, 1972). Actually, there are five categories rather than four. The fifth caste group- *Dalits* fall as the lowest rank in caste rankings. Even within the caste groups hierarchies exist. For example, *Shudras* can be further classified in to upper *Shudras* and lower *Shudras*. *Dalits* come even below the lower *Shudras* (Blair, 1972).

For administrative purposes and for affirmative action policy targeting, the castes are grouped as General (or forward class), Other Backward Class (OBC), Scheduled Caste (SC) and Scheduled Tribe (ST). Forward classes or General mainly include all 'twice born castes'; backward classes include all the Shudra sub-castes. *Dalits* belong to the SC and *Adivasis* (tribals) belong to Scheduled Tribes (ST). This categorisation reflects the traditional hierarchy.

British Raj politics transformed caste in India. During the Raj, censuses were taken giving a great deal of detail of importance to caste groups. This immediately triggered the caste associations and mobilised caste groups. Caste associations played roles of pressure groups and interest groups. These caste associations came around as groups for reservations in educational institutions, the civil services and other institutions (Jaffrelot, 2010).

In Bihar, the twice born castes are- Brahman, Bumihar, Rajput, Kayastha and Bania. *Shudras* can be further classified in to upper *Shudra*s and lower *Shudras*. The main upper Shudra castes are Yadav, Kurmi and Koiri. The main lower *Shudra* castes are Barhi, Dhanuk, Kahar, Kandu, Kumhar, Lohar, Mallah, Nai, Tatwa, Teli and others. Caste-based conflicts and discrimination are still part of Bihar's social fabric (Bhatia, 2005; Gajrani, 2004; Sharma et al., 2012). In Bihar, Gaya has the highest proportion of SC population (Census of India, 2001). 29.6% of the population in Gaya belongs to the SC, and they predominantly live in the rural areas (Census of India, 2001). The population of the Manjhi community is one of the common caste groups in the SC population. Although caste group wise literacy rates are not available at the district level, the state average SC literacy rate in 2001 was 28.5% just over half of the overall state average (54.07 %) (Census of India, 2001).

Chapter Two: Conceptual review and conceptual framework

2.1 Introduction

As laid out in the previous chapter, my central research question asks: *What* factors influence the performance of AWWs and *how* does the addition of a technology-augmented intervention influence AWW performance in the context of a state with a high burden of child undernutrition? The specific sub-research questions outlined in the previous chapter were developed based on a conceptual review of the literature on the performance of workers like the AWWs. They were developed to comprehensively study AWW performance and inform the research gaps identified in the relevant literature streams. In this chapter, I aim to demonstrate these research gaps and how they are linked to my sub-research questions.

This chapter has two aims. They are: i) present the lessons from the conceptual review (sections 2.3 to 2.5) and ii) discuss the conceptual framework (section 2.6). Structurally, the lessons from the conceptual review are presented in three sections: section 2.3 summarises the empirical and conceptual research gap in understanding AWW performance within the ICDS literature; section 2.4 lays out key lessons from the existing public health literature on conceptualising[23] performance of workers such as AWWs; and section 2.5 introduces the emerging fields of m-Health and m-Nutrition and the relevance of studying the influence of mobile phone technology and monetary incentives on performance of workers like AWWs. In section 2.6, I discuss how I used the lessons from the conceptual review as the point of departure in developing a conceptual framework on AWW performance. Finally, a summary of this chapter and the focus of the following chapter is provided.

2.2 Methodology

The conceptual review drew on a literature search for peer-reviewed academic papers, conference papers, and grey literature such as research reports that studied performance, especially of workers such as AWWs. I used a comprehensive list of key search terms, specified time frames, geographic regions (or countries), and language to guide the search. To review the literature, I used the following databases and search engines: Google Scholar, Web of Science, Scopus, University e-library catalogues, and government ministry websites. I selected articles,

[23] Conceptualisation here means the process of forming the concept of performance which includes gaining clarity on determinants of performance, the definition of performance, and how the determinants of performance lead up to the measurable outcome of performance. The conceptualisation of performance of AWWs also includes contextualizing the definition of performance, and factors influencing performance for the AWW context as well.

books, and published reports to use in the review after a two-stage screening process –title and abstract screening.

Table 3 Conceptual review search specifications

Theme	Key search terms	Timeframe	Regions/Countries	Language(s)
ICDS	ICDS+ Nutrition/ Malnutrition Anganwadi+ Nutrition/Malnutrition Anganwadi worker+ Nutrition/Malnutrition	1975-2017	India	English and Hindi
	CHW/ Health worker+ Mobile phone/Celluar phone/Cell phone+ Performance	2000- 2017		
Public health *Performance and factors influencing it*	CHW/ Health worker+ Motivation CHW/Health worker+ Performance CHW/ Health worker+ Motivation+ Performance CHW/Health worker+ Performance+ Conceptual framework	1978- 2017	Latin America, Sub-Saharan Africa, South Asia	English
Mobile phone technology and monetary incentives	CHW/ Health worker+ Mobile phone/Celluar phone/Cell phone+ Performance CHW/ Health worker+ financial incentives/Monetary incentives/Pay for performance+ Performance	2000- 2017	Latin America, Sub-Saharan Africa, South Asia	English
Inter-disciplinary	Worker+ Motivation+ Performance Worker+ Motivation+ Performance+ Theory	No specification	No specification	English

Table 3 summarises the search specifications I used in the conceptual review process. I used various combinations of the search terms to narrow down the relevant literature. I used specific timeframes for the review of the ICDS and public health literature as those were significant periods for the development of the literature streams. Although I did not specify any geographic specification for the inter-disciplinary search to review the broader literature on worker motivation and performance, I specifically searched for public health literature from Latin America, Sub-Saharan Africa, and South Asia to understand the performance of workers such as AWWs in Low and Middle-Income Countries (LMICs).

As part of the doctoral research, I continuously reviewed the relevant literature. I also used web alerts, and snowballing methods to be up-to-date with newly emerging evidence on the topic. Hence, this conceptual review was gradually developed and constantly reviewed.

2.3 Conceptual and empirical evidence on AWW performance

The studies that have been conducted on the ICDS and AWWs can be broadly classified into three categories. In reviewing these three categories of studies, I found empirical and conceptual research gaps in understanding AWW performance. The studies of impact and implementation of the ICDS do not link to variations at the AWW level (so reveal limited understanding into the drivers of AWW performance), whereas studies that assessed the influence of AWW characteristics on health and nutrition service delivery have limited conceptual clarity on how they define performance. Table 4 provides a synthesis of these three categories of studies on the ICDS and AWWs and highlights the research gaps in understanding AWW performance. In the next sub-sections, I discuss each of these three categories of studies in detail.

Table 4 Research gaps on AWW performance

Categories and aim of studies	Overall findings	Definition of performance	Research gap
Assessed the ***impact*** of the ICDS on child health and nutritional outcomes, infant survival, child food intake, and women's labour force participation	Overall the studies show the mixed impact of the ICDS.The more recent studies show positive influence of the presence of AWCs in the village or utilisation of the SNP on child health and nutritional outcomes, infant survival, child food intake, and mother's labour force participation.	ICDS performance as impact on populatiuon outcomes	Due to data limitations, these studies cannot explain to what extent an AWW's effort and characteristics leads to improvements in the ICDS impact
Assessed the ***implementation*** status of the ICDS and analysed its achievements, potential, and limitations in reaching out to its intended beneficiaries	The ICDS implementation has several gaps, but it varies across states. The reason for the gap is rooted in political and institutional context	ICDS performance as the availability of physical infrastructure, uptake of services, etc. AWW performance as skills and knowledge	Do not conceptually explore AWW performance beyond skills and knowledge Need more empirical evidence on how AWWs negotiate challenges and what factors help and hinder her performance beyond skills and knowledge
Assessed the ***influence of AWW level factors*** on delivery of health and nutrition service delivery by the ICDS	Empirical evidence on how a few AWW characteristics and programme factors influence AWW performance	AWW performance as coverage of services	Limited conceptual understanding of what constitutes AWW performance Lack of AWW perspectives on what factors influence her actions or efforts

Studies on the impact of the ICDS

The set of studies that focused on the impact of the ICDS examined its impact on child health and nutritional outcomes, child food intake, infant mortality, and caregiver's labour force participation (Gragnolati et al., 2005; Jain, 2012, 2013, 2015; Kandpal, 2011; Mittal & Meenakshi, 2016; Yatsu, 2012). These studies found mixed impact of the ICDS on child health and nutritional outcomes and a significant positive impact on child survival, child food intake, infant mortality, and caregiver's labour force participation.

The majority of the studies that assessed the impact of the ICDS on child health and nutritional outcomes used different rounds of the NFHS data (Deolalikar, 2005; Gragnolati et al., 2005; Jain, 2015; Kandpal, 2011; Viswanathan, 2003). The studies that used the first two rounds of the NFHS data (NFHS–1 (1992–93) and NFHS–2 (1998–99)) found limited or no evidence of the impact of ICDS on child health and nutritional outcomes. For example, Deolalikar (2005) found that the presence of an ICDS centre in a village is associated with a 5% reduction in the probability of being underweight for boys but not for girls using the NFHS–1 data.

One of the first studies that used the NFHS–2 found that the ICDS programme placement to be regressive across states (i.e. states with the highest prevalence of child undernutrition has the lowest coverage of the AWCs) and no significant effect of the programme on child nutritional outcomes[24] (Gragnolati et al., 2005). The main limitations of these studies are that they used non-experimental cross-sectional data. As Gragnolati et al. (2005) pointed out, panel data that tracks villages, households, and individuals are necessary to understand the ICDS impact fully. Non-experimental cross-sectional data might induce selection bias in estimating the impact. Moreover, in the first two rounds of the NFHS, the data on household utilisation of the ICDS services were unavailable, and the child reference group was below three years. Due to this, the analysis focused on estimating the impact only through programme placement (i.e., the presence of the AWC in the village). Focusing on a younger reference group of children (below three years) could also be a limitation in estimating the impact of the ICDS on a long-term nutritional measure like stunting (i.e. height-for-age z scores below -<2 SD).

In 2011, using the third round of the NFHS, Kandpal (2011) found that the ICDS programme placement (presence of an AWC in a village) had a significant positive impact on the most malnourished children[25]. The same study also reported that the ICDS effectively targeted poorer areas, but it failed to target areas with low levels of average education or those with unbalanced

[24] Height-for-age z scores and weight-for age z scores of children below three years of age.
[25] Height-for-age z scores of children below five years of age.

female sex-ratios[26]. Using the same data, Jain (2015) reported a significant positive impact of ICDS service receipt on child nutritional outcomes. The study found 0–2-year-old girls who received supplementary feeding daily from the ICDS centres are around 1 cm taller than other girls in rural India. Two other studies by Jain (2012, 2013) using the NFHS–3 suggest that the provision of day care through preschool service, immunisation, feeding, and health check-ups of children significantly increase mothers' labour force participation and school attendance of elder siblings (girls 6–14 years). Although these studies used better econometric strategies and improved data[27], they still have limitations arising from using non-experimental cross-sectional data to estimate the impact.

Other than the above-discussed studies by Jain (2012, 2013, 2015), three other studies examined the impact of the receipt of ICDS services. All of them focused on the SNP component of the ICDS. The receipt of SNP from the AWCs is found to be positively associated with infant survival (Rao, 2005; Yatsu, 2012). Another study by Mittal & Meenakshi (2016) suggested that children (3–6 years) who received hot-cooked-meals as part of the SNP component demonstrated a significant positive effect on the net intake of food (calorie, protein, and iron). However, for children below three years of age, who received take-home rations, there are no improvements in the intake of calories or any nutrients (Mittal & Meenakshi, 2016).

The set of impact studies on the ICDS implicitly or explicitly considered population impact as the performance of the ICDS programme. Due to data limitations, none of these quantitative studies used any AWC (e.g. infrastructure) or AWW (e.g. education, social background) characteristics as explanatory variables in the analysis. Hence, these studies are inconclusive about how variations of the AWC or AWW level characteristics influence the impact of ICDS.

Overall the impact studies of the ICDS show mixed evidence. The more recent studies show a positive influence of the presence of AWCs in the village or receipt of SNP on child health and nutritional outcomes, infant survival, child food intake, and mother's labour force participation. However, due to data limitations, these studies cannot explain to what extent an AWW's effort

[26] Sex ratio is the ratio of male to females. In India, states vary in terms of sex ratio. For example, the state Kerala has the highest female sex ratio (1058 females for 1000 males). However, the state Haryana has the lowest female sex ratio (861 females for 1000 males). The author (Kandpal, 2011) refers to states with lower female sex ratios as unbalanced.
http://censusindia.gov.in/Census_Data_2001/India_at_glance/fsex.aspx

[27] NFHS–1 and 2 did not have any ICDS service utilization data and the child reference group was below three years. But, NFHS–3 included limited information on ICDS service utilization and the child reference group was below five years complying with the standard WHO child reference group for anthropometric indicator measurement.

leads to improvements in the ICDS impact. Hence, they are inconclusive about what factors influence an AWW's performance and how that influences the impact of ICDS.

Studies on the implementation of the ICDS

The studies that examined the implementation of the ICDS include assessments of the ICDS by national agencies, surveys that report national and sub-national coverage of ICDS services, and explorative small-scale studies that looked at reasons for low coverage and quality of services (CBGA, 2011; Dasgupta et al., 2012; FOCUS, 2006; HUNGaMA, 2011; Nayak & Saxena, 2006; NIPCCD, 2009a, 2009b; Planning Commission, 2011; RSOC, 2014; Saxena & Srivastava, 2009). These studies identified several implementation gaps such as a lack of focus on under three children, poor AWC infrastructure, poor coverage of beneficiaries under the SNP, poor record maintenance, poor maintenance of growth charts for children, absence and ineffective utilization of weighing machines, socially exclusionary practices in service delivery, greater emphasis on the SNP component for children 3-6 years compared to other services, ineffective training and monitoring of AWWs, and lack of awareness among beneficiaries leading to poor coverage and quality of the ICDS services (Borooah et al., 2014; Dasgupta et al., 2012; Diwakar, 2014; Drèze, 2006; Faker et al., 2012; Gupta et al., 2013; Mander & Kumaran, 2006a; Sinha, 2006). However, a few studies also suggest that these implementation gaps vary across states (FOCUS, 2006; HUNGaMA, 2011; Maity, 2016; Planning Commission, 2011). The state of Bihar performs poorly interms of physical infrastructure and coverage of beneficiaries (Maity, 2016).

The majority of these studies articulate the shortfalls between policy design and implementation. A few studies that explored the reasons for the implementation bottlenecks highlight how the political context – and the specific institutional structure of ICDS (such as incentives) - might create and sustain these shortfalls (Biswas & Verma, 2009; CBGA, 2011; Drèze, 2006). Although the implementation studies highlight the challenges AWWs face regarding financial and physical resources, no studies so far have explored the viewpoints of AWWs as to what factors help and hinder them in performing their job responsibilities.

Two studies explore the availability of physical infrastructure, awareness of beneficiaries, AWW skills and knowledge, and utilisation of services by beneficiaries as components of ICDS performance (Maity, 2016; Planning Commission, 2011). The national evaluation of the ICDS by the Planning Commission (2011) defined the performance of the ICDS in terms of physical infrastructure availability (as a statewide facility infrastructure index) and skills and knowledge of the AWW (AWW performance index). A recent study by Maity (2016) too followed a similar approach to the Planning Commission study in defining the ICDS performance by adapting these

indices using recent data from the RSOC (2013–14). In addition to the Planning Commission evaluation, this study provided a services index which ranked Indian states in terms of the receipt of services by households. The AWW performance index by Maity (2016) measured AWW performance as the skill level of the AWW in terms of her accuracy of knowledge about health and nutrition requirements of pregnant women and young children.

These studies focus on the AWW's skills–especially accuracy in health and nutrition knowledge, ability in using growth charts, accuracy and completeness of records–as the most common factors contributing towards the programme performance. However, an AWW's skill level is only one aspect of her performance. Although the statewide indices are helpful to understand the status of the ICDS performance and AWW skills across states, these studies do not shed light on how the variation in AWW skill across states explain the variation in receipt of services by households (Maity, 2016; Planning Commission, 2011).

In sum, the majority of the implementation studies suggest that the ICDS implementation has several gaps and that varies across states. These studies also shed light on the reasons for the implementation gaps and trace the root cause to the political and institutional context. Although these studies have discussed constraints AWWs face (resources, skills, knowledge), they have not explored what contributes to an AWW's performance beyond these factors or looked at the effects of variation amongst individual AWWs. Moreover, these studies do not address how AWWs negotiate these challenges and what factors help or hinder them from continuing with their daily job responsibilities, which are crucial in understanding an AWW's performance.

Studies on the influence of AWW level factors on health and nutrition service delivery

Table 5 provides a summary of evidence from studies that researched the influence of AWW level factors on AWW performance. The majority of these studies defined AWW performance as coverage[28] (uptake of services by households) of one or more health and nutrition services delivered through the ICDS. These studies show that AWW's characteristics like knowledge, education, experience and programme factors like incentives (financial and non-financial), supervision, the size of the catchment area and supplies influence AWW performance. They used household level service utilisation data on one or more services delivered through the ICDS to define performance.

[28] One study examined the coverage and quality of home visit services by the AWW. The quality was defined as the adherence to protocol on home visit observed by the study team (Mohan et al., 2011).

Table 5 Evidence on AWW performance and determinants of performance

Factors	Influence on AWW performance	Studies
AWW characteristics		
Knowledge	Coverage of antenatal home visits and newborn care practices (e.g. initiation of breastfeeding, clean cord care, and thermal care) were positively correlated with AWW knowledge[29] levels	(Agrawal et al., 2012)
	AWWs with a nutrition knowledge score of more than 4 out of 7 performed better (coverage of services)	(Gujral et al., 1991)
Education	AWWs with at least high school education performed better (coverage of services)	(Gujral et al., 1991)
	Less educated AWWs performed better	(Bhattacharji et al., 1986)
Experience (years)	More experienced AWWs (years of experience as an AWW) performed better (coverage of services)	(Bhattacharji et al., 1986)
Programme factors		
Incentives	Non-financial incentives like social recognition influence the AWW to volunteer (malaria curative activities)	(Das et al., 2008)
	Team-based and target oriented non-financial incentives for AWWs (with ASHA and ANM) improved performance (coverage of services)	(Borkum et al., 2014)
	Monetary Incentives for immunisation positively influenced the receipt of services	(Kosec et al., 2015)
	Financial incentives for AWWs improved child health and nutritional outcomes	(Singh & Masters, 2016)
Supervision	Intense supervision improves performance scores; poor supervision hampered performance (coverage and quality of home visits)	(Bhattacharji et al., 1986)
	More than one supervisor visits in three months improved AWW performance (coverage of services)	(Mohan et al., 2011)
	Supervisor's (ANM) activity score of more than 2 out of 9 improved AWW performance (coverage of services)	(Gujral et al., 1991)
Catchment population size	Performance (coverage of services) deteriorated with increasing population size	(Bhattacharji et al., 1986)
Essential supplies	Inadequate essential supplies (e.g. medicines) hampered performance (coverage and quality of home visits)	(Mohan et al., 2011)

Although these studies provide evidence on a few factors that influence AWW performance, they pose limitations in conceptually understanding AWW performance. Firstly, although these studies shed light on factors influencing AWW performance, the definition of performance is limited as

[29] Agrawal et al. (2012) computed a knowledge score for AWWs through Principal Component Analysis (PCA) based on their knowledge of preventive care and maternal and newborn danger signs.

it only focuses on the coverage of services. Coverage is not fully within the control of AWWs because it is also dependent upon beneficiary demand and other mediating factors such as availability of supplies. Therefore, it is not an ideal proxy for the effort of the individual AWW.

Secondly, older studies provide conflicting evidence on factors that influence AWW performance. For example, Gujral et al. (1991) found a positive association between AWW education and her performance, but Bhattacharji et al. (1986) found less educated AWWs performed better. Bhattacharji et al. (1986) explained this negative association by the fact that most of the AWWs with higher education came from the better-off sections of the community and experience more difficulty in visiting poorer areas. However, AWWs who received intensive supervision overcame this challenge. A caveat for these two studies is that they belong to the early phase of the ICDS and since then the ICDS has become a national programme with a broader range of services (Bhattacharji et al., 1986; Gujral et al., 1991).

Thirdly, these studies do not engage with the AWW's perspective about which factors influence her actions or effort towards the coverage of services.

In summary, the studies that have examined the influence of AWW level factors on health and nutrition service delivery (especially coverage of services) provide useful empirical findings. However, they do not engage with the concept of AWW performance conceptually. They only focus on one dimension of performance (coverage of services) and do not consider her action or effort as an important dimension in understanding her performance. Moreover, none of these studies provide the perspective of the AWW on factors influencing her actions.

2.4 Evidence and frameworks from the broader public health literature

Due to the lack of engagement with the concept of performance in the existing evidence base, I looked to the broader public health literature to inform the conceptualisation of performance. Performance is a concept that crosses different disciplinary (economics, psychology, public management) and topical (e.g. education, health and nutrition, agriculture) boundaries. Even with non-health responsibilities, AWWs are a type of CHW (see Box 2). Hence, I primarily locate my inquiry within the public health literature. Moreover, being based at a facility (i.e. AWC) means that the work environment features of facility-level frontline health workers are also relevant for AWWs. The public health literature considers both CHWs and facility-based frontline health workers as necessary human resources for health. To conceptualise the performance of AWWs, I reviewed the public health literature to understand how the literature has dealt with the conceptualisation of the performance of similar workers and how performance may be improved.

In the review, I found the conceptualisation of health worker performance by Dieleman & Harnmeijer (2006) as a useful starting point in defining the performance of AWWs and developing a conceptual framework on AWW performance. Considering the Dieleman & Harnmeijer (2006) conceptualisation of performance was primarily for professionally trained health staff at facilities, to contextualise it to AWWs who are predominantly a CHW, I supplemented this with empirical evidence from studies that specifically examined CHW performance.

Box 2 Locating AWWs within the public health literature

AWWs: similarities and dissimilarities with CHWs and other health workers

The cadre of AWWs existed even before the Alma-Ata conference (1978) declaration that recognised CHWs as the cornerstone of comprehensive primary health care and urged national governments to give importance to community-based care that would bring "health care as close as possible to where people live and work" (Lehmann & Sanders, 2007; Lewin et al., 2010; WHO, 1989). An evolved definition of CHWs widely used in studies and reviews is by Lewin et al. (2010) pg 2. They define the CHW as "*any health worker carrying out functions related to health care delivery; trained in some way in the context of the intervention, and having no formal professional or paraprofessional certified or degreed tertiary education*". China's Barefoot doctors, Pakistan's Lady Health Worker programme, Bangladesh's BRAC community health worker programme, Thailand's Village Health Programme, Brazil's Programa Saude da Familia, and Ethiopia's Health Extension Programme are a few popular examples of CHW programmes in Asia, Latin America, and Sub-Saharan Africa (GHWA, 2010). A few common features of these global CHWs are:

- Agents of health promotion and development
- Provide a link between local communities and the health system by delivering local outreach services that might otherwise be unavailable to communities
- Can be part of general health promotion programmes or specialist health programmes
- Perform promotional, preventive, or curative tasks or a mix of all these
- Operate in a government or non-governmental systems or a combination of both
- Respond to single or multiple diseases and health issues
- Show difference in their levels of knowledge and training, practice settings, remuneration, and relationship with the regulatory systems

(Bloom & Standing, 2001; GHWA, 2010; Glenton et al., 2013; Lehmann & Sanders, 2007; Lehmann et al., 2004; Lewin et al., 2010)

AWWs were identified in the literature as CHWs especially before 2006. Since 2006, ASHAs were introduced. The majority of studies on CHWs in India since then treat ASHAs as the default CHW cadre (or combine both), as they only perform health responsibilities. Although AWWs still deliver significant health and nutrition services, unlike other global CHWs, they also deliver additional early childhood developmental responsibilities such as preschool teaching. They remain as a unique CHW model delivering a full cycle of 'child development' activities– pre-pregnancy to pre-school education. The global CHWs are predominantly non-facility based but linked to a nearest health facility, but the cadre of AWWs primarily operate from a facility (i.e. AWC). Other than non-health responsibilities, this is one crucial distinction between CHWs and AWWs and a similarity between facility-based frontline health workers. A few AWW characteristics which make her different from CHWs and facility-based frontline health workers are–

AWW Characteristics	*CHWs*	*Facility-based health Workers*
Education requirement	×	√
No professional health training	√	×
Non-health responsibilities	×	×
Managed by a non-health regulatory system	×	×
Facility-based	×	√
From the community	√	×
All females	×	×

Therefore, AWWs share characteristics with both CHWs and facility-based health workers and frameworks on performance for both these are relevant for AWWs.

Performance conceptualised the public health literature

In the public health literature, performance, especially staff performance (including CHWs) was considered as a function of skills and knowledge. Since the early 2000s, additional factors such as organisational and contextual factors have been increasingly recognised as influencing performance (Dieleman & Harnmeijer, 2006; Franco et al., 2002; Rowe et al., 2005; WHO, 2006).

In understanding the theoretical origins of performance, a variety of theories exist to explain why individuals behave in certain ways, and this, in turn, can facilitate the development of strategies to improve performance (Hughes et al., 2002). However, the studies that examined health worker motivation and performance are not based on one specific theory. In fact, they demonstrate some understanding of these theories in explaining the concepts of motivation, job satisfaction, self-esteem, etc. (Dieleman & Harnmeijer, 2006).

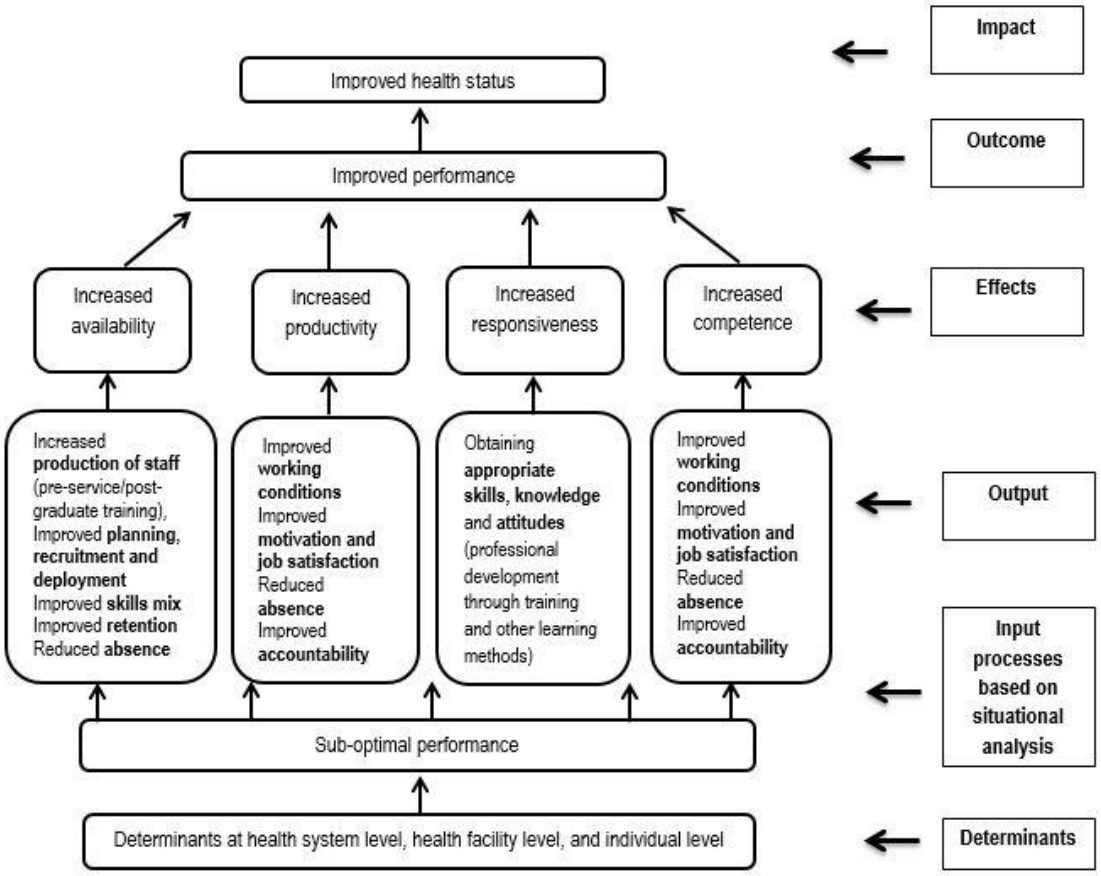
The World Health Report 2006 and the World Health Organisation (WHO) report by Dieleman & Harnmeijer (2006) remain as key studies that recognised that health worker performance is influenced by factors at the macro (health systems), micro (health facility), and individual levels[30]. Dieleman & Harnmeijer (2006) draw on studies such as Franco et al. (2002) Rowe et al. (2005), and Hongoro & Normand (2006), all of whom stressed that health worker motivation and performance are a complex interaction of factors at different levels. The concept of performance has different elements embedded within it. Thus, the depth and breadth of the concept of performance are influenced by individual and organisational mandates (Dieleman & Harnmeijer, 2006). In organisational contexts, to meaningfully understand and explain performance, it is often studied with concepts such as motivation, job satisfaction, etc. (Dieleman & Harnmeijer, 2006; Franco et al., 2002; Rowe et al., 2005; WHO, 2000, 2006).

In conceptualising performance, Dieleman & Harnmeijer (2006) describe the performance as 'implementing tasks to a certain standard in line with the mission and goals of the organisation'. Using the WHR 2006 definition of performance, Dieleman & Harnmeijer (2006) explain improved performance as a combined effect of four elements–availability, productivity, responsiveness, and competence. These are influenced by performance outputs– improved working conditions, motivation, job satisfaction, retention, absenteeism, skills and knowledge, and accountability. These outputs are determined by factors at the

[30]Dieleman & Harnmeijer (2006) noted in their report that the subdivision between health facility (micro level) and health system (macro level) is not always clear-cut, and depends on the roles and responsibilities at national and local levels (district facility) in each specific context.

health systems, health facility, and individual levels. This is summarised in an overall conceptual framework (see Figure 3).

Figure 3 Framework for analysing health worker performance



Source: (Dieleman & Harnmeijer, 2006)

In conceptualising AWW performance, I decided to use the Dieleman & Harnmeijer (2006) conceptual framework on health worker performance as a departure point. This is primarily because the Dieleman & Harnmeijer (2006) conceptual framework clearly defines performance and used definitions of concepts such as motivation and job satisfaction from existing theories on motivation and performance. Moreover, they use a systemic approach to health worker performance (situational analysis, intervention (input/process), outputs, effects, outcomes, and impact) which would be valuable to adapt in a context like AWWs. I consider it as a point of departure to build my own conceptual framework on AWW performance as it was developed for 'professionally trained health staff in facilities'. For AWWs who are community-based, the conceptualisation of performance requires contextualisation using the empirical evidence from studies that specifically focused on CHW performance.

Contextualising the concept of performance using empirical evidence on CHW performance

As described earlier, the performance of human resources for health is influenced by factors at the health system, health facility and individual levels. However, considering the AWWs are community-based, their performance could also be influenced by contextual factors such as community-level factors. The public health literature that specifically focuses on CHW performance has a diverse and extensive number of studies that have examined a wide range of factors that influence a CHW's performance. These studies present empirical evidence from different programmes, political and geographical contexts. I reviewed this empirical evidence to better understand CHW programme and context-related factors that could influence the performance of CHWs that could also be relevant for AWWs. In conceptualising AWW performance, I aim to include the lessons from this empirical evidence to define the categories of determinants that clearly lead to performance.

The majority of the studies that have examined CHW performance suggest that intrinsic and extrinsic factors at the individual, programme, community, and institutional levels influence the motivation and performance of CHWs. For example, financial incentives (e.g. fixed salaries, pay for performance, and income from selling products in the community) and non-financial incentives (e.g., material rewards, social recognition, and community trust and respect) influence CHW performance in positive and negative ways (Bhattacharyya et al., 2001). Moreover, CHWs are an integral part of the social context, so their interactions with the community, and how they are perceived within the community also influences their performance (Bhattacharyya et al., 2001; Razee et al., 2012).

Two systematic reviews by Kok et al. (2014, 2015)[31]remain the most recent and comprehensive studies that synthesised evidence on factors influencing CHW performance. These two effectively present a synthesis of various intervention[32] design factors and contextual factors that are shown to have influenced CHW performance.

The Kok et al. (2014) review summarised six intervention design factors identified by the review as key in influencing CHW performance. These factors influence different performance outcomes

[31] The Kok et al. (2014, 2015) reviews came in December 2014 and January 2015. By then I had already reviewed the same papers reviewed by Kok et al. (2014, 2015) but decided to use their findings to avoid duplication and for consistency.

[32] Although Kok et al. (2014) do not explicitly say why they used the term 'intervention'; I believe it is because they used the definition of CHWs from Lewin et al. (2010) which considers the CHW as part of an intervention. To remind the definition of CHWs by Lewin et al. (2010) pg 2: "*any health worker carrying out functions related to health care delivery; trained in some way in the context of the intervention, and having no formal professional or paraprofessional certified or degreed tertiary education*".

differently (see Table 6). Moreover, variations in the design of CHW programmes have a significant influence on performance. The six intervention design factors are—

1. Nature of tasks and time spent on service delivery;
2. Human resource management (CHW characteristics, workload clarity of tasks/roles, selection and recruitment process, incentives, supervision, performance appraisal, and training);
3. Quality assurance (protocols and guidelines, and monitoring and evaluation);
4. Community links (support, selection, monitoring, and community expectations);
5. Health system links (embedment within the health department and communication and coordination);
6. Resources and logistics (job aids, transport, and supplies).

Table 6 presents a summary of the intervention design factors identified by the review as prominent factors that positively, negatively and in mixed ways influence CHW performance. It also provides information on factors that are thought to influence CHW performance but where there is no published evidence to prove or disprove the influence.

Table 6 Intervention design factors that proved to have positive, negative, and mixed influence on CHW performance[33]

Type of influence on CHW performance	Intervention design factors proved to influence CHW performance
Positive	Nature of tasks and time spent on service delivery – *Inclusion of curative tasks in CHWs job description* – *Longer service delivery times* CHW characteristics – *Higher education level* – *Experience with health conditions to be dealt with* – *Fewer household duties and lower wealth* Incentives: *financial and non-financial* Supervision: *availability of supervision* Training Community support – *Selection and monitoring* Health system links – *Recognition by and coordination and communication with other health staff*
Negative	Human resource management – *High workload* – *Lack of clarity on CHW roles* Lack of resources and logistics
Mixed	CHW characteristics – *Gender* – *Age* – *Marital status* – *Past experience* Selection of CHWs from within the community they serve
No evidence	Mechanisms and specific factors related to training and supervision Performance appraisal Quality assurance – *Guidelines and protocols* – *Specific aspects of monitoring and evaluation related to health system* Health system links Experience sharing visits Career advancement Functionality of the referral system

The five main contextual factors that influence CHW performance identified by the review are:

1. Community: socio-cultural factors (such as social and cultural norms, values, practices and beliefs, gender roles and norms, and disease-related stigma), safety and security for the CHWs, and education and knowledge levels of target groups;
2. Economic: economic hardships of the CHW;
3. Environment: geography and distance, and climate;
4. Health system policy: CHW and human resources policy, legislation related to CHWs, and political commitment;

[33] Summarised from the Kok et al. (2014) review.

5. Health system practice: health service functionality, human resources provisions and their match with CHWs' expectations, level of decision-making, costs of health services, and governance/coordination structure.

Out of these five contextual factors, community factors (context) are found to most prominently influence CHW performance (Kok et al., 2015).

These contextual factors sometimes serve as a pre-condition for the performance of CHWs or CHW programmes and represent characteristics of settings in which the programme operates. Pre-condition factors such as the presence of well-functioning health services including functioning logistic and supply chains affect the ability of CHWs to conduct their jobs. These factors affect CHWs and beneficiaries.

The overall empirical evidence on CHW performance is useful in conceptualising AWW performance as it helps to elaborate determinants of performance. However, not all factors identified in the CHW contexts are relevant for AWWs. A few factors are either absent or yet to be found influential or potentially influential in the AWW context. For example, AWWs are female, married, without a defined performance appraisal system, and not covered by legislation. Table 7 provides a comparison of overall empirical evidence on factors influencing CHW performance in the AWW context. It shows whether the factor identified by the Kok et al. (2014, 2015) review is relevant in the AWW context (based on the descriptive literature on the ICDS) and shown to influence AWW performance (based on the studies summarised in Table 5).

Table 7 Relevance of factors influencing CHW performance in the AWW context

Factors	Sub-factors	Whether the factor is relevant in the AWW context?	Is there evidence on whether it Influences AWW performance?
Intervention design factors	Tasks and in-service delivery time	Yes	No
	Human resource management		
	AWW characteristics		
	Gender	Not relevant	
	Education	Yes	Yes
	Experience (years)	Yes	Yes
	Experience (with the health conditions)	Yes	No
	Residence/ community of origin	Yes	No
	Age	Yes	No
	Household duties	Yes	No
	Marital status	Not relevant	
	Social class	Yes	No
	Wealth	Yes	No
	Workload	Yes	No
	Clarity of tasks/roles	Yes	No
	Selection and recruitment process	Yes	Yes
	Incentives	Yes	Yes
	Supervision	Yes	Yes
	Performance appraisal	Not relevant	
	Training	Yes	No
	Quality assurance		
	Protocols and guidelines	Yes	No
	Monitoring and evaluation	Yes	No
	Community links		
	Support, selection, monitoring	Yes	No
	Expectations	Yes	No
	Health system links		
	Embedment	Yes	No
	Communication and coordination	Yes	No
	Resources and logistics		
	Job Aids	Yes	No
	Transport	Yes	No
	Supplies	Yes	Yes
Contextual factors	Community context		
	Socio-cultural factors	Yes	Yes
	Safety and security	Yes	No
	Education and knowledge level of the target group	Yes	No
	Economic context (AWWs)	Yes	No
	Environment		
	Geography and distance	Yes	Yes
	Climate	Yes	No
	Health system links		
	CHW/AWW and human resources policy	Yes	No
	Legislation related to CHWs	Not relevant	
	Political commitment	Yes	No
	Health system practice		
	Health service functionality	Not relevant	
	Human resources provision and their match with CHW's/AWW's expectations	Yes	No

In conclusion, the studies that have examined the influence of various factors on CHW performance suggest that a range of intervention-related and context-related factors influence CHW performance. Not all factors are relevant in the AWW context or are shown to influence AWW performance as the evidence on factors influencing AWW performance is limited. However, the overall empirical evidence is useful to conceptualise performance, especially to define the determinants of performance.

2.5 Role of mobile phone technology-based interventions on performance

One of the evidence gaps identified in Table 7 is the potential for mobile phone-based job aids to influence AWW performance. In the last decade, the exponential growth of mobile phones and search for effective ways to deliver health services to populations have resulted in a rapid proliferation of small-scale pilots of m-Health projects across the world. The term m-Health is used to describe interventions that use the potential of mobile phones to improve the health system functioning (Agarwal et al., 2015; Labrique et al., 2013). M-Health interventions are commonly used for client education and behavioural change communication, sensors and care diagnosis, registers/vital events tracking, data collection and reporting, electronic health records, electronic decision support, provider-to-provider communication, provider work planning and scheduling, provider training and education, human resources management, supply chain management, and financial transactions and incentives (Labrique et al., 2013).

The growing body of literature that examines the use of m-Health by CHWs claims that the use of mobile phones by CHWs presents promising opportunities to improve the range and quality of services provided by them (Agarwal et al., 2015; Braun et al., 2016; Källander et al., 2013). Although a large number of m-Health interventions using CHWs exist, the number of high-quality studies that evaluated the influence of m-Health strategies on CHW level service performance, health system efficiencies and uptake and cost-effectiveness of service delivery, and improvement of population health outcomes remain low or absent (Agarwal et al., 2015; Braun et al., 2016; Källander et al., 2013). M-Nutrition, an evolving field of research on the use of mobile phone technology in nutrition service delivery too suffers from this research gap (Barnett et al., 2016; Barnett & Gallegos, 2013; Barnett et al., 2016)

In the field of m-Nutrition, so far only three studies have examined the influence of mobile phone technology on nutrition service delivery. These studies suggest that mobile phones do have a potential to improve data accuracy, timeliness, and responsiveness of nutrition surveillance such as weight monitoring (Barnett et al., 2016; Berg et al., 2009; Blaschke et al., 2009). All these studies examined the use of mobile phone technology (Short Message Service (SMS) or mobile

application) in improving the weight monitoring service provided by CHWs. In addition to the evidence[34] that mobile phones help to improve the overall data collection accuracy, speed, and the effective use of data by the worker in nutrition surveillance, we also need more empirical assessments on how these improvements can increase coverage, utilisation, efficiency, quality, or household level outcomes.

Sustaining CHW motivation to adopt the use of mobile phone technology in their work is crucial for the scale-up and sustainability of these small-scale projects and pilots (Källander et al., 2013). The role of monetary incentives[35] is one potential factor that could motivate CHWs to adopt the use of mobile phone technology (Källander et al., 2013). The well-established evidence base on incentives suggest that it is a key influential (positive and negative depending on the availability, type, and value) factor in CHW performance[36] (Alam et al., 2012a, 2012b; Bartos et al., 2009; Bhattacharyya et al., 2001; Callaghan-Koru et al., 2012; Furth & Crigler, 2012; Lewis, 2010; Rahman & Tasneem, 2008; Rowe et al., 2007; Srivastava et al., 2009; Winch et al., 2008). Considering the (limited) evidence suggests that mobile phones help improve nutrition surveillance by CHWs and monetary incentives play a crucial role in improving the motivation and performance of CHWs, combining these two (monetary incentives and mobile phones) could lead to better quality of services and improve the number of beneficiaries receiving services. However, empirical assessments that examined the question of incentivising CHWs to use mobile phone technology have not emerged so far. This could be because i) monetary incentives are not identified in the technology acceptance literature as a factor that could influence the adoption of technology and ii) reservations on the cost-effectiveness of combining mobile phone technology and monetary incentives. Hence, findings from my second research question would be one of the first studies that examined the combined effect of monetarily incentivised mobile technology on the uptake of services provided by CHWs like AWWs and their performance.

[34] Studies were conducted in three countries (Kenya, Malawi, and Indonesia) using small and purposefully chosen samples.

[35] A well-established body of evidence on technology acceptance (not just for CHWs) suggest factors such as perceived usefulness, perceived ease of use, trust and perceived self-control lead to the perceived intention to use. Monetary incentives are not part of this literature (Blanas et al., 2015; Davis, 1989; Kim & Garrison, 2009).

[36] The evidence also suggests that incentivising CHWs based on their performance could make them biased towards those activities. Two studies that support this notion studied one of India's CHW work force, ASHAs. However, ASHAs do not receive a monthly salary or stipend and fully rely on performance oriented monetary incentives (Scott & Shanker, 2010; Srivastava et al., 2009).

2.6 Conceptual framework on AWW performance

In this section, I present the conceptual framework on AWW performance developed based on the lessons from the conceptual and evidence review presented in the earlier sections (2.3 to 2.5). The framework forms the conceptual basis of my thesis.

As discussed in the earlier section, I chose the conceptual framework of Dieleman & Harnmeijer (2006) on health worker performance as the point of departure (see Figure 3). To adapt the framework to the specific context of AWW performance using the analysis in section 2.4, I conducted the following steps:

1. Realigned the health facility and health system determinants as **programmatic and organisational factors** to recognise the fact that the AWW is based at a child development programme facility (AWC), not at a health facility. Moreover, the AWW is not employed by the health department but by a non-health department which is a part of the broader organisational structure;
2. Added a category of **community factors** on top of the individual, programmatic and organisational categories of determinants to recognise the influence of various community factors on the AWW who is based in a community setting. This brings it in line with recommendations of various authors who have regrouped the determinants into: health worker characteristics (individual level), health system and facility characteristics (macro and micro levels), characteristics of the wider political and socioeconomic environment (contextual factors), and community/population characteristics (contextual factors) (Hongoro & Normand, 2006; Rowe et al., 2005; WHO, 2006);
3. **Excluded one of the 'effects', availability,** because AWWs are village-level workers selected from the community rather than trained and deployed to facilities. The evidence on the ICDS and AWWs does not suggest the availability of applicants at the recruitment stage or retention of AWWs as an issue. Thus, the availability aspect is not relevant in the AWW context;
4. Although I use the overall definition of performance as 'implementing tasks to a certain standard in line with the mission and goals of the organisation' (Dieleman & Harnmeijer, 2006), I adapted it for the AWW context. Implementing tasks to a certain standard in line with the mission and goals of the organisation in the AWW context means that the AWW makes the ICDS services accessible with adequate quality. Moreover, every service has access and quality elements. Thus, ***I define AWW performance as 'AWWs making services accessible to the required number of beneficiaries***

with adequate quality'. Access can be defined as making service accessible for a certain number of beneficiaries and quality as making services accessible with required fidelity to guidelines[37];

5. Recognised the direct link between determinants and performance – considering a few determinants categories such as the availability of resources can directly influence AWW performance not just via the outputs and effects, I incorporate it to the framework;
6. Included household level outcomes to recognise that improved access and quality of supply only translate into programme impact if there is utilisation of services by beneficiaries at the household level;
7. After refining the framework, I drew up an initial list of sub-factors for the four categories of factors (individual, programmatic, community and organisational) that are identified as determinants leading to performance. These sub-factors listed are those that have been shown to impact on performance outputs in the literature in the Kok et al. (2014) systematic review, with some contextualization for the ICDS programme

Figure 4 presents the resulting conceptual framework on AWW performance I employ in this thesis.

In summary, the conceptual framework on AWW performance envisages that the individual, programmatic, community, and organisational factors are determinants of performance. These determinants of performance are interdependent and lead to improvements in outputs such as working conditions, motivation, job satisfaction, accountability, and AWW's skills knowledge, and attitudes. These outputs further lead to effects such as improved productivity, competence, and responsiveness of the AWWs and lead to performance outcomes at AWW level i.e. improved access and quality. Table 8 presents the 'access' and 'quality' aspects of each of the main services of the AWW in Bihar. Although I contextualised the activities using Bihar state-level documents, the core services are similar across the country. I used this table to guide my data collection tools and data analysis. As evident from Table 8, all services an AWW delivers have 'access' and quality' elements.

[37] For example, in the case of food distribution (THR and HCM) making the service accessible to required number of beneficiaries (i.e. 40 children 3-6 years, 40 children 6 months to 3 years, 8 pregnant women and 8 lactating mothers) with fidelity to guidelines (specific quantity of decent quality rice and dal for each beneficiary category) are two components of AWW performance outcomes (SWD, 2017).

Figure 4 Conceptual framework on AWW performance

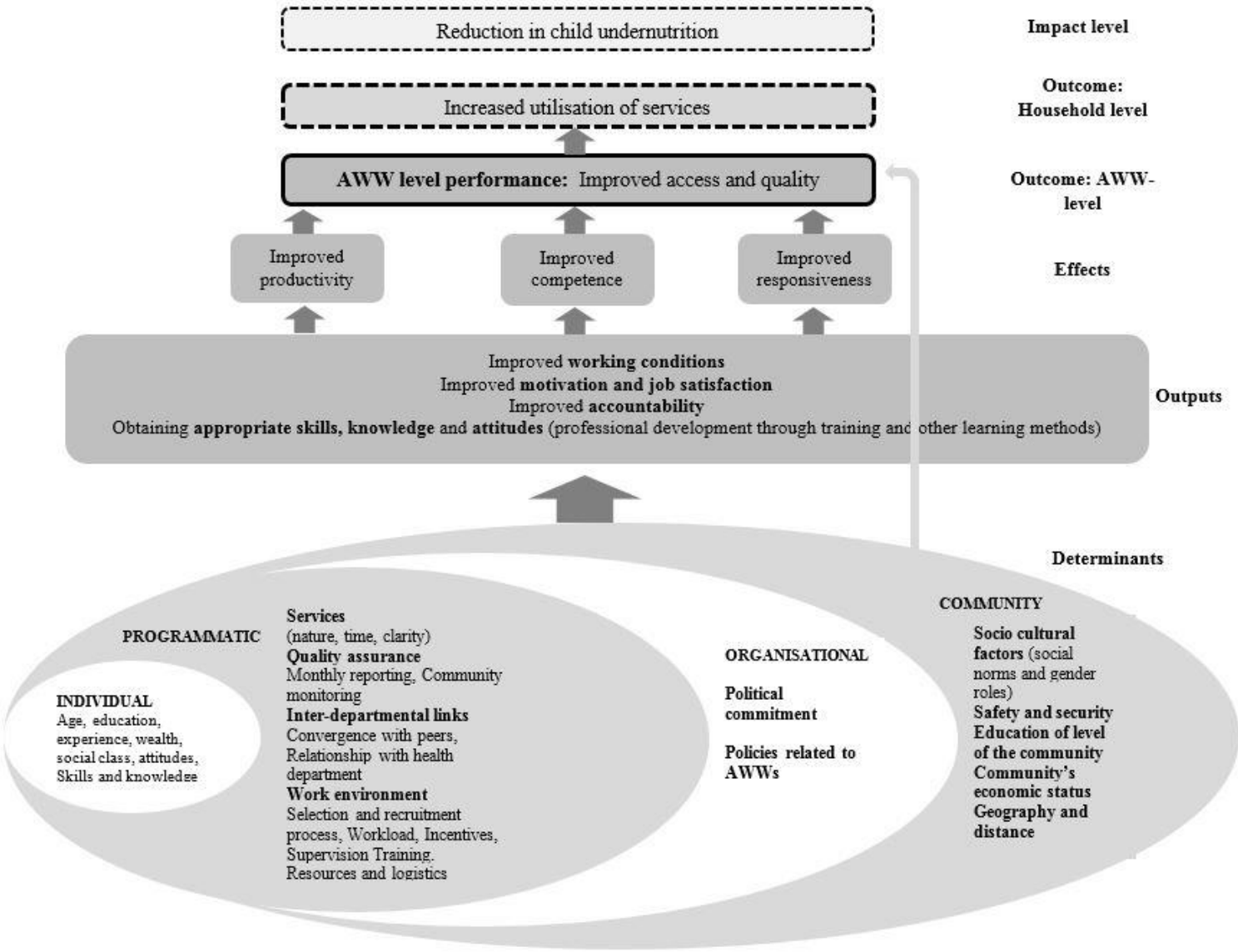


Table 8 Performance elements for the main job responsibilities of an AWW in Bihar (SWD, 2015a, 2017)

Core services	Quality		Access
Pre-school	Teaching: -Rhymes, alphabets, stories, and games by the AWW -Record of children -Keep the space clean and attractive for children -Use teaching aids such as blackboard, posters, books, educational and toy kits	Daily 9 am–12 pm	40 Children 3 to 6 years
Supplementary Nutrition[38]	HCM (daily lunch) -Distribute pre-decided menu based hot cooked meal such as Khichdi, Rasiya, and Halwa. -Once a week eggs -Purchase raw materials and give it to AWH for cooking -Record of purchase and distribution	Daily 12–1 pm	40 Children 3 to 6 years
	THR (monthly dry ration) -Identify beneficiaries (children based on malnutrition status; women based on pregnancy and child age) -Inform beneficiaries -Distribute pre-decided quantity of rice and lentils for each beneficiary category. o Severely malnourished children: 4 kg rice and 2 kg lentils o Malnourished children: 2.5 kg rice and 1 kg lentils o Pregnant and lactating women: 3 kg rice and 1.5 kg lentils o Everyone, twice a week eggs -Record of purchase and distribution	Monthly 9 am –5 pm	8 Pregnant women 8 Lactating mothers 40 Children 6 months to 3years: (28 severely malnourished and 12 malnourished)
Immunization	-Provide space for VHSND -Help the ANM to carry out the VHSND at the AWC premises -Ensure age-appropriate immunisation and reporting -Inform beneficiaries, upkeep of immunisation due-lists	Monthly Half day	All Pregnant women Children below two years
Health Check-ups	Weighing of pregnant women and children -weight check, counselling, and record keeping	Monthly Half day	All Pregnant women, children below three years
	Weighing of pre-school children -weight check, counselling of parents, and record keeping	Quarterly Half day	40 Children 3–6 years
Health and Nutrition Education	Group counselling -Lead health, nutrition and sanitation theme-based discussions	Weekly After 1pm	All Women, adolescent girls
	Home visits -Visit mothers to counselling them one to one on individual needs such as breastfeeding, complementary feeding, etc.	Daily After 1pm	All (2–3 per day) Pregnant women Lactating mothers Children below two years
Referral	Referral of Severely and Acutely Malnourished (SAM) children -Identification of SAM children and referral to district facilities and accompany them if needed	Any time	All Children

2.7 Conclusions

In this chapter, I presented the lessons from the conceptual review of the literature to demonstrate the conceptual and empirical research gaps in understanding AWW performance. Although I primarily located the AWWs within the public health literature considering they are a type of CHW, I also discussed their similarities and dissimilarities with standard definitions of CHWs and facility-based frontline health workers. Moreover, by presenting the current literature context of the fields of m-Health and m-Nutrition, I highlighted the limited number of studies that have examined m-Nutrition interventions and the value addition of examining the influence of mobile phone technology on AWW performance. To conceptualise AWW performance, I used the definition of performance and the understanding of how performance is generated from the Dieleman & Harnmeijer (2006) conceptual framework on health worker performance as a departure point. I developed it as a conceptual framework on AWW performance by contextualising it to the AWW context using empirical evidence on CHWs and AWWs and the ICDS programme context. I presented the definition of AWW performance as 'AWWs making services accessible to the required number of beneficiaries with adequate quality' (i.e. adhering to guidelines) and visualised the conceptual framework of AWW performance. I also discussed the key adaptations I took in developing the conceptual framework and provided a detailed description of the two aspects of the AWW performance definition–access and quality– in the context of AWWs in Bihar. In the next chapter, I present the overall methodological approach undertaken in this thesis to explore the concept of AWW performance using the conceptual framework.

[38] Unlike other states, the Government of Bihar provides supplementary nutrition to targeted number of beneficiaries

Chapter Three: Empirical context and methodology

In the previous chapters, I introduced my research including my personal and academic motivation, the geographic and programmatic context, the specific research questions, the overall analytical approach, concepts, and a conceptual framework developed to study AWW performance. This chapter focuses on how I designed and implemented my doctoral research. In this chapter, I discuss the main features of the BCSP, my rationale for choosing it to situate my doctoral research within, and how I utilised the BCSP context. Although I introduced my overall analytical strategy in Chapter 1, this chapter describes in detail the methodological foundation of this thesis and the specific methods I used in qualitative and quantitative research.

The remainder of this chapter is organised as follows: section 3.1 describes the BCSP empirical context; section 3.2 discusses my rationale to conduct qualitative and quantitative research and my approach in combining them; section 3.3 outlines the qualitative methods used including selection of participants, data collection, and data analysis; and section 3.4 provides a brief overview of the quantitative data and estimation strategy.

3.1 Empirical context: the BCSP

The BCSP, primarily a maternal and child nutrition Conditional Cash Transfer (CCT), was piloted in three administrative blocks of Gaya district of Bihar from August 2014 to November 2016 (OPM, 2017). The government of Bihar piloted the BCSP to understand the feasibility of developing a system to deliver a maternal and child cash transfer with maximum transparency, whilst efficiently and effectively monitoring the meeting of conditions by beneficiaries (OPM, 2014). The BCSP targeted pregnant women and mothers of young children. These beneficiaries were eligible for a monthly payment of Rs. 250 ($ 3.75) between the end of the first trimester of pregnancy and the child's second birthday (a total of 30 months). The transfer was conditional to influence appropriate health and nutrition behaviours (OPM, 2014).

As mentioned in Chapter 1, the BCSP design attempted to improve the overall delivery of health and nutrition services at the village level by investing in both demand-side interventions (incentivising beneficiaries to take up services through the CCT) and supply-side interventions (investing in the performance of AWWs by introducing mobile phone technology and monetary incentives) (OPM, 2014). The AWW in programme villages played a crucial role in the BCSP, as she was responsible for registering beneficiaries, reporting on their receipt of conditions and providing some of the services that the conditions were based upon. The AWW was provided

with a mobile phone upon which a BCSP application known as the CommCare[39] application was preloaded. Using the mobile phone application, AWW registered beneficiaries on the application, reported on service availability and recorded which beneficiaries received which services. The AWW received incentive payments to use the phone and to provide services to beneficiaries (OPM, 2014). The mobile phone application aimed to improve AWW's service delivery by providing the following three features:

- a case management tool to follow-up with pregnant women
- pre-installed Behavioural Change Communication (BCC) messages that could be played to beneficiaries during counselling sessions
- a pre-installed weight monitoring tool to ease the weighing of children.

Furthermore, the weight monitoring tool in the mobile phone application provided an automatic calculation of the nutritional status of the child (e.g. severely underweight) when an AWW entered weight monitoring data and gave appropriate instructions (e.g. refer to the NRC) (OPM, 2014).

The BCSP, has two interventions designed as three treatments assigned to three administrative blocks. The two interventions are i) a demand-side intervention (cash transfers to pregnant women and mothers with young children) and ii) supply-side intervention (the provision of mobile phones and monetary incentives to AWWs). The three treatments are—i) cash transfer with "hard" conditions and the supply-side intervention, ii) cash transfer with "soft" conditions and the supply-side intervention, and iii) just the supply-side intervention i.e. mobile phones and monetary incentives to AWWs (OPM, 2014, 2016)

In one block, the transfer was conditional on meeting "hard" conditions where women were required to receive certain services, particularly weight monitoring of pregnant women and children, Iron and Folic Acid (IFA) supplementation for mothers, Vitamin A supplementation for children, ante-natal and post-natal check-ups for women and appropriate treatment for diarrhoea. In the second block with "soft" conditions, the transfer was conditional on women attending VHSNDs every month. To delineate the effect of the supply-side intervention (mobile phone application and monetary incentives to AWWs), the third block in BCSP was assigned to provide the mobile phone application and incentives to AWWs but no cash to the beneficiaries. As part of the BCSP, an impact evaluation was designed at the inception stage itself. The BCSP impact evaluation design selected a fourth administrative block as a comparison block for the

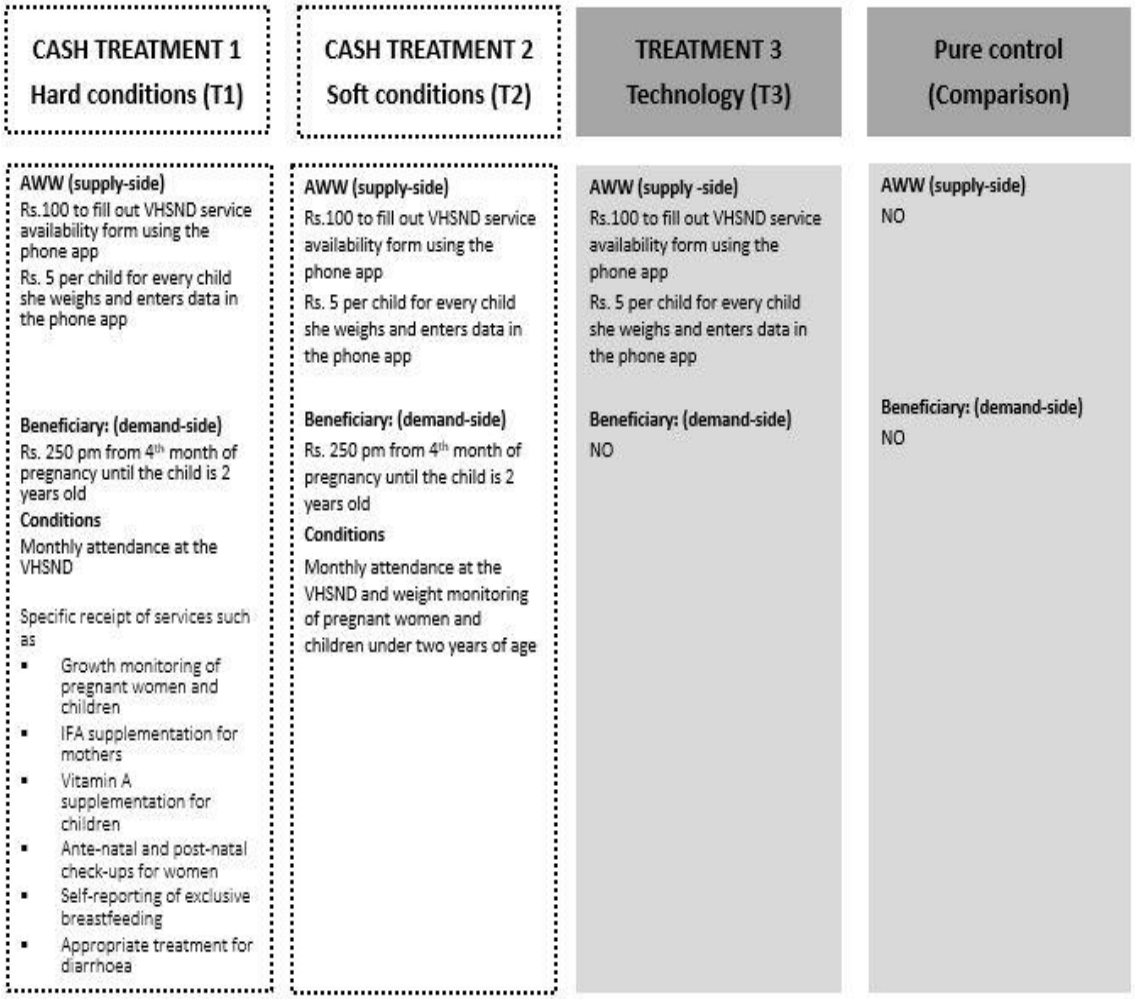
[39] CommCare application was developed by Dimagi https://www.dimagi.com/products/.

impact evaluation purpose (OPM, 2014). The demand-side intervention (cash for beneficiaries) targets pregnant women and the supply-side intervention (mobile phone technology and monetary incentive) targets AWWs.

I do not consider my research as an impact evaluation of BCSP, rather it is examining whether the supply-side intervention by the BCSP had any impact on services provided by the AWWs as the formal BCSP evaluation does not cover this aspect.

Figure 5 shows that all three treatment blocks have the supply-side intervention for AWWs and only the first two blocks have the demand-side intervention.

Figure 5 The BCSP design



To clarify terminology, "the supply-side intervention" is also termed in the thesis "the AWW treatment", "mobile phone and monetary incentives intervention", and "technology augmented intervention". I call it the "supply-side intervention" and "the AWW treatment" when comparing it with the cash transfer arms of the BCSP and the "mobile phone and monetary incentives

intervention" and "technology augmented intervention" when analysing data related to the intervention.

The BCSP mobile phone application was designed to improve an AWW's performance by improving her productivity, competence, and responsiveness (in line with the performance effects in the conceptual framework). In particular it focused on weight monitoring of children and pregnant women, facilitation of the VHSNDs, and counselling activities. As an incentive, AWW received Rs. 5 (approx. $ 0.08) per child for entering the weight of the child in the weight monitoring tool and Rs. 100 (approx. $1.5) per month for filling the service availability form on the VHSND (OPM, 2014). The BCSP aimed to improve service quality, increase the number of children being weighed at the AWC and improve attendance during the VHSND as it provided a direct incentive for AWWs to conduct these activities and beneficiaries to receive them.

The VHSND is a monthly service delivery platform organised at the AWC every month. The schedule of the VHSND is pre-decided between the Health and Social Welfare departments. At the AWC level, the ANM, ASHA, and AWW work together to provide a set of health and nutrition services. An ANM visits the AWC on VHSNDs and provides Ante Natal Care (ANC) check-ups for pregnant women, child immunisations, and referrals. The AWW weighs children and pregnant women, and provides counselling. The ASHA informs the beneficiaries and facilitates their participation (GoI MWCD, 2010; OPM, 2014).

Table 9 provides a summary of services expected to have been influenced by the supply-side intervention and the rationale.

Table 9 The ICDS services expected to have been influenced by the BCSP supply-side intervention

Services and expected influence			Rationale
Direct	Weighing		
		Child	The AWW receives Rs. 5 per child. She has the weight monitoring tool to calculate the grade and a pre-recorded counselling message for the mother depending on the child growth grade.
		Women	No direct monetary incentive or weight monitoring tool, but the pregnancy care application asks for the pregnant woman's weight, which also needs to be recorded in the Maternal and Child Health (MCH) card.
Direct	VHSND attendance		
		Child *Women*	The AWW receives Rs. 100 to fill out the service availability form on the VHSND. It is identified to be a platform for weighing services. Considering the AWW is incentivised to weigh, and the process (grading and counselling) is eased by the phone, she would have an incentive to attract more beneficiaries on the VHSND (caregivers of children and pregnant women) so that she can weigh more beneficiaries and earn more money.
Indirect	Counselling		The phone has BCC videos and audios useful individual and group counselling. As a secondary impact, AWWs could use those to improve the quality of their counselling sessions and attract more beneficiaries for the sessions.

I decided to utilise the BCSP setting for my thesis due to two reasons. They were:

- *Programme design features*: these enabled me to examine the effect of an intervention that aimed to improve AWW performance in line with the conceptual framework
- *Evaluation design and availability of the impact evaluation data*: allowing me to comprehensively explore the influence of the intervention on AWW performance

Programme design features: global evidence suggests that weight monitoring services have a significant role in combating child undernutrition if combined with effective infant and young child behavioural change counselling (Black et al., 2013; Mangasaryan et al., 2011). The evidence on the ICDS suggests that the quality of the weight monitoring service suffers from resource and capacity constraints such as the unavailability of weighing equipment and growth charts and AWWs' lack of knowledge and skills in using growth charts, leading to low uptake of services (Planning Commission, 2011). The BCSP seems to have incorporated these issues into the design by providing an automatic weight monitoring tool with a counselling component. This explicitly targets the unavailability of growth charts as they are no longer needed, as well as the knowledge and skills of AWW as the application independently undertakes the calculation and provides tailored counselling messages. Moreover, the theory of change of the BCSP is in line with the conceptual framework on AWW performance used in this thesis. The BCSP aims to improve the performance of AWWs by focusing on improving two factors (mobile phone and monetary incentives) also identified in the conceptual framework. Through the mobile phone and monetary incentives intervention it expects to improve the performance of the AWWs by improving their productivity, competence, and responsiveness.

The BCSP also incentivised the AWW to report the weight outcome per child. Essentially, the BCSP introduced monetary incentives similar to their peers, ASHAs, on top of the AWWs' fixed monthly income. The evidence on the influence of monetary incentives on ASHA workers who are solely dependent on performance-oriented monetary incentives suggests that they are biased towards those services they receive payment (Scott & Shanker, 2010; Srivastava et al., 2009). The BCSP context enabled me to explore whether this phenomenon holds true in the context of AWWs as well. Although I would not be able to delineate the separate effects of the mobile phone and monetary incentives, the findings will be an addition to the existing knowledge base within the public health and the public service delivery literature.

Evaluation design and availability of the impact evaluation data: the BCSP pilot used a quasi-experimental impact evaluation design with three treatment arms and one comparison arm. The

BCSP impact evaluation focuses on estimating the impact of the cash transfer on maternal and child health and nutrition outcomes (OPM, 2014, 2016).

The BCSP used a quasi-experimental impact evaluation design rather than a randomised controlled trial (RCT) design because the random allocation of treatment (cash transfer or AWW treatment or both) at the AWC or village or beneficiary level was not possible due to the need to test the ability of government administrative tiers to deliver the programme in the same way that they would have to were it to be scaled-up (OPM, 2014). The BCSP pilot was conceived and implemented as a government policy similar to policy changes in real-world settings. The government of Bihar decided the choice of the district, implementation mechanisms, and time of roll out. The evaluation team matched administrative blocks to ensure robust comparisons between blocks based on an evaluation strategy.

A quasi-experimental treatment allocation using a block matching exercise was done at the baseline stage to allocate treatments to blocks (OPM, 2014). At the baseline stage, blocks were selected based on a matching algorithm to ensure they were as similar as possible. Econometrically, matching was not done on the evaluation indicators–i.e. beneficiary uptake of ICDS services that would be influenced by the BCSP. Rather, it was done on factors that may have had a confounding effect on these indicators (OPM, 2014). The number of matching factors was kept limited to avoid over-specification, and only continuous scale variables were used. The following variables were considered:

- Female literacy
- Population per AWW (to proxy service delivery)
- AWW per LS (to proxy supervisory levels)
- Average population per village (to proxy population density)
- Proportion of socially excluded groups (SCs), who may face differential access to services due to discrimination
- Male: female population ratio (proxy for migration)

Based on this matching exercise, one block was selected as the ‘pure control block’ (the comparison block for my research) for the overall BCSP impact evaluation. The best match for the pure control block received only the supply-side intervention, i.e. mobile phone technology and monetary incentive intervention (hereafter, T3). The other two blocks were assigned for the overall cash transfer experiment (hereafter, T1 and T2).

The availability of a treatment arm comprising only the mobile phone technology and monetary incentive intervention alongside a comparison arm in the evaluation design makes it possible to estimate the effect of the intervention on different outcomes. This was not the primary aim of the BCSP impact evaluation. However, I found this possibility econometrically viable and it met my motivation to study the effect of technology-based strategies to improve AWW performance.

Before starting my PhD, I worked on designing and managing the BCSP evaluation as a national survey manager at OPM. The BCSP pilot was funded by DFID. My involvement with the BCSP and DFID's open access data policy gave me the opportunity to use the impact evaluation survey data for my doctoral thesis. Moreover, I was familiar with the geographic area and spent long periods of time before my PhD conducting explorative studies and surveys. Due to the viable evaluation design, availability of data, and previous experience in the area, I decided to situate my doctoral research examining the influence of the mobile phone technology and monetary incentives intervention on AWW performance in the BCSP setting.

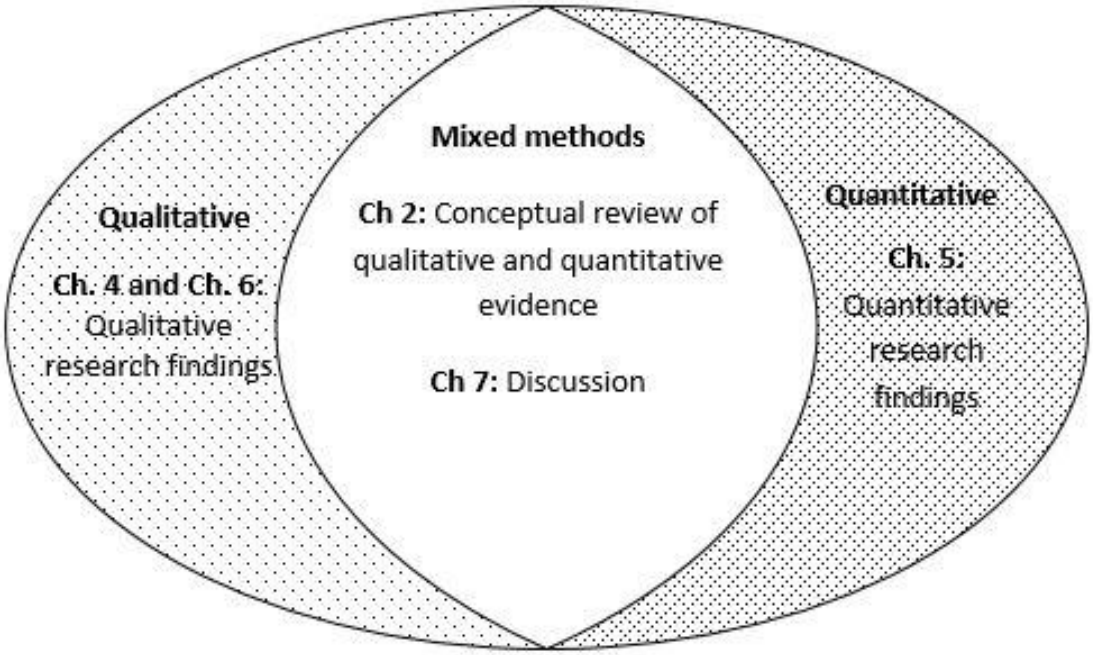
As described earlier, I utilise the BCSP setting to answer my second research question (RQ2). Using the BCSP quantitative data, I compare between two different sample populations: one set of the population that access AWCs where AWWs use the mobile phones and receives monetary incentives and a second set in the comparison block where the intervention is absent. Moreover, to attribute impact to the bundle, I measure the change over time and compare it to the change over time in the counterfactual. A comparison group (non-intervention area) is one way of having a counterfactual, which the BCSP clearly provides. This quasi-experimental specification is described in more detail in Chapter 5. My qualitative fieldwork comprising the two separate objectives was conducted in two blocks–the T3 and the comparison blocks. The two objectives were–1) understand what and how individual, programmatic, community and organisational factors influence AWW performance and 2) understand how and why the technology augmented intervention with a monetary incentive component influences AWW performance.

3.2 Combining qualitative and quantitative research: rationale and analytical approach

As described in Chapter 1, my thesis employs qualitative and quantitative research methods. The qualitative and quantitative findings together will help to address my overarching research question more comprehensively than I believe a single research method could do. In Figure 6 I have visualised how each chapter contributes towards the overall mixed methods analytical approach. Although I have used mixed methods by sequentially combining qualitative and quantitative research in my thesis, my analytical chapters describe individual studies that used

either qualitative or quantitative research methods (shown in Figure 6). In Chapter 7, I bring together the findings from studies that used both qualitative and quantitative methods. In this section, I will discuss my rationale to conduct qualitative and quantitative research and the philosophical approach in combining qualitative and quantitative research strategies used all throughout my doctoral study.

Figure 6 Overview of qualitative and quantitative research used in the thesis



3.2.1 Rationale to conduct qualitative and quantitative research

> *"[...] choose the combination or mixture of methods and procedures that work best for answering the (your) research questions."*
>
> – (Johnson & Onwuegbuzie, 2004) pg. 17

My qualitative research aimed to gain a deeper understanding of factors that help and hinder AWWs in their performance, and the role of monetarily incentivised mobile phone technology. I needed to capture AWWs' feelings, emotions, and opinions about their job responsibilities to meaningfully understand factors that influence their performance. In general, the purpose of qualitative research is to gain an understanding of the quality or nature of human experiences and what these phenomena mean to individuals (Bernard, 2006; Bryman, 2012; Draper, 2004). It can be broadly embedded in the interpretative and naturalistic tradition, as it seeks to understand and explain beliefs and behaviours within the context that they occur (Draper, 2004). Qualitative research methods are used in a range of fields and disciplines. In the literature on performance, especially in the public health literature that discusses human resources for health including CHWs, studies use both qualitative and quantitative methods to understand performance and

factors influencing it. To understand workers' viewpoints, feelings, and thought process about factors influencing their motivation and performance, the majority of these studies used qualitative research methods (Glenton et al., 2013; Kok et al., 2014). Hence, to understand AWWs' perspectives and experiences on factors that influence their performance, especially their experiences regarding the introduction of monetarily incentivised mobile phone technology, I decided to use qualitative research methods. Although conducting one-off qualitative interviews can be considered as one of the limitations of my qualitative research, I did extensive context setting phase to overcome this challenge (in detailed described in the next section).

My quantitative research aimed to examine the influence of monetarily incentivised mobile phone technology used by AWWs on the household uptake of ICDS services linked to the intervention. I decided to use quantitative research methods to examine the influence of the bundled intervention because I had access to quantitative data collected as part of an impact evaluation that allows me to assess the association between the levels of service uptake and the intervention. Quantitative analysis also has the benefit that it draws on a larger representative sample that allowed me to make a generalisable conclusion about the impact of the intervention on service uptake at the household level. The tradition of quantitative research, which is rooted in the positivist and materialistic tradition, places its emphasis on the measurement and quantification of phenomena as essential steps in the process of inquiry. In the public health and programme evaluation literature, the majority of studies that have examined the influence of specific factors on service uptake used quantitative research methods such as descriptive or causal analysis using social surveys (Glenton et al., 2013; Kok et al., 2014). Due to the availability of a unique data set (two rounds - before and after) and sampling methodology I could make a generalisation to the whole population and compare and generalise between two different sample populations—one segment of the population that access AWCs where AWWs use the mobile phone and receive monetary incentives and a second set where the intervention is absent.

3.2.2 'Pragmatic approach' in combining qualitative and quantitative research

Since the 1990s, the mixed methods approach emerged as a third research paradigm establishing it alongside the positivist (associated with quantitative methodologies) and constructivist (associated with qualitative methodologies) paradigms. According to Johnson et al., (2007: p.117), "*we currently are in a three methodological or research paradigm world, with quantitative, qualitative, and mixed methods research all thriving and coexisting*".

Pragmatism is one of the philosophical partner of the mixed method approach. It provides a set of assumptions about knowledge and enquiry that underpin the mixed methods approach and

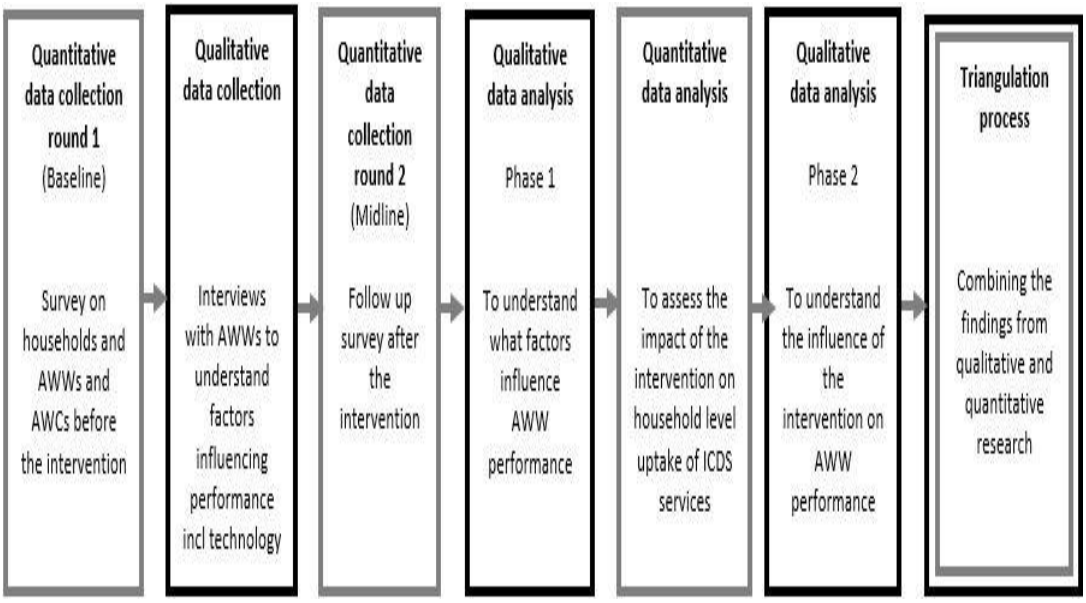
which differentiates the approach from purely quantitative approaches that are based on the philosophy of (post) positivism and purely qualitative approaches that are based on the philosophy of constructivism (Johnson & Onwuegbuzie, 2004). I use this pragmatic approach in combining qualitative and quantitative research methods as proposed by Johnson and Onwuegbuzie (2004) and developed by Morgan (2007).

The pragmatic approach puts emphasis on three key aspects: abductive reasoning, intersubjectivity, and transferability. In the pragmatic approach, abductive reasoning relies on connecting theory and data by using inductive qualitative and deductive quantitative approaches sequentially. The abductive process, i.e. the movement back and forth between different approaches to theory and data can happen in a single project or different projects that complement each other (Morgan, 2007).

The intersubjectivity aspect of the pragmatic approach captures the duality of subjectivity and objectivity in the research process. It allows the coexistence of beliefs that there is a single 'real world' (quantitative belief) and that all individuals have their own unique interpretations of that world (qualitative belief). The intersubjectivity aspect of pragmatic approach allows exploration of findings that emerged from one research strategy in the context of the other (Morgan, 2007).

Transferability, the third aspect of the pragmatic approach, means the implication of findings to other research settings. In the research process, it is the movement back and forth between the contextual inference in qualitative research (i.e. research findings are relevant for the studied context) and generality inference (i.e., research findings can be generalised to a wider population) in quantitative research (Morgan, 2007).

Figure 7 Sequencing of qualitative and quantitative research methods in the thesis



In applying the pragmatic approach, I used qualitative and quantitative research methods sequentially. Figure 7 depicts the sequencing while mixing the methods. Although I consider this thesis as a single project, it is also a combination of separate projects (or chapters) that use qualitative and quantitative research methods to complement each other to gain a better understanding of the concept of performance in the AWW context. In Chapter 7 I discuss the qualitative and quantitative research findings in relation to each other to present a comprehensive understanding of AWW performance. Moreover, I also discuss the implications of findings for different geographical and policy contexts.

3.3 Qualitative methods

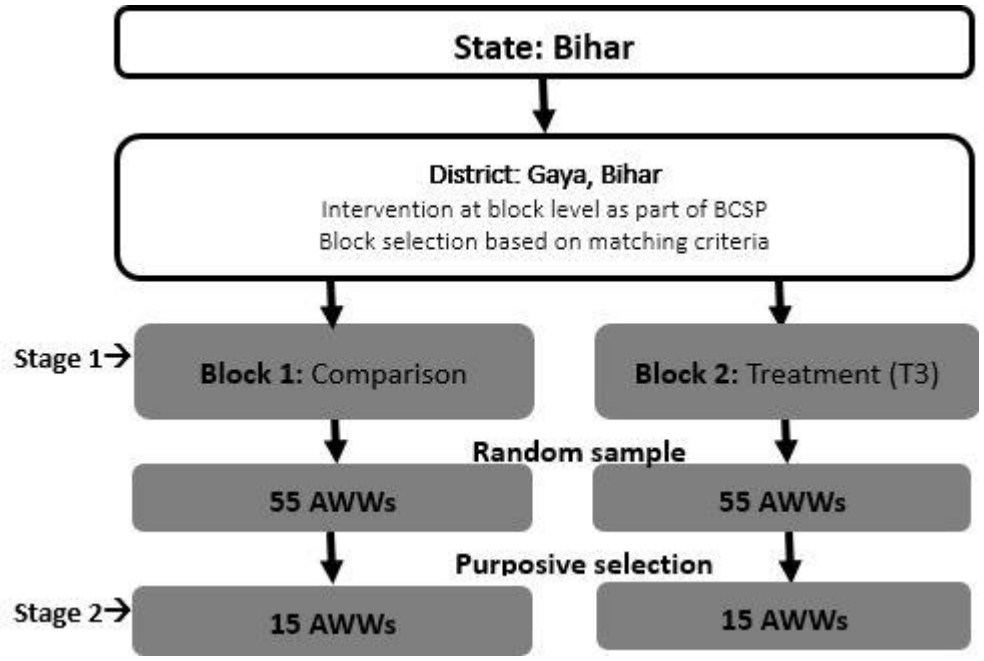
Qualitative methods offer richer meanings of intricate details of phenomena such as feelings, thought process and emotions (Strauss & Corbin, 1998). I chose the qualitative method of interviewing to deeply engage in capturing the perceptions and experiences of AWWs on working arrangements, relationships and negotiations with peers, supervisors, community members, and family, and overall motivation (Bernard, 2006; Ritchie et al., 2014). I chose semi-structured interviews with open-ended questions as the qualitative interview method to provide an opportunity for participants to directly articulate their meanings and interpretations to events and experiences (Ritchie et al., 2014). Furthermore, to understand the multi-dimensional concept of performance, the qualitative approach allowed me to explore the concept by allowing the participants' self and voice in the research process. The semi–structured interview structure also provided space for any sensitive topics to emerge and to ensure the privacy of the interviewee.

3.3.1 Selection of sites and participants

As I described earlier, I had access to the survey data from the BCSP evaluation surveys which had demographic information on AWCs and AWWs. Using the BCSP survey data on AWCs and AWWs, I undertook a two–staged purposive sampling. The stages in selecting the sites and participants are illustrated in Figure 8. As the first step, I purposively selected two administrative blocks assigned as the third treatment block (T3) and comparison block for my qualitative fieldwork. This was because one of the aims of my qualitative fieldwork is to understand AWWs' perceptions and experiences in using the mobile phone and monetary incentives and how it influences their performance. As the second step, using the survey data set for the chosen two blocks, I selected the participants for the qualitative research purposively. For each block, the BCSP had randomly selected 55 AWWs. From the list of 55 AWWs from each block, I selected 30 AWWs (15 from each block) using three criteria:

- Distance to the block office from the Gram Panchayat (GP)[40]
- Caste[41] of the AWW
- Education of the AWW

Figure 8 Selection of sites and participants



The distance the worker travels for meetings and office work has been suggested to influence work routines (Saprii et al., 2015). The distance to the block office from the Gram Panchayat is a significant distance an AWW needs to travel regularly for official work such as meetings, voucher signing to receive money to buy food, and monitoring report submission. The distance might also influence how frequently the AWW sees her supervisor and receives external monitoring visits. Thus, the distance factor could potentially have an impact on AWW performance. Therefore, I purposively selected AWWs who lived within different distances from the Gram Panchayat. The caste of the AWW could be influential in her relationship with the community and the overall trust she receives from the community (Mander & Kumaran, 2006). Education of the worker is a key recruitment criterion and evidenced to influence AWW performance (Gujral et al., 1991), thus was included as a selection criterion.

Considering one of the objectives of my qualitative research was to understand the influence of the mobile phone technology and monetary incentives bundled intervention on AWW

[40] Gram Panchayat is the lowest elected governance tier and consists of a group of villages.
[41] Refer to the Box 1 given in Chapter 1.

performance, I did not use any intervention specific criteria[42]to select participants. This was because I did not want any programme implementation bias to affect my selection of participants.

3.3.2 Data collection

I used semi-structured interviews guided by a topic guide based on the conceptual framework on AWW performance (see Chapter 2 for details). I carried out several rounds of iterations of the topic guide after multiple field visits to further contextualise the topic guide and to aid the flow of the interview. Discussion topics in the guide included the following domains: overall motivation, workload, supervision, training, community, and incentives associated with the AWW role. In addition to these, it discussed facilitators and barriers influencing the delivery of each of the six ICDS services (supplementary nutrition, immunisation, health check-up, referral services, pre-school education, and nutrition and health education) at the AWW level. In the block where the AWWs were using the monetarily incentivised mobile phone technology intervention, I discussed in detail about their perspectives and experiences regarding the intervention. I did three phases of pre-test interviews to refine the topic guide. Ten pilot interviews were conducted to finalise the topic guide. The extensive phase of pre-test and pilot gave me ample time to refine myself as a qualitative researcher–to tune my body language, voice modulations, and familiarise myself with the context.

In addition to the interviews, I also collected administrative background documents and asked clarification questions to the BCSP Programme Manager in the district after the interviews with AWWs for more clarity about the programme implementation. The views or experiences of the Programme Manager or ICDS officials were not sought because the aim of the research is not to present a multi-stakeholder perspective; rather it is to focus on the primary user perspective. The collected documents and clarifications were used to support and elaborate on AWW views and experiences.

I conducted the qualitative interviews with the help of a female research assistant, two note-takers and a logistics manager[43]. I interviewed half (15) of the participants, and the research assistant conducted the rest. The selected female research assistant was fluent in the local Bihari

[42] The BCSP criteria could have included the AWW's differential programme participation, phone use ability, period of phone use etc.

[43] I received funding from the POSHAN (Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India) project led by the International Food Policy Research Institute (IFPRI) and funded by BMGF. The funding was awarded to include one more donor-funded programme piloted to improve AWW performance in another district in Bihar. Due to my PhD time constraints, we decided to carry out the fieldwork in the second district using a team trained by me. Thus, I needed to include a logistics manager and train him on study objectives and routine by working with me in Gaya, so that he could independently manage logistics in the second district.

dialect (Magahi). We did the initial introduction together because she was a good entry point for an outsider like me to get to know the AWW and her social relationships. I listened to all interviews conducted every day by the female research assistant to check whether the interviews were of expected depth. Two note-takers (one male and one female) teamed up with the female interviewer and myself to record meticulous field observations. A few examples from the field observations include the details of the physical setting of the interview, the body language of the participants and any details participants wanted to share without the presence of the audio-recorder (Bernard, 2006). The interview phase of the field work was completed in three weeks before the state assembly elections in Bihar. Gaya was under the high-security category due to the presence of the Naxalite movement[44]. An experienced male field logistics manager was included in the team to mitigate any risks in logistics arrangements due to the elections. It was a practical decision to include two male members to avoid any gender or context-specific potential risks due to the state elections and the presence of insurgency. I provided five days of training, which included three days of classroom training and two days of field training to introduce them to the research objectives, interview techniques, and the daily fieldwork routine and logistics. I kept a daily diary in English to describe the day in detail. I also kept a small 'notes to self' journal in my mother tongue — Malayalam— to jot down my thinking around stories I heard and scenes I witnessed. There was also a team diary to log daily activities and record de-briefing sessions to reflect on our daily experiences.

All interviews were audio-recorded with the permission of the AWWs. Each interview lasted for 45—60 minutes. Every day, as part of the fieldwork team routine, I saved the audio-recordings in designated folders onto a password protected web-based server. I followed a systematic file naming procedure. After conducting the first six interviews[45], I read the interview transcripts carefully to make further iterations to the topic guide. Each interview was verbatim transcribed and translated into English. After the translation, all transcripts went through one more round of

[44] The Naxalite movement started in Bihar from 1967 as a peasant struggle as part of the wider Naxalite movement in India (B. Bhatia, 2005; Sundar, 2011). It originally started in Naxalbari, West Bengal, thus the name Naxalite. The movement represented the revolutionary branch of Indian Marxism aiming to take control of the Indian state through armed struggle rather than parliamentary democracy (Sundar, 2011). In 1995—96, approximately 17 Naxalite groups were active in different parts of Bihar (B. Bhatia, 2005). One of the main groups is the Maoist Communist Centre (MCC), and the rest are part of the Communist Party of India (CPI) (Marxist–Leninist) (B. Bhatia, 2005). Since 2004 after the merger of CPI (ML) People's War and the MCC, the Communist Party of India (Maoist) is the biggest Naxalite political force. The CPI (Maoist) is one of the main actors in my research area, Gaya. The Indian state has attempted to crush the movement since 1970 and considers Naxalism as a security threat which needs to be fought with the army and special forces. The fighting between the Naxalite groups and the state has caused several episodes of violence across state and country (Sundar, 2011).

[45] I conducted four and the research assistant conducted two.

quality control– verbatim quality (word by word against the audio) and translation quality. I read the transcripts several times during the transcription, translation, and quality control phases to familiarise myself with the content and to start coding.

My positionality during the fieldwork was influenced by my identity as an Indian student studying at a British university, and as a South Indian. In addition, while conducting qualitative fieldwork my primary training in quantitative methods and experience in surveys influenced my positionality. Being a student at a British university, I felt it was easier to seek interviews with AWWs as they seemed to value that identity. Although the British university student identity helped me, I was aware of the distance my outsider urban identity could have created. I involved the female research assistant, a middle-aged woman from one of the northern districts of Bihar to ease my entry into villages. I wanted to minimise the distance between us due to our identities. The presence of the female research assistant, her age and knowledge in the local dialect helped to bridge this identity gap. Moreover, being with her and other team members (one female and two males) and me being the youngest and my local attire to some extent helped me merge into the local Bihar context.

As a quantitative researcher with previous experience in survey management, I had to approach the qualitative data collection in a different way. I used the extensive phase of pre-test and piloting of topic guide to achieve the right level of comfort in the interview process. During the pre-test phase, I realised that the qualitative interviews required a totally different body language compared to survey interviews. I had to remind myself to relax, smile, and consider it as a visit to get to know someone. During this phase, I also realised that AWWs were not used to people talking to them about their perceptions, feelings, or problems as working women. They were, however, used to spot checks, surveys, enquiries, and social audits. To increase AWWs' comfort, I relied on my young-female-student identity and tried to connect with AWWs on a personal level. Talking about their own children proved the best way to connect with them. Children of all interviewed AWWs pursued higher education in district headquarters, or Patna (the state capital), or Delhi. They expressed pride in their children's achievements, and discussions about children's educational trajectory helped to set the mood for an open discussion about work and life.

As part of the context setting before starting the interviews, I talked to AWW labour union leaders in the district and the state. In my selected sample, two AWWs led the union activities in their area, and I interviewed them in the first round. When a research team visits a village, the news spread informally. Interviewing the AWWs who led the union activities in a way alleviated the inhibitions of rest of the AWWs. Before my fieldwork period, AWWs called in a national level strike on 2nd September 2015. In Bihar, AWWs protested at the state capital, Patna and respective

district and block headquarters. The strike in Bihar started off as an indefinite strike with twelve demands: minimum wage, permanent employment, pension, insurance and so on. A few AWWs even set fire to their uniform as a symbolic protest method. After a few days of the strike, the government agreed to hike their salary by 25%. Although it was an earlier promise, AWWs called off the strike due to the invisible pressure put on them by the government. During my field work, many interviewed AWWs spoke about their participation in the strike, as a resistance to the government's attitude towards them. I also documented newspaper articles that reported on the AWW strike.

My field sites were situated 50 to 60 kilometres away from Gaya town, bordered with rocky hills with very limited public transport connectivity. Due to the distance and lack of accommodation at the sites, we travelled in a hired car. Women travelling into villages without close family or male members is unusual in rural Bihar. The presence of the two male members helped us in this regard.

The ethics committee at the International Food Policy Research Institute (IFPRI)[46], USA and University of Sussex, UK gave the ethics approval for the research. An Indian organisation, Centre for Media Studies (CMS), New Delhi provided the local ethics approval. The oral consent information explained the purpose of the research, participant's right to anonymity and voluntary withdrawal at any stage of the interview, expected time commitment and my contact details. The interview audio recordings include the oral consent given by the participants at the start of the interview. During the pilot stage, I noted that a few AWWs did not feel comfortable in the presence of the audio-recorder. Thus, before starting the interview and official consent procedure, we spent time with AWWs in explaining the research aims, clauses in the consent form, and started the interview once we achieved a friendly rapport. The female research assistant was an experienced interviewer trained in the importance and delivery of oral consent. Because the consent was audio-recorded, it was easier to check the consistency of the process. I anonymised the interview recordings and transcripts by deleting names, locations, and AWC codes from the transcripts to preserve the anonymity of participants. Each participant was assigned a unique identification number for de-identification and tracking purposes. The qualitative interviews discussed sensitive issues within the ICDS context, hence, in presenting the findings, especially qualitative interview excerpts I decided not to include names of the blocks, panchayats, and demographic characteristics of AWWs to avoid any potential threat to

[46] As mentioned earlier, the data collection for this research was funded by POSHAN project led by IFPRI and funded by BMGF. Because the data collection was funded by IFPRI, I took ethical clearance from IFPRI in Washington, DC as well.

anonymity. Although my previous identity associated with the BCSP baseline could have been an ethical concern, however, the time gap between baseline data collection and qualitative data collection (two years) and my distance with the programme implementation phase helped in this regard.

3.3.3 Data analysis

I used a hybrid method of inductive and deductive thematic analysis to analyse the data (Fereday & Muir-Cochrane, 2006; Ritchie et al., 2014). As suggested by Fereday & Muir-Cochrane (2006), the hybrid method incorporated both a data-driven inductive approach (Boyatzis, 1998) and the deductive a priori template of codes approach (Crabtree & Miller, 1999). I chose this method of analysis because it allowed me to combine deductive analysis guided by the conceptual framework on AWW performance and inductive analysis with the generation of new emerging themes from the data.

I developed a code list as a data management tool for organising fragments of similar or related text to facilitate interpretation (Crabtree & Miller, 1999). This code list was developed a priori, based on the research question and the conceptual framework on AWW performance. It included seven broad categories of codes, namely: motivation, selection and recruitment, workload, service-specific facilitators and barriers, community, supervision, and training. I revised the code list after testing the applicability and reliability of codes to the raw data. In the initial phase, I coded two interview transcripts using the a priori code list. A few sub-codes were not needed as the main codes were found to be organising the data meaningfully. After testing the code list, I uploaded the transcripts and coded it with the help of the qualitative data management program NVivo 10. I entered the codes developed from the code list manually to NVivo as nodes and coded transcripts by matching codes with fragments of data selected as representative of the code. Though the coding used an a priori code list, I did not restrict the analysis to the preliminary code list. While coding transcripts, inductive codes were assigned to fragments of data that showed a new theme emerging from the text. These 'data-driven' codes were either separate from the categories in initial codes (e.g. caste, corruption) or they expanded a code from the code list (e.g. self-identity under the motivation code). After line-by-line coding of ten transcripts, I wrote a summary of each code. During the coding and summarising processes, I wrote analytical memos for each code to capture emerging analytical threads and operational notes. These analytical memos and summaries helped me to connect codes to identified themes in the data. In the next level of interpretive understanding, I further clustered these themes and gave suitable names to

describe the meaning that underpinned the theme. This rigorous[47] process of analysis (step-by-step with a clear audit trail) until the clustering phase ensures that these clustered themes were representative of the initial data analysis and assigned codes.

In analysing qualitative interviews as a researcher predominantly trained in quantitative methods, I found the mental load different from conducting quantitative analysis. I found this process similar to learning a new language and reminded myself of being a bilingual (native language and English). I relied heavily on the process of writing in the form of analytical memos, summaries, and chapter drafts to attain the analytical saturation.

To answer the second aim of my qualitative research, I only used data from Block 2 (T3block), where the intervention was underway.

3.4 Quantitative methods

In this section, I only introduce briefly my quantitative analysis, as it is discussed in detail in Chapter 5. As discussed before, I use two rounds of survey data from the BCSP pilot evaluation undertaken by OPM. The two surveys present a panel of Primary Sampling Units (PSUs)—in this case, the PSU is the catchment area of AWCs. From the treatment and comparison blocks, each survey round collected data from approximately 55 AWCs, 1500 households (with at least one woman having a child less than age two) and community fixed characteristics from 55 PSUs.

To estimate the impact of the monetary incentives and mobile phone technology intervention on the household uptake of the ICDS services linked to the intervention, I use the Difference-in-Difference (DID) estimation strategy (Card & Krueger, 1993; Wooldridge, 2003). The rationale for using the DID estimation strategy and how I applied it using the data is discussed in detail in Chapter 5.

3.5 Conclusion

In summary, this chapter discussed the overall methodological approach used in this thesis. As part of the mixed methods research strategy, I conducted qualitative and quantitative research to answer my specific sub-research questions. I chose the pragmatic approach from the mixed methods paradigm to combine the use of qualitative and quantitative research methods. I sequentially used these methods to complement each other to present a coherent narrative on AWW performance. I discuss the findings using each method in light of the other in the last chapter (Chapter 7). In the qualitative research, I interviewed 30 purposively selected AWWs

[47] Rigour means demonstrating integrity and competence within a study (Aroni et al., 1999).

using a two-stage selection criteria. I used a hybrid method of deductive and inductive thematic analysis to analyse the data. In the quantitative analysis, to estimate the impact of the mobile phone and monetary incentives intervention on the household level service uptake of ICDS services linked to the intervention, I applied the DID estimation strategy on a panel of workers and linked mothers and children in treatment and comparison blocks. Moving on from context and methodology, in the next chapter, I discuss the findings of my qualitative research that explored the individual, programmatic, community, and organisational factors that influence AWW performance.

Chapter Four: Individual, programmatic, community, and organisational factors that influence Anganwadi workers' performance

4.1 Introduction

In this chapter, I present findings from my qualitative research which aims to understand the individual, programmatic, community, and organisational factors that influence AWW performance.

As demonstrated in the literature review (Chapter 2), in understanding the factors that influence the motivation and performance of AWWs in delivering services, the perspectives of the AWWs are often underexplored. Hence, I focused my research inquiry to unpack the determinants of performance from the point of view of AWWs themselves. To unpack the concept of AWW performance from their point of view, I believe it is important to gain insights into what factors AWWs perceive as facilitators and barriers in performing their job responsibilities. Hence, the research aimed to capture a deeper understanding of an AWW's lived experiences and perceptions as a village woman and as a programme worker.

Structurally this chapter has four sections and relevant sub–sections. The next section 4.2 discusses briefly the concepts and methods used in the research. Section 4.3 presents the findings of this research. The findings section is followed by a discussion section (4.4) and concludes with a summary of conclusions (4.5).

4.2 Background

My qualitative research was guided by the conceptual framework on AWW performance laid out in Chapter 2. The framework contextualised the definition of performance in the AWW context as –'AWWs making services accessible to the required number of beneficiaries with adequate quality' (i.e. adhering to guidelines).

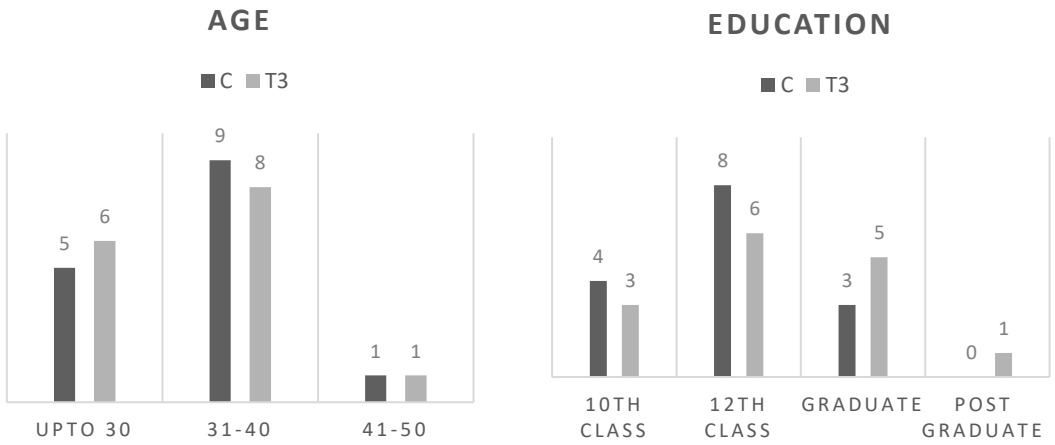
As discussed in Chapter 3, I conducted qualitative research among 30 AWWs. I used semi-structured interviews with open-ended questions as the qualitative interview method to provide an opportunity for participants to directly articulate their meanings and interpretations to events and experiences (Ritchie et al., 2014). The semi–structured interview structure also provided space for any sensitive topics to emerge and to ensure the privacy of the interviewee. I selected the interview participants using a two-stage purposive sampling. I chose the blocks purposively to include the block where only the BCSP's mobile phone and monetary incentives intervention. I used the demographic characteristics of AWWs from the BCSP baseline survey conducted in 2013 to select the AWWs for the interviews. I used the distance of the AWC from the block

headquarters, education, and caste as the selection criteria as these could influence AWWs' performance and lived experiences. I conducted the fieldwork in the two blocks of Gaya in August–September 2015. I used a hybrid method of inductive and deductive thematic analysis to analyse the data (Fereday & Muir-Cochrane, 2006).

4.3 Findings

I discuss the analytical findings after providing a summary of the demographic characteristics and job responsibilities of AWWs and the infrastructural conditions of AWCs. Findings are categorised into four categories namely: individual, programmatic, community, and organisational factors that influence AWW performance.

Figure 9 Age and education levels of interviewed AWWs, block wise



Overall in this research blocks are named as C (Block 1, Comparison block of the BCSP and T3 (Block 2, T3 block of the BCSP

As shown in Figure 9, most of the interviewed AWWs were in the 31—40 age group or younger (eleven in the below 30 age group). Only two AWWs belonged to the 41—50 age group. Considering the minimum education qualification for the job is ten years of education, seven AWWs belonged to this group. The rest possessed higher education levels: fourteen completed twelve years of education, a considerable number (eight) of AWWs were graduates, and one even completed her post-graduate degree. In the selected group of AWWs for interviews, one practised Islam, and the rest believed in Hinduism. They belonged to three caste categories—General[48], OBC[49], and SC[50]. Most (seventeen) of the AWWs were from OBC, including the only Muslim one. Though AWWs primarily belonged to the village (marital home) where the centre is

[48] General category included higher caste groups like Brahmans, and Rajputs etc.
[49] OBC community mainly comprises of Yadavs and Kormis, in Bihar.
[50] SC category consists of lower caste groups like Manjhi (dominant in Gaya), Paswan and Ravidas etc.

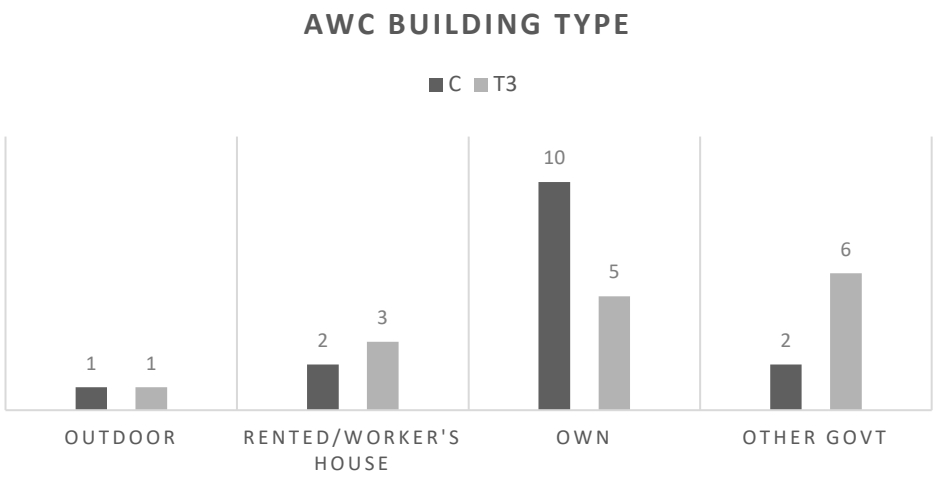
located, not all (fourteen) lived in the same hamlet as the centre. Five lived in the town for their children's education and commuted to the village every day.

Table 10 provides a detailed description of AWW job responsibilities summarised from the interviews. It shows that the interviewed AWWs have a wide set of responsibilities ranging from pre-school teaching to food distribution to weighing and counselling. The responsibilities listed in Table 10 are similar to responsibilities listed in Table 8 in Chapter 2.

Table 10 Detailed Responsibilities of AWWs reported in the interviews

Core services	Activity	Content	Frequency and Time	Type and number of beneficiaries	
Pre-school	Teaching	Rhymes, alphabets, stories, and games taught by the AWW	Daily 9 am–12 pm	Children 3 to 6 years	40
Supplementary nutrition	HCM (daily lunch with the help of AWH)	Distribute pre-decided menu based Hot cooked meal such as Khichdi, Rasiya, and Halwa. Once a week eggs	Daily 12–1 pm	Children 3 to 6 years	40
	THR (monthly dry ration)	Distribute pre-decided quantity of rice and lentils for each beneficiary category. Twice a week eggs	Monthly 9 am –5	Pregnant women	8
				Lactating mothers	8
				Children 6 months to 3years	40
Immunization	Provide space for VHSND	Help the ANM to carry out the VHSND at the AWC premises	Monthly Half day	Pregnant women Children below two years	All
	Ensure age-appropriate immunisation and reporting	Inform beneficiaries, upkeep of immunisation due-lists	Monthly Half day	Pregnant women Children below two years	All
Health Checkups	Weighing of pregnant women and children	Weight check, counselling, and record keeping	Monthly Half day	Pregnant women, children below three years	All
	Weighing of pre-school children	Weight check, counselling of parents, and record keeping	Quarterly Half day	Children 3–6 years	40
Health and Nutrition Education	Group counselling	Lead Health, Nutrition and Sanitation theme-based discussions	Weekly After 1pm	Women, Adolescent girls	All
	Home visits	Visit mothers to counselling them one to one on individual needs such as breastfeeding, complementary feeding, etc.	Daily After 1pm	Pregnant women	All (2–3 per day)
				Lactating mothers	
				Children below two years	
Referral	Referral of SAM children	Identification of SAM children and referral to district facilities	Any time	Children	All

Figure 10 AWC building type, block wise



The literal meaning of the word '*Anganwadi*' is '*courtyard shelter.*' This proved true for two AWCs included in the interviews—children gathered under a tree. Out of thirty interviewed AWWs, five AWWs either operated out of the courtyards of rented buildings or from the AWW's home. Fifteen of the AWCs included in this research functioned in a building owned by the ICDS department, and the rest (eight) of them used the space given in other government buildings such as schools, community halls (*Saamudayik bhawan)*, or local government (*Panchayat bhawan*) halls (Figure 10).

4.3.1 Individual factors

The initial financial motive rooted in family income needs, and family support emerged from the interviews with the AWWs as two individual factors that influence AWWs' continued motivation and performance.

Financial motives rooted in family income needs

In the interviews, AWWs discussed three types of initial motives (financial, moral, and social) to take up the job. Whilst some AWWs actively chose to take up the role due to "moral" motives (the opportunity to positively impact their community), for many it was their families who were the driving force.

For the majority of AWWs, their families decided to apply for the job after a brief consultation with them. Their families tended to be more focused on the "financial" and "social" motive – the additional income and prestige within the community and access to social and bureaucratic networks that came with the job. In most cases, an AWW's access to resources and power

remained entangled with the family because she lacked an independent identity in the village setting. As the sign of a deep-rooted patriarchy in villages, her identity intertwined with her marital family's identity. Her identity in the village remained as the 'daughter-in-law' of a specific family or 'wife' of an adult male. In interviews, a few AWWs voiced the existing gendered power relation by referring to their husbands or other male members (e.g. father-in-law or husband's elder brother) as 'guardians'[51]. The ICDS programme in Bihar somewhat institutionalised this joint identity. For example, the ICDS AWW recruitment guidelines [52] list *daughter-in-laws settled in the village'* as an eligibility criterion. Though the guidelines must have included this criterion pragmatically based on the common societal practice of women shifting from her natal home to marital home after marriage, it directly connects the identity of an AWW to her marital family even at the stage of recruitment. Thus, institutionally and societally, family identity is entangled with the female worker's (AWW) identity and the financial and social motive to take up the job is deeply rooted in family income needs.

Even those AWWs who entered the ICDS with a set of moral motives, with or without the help of the family, needed to support their families financially. They too shared the family identity. Thus, the motives rooted in family income needs directly or indirectly influenced an AWW's initial and continued motivation. In some cases AWWs fought against the familial and social pressures that prevented her from working outside the home. In these cases too, they chose to work as an AWW to contribute to the family income and secure their children's future. In one of the interviews, a graduate AWW who works predominantly in a Dalit settlement and who echoed the opinion of many AWWs, said:

> *"Reason is that see everybody, even every woman wants to do something now, and they do not want to sit idle at home as earlier women used to do. Now we are getting educated, and for the sake of our children, we have to do it. Then poverty is also a reason as we are very poor."*
>
> *(AWW Interview)*

As the above quote illuminates, irrespective of the wider drivers leading AWWs to take up the role, there was a strong "finance" motive for workers and their families; the salary (Rs. 3000 per month) was a key source of household livelihood. Therefore, the finance motive was more important than the social and moral motives, both for taking up the role but also for continued motivation. To conclude, the initial financial motive rooted in family income needs did not directly

[51] AWWs either used the English word 'guardian' or the Hindi word 'Malikh' which means master or owner.
[52] The ICDS Bihar website has detailed guidelines on AWW recruitment (http://www.icdsbih.gov.in/) or (SWD, 2015b)

influence the access or quality aspects of performance. Nevertheless, this emerges as a significant factor influencing AWWs' continued motivation. The conceptual framework on AWW performance used in this thesis, which is derived from the literature, did not have the initial financial motive of the worker as a factor contributing towards continued motivation.

Family support

The families of AWWs not only influenced their initial motives to obtain an AWW position. The majority of AWWs reported that their husbands often support them in their daily job responsibilities. Husbands help them in bringing sacks of rice from the collection point in the Gram Panchayat, filling out the ICDS monitoring registers, and providing transport to the block office. AWWs whose husbands were deceased are either helped by sons or other male family members as most of them lived in joint families. The husband or other family members who support the AWW in daily job responsibilities helps the AWW to make services such as food distribution accessible (performance outcome) to beneficiaries. One of the AWWs helped by her husband who works as a local self-government representative in the village explains why she needs help from family to fulfil her job, especially in bringing heavy rice sacks:

> *"Both husband and wives are involved in this job. This Anganwadi is not meant for one. It cannot be done unless two people are there. When the rice comes, my husband has to go and bring it. It is very heavy, and a woman cannot lift it. So for that, I send my husband. No matter it takes 3 hours or 2 hours, my husband will bring it from there. If there is some urgent report or vaccination is going on at my place, then I cannot go leaving my duty. So I have to send my husband. So out of 3000, only 1500 is given to the worker and 1500 to her husband. So what does one get?"*
>
> *(AWW Interview)*

4.3.2 Programmatic factors

Two programmatic factors, which emerged in the interviews, which seem to influence AWW performance, are the service preferences of beneficiaries and AWWs, and work environment factors. I further classify the work environment factors as workload, honorarium, supervision, and resources.

Service preferences of beneficiaries and AWWs

The services AWWs deliver comprise of product–oriented services (involves a product such as food and vaccines by ANM) and information–oriented services (involves information such as

individual and group counselling) (Kosec et al., 2015). A dominant view existed among AWWs suggests that beneficiaries preferred product–oriented services over information–oriented services. AWWs perceived that beneficiaries' explicit preference for products attracted better attendance for the THR distribution and immunisation compared to the individual and group counselling sessions. The majority of AWWs felt that there was a higher likelihood of beneficiary visits on product distribution days (i.e. of dry rations, eggs, money for uniforms, and vaccines). They felt that this occurred due to the beneficiaries' perception of an AWW as a source of benefit and the belief that they should receive a tangible benefit for their time. AWWs often mentioned that while giving counselling messages during home visits, the beneficiaries said: "*you do not give us anything and keep telling us the same things*".

In the past, AWWs provided tea and snacks for beneficiary women and their children during group counselling sessions at the AWC. However, the SWD cut the budget for refreshments (per month Rs. 200 ($3). Once the refreshments discontinued, it became difficult for AWWs to convince women to attend group counselling sessions. The beneficiary women showed their disinterest by responding to AWWs' request to attend meetings as "*you call us and do not even give us 'nashta–pani' (tea and snacks)*". Consequently, fewer beneficiaries attended the sessions. A few AWCs even discontinued the sessions due to the lack of the budget and beneficiary interest. This adds further elaboration to the claim that beneficiaries showed a preference for the product–oriented services over information–oriented services. In the below quote an AWW eloquently explains the beneficiary preference for the product–oriented services.

> *"We do not need to tell them much the day we distribute egg, rice or dress. The day money is distributed; there is no need to tell more than once. However, on the day of Mahila Mandal (group counselling) and immunisation, we have to call them several times. Some lie and say that they cannot come they have to go somewhere. We feel very bad, and many times we get angry as well and say that "on the day of distribution you all come running. When we call you to tell something, then you all don't come".*
>
> *(AWW Interview)*

In comparing the two product–oriented services (food and vaccines), AWWs felt a minority of beneficiaries needed further convincing to take up immunisation. The hesitant minority were either persuaded to take up immunisation by using the food as an incentive or via the help of external monitors[53]. Pre-school services, predominantly an information-oriented service is linked

[53] On the day of immunisation or during special immunization drive, external monitors, i.e. officers from the health or the ICDS departments visit the AWCs.

to a product i.e. food in the form of daily hot cooked meals. Interviewed AWWs perceived that children, as pre-school beneficiaries, also showed a clear preference towards the product component of the service. On days without food (due to lack of supply from the state), all AWWs said that the daily attendance of children fell. The type of food also influenced children's attendance. For example, children showed clear preference towards eggs, *Halwa*, and *Rasiya*. On days of egg distribution, more than forty children turned up.

Even when the food was not available, AWWs reported that they provided pre-school teaching. A few AWWs stated that they even distribute biscuits and toffees by themselves to keep children interested in the pre-school activities on days without food. Although this could be due to strict supervision, detailed exploration revealed another type of preference. This preference stemmed from AWWs' preference towards the pre-school service. The majority of AWWs self-identified themselves as teachers. AWWs stated that they liked pre-school services the most, as it gave them the status of a teacher for children. A teacher's job remains as an available, achievable and respectable position for educated women in villages. Moreover, 'pre-school teaching' remained as the most visible role of an AWW in the village setting as people often referring to the AWC as the 'school for small children'. In the interviews, the majority of AWWs added that they had always aspired to becoming teachers but were not able to get positions as teachers. The below quote by an AWW who used to be a literacy programme facilitator is a good example revealing the initial aspiration to become a teacher:

> *"What else could I do, I filled the form here and got selected. I came for teacher only. Later on, when the vacancy came for a teacher's post, I was short of money[54]."*
>
> *(AWW Interview)*

To conclude, the perception that beneficiaries have a preference for product-oriented services has a mixed influence on AWW performance. This encourages the AWWs to make product–oriented services such as food distribution, immunisation and pre-school accessible and hinders the provision of information–oriented services like home visits and group counselling sessions. AWWs also prioritise pre-school teaching due to their self-identity as teachers.

Work environment

In this section, I summarise the influence of various work environment factors such as workload, honorarium, supervision, and resources on AWW performance.

[54] This quote also evidences the corruption practices in selection and recruitment (discussed in 4.3.4).

Workload: AWWs commonly viewed themselves as an overburdened workforce. In the interviews, AWWs frequently compared their responsibilities to other occupational groups that served the village population such as ANMs, teachers, and village government officials. Based on this comparison, AWWs often felt that they had to undertake a disproportionate amount of the total work in the community whilst also tending with frequent additional requests to undertake work that was not part of their job description. For example, AWWs were often asked to undertake work such as surveys for government departments, facilitate health smart cards for Below Poverty Line (BPL[55]) families, facilitate the formation of self-help groups, mobilise communities to participate in elections, and undertake official duty on the state or national election days.

> *"[……] we do feel that we are the only ones who are burdened with all the work. We have been made a multi-purpose worker. The entire load comes to us. In a village, AWW is there, then the ward members, the village head, ASHA, ANM, doctor, BDO, CEO, etc. However, the entire burden is on us only".*
>
> *(AWW Interview)*

The majority of AWWs I interviewed felt overburdened and emphasised that the high workload demotivated them and influenced job satisfaction, especially as they felt that the government did not pay them an adequate wage for their effort.

Honorarium: All interviewed AWWs discussed low and delayed honoraria as a major demotivating factor in the work environment. There were two ways in which low honorarium induced demotivation.

Firstly, AWWs considered the honorarium as a proxy for the government's respect towards them. Despite being an educated workforce, they complained that their pay remained lower than the daily wage rate of casual manual labourers. Under the National Rural Employment Guarantee Act (NREGA), a casual manual labour receives Rs. 167 per day ($2.5) for a maximum of 100 days of employment. In the case of AWWs, the monthly (average 25 days per month) honorarium is Rs. 3000 i.e. Rs. 120 per day ($45 per month, $1.8 per day). In one of the interviews, a graduate AWW who serves a predominantly Muslim community questioned the disparity between the AWW wage and local labour market wage and voiced her demoralisation in the below quote. She said:

[55] The BPL targeting in India is a controversial method of targeting to identify the beneficiaries of social welfare schemes such as the PDS (Drèze & Khera, 2010). The 'BPL' families are identified through a BPL census. They receive a 'BPL' card to collect grains from the PDS.

> *"These days, a labourer also brings Rs. 200 in the evening as a day's wage. Are we not worth more than a labourer? Are we not worth being a labourer even after doing graduation? We were sad when we did not get increment this time. This hurt not only me but all the Sevikas[56]".*
>
> *(AWW interview)*

AWWs' demotivation was aggravated because they have not received any increment in their pay since 2009. In the expenditure sharing agreement between the state government and the central government to implement the ICDS, the latter contributed towards the honorarium of AWWs. The central government has not revised the honorarium (i.e. Rs. 3000 per month) since 2009. Though the state promised to raise the pay by 25% as an additional contribution from the state budget, it has not materialised so far[57]. This caused loss of trust between the AWW and the state government and stirred the state–level strike that AWWs participated in a few weeks before the interviews[58]. Moreover, AWWs also received their monthly honorarium with three to four months of delay. The lack of financial liquidity and predictability also added to their demotivation.

Secondly, AWWs felt the provision of immunisation service to be an activity outside their responsibility. This perception arose because the ASHAs receive performance pay for immunisation and AWWs do not. After the introduction of ASHAs, AWWs were introduced to the concept of performance pay based on outcomes. From 2007—2012, both ASHAs and AWWs used to receive performance pay for immunisation as part of the Muskan-Ek-Abhiyan[59] programme (Goel et al., 2012; Kosec et al., 2015). Although the performance pay for AWWs got discontinued after the completion of Muskan-Ek-Abhiyan, the incentives for ASHAs continued as the ASHAs are completely dependent on performance payments. A quote from an AWW confirms the discontinuation of the payment:

> *"[…] like earlier we used to get something extra for doing immunisation but now we do not get anything."*
>
> *(AWW Interview)*

AWWs and ASHAs, two village–level female workers, working together in the same village towards similar goals can naturally compare their payment packages. Interestingly, none of the

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[56] Hindi term for AWWs

[57] Announced by the Chief Minister of Bihar before the state elections in October 2015 (http://bssc-bihar.in/bihar-sevika-salary-anganwadi-sahayika-salary-25-increase/)

[58] Discussed in Chapter 3.

[59] In October 2007, a special campaign called Muskaan Ek Abhiyan (The Smile Campaign) was launched under National Rural Health Mission to give a fillip to the immunization program. The programme incentivised AWWs and ASHAs to support the immunization activities (Goel et al., 2012).

interviewed AWWs perceived that the ASHAs received better payment than them. In absolute terms, they felt demotivated due to the discontinuation of the performance payments for immunisation.

Thus, the feeling of not being valued by the state government due to the inadequate honorarium (in both absolute and relative terms), the unreliable timing of honorarium payment, and the discontinuation of performance pay negatively influenced AWW motivation and self-esteem.

Supervision: The interviews with AWWs suggest that, when the departmental supervisor(s), external monitors and community monitoring group[60] members provide supportive supervision (i.e. help the worker in convincing reluctant beneficiaries to vaccinate their children, explain monitoring checklists, formats, and registers, and help with the THR distribution) the AWW appreciates the support and feels that the assistance enables her to fulfil her responsibilities. This in turn positively influence her motivation and delivery of overall services.

The departmental supervisors visited them once a month, external monitors paid random visits during immunisation drives or polio rounds, and community monitoring members were supposed to be present during the monthly food distribution days.

In a few cases when the AWW receives supervision that functions more as auditing and is hierarchical, the supervisor–supervisee relationship gets disturbed and negatively influences an AWW's motivation and the access and quality of overall services. An AWW recollects how a supervisor's behaviour evoked fear and damaged the purpose of providing feedback or task assistance:

> *"What a voice she [supervisor] has! [...], if there was a mistake she used to explain in such a bad manner […]. If there is a person, who has such a voice that one would fear and think that if one has to ask something then how should we ask?"*
>
> *(AWW Interview)*

The demotivation increased especially when supervisors were acting as a channel for organisational corruption (i.e. when a supervisor takes a share from the money that AWWs are meant to use to procure food for beneficiaries—discussed in a later section). Giving a share of money to the supervisor directly affects an AWW's ability to adhere to food distribution guidelines. Some AWWs reported experiencing corrupt practices more from their departmental

[60] Community monitoring groups are formed in the catchment area to monitor the THR process and to conduct the social audit of the AWC bi-annually or annually. Community monitoring group members are volunteers from the catchment area.

supervisor than from external or community monitors. However, a few AWWs mentioned that community monitoring group members ask for a share of food during the food distribution.

Resources: The interviews with the AWWs suggest that, three types of resources influence an AWW's performance: human, material, and financial. Table 11 summarises findings with regard to different resources and how these factors influence AWW performance.

Table 11 Summary of work environment resource factors

Work environment factor: Resources	Sub-factors	How these factors influence performance
Human	Anganwadi Helper	Positively influences performance by helping to improve the access and quality elements of pre-school service
Material *Supplies*	Erratic availability, inadequate quantity, and low quality of rice supply	Negatively influence performance by demotivating the AWW and impacting on the access and quality elements of food distribution
Job aid	Job aids such as immunisation due-list register	Positively influences the quality element of immunisation service by helping the AWW to adhere to guidelines
Infrastructure	Lack of building	Negatively influences AWW motivation and performance by influencing the access and quality elements of pre-school teaching
Financial	Inadequate and erratic funds (for food and uniform)	Negatively influence AWW motivation and performance by causing rifts in the community and affecting the access and quality elements of food distribution and pre-school

The only additional human resource support to the AWW is the Anganwadi Helper who cleans the AWC, prepares food, and brings the children to the AWC. A few AWWs reported that absence of the helper in previous circumstances overburdened them. Thus, the presence of helpers seems to influence AWW performance by helping to improve the access and quality elements of pre-school services.

Interviewed AWWs highlighted how constraints in material resources such as supplies and infrastructure negatively influence their performance.

Regarding supplies, the erratic availability, inadequate quantity, and low quality of rice supply influence an AWW's ability to deliver the service as prescribed by the guidelines. The issues of rice supply negatively influence the access and quality elements of food distribution. The erratic availability of rice negatively influences children's attendance at the AWC. The availability, quantity and quality issues regarding rice supply also strain the AWW's relationship with the community because people frequently suspect that the AWW deliberately avoids the distribution food as stated by one AWW:

> *"[….] Sometimes there are lapses in the supplies. Our children come to the AWC bringing their plate and ask "Didi, will there be food today?'. I feel bad when there is no food because they go back without eating. The women in the village fight with me sometimes when we are unable to deliver food because of no availability."*
>
> *(AWW Interview)*

According to the interviewed AWWs, they are given roughly two quintals of rice[61] per month. A majority of AWWs reported that they receive less than the required quantity of rice. This meant that they distribute less than the required amount of rice per beneficiary. AWWs also held a view that the quality of rice they received varied—sometimes the rice is old, broken, and with stones. AWWs are often asked by their supervisors to 'manage' these limitations. The erratic availability, inadequate quantity, and low quality of rice negatively influence an AWW's motivation and directly impact on the access and quality elements of AWW performance outcomes.

In the interviews, AWWs pointed out that the AWC infrastructure, especially the unavailability of AWC buildings with a kitchen area (especially the space to set up a stove), storage (to store food items, utensils, registers, and teaching aids), and water facilities (for cooking and cleaning children) affected their workload and further influenced their motivation and the quality of pre-school services. AWWs who use communal spaces in the villages due to the lack of infrastructure (AWC building) faced difficulties in freely interacting with children. Use of the communal space (e.g. community halls) for several AWWs meant that the worker frequently had to deal with anti-social behaviour and harassments by drunkards, continuous damage to the mud stove and offensive wall graffiti. This negatively influenced the motivation of AWWs and the quality of pre-school services.

The majority of AWWs filled registers for different services as required documentation. AWWs use immunisation due-lists to keep track of age-appropriate immunisation for children. Based on children's date of birth, they prepare immunisation due-lists for monthly immunisation days. Unlike other registers which they felt were filled to show that they were carrying out their tasks, the immunisation due-lists were mentioned by AWWs as a register that helped them. It helped them to identify children for age-appropriate immunisation. Thus, the immunisation due-list

[61] It is the required amount (2 quintals and 50 kilograms) for THR and hot cooked meals at the AWC. Every day AWWs instruct the Anganwadi Helper to cook for 40 children 3 to 6 years of age (i.e. the maximum number an AWW needs to cater to for that age group). On THR days, an AWW delivers 3 kilograms of rice and 1.5 kilograms of lentils to 8 pregnant women and 8 lactating mothers. Out of the 40 children between 6 months to 3 years, AWWs distribute 2.5 kilograms of rice and 1 kilogram of lentils to 12 severely malnourished children and 4 kilograms of rice and 2 kilograms of lentils to 28 malnourished children.

register acts as a job aid for the worker to adhere to guidelines, and therefore enhances the quality of services.

AWWs receive two types of financial resources—a) a monthly fund (Rs. 11,000/ $165) to procure and distribute food except for the rice (inclusive of transport allowance) and b) an annual uniform fund (Rs. 250/ $3.75) per child) to distribute among forty preschool children. The monthly fund to procure and distribute food is pre-fixed i.e. the government budgeted a certain amount of money for each of the raw material such as *Dal* (lentil), vegetables and eggs. The predefined *Dal* price given to the AWW is Rs. 55 per kg. However, the market rate during the fieldwork was Rs. 80—90 per kg and sometimes even higher. To cope with inflation, the AWW distributes less quantity (in the case of dal) to beneficiaries. They explain this to the community by pointing them to the current price. For example, a severely malnourished child should receive four kg of rice and two kg of dal. In reality, the worker only distributes less than four kgs of rice and Rs. 110 worth of *Dal* i.e. the money she receives for two kgs. As in the case of supplies, erratic availability and inadequacy of funds due to inflation negatively influence AWW's ability to deliver food grains to a required number of beneficiaries with required quality.

In the case of uniform funds, the money given for forty children per AWC (i.e. targeted to a fixed number) creates rifts with the community. The community demands uniform money for all children in the family, and this clash of expectation has caused even episodes of physical fights with AWWs and community members (in two cases). Thus, the targeting of funds to distribute among beneficiaries also adversely affects the AWW motivation and performance.

4.3.3 Community factors

Caste dynamics

As described in Chapter 1, in India, different caste groups are categorised into caste categories for administrative purposes (see Box 1 in Chapter 1). This categorisation necessarily reflects a traditional hierarchy. For example, that there are 'higher caste' groups such *Brahmans* and *Kshatriyas* that are categorised in the 'General' category; a group of the traditionally most excluded castes and tribal peoples categorised respectively as SC and ST, and those in between, the OBC. These are categories reflecting historical disadvantages and are important for various measures of redressal such as quotas for state education and employment. These caste categories are very broad, and within them, caste groups are perceived to be hierarchically organised. For example, although *Paswan* and *Ravidas* belong to the SC category, *Paswan* is seen as a higher caste group than *Ravidas*. In the rural social structure of Bihar, caste is a crucial factor.

In a few interviews, caste dynamics between the AWW and community, and discrimination towards the AWW, emerged as factors influencing AWW performance.

Caste dynamics of the AWW and community: AWWs serve communities with multiple caste groups who geographically live in separate hamlets. In two cases, where the AWW belongs to a higher caste than the predominant community caste, the caste dynamics explicitly influence the AWW's motivation and the access to and quality of services. Due to the targeting of the material and financial resources, AWWs find it hard to satisfy any caste, and this has led to physical violence between the AWW and the community. The hostile environment caused by physical violence interrupts the overall functioning of the AWC and delivery of services. For example, in one of the cases where an AWW belonged to the OBC and worked in a predominantly SC (*Manjhi*) hamlet; she faced conflicts with *Manjhis* and other higher caste groups (*Rajputs, Yadavs*). Due to the strict ceiling for food and other material benefits (uniform money for children), she could not either cover all *Manjhi* families or all from other caste groups. This led to perceptions of bias, physical violence episodes and created a hostile environment prohibiting the worker from doing her job.

> *"[…..] Villagers are trying hard to throw me out. They say that someone else should come at my place. Rajput people do not like a poor person working like that, and think that I should be thrown away just like that……..*
>
> *[…..] They think, and the villagers tell me, to distribute the things among the people of my caste (general caste) only. However, whatever I am getting, that is not sufficient for them. If I am getting things for eight pregnant women, then 14-15 pregnant women would come for it. Now they say, forcefully that give us the Poshahar (supplementary food) else give us money. Villagers only say such things".*
>
> *(AWW Interview)*

Caste discrimination: AWWs who belong to a lower caste group than the majority of the community faced caste discrimination from the community. In one of the cases, an AWW faced physical violence, and the community members prohibited her from using the AWC premises and caused overall service delivery disruption. In one example, the AWW belonged to the SC but a lower caste sub-group (*Ravidas*) compared to the majority of the community which were also SC, but a higher caste sub-group (*Paswan*). A quote from the interview suggests that the conflicts started right from the recruitment stage. Furthermore, the worker was banned from running the centre and faced physical violence multiple times.

AWW: Yes, then people came and said... I cannot do flag hoisting [on the Republic Day celebrations], they beat my husband and me, but some people said you do the flag hoisting.

Interviewer: What was the reason for beating you again? [This was the third time she reported the incidence of violence during the interview]

AWW: This is a Paswan Tola. When the recruitment happened, a Ravidas was chosen. I belong to Ravidas. Those people said that in a Paswan tola only a Paswan could be there not a Ravidas. "Paswan is cooking, and a Chamar (Ravidas) is sitting in the chair… so this is what they said regarding the recruitment.

(AWW Interview)

Seasonal migration

In the community context, seasonal migration by low income and lower caste groups during the monsoon months emerged as a factor negatively influencing AWW performance. Many low-income families migrate to brick kilns[62] every year for a few months. Seasonal migration was perceived as a challenge to the AWW as it complicated the delivery of food and other benefits. The strict demarcation of the AWC catchment area and ceiling on food distribution meant that when a family migrates out, they are no longer eligible to receive the food. In that case, AWWs replaced them with other families. However, when the low-income families return from the kilns, they needed to be re-introduced to the list and these created frictions in community dynamics. The friction happens because the families who get removed from the list fight with the AWW.

In another case, one AWW recollected from her experience that the health and nutrition situation of women and children had deteriorated when they come back from the kilns. This meant that an AWW's responsibility increased as children from families returning from seasonal migration often had poorer nutritional status (due to poor living conditions in brick kilns) and consequently needed more support from the AWW:

"Now lots of them are going to brick kilns in a month; all have taken 50,000 from the contractors as loans. They are blowing it up on chicken and alcohol.

[62] According to the latest data by the Mining Department, the district of Gaya has the highest number of brick kilns in Bihar. The data showed that the district of Gaya has 489 functional brick kilns in the year 2016-17 whereas the second highest, Patna, has only 388 (http://mines.bih.nic.in/Brick-Kilns.htm). These brick kilns hire laborers for a few months continuously after the monsoon season and the laborers often migrate to the kilns with their families during the work. A few studies have reported the exploitative labor relationships and low living conditions of laborers, especially women and children on the brick kiln sites in the Bihar and Jharkhand states (Saran & Sandhwar, 1990; Shah, 2006).

> *By the time, they go, they finish it all up. There they will drink, work, fight and repay- that is the situation. There is a wife of Paswan. I could not believe that she would survive. She had no strength in her body. Like that, she came back from brick kilns. She was admitted in that state. She also gave birth to a small daughter while she was there. People could not believe that she would survive seeing her state. Her mother in law and father in law fed her, and she regained health. Now again she has taken money to go to the brick kiln. What is the solution for this?".*
>
> *(AWW Interview)*

The seasonal migration of low income and caste groups is also a proxy for the low economic condition and poverty in the community. Seasonal migration acts as a barrier for the AWW to identify the most deserving beneficiaries for food entitlements, thus directly influencing her ability to adhere to guidelines in choosing beneficiaries—one element of the AWW performance outcome.

4.3.4 Organisational factors

Corruption

An organisational factor that emerged as a factor influencing AWW performance is corruption. I categorised corruption as an organisational factor because the interviews with AWWs suggest that it is a broader organisational phenomenon rather than an ICDS specific one.

Both institutionalised and individualised practices of corruption influence AWW performance. AWWs stated examples of institutionalised corruption as bribes during the selection process to increase the chance to be selected as AWW, monthly fixed cuts to supervisors, pilferage of rice from sacks before it reaches the AWC, and fraudulent reporting.

A few AWWs disclosed that they had given money to intermediaries (middlemen*)* during the selection process to get the job and that they pay a monthly cut (Rs. 500 to 2000) to supervisors, which they understand, is shared with others in the ladder of hierarchy. AWWs pay monthly cuts from the financial resources they receive to procure and distribute food. AWWs also indicated that they received less than the required quantity of rice per sack (35–40 instead of 50 kgs) because there is pilferage during the transport to AWCs. Receiving less than the required quantity meant not distributing the mandated food entitlements to beneficiaries. However, AWWs are forced to report that they have distributed the required quantity. AWWs felt demotivated facing these corruption practices. These institutionalised forms of corruption negatively influence

AWWs' motivation and force her to not adhere to guidelines on distributing food entitlements. Thus, they contribute to a direct and negative impact on the AWW performance.

In the below quote, an AWW elaborated on the deep-rooted, bureaucratic corruption practices. The same AWW also paid a bribe through a middleman to get the job.

> *When the CDPO joined here, she was very strict and no one had courage to talk to her. No one had the courage to keep the Centre closed or to not work but within 2 months she showed her true face. […] She was so strict. But gradually when she settled here then her real face came out….only about money. I am telling you the reality about Anganwadi. Everybody right from the top to bottom is after money in Anganwadi. At every step. Everything is only for the sake of money and whether anything is done or not they should get the money. From top level, if 10 are given then it becomes 2 while coming down to us. Step wise, people are sitting there to make money and that's why Anganwadi has a very bad reputation. That's why if you ask a common person that what does she get from Anganwadi, I am Sevika I will tell you, but you will see how she hate us or complains about us. We are also helpless because we cannot give them what we are actually supposed to give. We are giving them whatever we are getting. If we don't give money to our officers then there would be daily clash, explanation (Spastikaran) demanded etc. What can we do, it is under compulsion. What choice do we have but to follow the same. Supervisors come while I am working, I have already met the CDPO but now she also wants her share.*
>
> *(AWW Interview)*

Another AWW describes how she manages the pilferage of rice and adhering to distribution guidelines:

> *"To distribute take-home rations, we have selected five women. We have to distribute in front of them. Then at the time of distribution, we call the Mukhiya[63] and make him sit in front. There is no problem in that. After that in front of him we keep all the things and tell him and the people the situation that we have received less rice, […] However, here we will write in this that we have given 4 kgs, and you will have to sign. It is the intention of the government to cheat or not to cheat, but you have to cheat. Here we will write 4 kgs, and you will have to sign for 4 kgs. However, in the other register, we write that we have received 228 kgs whereas we have received only 170 kgs".*
>
> *(AWW Interview)*

[63] Hindi term for village headman.

The individualised form of corruption practised was by the AWWs themselves. A few AWWs disclosed that they use the THR rice and lentils for their home use. Although AWWs defend their act of pilferage as a 'consumption smoothing' activity due to low and delayed remuneration, it can negatively influence the AWW performance outcomes— by not adhering to the quantity guidelines and not make the required amount of food entitlements accessible to the target number of children.

> *"How do we give? We give 4 kg and 2 kg to severely malnourished. 3 kg and 1.5 kg has to be given to pregnant women and lactating women. 2.5 kg and 1.25 kg has to be given to malnourished children. We give a little bit less to women because it is not possible to manage in Rs. 3000. So when we give a little less to women, we get something for ourselves at the house as well. Also, Sahaika[helper] is there, so a little bit is given to Sahaika [helper] as well. We get money in 4-6 months, so she says that how will I purchase? She gets support in the way of pulse and rice from Anganwadi. So we do not purchase pulse and rice, we eat from it and rest we eat on credit. Rest, we pay the money of Rashan [food distribution] storekeeper when we get our money".*
>
> *(AWW Interview)*

Although the AWWs admit to the practice of corruption institutionally and individually, they do not seem to take bribes from their programme beneficiaries. However, the interviews suggest that the beneficiaries are aware of the practice of corruption. The beneficiaries' perception that AWWs participate in corruption adversely affects the AWW's image in front of the beneficiaries and strains the relationship as well.

4.4 Discussion

One of the main aims of my qualitative research focused on understanding *what* and *how* individual, programmatic, community, and organisational factors influence AWW performance by capturing a deeper understanding of an AWW's lived experiences as a village woman and as a programme worker. I found the following factors as influential in AWW performance: individual factors including initial financial motive and family support; programmatic factors including beneficiaries' and AWW's service preference and work environment; community factors including caste relationship of AWWs and the community and seasonal migration; and organisational factors including individualised and institutional corruption. The findings are summarised in Table 12.

Table 12 Summary of findings: factors influencing AWW performance

Factors	Sub-factors	Does the factor affect outputs? (Yes/No)	Which outputs are affected?	Which services are affected?	Does the factor affect outcomes? (Yes/No)	Which outcomes does the factor affect? (Access, quality or both)	How does the factor affect? (Positive or negative)
Individual	*Initial financial motive*	Yes	Motivation	All job	No		
	Family support	No		Food distribution	Yes	Access	+
Programmatic	*Service preference of beneficiaries and AWWs*	Yes	Motivation	Food distribution	Yes	Access	+
				Immunisation	Yes	Access	+
				Pre-school	Yes	Access	+
	Work environment Workload	Yes	Motivation Job-satisfaction	All job	No		
	Honorarium	Yes	Motivation Self-esteem	All job	No		
	Supervision	Yes	Motivation	All job	Yes	Access Quality	+/–
	Resources Human: helper	No		Pre-school Food distribution	Yes	Access Quality	+
	Material: supplies	Yes	Motivation	Food distribution Pre-school	Yes	Access Quality	–
	Material: job aid	Yes	Skills and knowledge	Immunisation	Yes	Access Quality	+
	Material: infrastructure	Yes	Motivation	Pre-school Food distribution	Yes	Quality	–
	Financial	Yes	Motivation	Food distribution	Yes	Access Quality	–
				Pre-school	Yes	Quality	–
Community	*Caste dynamics of the AWW and community*	Yes	Motivation	All job	Yes	Access Quality	–
	Seasonal migration	No		Food distribution	Yes	Access	–
Organisational	*Corruption*	Yes	Motivation	Food distribution	Yes	Access Quality	–

The conceptual framework on AWW performance (presented in Chapter 2) envisages that the individual, programmatic, community, and organisational factors are determinants of performance. These determinants of performance are interdependent and lead to improvements in outputs such as working conditions, motivation, job satisfaction, accountability, and AWW's skills knowledge, and attitudes. These outputs further lead to effects such as improved productivity, competence, and responsiveness of the AWWs and lead to performance outcomes at AWW level i.e. improved access and quality.

The findings of this chapter confirm the interdependence of factors that influence AWW performance envisaged by the conceptual framework. The interdependence of factors are visible within categories and between categories. For example, I categorised the 'preference of beneficiaries and AWWs' as a programmatic factor; however it is a good example of programmatic and community contexts interacting with each other and their dynamics influencing AWW performance. Another example of an interdependent factor is caste. The conceptual framework on AWW performance classified 'social class' of the AWW as an individual factor. However, the findings suggest that caste influenced AWW performance due to caste dynamics of the AWW and the community, which makes it more of a community factor than an individual or programmatic factor.

The conceptual framework on AWW performance also provides a summary of factors that have been identified to influence the performance of workers such as the AWWs. Some of the factors I discussed in this chapter as influential on AWW performance were present in the framework, and others in the framework did not arise in my findings. I also found newly emergent factors that influence AWW performance not identified in the literature, and hence were not in the framework (see Table 13).

Table 13 Comparing the factors found in the framework and in my research findings

Framework	Findings	Individual	Programmatic	Community	Organisational
Yes	Yes	Initial financial motive	Work environment: Workload, Honorarium, Supervision, Resources	Caste dynamics	None
No	Yes	Family support	Service preference of beneficiaries and AWWs	Seasonal migration	Corruption
Yes	No	Age, education, experience, wealth, attitudes, skills and knowledge	Services (nature, time, clarity) Quality assurance (Monthly reporting and community monitoring) Interdepartmental links (convergence with peers; relationship with health department) Work environment (selection and recruitment, training)	Socio-cultural factors (social norms and gender roles) Safety and Security Education levels of the community Community's economic status Geography and distance	Political commitment and policies related to AWWs

In comparing the factors listed in the framework and in this chapter, I find four sets of newly emerged factors – i) family support (individual factor); ii) perceived service preference of beneficiaries and AWWs (programmatic factor); iii) seasonal migration of low-income families (community factor); and iv) corruption practices (organisational factor).

Family support: Although a couple of studies have reported the influence of household duties on community-level workers' performance, the role of family on daily job responsibilities is often underexplored (Alam et al., 2012b; Olang'o et al., 2010). The family support, which emerged in the AWW context as influential in their performance, offers a deeper understanding of the interaction between her personal and professional worlds and demonstrates that the blurring of this boundary is often a coping strategy of the AWW. The finding also highlights that, beyond directly helping the AWW, the family's income needs have shaped her motive to take on, and then continue with, the job even if she is demotivated.

Preference of the beneficiary and AWW: The AWW perception of beneficiary preference towards product-oriented services and individual preference rooted in her self-identity as a pre-school teacher offers unique empirical understanding on how an AWW manages her diverse service delivery basket and her latent biases towards certain services. Although a few studies have pointed out the identity clashes that AWWs feel, i.e. pre-school teacher vs. nutrition worker, the findings of this chapter contribute a rich analytical account of how her self-identity as a pre-school teacher augments her motivation and favours the delivery of pre-school and food distribution to encourage pre-school attendance services, but impedes the delivery of information-oriented counselling services (Gupta, 2001, 2012). This finding highlights the unique ways in which beneficiary preferences for product-oriented services significantly shapes an AWW's performance. It also underscores that beyond the skills and knowledge of a worker, beneficiary preference is also a critical determinant of performance.

Seasonal migration: The finding on the influence of seasonal migratory patterns of low-income households on AWW performance could be argued as a unique feature of the local Bihar context. However, migratory patterns induced by seasonality, poverty, conflict, and calamity increasingly exist in many geographical and programmatic settings. The community-level workers are primarily tasked to reach out to the community members and groups who are excluded by the formal systems (Lewin et al., 2010). Hence, this finding seeks to contribute towards providing a better understanding of the relationship between meta factors such as migration on worker performance by explaining how seasonal migration in the AWW context influences her performance.

Corruption: The topic of corruption—its different forms, nature, and mechanisms– are more widely discussed in the fields of political sciences, economics, anthropology, and sociology than in public health. At the start of my thesis (and until now), the studies that examined the performance of community and facility-based health workers did not identify corruption as a factor that could influence performance[64]. Although they recognised that factors within the formal health system policy and practice are influential on performance, the dynamics of bureaucratic practices and politics is often considered as part of the local context and remains inadequately explored. The findings of this chapter emphasise that individual and institutional corruption hampers the performance of AWWs as they use the food items themselves or give a share of the financial resources to their supervisors. In addition to providing novel empirical evidence of the relationship between corruption and AWW performance, this finding contributes towards a deeper understanding of the embeddedness of corruption in community-level health and nutrition service delivery.

The findings which resonate with the existing literature are–i) initial financial motive (individual factor); ii) work environment factors (programmatic factor) and iii) caste dynamics of the AWW and the community (community factor). Although I consider the caste dynamics as an existing factor identified in the literature, so far only a few studies have studied it in the Indian CHW context. Hence, the findings of this chapter will be an important contribution towards understanding the influence of caste on the performance of workers such as the AWW.

AWWs consistently reported their current low honorarium and high workload as sources of demotivation. The literature on CHW performance also confirms this finding that high workload and low and irregular financial incentives negatively influence CHW motivation (Alamo et al., 2012; Burn, 2008; Callaghan-Koru et al., 2012; Ge et al., 2011; Gusdal et al., 2011; Javanparast et al., 2011; Kalyango et al., 2012; Kebriaei & Moteghedi, 2009; Kok & Muula, 2013; Lewis, 2010; Medhanyie et al., 2012; Perez et al., 2009; Puchalski Ritchie et al., 2012; S. M. Rahman et al., 2010). The low honorarium of AWWs has been discussed as a crucial constraint for AWWs in the ICDS literature as well (Biswas & Verma, 2009; HUNGaMA, 2011; Nayak & Saxena, 2006; NIPCCD, 2009a, 2009b; Saxena & Srivastava, 2009). The importance of the honorarium for AWWs as a key source of household income runs against the original design of the ICDS which is predicated on a voluntary worker with a strong moral motive who receives an honorarium.

[64] A few of studies on the ICDS have highlighted practices of corruption in the ICDS, but did not report evidence for it or explore its relationship with AWW performance (Diwakar, 2014; Drèze, 2006; Faker et al., 2012; Akhil Gupta, 2001, 2012, NIPCCD, 2009a, 2009b; Planning Commission, 2011; Sinha, 2006; Sundararaman, 2006; Verma et al., 2017).

Many studies reported supervision (availability, frequency, and location) to be important to increase CHW performance. However, due to unavailability of details of the supervision structure and its implementation these studies could not examine the influence of the nature of supervision on CHW performance (Amare, 2009; Callaghan-Koru et al., 2012, 2013; Chanda et al., 2011; Gusdal et al., 2011; Hill et al., 2008; Javanparast et al., 2011; Kok & Muula, 2013; Lewis, 2010; Martinez et al., 2008; Moetlo et al., 2011; Nsabagasani et al., 2007; Perez et al., 2009; Puett et al., 2013; Rowe et al., 2007; Simwaka et al., 2012; Smith et al., 2013; Suri et al., 2007). Although the same limitations apply to my research, the mixed influence of supervision on AWW performance discussed in this chapter augments the existing evidence on supervision and performance. It extends the understanding on how the nature of response AWWs receive from supervisors constructively or adversely affects their performance.

The negative influence of the lack of supplies, infrastructure, and financial resources and positive influence of job aids such as immunisation due-lists corroborate with the existing empirical evidence. The global literature on CHW performance suggests that job aids are often reported as facilitating CHW performance, while lack of supplies is often reported to hinder CHW performance (Gill et al., 2012; Hamer et al., 2012; Javanparast et al., 2012; Lemay et al., 2012; Rowe et al., 2007; Sadler et al., 2011). Resource constraints in the ICDS are also well-evidenced in the ICDS literature as a factor negatively influencing the functioning of AWCs (CBGA, 2011; Dasgupta et al., 2012; FOCUS, 2006; HUNGaMA, 2011; Nayak & Saxena, 2006; NIPCCD, 2009a, 2009b; Planning Commission, 2011; RSOC, 2014; Saxena & Srivastava, 2009). Thus, the negative influence of the lack of supplies, infrastructure, and financial resources and positive influence of job aids such as immunisation due-lists are in line with the existing empirical evidence.

Training —categorised by the conceptual framework as a work environment factor—did not emerge from the AWW interviews as a factor they perceived as a facilitator or barrier in their performance. Although I found it surprising, a study by (Kosec et al., 2015) in Bihar also confirms this. They found that training was not a significant predictor of delivery of product-oriented services (Kosec et al., 2015). However, they take a cautionary approach by attributing it to the historically poor record of supervision and training in rural India.

As discussed earlier, a few studies examined the influence of caste on the working of ASHAs and AWWs (Abbott & Luke, 2011; Srivastava et al., 2009). The four studies that examined caste in the ICDS context as a factor in achieving inclusive service delivery support the finding of this chapter (Borooah et al., 2014; Gill, 2012; Mander & Kumaran, 2006b; Thorat & Sadana, 2009). These studies did not look at how caste influences AWW performance; instead, they discussed the role of caste in shaping the service delivery experience of the provider (AWW) and the beneficiary

(community members). The findings presented in this chapter clearly demonstrate the relationship between caste and AWW performance. These show the intricate ways in which caste dynamics operate in the AWW context. These also demonstrate how inclusive service delivery is hampered at the village settings due to physical violence induced by caste dynamics.

In addition to contributing newly emerged factors towards the empirical literature, some other contributions and themes also emerge from the findings of this chapter.

Firstly, the findings inform towards a better conceptual understanding on performance. The majority of the public health and nutrition literature on worker performance assumes that factors that influence performance affect through improving outputs (e.g. working conditions, motivation, job satisfaction, accountability, and worker's skills, knowledge, and attitudes). The factors identified in this chapter also seem to affect outputs such as motivation, job satisfaction, self-esteem and skills and knowledge of the AWW (see Table 12). However, these findings question the strength of the linear relationship between outputs and outcomes. Some factors affect outcomes without affecting outputs (e.g. family support, helper, and seasonal migration). Some factors affect outputs without affecting outcomes (e.g. initial financial motive, high workload, and low honorarium). Although the majority of factors affect both outputs and outcomes, the relationship does not seem to be linear.

Secondly, these findings also challenge the assumption that pervades the literature that motivation is one of the main drivers of performance outcomes. This chapter's findings argue that, whilst among AWWs demotivation is a strong feeling, it is the initial financial motive to take up the job which retains them in the job. However, it is evident that the financial motives of AWWs are not fully satisfied by their honorarium. The findings also show alternate ways in which AWWs satisfy their initial financial motives (e.g. by consumption smoothing using the ICDS financial resources and supplies of food). It is the combination of the initial motive of the worker (the need to retain the job for financial needs rooted in family income needs) with the community's expectations (for a product-oriented services) which ensure continued efforts even when her motivation is low. The main constraints to performance (outcomes) are factors outside of her control. These include unavailability of programmatic resources (means to do her job) and community demand for her services (the opportunity to do her job).

This research is limited by several factors. First, the interviews were conducted by myself and the female research assistant; hence there are possibilities of interviewer biases. However, we worked closely with each other, listened to the audio every day and de-briefed every day as a team to mitigate the possible bias. Secondly, due to the small geographical sample, it could be

argued that this could affect the generalisability of findings within the state and country. However, the findings presented in this chapter corroborates with the ICDS literature, and in fact augments it by providing a comprehensive picture on AWW performance. I believe that the findings are likely to be similar elsewhere in the state and the main conclusions from the findings will be relevant at the national level. Considering the generalisability was not the intention, the findings are contributing to the understanding on AWW performance by deeply capturing the voices and experiences of AWWs, which are not represented in the ICDS literature. I further discuss the policy implications of the findings in the last chapter (Chapter 7).

4.5 Conclusion

This chapter finds the following factors as influential in AWW performance; individual factors including initial financial motive and family support; programmatic factors including beneficiaries' and AWW's service preference and work environment; community factors including caste relationship of AWWs and community and seasonal migration; and organisational factors including individualised and institutional corruption. Some of the factors discussed in this chapter as influential on AWW performance are in line with the existing empirical evidence (summarised in the conceptual framework) as influential in the performance of workers such as AWWs, and other factors listed in the literature did not arise. I also found newly emergent factors that influence AWW performance not identified in the literature, hence not already summarised in the framework. The findings suggest that the initial motive of the worker (the need to retain the job for financial needs rooted in family income needs) and the community expectations (for product-oriented services) ensure continued efforts even when her motivation is low. The main constraints to performance (outcomes) are factors outside of her control. These include unavailability of programmatic resources (means to do her job) and relationships shaped by caste dynamics, seasonal migration, and practice and perception of corruption.

Can technology and monetary incentives deliver improved uptake of the ICDS services? The next chapter explores this thread and presents findings from the quantitative analysis I conducted to understand the influence of the mobile phone technology and monetary incentives intervention on the household uptake of ICDS services linked to the intervention.

Chapter Five: Effect of the mobile phone technology and monetary incentives intervention by Anganwadi workers on the household uptake of the ICDS services

5.1 Introduction

The previous chapter presented the overall factors that influence AWW performance. In this chapter I move on to explore the role of the mobile phone technology and monetary incentives intervention on AWW performance. This chapter specifically focuses on understanding the potential of mobile phone technology as a job aid combined with monetary incentives in improving the household uptake of ICDS services. I examine the effect of the mobile phone technology and monetary incentive bundled intervention on the beneficiary uptake of the ICDS services directly linked to the intervention by conducting quantitative analysis using two rounds of quasi–experimental survey data. To provide a comprehensive understanding of the influence of technology augmented interventions on health and nutrition service delivery, I decided to examine the influence of the technology augmented intervention at the household level and at the AWW level (Chapter 6). Moreover, the findings of the quantitative analysis aim to address the research gap identified (discussed in Chapter 2) in the fields of m-Health and m-Nutrition on the potential of technology augmented interventions to improve the performance of workers like AWWs.

Structurally this chapter has seven sections and relevant sub-sections. The next section, 5.2**,** provides a brief recap of the empirical site features. The sections 5.3 and 5.4 discuss the data and estimation strategy used in the quantitative analysis. Section 5.5 presents the results of the quantitative analysis, and the last section (5.6) concludes this chapter with a discussion of findings. This chapter is also accompanied by a section on supplementary statistical tables in section 5.7.

5.2 Background

As described in Chapter 3, my quantitative research utilises the empirical context of the BCSP. I specifically examined the influence of the supply-side intervention of the BCSP. I chose the BCSP setting to understand the effect of the mobile phone technology and monetary incentive bundle on the household uptake of ICDS services due to its unique programme features, evaluation design, and availability of data.

The BCSP has a unique programme design because it piloted a widely tested model of conditional cash transfers and provided mobile phone technology to AWWs as a job aid for real-time

monitoring. The BCSP introduced the mobile phone technology to ease AWWs' effort in weighing of children and pregnancy case management. The monetary incentives component aimed to motivate AWWs to use the phone, comply with the cash transfer monitoring responsibilities, and incentivise them to weigh more children. These programme features offer a unique empirical setting to study the influence of the mobile phone technology and monetary incentives intervention on AWW performance in line with my conceptual framework.

The BCSP evaluation design and the availability of the data enabled me to examine the impact of the mobile phone and monetary incentives intervention. Using the data, I compare between two different sample populations: one set of the population that access AWCs where AWWs use the mobile phones and receive monetary incentives and a second set where the intervention is absent.

As discussed in Chapter 3, the BCSP has three treatment blocks and one comparison block. To understand the impact of the supply-side intervention, I compare the third treatment block and the comparison block. The third treatment block only has the supply-side intervention and no demand-side intervention (i.e. cash transfer). I do not consider my research as an evaluation of the BCSP, rather I examine whether the supply-side intervention by the BCSP had any impact on services provided by the AWWs as the formal BCSP evaluation does not cover this aspect. Although my research is only focusing on the third treatment block and the comparison block, to offer comparisons and to explain the results better, I also use the data from the first two treatment blocks in which both demand and supply-side interventions are employed.

In this chapter, I focus on household level outcomes identified in the conceptual framework on AWW performance (discussed in Chapter 2) which is a level above AWW level performance. I did not measure the impact of the intervention at the AWW level using quantitative data because of the small sample size at the AWW level.

5.3 Data

I use two rounds of survey data (baseline in 2013 and midline[65] in 2015) from the BCSP pilot evaluation undertaken by OPM. The two surveys present a panel of PSUs—i.e. the catchment

[65] The second round of the data is called midline because the overall evaluation had three rounds of data collection—baseline, midline, endline. Endline data collection was carried out in November 2016. However, due to monetary constraints, the overall evaluation did not include the comparison block ('pure control' block for the cash transfer) in the endline. Thus, the only opportunity to estimate the effect of the mobile phone technology and monetary incentives intervention on household utilization of the ICDS services is by comparing the baseline and midline data sets.

area of AWCs. Thus, it is a panel of AWCs, but a different cross-section of households per PSU per survey round due to the need to have comparable age groups over time.

My engagement in the designing and managing of the OPM evaluation of the BCSP pilot and the evaluation donor DFID's open access data policy gave me the opportunity to use the data set for my doctoral thesis. My overall doctoral research ethical clearance from the University of Sussex covers the secondary data analysis of the BCSP impact evaluation data as well.

From each block, each survey round collected data from approximately 55 AWWs, 1500 households (each with one woman having at least a child less than age two years of age) and PSU characteristics from 55 PSUs. Household, woman and child datasets cover demographic characteristics, household food security and diet, child anthropometry, Body Mass Index (BMI) and haemoglobin levels of the woman to assess anaemia status. Anganwadi data includes observations about the AWC infrastructure, AWW level service delivery frequency and quality, observations about the AWW's behaviour and capacity to provide various services such as dry ration distribution, hot cooked meals, and immunisation days, adherence to reporting procedure, and flow of financial resources. The BCSP data also has PSU level data on infrastructure, availability and access to markets, health, and education services. The baseline was conducted from July to September 2013, and the midline was carried out after two years (August to October 2015). Table 14 depicts in detail the sample size of different components of the two rounds of surveys and data collection periods for each round. Table 25 in section 5.7 provides the sample size for both cash treatment blocks (T1 and T2) as well. Annex C summarises the sampling methodology used for the survey, data quality procedures during the data collection and data cleaning stages by the evaluation agency OPM.

Table 14 Sample size for T3 and Comparison blocks

Data	Sample size					
	Baseline 2013 (July to September 2013)			Midline 2015 (August to October 2015)		
	Treatment (T3)	Comparison	Total	Treatment (T3)	Comparison	Total
Household	1515	1454	2969	1545	1393	2938
Woman	1515	1454	2969	1545	1393	2938
Child	1566	1498	3064	1610	1455	3055
Anganwadi	53	53	106	53	52	105
Community (PSU)	53	54	110	54	52	110

The intervention expected to directly influence two services (weight monitoring and VHSND attendance) and indirectly influence one service (individual and group counselling). However, due to data limitations[66] at the baseline stage, I decided to focus on services which are hypothesised to be directly influenced by the intervention (weight monitoring and VHSND attendance for children and women). Although the baseline was conducted in August–September 2013, the programme only started after a year in August 2014. Hence, by the time of midline data collection, the maximum exposure to BCSP would have been twelve months. Considering the intervention was only active at the maximum for a year, I decided to restrict my child level sample to less than one-year-old children.

5.4 Estimation strategy

In the absence of randomised controlled trials and when programmes are rolled out as a 'natural experiment' or follow a 'quasi-experiment', using a DID estimation strategy is considered a popular way to estimate causal relationships (Card & Krueger, 1993; Imbens & Wooldridge, 2007, 2009; Wooldridge, 2003). In this analysis, to estimate the effect of the mobile phone technology

[66] AWW level service delivery frequency and quality for services provided by the AWW was not collected at the baseline. For example, frequency and quality aspects of individual and group counselling services are not available for the baseline period. This was because the mobile phone technology and monetary incentives intervention evolved after the baseline (August–September 2013) and before the start of the programme in August 2014.

and monetary incentives bundled intervention on the beneficiary uptake of the ICDS services, I use a DID estimation strategy.

The DID estimation consists of identifying a specific intervention or treatment[67] and then compares the difference in outcomes[68] after and before the intervention for groups affected by the intervention to the same differences for unaffected groups. The DID estimation strategy is widely used because of its simplicity and potential to avoid the endogeneity problems that typically arise when making comparisons between heterogeneous individuals (Duflo, 2009). It is also an explicit way to remove time constant confounders[69] and can be easily used with grouped data, typically at the regional unit. The double differencing removes biases in the second-period comparisons between the treatment and comparison group that could result from permanent differences between those groups. It also removes the biases from comparisons over time in the treatment group that could be the result of time trends unrelated to the treatment (Imbens & Wooldridge, 2009).

Commonly, the treatment is directly provided to individual beneficiaries or households or any other participant groups. In this analysis, the main[70] treatment I focus on is at the AWW level. The change in outcome is measured as the difference between beneficiary (children or pregnant women) uptake of services provided by the AWWs who received the treatment compared to beneficiary uptake of services provided by AWWs who did not receive the treatment. The beneficiary level treatment is defined as children and pregnant women who *attended the VHSND or were weighed* by AWWs.

As mentioned earlier, the treatment in the first two blocks has pregnant women or mothers of children also receiving cash transfers conditional upon meeting soft or hard conditions.

I employ an intent to treat (ITT) estimation in my analysis, which ignores noncompliance, protocol deviations, withdrawal, and anything that happens after the treatment has been assigned (Gupta, 2011; Hollis & Campbell, 1999; Imbens & Wooldridge, 2007). The ITT estimator is widely considered to be an important treatment effect estimator when trying to determine the effect of the intervention in practical settings. Within the treatment block, all pregnant women and mother/child dyads in my sample were eligible to receive the treatment, i.e. to be weighed by

[67] The event for which I want to estimate the causal effect is called the *treatment* (Lechner, 2010).
[68] The *outcome* is the variable that will be used to measure the effect of the treatment. Outcomes that would be realized if a specific treatment has, or would have been applied, are called *potential outcomes* (Lechner, 2010).
[69] A *confounder* variable is a variable that is related to the treatment and the potential outcomes (Lechner, 2010).
[70] I also estimate the treatment effect in the first two treatment blocks to provide comparison. Hence, I use the word main.

AWWs who were using the mobile phones and receiving monetary incentives. As part of the ANC check-up during pregnancy, pregnant women are supposed to be weighed, and children are weighed monthly by AWWs. The weight monitoring included weighing and communication of the weight to the beneficiary with appropriate counselling messages. Hence, all pregnant women and mother/child dyads were "intended" to be treated, regardless of whether or not they actually received treatment. This ITT estimate would be smaller than the Average Treatment Effect (ATE) because the ATE is calculated based on the assumption of perfect compliance.

Formally, the identification strategy for my ITT analysis can be summarised as follows:

$$y_t^{hB} = \alpha + \theta T^B + \emptyset M_t^k + \omega T^B M_t^h + \beta \boldsymbol{X}_t^{hB} + v_t^{hB} \quad (1)$$

Where y_t^{hB} is outcome y for household h in block B at time t. T is the treatment dummy that will be equal to one if the household is in a treatment block, irrespective of whether it actually was treated. M is a time dummy that is equal to one if the observation is from follow-up. Finally, α is a constant, $\boldsymbol{X}$ is a vector of control variables at the household, woman, child, AWC, AWW and PSU levels, and $v_t^{hB}$is an error term. The coefficient on the interaction of treatment with time (ω) can then be interpreted as difference-in-differences impact estimator of the treatment effect.

Table 15 Key outcome indicators

Key outcome indicators		
Child level	1.	Proportion of children < 1 year who received weight monitoring ever after the birth weight check-up
	2.	Proportion of children <1 year attended the VHSND
	3.	Proportion of children < 1 year who attended the VHSND who received weight monitoring
Woman level	4.	Proportion of women attended the VHSND at least once during the last pregnancy
	5.	Proportion of women who attended the VHSND at least once during the last pregnancy who received weight monitoring

Table 15 summarises the key outcome indicators used in the analysis. Although I estimate ITT estimators for indicators 1,2, and 4; for indicators 3 and 5, I use the Local Average Treatment Effect (LATE) estimator (Angrist & Imbens, 1991). The LATE equals the ITT effect divided by the share of compliers in the population—in this case, the proportion of sampled women who attended the VHSND with their index child or during the last pregnancy. Thus, the LATE calculates the proportion of people who actually attended the VHSND who received the service.

In this analysis, the mobile phone technology and monetary incentives intervention is hypothesised to influence the proportion of children being weighed and attending the VHSND. For example, if I consider the proportion of children being weighed ever after birth weight check-up as the outcome indicator, the effect of the intervention ω (impact estimator of the treatment) will be–

$$\omega = (WT_A - WC_A) - (WT_B - WC_B) \quad (2)$$

WT_A = proportion of children being weighed ever after birth weight check-up, **midline**; **treatment block**

WC_A = proportion of children being weighed ever after birth weight check-up, **midline**; **comparison block**

WT_B = proportion of children being weighed ever after birth weight check-up, **baseline**; **treatment block**

WC_B= proportion of children being weighed ever after birth weight check-up, **baseline**; **comparison block**

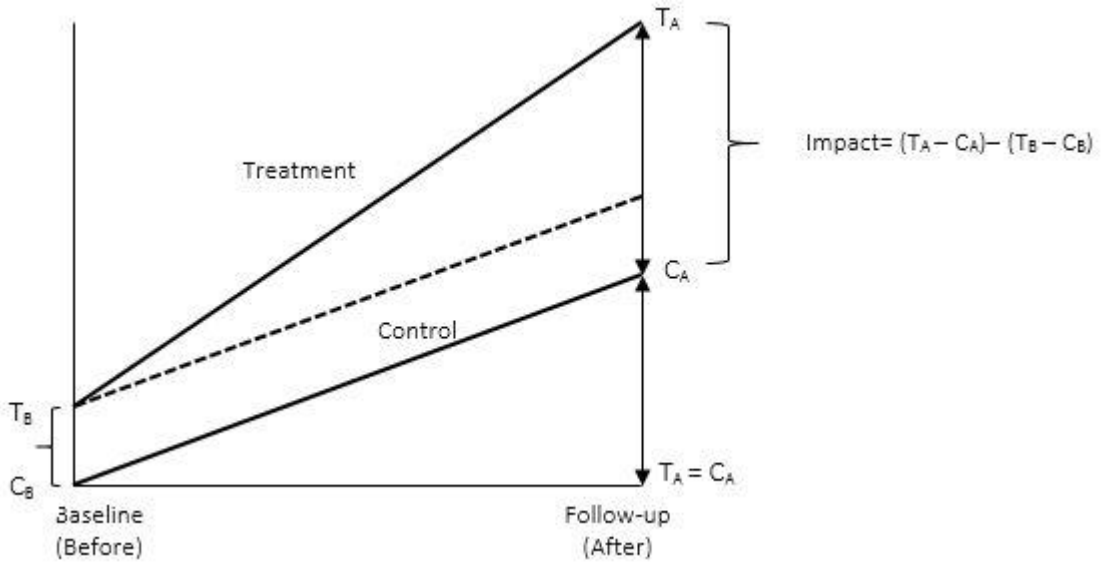
In the first two treatment blocks, a combined effect of demand-side (cash transfer) and supply-side (mobile phone technology and monetary incentives) is hypothesised to influence the key outcome indicators.

I used the statistical software STATA version 11 for the quantitative analysis (StataCorp, 2009).

Parallel paths assumption

The underlying assumption for the DID method is that of 'parallel paths', which suggests the average change in the comparison group represents the counterfactual change that would happen in the treatment group if there were no treatment. Figure 11 illustrates this assumption, the dotted line being the assumed 'parallel' trajectory for treatment outcomes in the absence of the treatment. The difference in how those outcome indicators changed in the treated group vs. the comparison group is assumed to be due to the effect of the intervention on household uptake of the selected ICDS services. Households in the comparison block, which did not receive the treatment, provide a measure of what would have been expected to have happened to beneficiaries without the intervention. The DID measure thus captures the difference between treatment block at baseline and midline, minus the difference between comparison blocks at baseline and midline. (See Figure 11).

Figure 11 Difference-in-difference method estimation of treatment effect



Source: Author

Parallel paths require the assumption that there are no time varying, unobservable confounding factors that are systematically different between treatment and comparison areas. Using the BCSP quasi-experimental evaluation data, it is not possible to directly observe the validity of the parallel paths assumption due to the implementation occurring in the treatment block. In quasi-experimental studies, it is normal to test for the likelihood of parallel trends occurring by i) comparing trends in outcome in time periods before the intervention to demonstrate similar historical paths and ii) comparing observable characteristics between treatment and comparison areas at the baseline to ensure that they are very similar, as they will influence changes over time and may be correlated with unobservables. Neither are direct assessments of parallel paths. The former cannot be undertaken due to the unavailability of pre-baseline data. To estimate parallel paths will require more than two rounds of data before the intervention has started. Thus, in this analysis, it is not possible to test for parallel paths, as there is no pre-baseline data.

However, I will present the comparison of key observable characteristics for the treatment and comparison blocks to establish that these blocks have similar levels of observable characteristics at the baseline (i.e., test for equivalence). If there is a statistically significant difference between groups at the baseline on observable characteristics, I aim to check for means difference at midline for these characteristics which are independent of the intervention. Comparing the levels of outcome indicators and observable characteristics (of PSU, household, woman, child) to establish the parallel paths assumption is not the most robust strategy, but useful when more than two rounds of data are not available, and the blocks were pairwise matched at the baseline stage. Out of the four blocks in the overall BCSP pilot evaluation; the comparison block in this

analysis was best matched with the T3 block—i.e. supply-side intervention only block. The matching was to try and ensure treatment and comparison areas were as similar possible to minimise the likelihood of the parallel paths assumption not holding (see Chapter 3 section 3.1)

Test for equivalence

Table 16 displays the significance levels of means difference of groups (comparison vs. treatment) at the baseline and midline[71] for observable confounding factors. I used these variables as covariates in this analysis. In general, it is only required to examine the means difference of groups at the baseline for selected observable characteristics. However, in this case, I found significant means difference at the baseline for household head's education, and household's access to agricultural land, drinking water, and toilet facility. At the woman level, significant levels of means difference are showcased by variables such as the proportion of women without any education, age at marriage, receipt of at least one tetanus injection during the last pregnancy, and institutional delivery during the last pregnancy. All the reported variables at the child level are not significantly different at the baseline between the two groups.

In cases where a set of variables show significant differences at the baseline, it is advisable to look at multiple time periods before the baseline to cross-check whether the difference is historically similar, also known as tests for the parallel paths assumption. In this analysis, due to the lack of pre-baseline data, I decided to look at the means difference between the two groups at midline. I decided to do this to check whether the baseline difference still holds at the midline for variables which showed significant levels of differences at the baseline. If they are significantly different at baseline and midline, they could be different before the baseline too. Although this is not the perfect way to test for parallel paths, understanding whether the means difference between the groups that were different at baseline showcase the same levels of difference at midline could still be relevant for the DID analysis. Moreover, these characteristics are independent of the programme and the significant difference in both time periods could mean that the direction of influence of these variables on the key outcome indicators remains the same.

Table 16 suggests that all variables that showed a significant difference at the baseline show more or less the same difference at midline, providing evidence to support the DID model specification. One variable, the proportion of household heads with a middle level of education, showed significantly different means at baseline but not at midline. However, it is a sub-category of the overall household head's education with a small sample size. Also, the difference at the baseline

[71] I used *ttest* command in STATA 11 to calculate the means difference between the comparison and treatment groups at the baseline and midline.

was significant only at the 95% confidence interval. In the DID regression, I ran models with and without this variable as a covariate to see whether it changed the impact estimator. Two other variables, access to toilet facilities and mothers with secondary education, dropped the significance level at the midline. Also, the proportion of households that belong to the general category and mother's age show a significant difference at midline. I introduced these variables into the DID regression model one by one to control for any bias towards the impact estimator.

If parallel paths do not hold, the estimate of the effect of the intervention will be imprecise or biased. To further improve the validity of the DID model specification, I also add controls to the regression based on observed confounding factors.

5.5 Results and discussion

5.5.1 Descriptive statistics

In this section, I present the descriptive statistics of observable characteristics included in the regression models (Table 16 and Table 17). In Table 18, I present the descriptive statistics of key outcome indicators from baseline to the midline to understand the change in levels of these indicators.

Table 16 Descriptive statistics: household, woman, and child characteristics (T3 and Comparison blocks)

Variables	Baseline 2013					Midline 2015				
	Treatment (T3)		Comparison		T3-C	Treatment (T3)		Comparison		T3-C
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Household										
Male headed	0.97		0.96		0.00	0.92		0.92		0.00
Household Head's education										
No education	0.50	0.50	0.57	0.50	-0.06***	0.46	0.50	0.53	0.50	-0.08***
Primary	0.13	0.34	0.14	0.35	-0.01	0.17	0.38	0.16	0.37	0.01
Middle	0.14	0.35	0.11	0.32	0.03**	0.11	0.32	0.10	0.30	0.01
Secondary	0.15	0.36	0.11	0.32	0.04***	0.16	0.37	0.11	0.31	0.05***
Higher secondary	0.04	0.20	0.04	0.19	0.00	0.06	0.23	0.05	0.23	0.00
Graduate	0.03	0.16	0.03	0.17	0.00	0.03	0.18	0.04	0.19	0.00
Post-graduate	0.01	0.08	0.00	0.04	0.00*	0.00	0.06	0.00	0.03	0.00*
Religion										
Hindu	0.97	0.17	0.97	0.17	0.00	0.96	0.19	0.96	0.19	0.00
Islam	0.03	0.17	0.03	0.17	0.00	0.04	0.19	0.04	0.19	0.00
Caste										
Scheduled caste (SC)	0.48	0.50	0.45	0.50	0.02	0.46	0.50	0.45	0.50	0.00
Other Backward Class (OBC)	0.42	0.49	0.42	0.49	-0.01	0.44	0.50	0.41	0.49	0.03
General	0.11	0.31	0.12	0.33	-0.01	0.10	0.30	0.13	0.34	-0.03***
Access to ***agricultural land***	0.41		0.45		-0.04**	0.40		0.44		-0.04**
Access to ***drinking water facility***	0.99		0.90		0.09***	0.99		0.84		0.15***
Access to ***toilet facility***	0.10		0.07		0.04***	0.14		0.11		0.03**
Asset Index	3.03	1.36	2.88	1.37	0.15***	3.10	1.35	2.62	1.44	0.47***
Woman										
Age	26.12	4.97	25.97	4.79	0.14	24.85	4.75	25.44	4.96	-0.58***
Education										
No education	0.68	0.47	0.72	0.45	-0.05***	0.59	0.49	0.65	0.48	-0.05***
Primary	0.10	0.29	0.10	0.30	0.00	0.13	0.33	0.12	0.32	0.01
Middle	0.09	0.29	0.08	0.27	0.01	0.09	0.28	0.07	0.26	0.01
Secondary	0.08	0.27	0.05	0.21	0.04***	0.09	0.29	0.07	0.25	0.02**
Higher secondary	0.04	0.19	0.03	0.18	0.00	0.07	0.25	0.06	0.23	0.01
Graduate	0.01	0.12	0.02	0.12	0.00	0.03	0.18	0.03	0.18	0.00
Post-graduate	0.00	0.03	0.00	0.03	0.00	0.00	0.04	0.00	0.03	0.00
Age at marriage	14.72	3.06	14.21	3.12	0.51***	15.40	2.80	15.18	2.72	0.22**
Number of children	2.92	1.70	2.92	1.79	0.00	2.79	1.66	2.88	1.71	-0.09
Employment: non-HH work	0.14		0.13		-0.01	0.30		0.32		-0.02
Received ***at least one tetanus injection*** *during last pregnancy*	0.96		0.91		0.05***	0.89		0.82		0.07***
Had ***institutional delivery*** *in for last childbirth*	0.56		0.45		0.11***	0.65		0.53		0.12***
Child										
Age	13.57	6.96	13.90	6.97	-0.33	11.81	6.53	11.67	6.31	0.14
Sex: Girl	0.51	0.50	0.51	0.50	0.01	0.46	0.50	0.48	0.50	-0.02
Moderate ***stunting***	0.55		0.58		-0.02	0.40		0.39		0.02
Moderate ***underweight***	0.50		0.52		-0.01	0.45		0.45		0.00
Moderate ***wasting***	0.24		0.22		0.02	0.29		0.29		0.00
N=	1566		1498			1610		1445		

Note: Means of variables by group. *** p<0.01, ** p<0.05, * p<0.1

Descriptive statistics of observable characteristics: household, woman and child level

Table 16 presents household, woman and child characteristics, also included in the regression models as covariates to improve the robustness of the model. Although Table 16 provides the proportion of households with access to clean drinking water and toilet, I did not use these variables directly in the regression models because the Asset Index[72] variable I used in the regression as a covariate is a composite variable including these two variables. Moreover, in the regression models, I used a continuous variable for the household head's and mother's education.

As shown in Table 16, the majority of the households in both blocks are headed by male members (more than 92%), practise the Hindu religion (97% and 96%), and belong to SC or OBC categories (85%) at baseline and midline. Considering the majority of the households are headed by male members, almost half of them do not possess any education. In the T3 and comparison blocks, the majority of households did not own agricultural land or have access to a functional toilet facility, but they have access to safe drinking water facilities such as hand pumps.

In both blocks, the mean age of the sampled women at baseline and midline is approximately 25 to 26 years, and a majority married below the legal age of marriage (i.e. 18 years), do not have any education, and on average reported having three children. The proportion of women who reported undertaking employment outside the home increased from baseline to midline in both blocks. The proportion of women reported to have taken at least one tetanus injection during their last pregnancy decreased in both blocks from baseline to midline, but the proportion who had an institutional delivery for the last childbirth increased in both blocks.

The baseline sample has children with average age 14 months for both blocks, but the midline sample has a slightly younger cohort (almost 12 months). In the baseline sample, both blocks had a slightly higher proportion of girls than boys, but this proportion reversed in the case of the midline sample. More than half of children are either stunted or underweight at baseline in both blocks, but this proportion reduced by midline for both blocks. At baseline, considering almost a quarter of children were wasted, it became almost one third by the midline in both blocks.

[72] I used the asset index already provided in the data set. The OPM evaluation team calculated the asset index by using a principal component analysis (PCA) method (OPM, 2016). From a set of correlated variables, the PCA extracts a set of uncorrelated 'principal components'. Each principal component is a weighted linear combination of the original variables. This method is also used by other standard surveys like the NFHS (OPM, 2016). The asset index was constructed by combining information on 33 household assets and housing characteristics such as ownership of customer items, type of dwelling, source of water, and availability of electricity, into a single asset index. The household population was divided into five equal groups of 20% each (quintiles) from one (lowest, poorest) to five (highest, wealthiest) (OPM, 2016).

Comparing the two blocks at two-time periods, the treatment block (T3) on average is slightly better than the comparison block in terms of standard of living (access to drinking water, toilet, and Asset Index), education (household head and mother), and services uptake (tetanus injection and institutional delivery) indicators, but slightly worse off in terms of access to agricultural land. The indicators which showed a significant difference (magnitude and direction) remains the same in both time periods. Table 26 in section 5.7 provides the descriptive statistics of the same set of variables for the cash transfer blocks T1 and T2. The levels of indicators in the cash transfer blocks are also similar to the T3 and comparison blocks. The variables (except two) that show significant means differences between T3 and comparison groups demonstrate means difference between T1 and T2 as well. The two variables that show a significant baseline difference in means of groups only for T1 and T2 are the proportion of households belonging to SC and OBC categories. However, the difference remains at the midline as well. Table 27 in section 5.7 summarises the means difference between T1 and T2, T2 and T3, and T3 and C, in one comprehensive table.

Table 17 Descriptive statistics: AWC, AWW and PSU characteristics (T3 and Comparison blocks)

Variables	Baseline 2013					Midline 2015				
	Treatment (T3)		Comparison		T3-C	Treatment (T3)		Comparison		T3-C
	Obs.	Mean	Obs.	Mean		Obs.	Mean	Obs.	Mean	
AWC										
AWC is functioning in a pucca building	53	0.58	53	0.66	-0.08	44	0.64	37	0.84	-0.20**
AWC has own building	53	0.36	53	0.34	0.02	53	0.23	52	0.37	-0.14
AWC has a functional toilet	53	0.08	53	0.28	-0.21***	44	0.16	37	0.22	-0.06
AWC has portable drinking water facility	53	0.40	53	0.47	-0.08	44	0.57	37	0.65	-0.08
AWC has functional weighing machine(s)	53	0.51	53	0.19	0.32***	47	0.81	48	0.92	-0.11
AWW										
Age (years)	52	0.34	53	0.35	-0.02*	53	0.36	52	0.38	-0.01
Experience (years)	53	0.09	53	0.11	-0.02**	53	0.10	52	0.12	-0.02***
Education										
Middle	53	0.00	53	0.00	0.00	53	0.02	52	0.00	0.02
Secondary	53	0.32	53	0.36	-O.04	53	0.28	52	0.40	-0.12
Higher secondary	53	0.47	53	0.40	0.08	53	0.42	52	0.33	0.09
Dip/certificate	53	0.02	53	0.04	-0.02	53	0.00	52	0.00	0.00
Graduate	53	0.19	53	0.15	0.04	53	0.26	52	0.23	-0.03
Post graduate	53	0.00	53	0.06	-0.06*	53	0.02	52	0.04	0.02
Caste										
Scheduled Caste (SC)	53	0.19	53	0.08	0.11*	53	0.26	52	0.12	0.15*
Other Backward Class (OBC)	53	0.62	53	0.64	-0.02	53	0.55	52	0.58	-0.03
General	53	0.19	53	0.28	-0.09	53	0.19	52	0.31	-0.12
PSU										
Average PSU population	53	1069	53	1260	-190.67**	52	1140	54	1254	-113.9*
ASHA resides in the PSU	53	0.68	53	0.87	-0.19**	52	0.56	54	0.85	0.29***
Village headman resides in the PSU	53	0.15	53	0.19	-0.04	52	0.23	54	0.22	0.01

Note: Means of variables by group *** p<0.01, ** p<0.05, * p<0.1

Table 17 summarises the levels of AWC, AWW, and PSU characteristics included in the DID regression model as covariates for T3 and comparison blocks. The proportion of AWCs with access to toilet facilities and functional weighing machines remained significantly different at baseline, and this difference has vanished by the time of the midline. Since the sampled children are too young to access the AWC infrastructure, the access to toilet indicator might not be relevant for our analysis. However, the means difference of access to the functional weighing machine at baseline and no difference at the midline could potentially bias our impact estimator or may even explain the direction of the impact estimator. Hence, I decided to include it as a control variable in the regression model. Furthermore, AWCs in the comparison block saw an improvement in building type, ownership, potable drinking water facility and functional weighing machine availability. Although there is a decline in the availability of functional toilets in the comparison block from the baseline to midline, it is still higher than the treatment block.

Considering the data is a panel of AWWs, as expected, the characteristics of AWWs such as caste and education remained the same and age and experience increased from baseline to midline. The caste profile of the AWWs is different from the households' caste profile outlined in Table 16. While the majority of households belonged to either SC or OBC categories, the majority of AWWs belonged to OBC and General category.

The PSU characteristics showed an increase in the PSU population in T3 block and a slight decrease in the comparison block from baseline to midline. Whilst the proportion of PSUs with ASHA's presence decreased, the proportion of PSUs with the village headman's residence increased in both blocks from baseline to midline. Table 28 in section 5.7 summarises the levels of the same list of variables for cash transfer blocks. Although the levels of AWC, AWW, and PSU levels are similar between T1 and T2, a significant means difference exists for variables such as availability of functional toilet, potable drinking water, and functional weighing machines. However, this difference disappears in midline for the availability of functional toilets and weighing machines but remains the same for potable drinking water facility.

Key outcome indicators

Table 18 reports the descriptive statistics for child and woman level indicators used in this analysis as key outcome indicators. I examine three indicators at the child level and two at the woman level (shown in Table 15).

Child weighing

Considering the intervention incentivised AWWs to weigh children and eased the weight grading process with the mobile phone application, the proportion of children being weighed by AWWs could be directly influenced by the mobile phone and monetary incentives intervention from baseline to the midline. Table 18 shows that the proportion of children below one year of age who received weight monitoring after birth weight check-up increased in the comparison block by ten percentage points. This proportion fell in the T3 block by 1.25 percentage points. At the baseline, means of T3 and comparison group was significantly different. The significance of the means difference remains at the midline, but with a reduced magnitude (0.16 to 0.05). Therefore, significant improvements were seen in the comparison block but not in T3 block.

Across social categories (SC, OBC and General) this proportion increased in the comparison block, with the highest levels of increase reported for the SC category. However, in the T3 block, the slight decline (1 percentage points) experienced seems to be caused due to the decline in the OBC category (-3.13 percentage points).

Child VHSND attendance

Considering the AWWs receive Rs. 100 (approx. $15) for filling the service availability form on the VHSND and Rs. 5 (approx. $ 0.08) per child for the weighing, if AWWs want to maximise their incentives, they can mobilise more beneficiaries (mothers of young children) to attend the VHSND. However, the proportion of mothers of children under one year of age that attended the VHSND at least once before the respective surveys declined in both comparison and T3 blocks. The fall is sharper in the case of the treatment (-37.69 percentage points) than in the comparison block (-30.70 percentage points). Although the proportion fell from baseline to midline in both blocks and the fall is sharper in the T3 block, the significant means difference exists between two groups (T3 and comparison blocks) at baseline and midline with a reduced magnitude.

Across social categories, VHSND attendance fell in both comparison and T3 blocks. In both blocks, the fall was the highest for the General category compared to other two categories. Compared to the comparison block all social categories in the T3 block witnessed a sharper fall in the VHSND attendance.

Table 18 Descriptive statistics: child and woman outcome variables (T3 and Comparison blocks)

Variables	Baseline 2013					Midline 2015				
	Treatment (T3)		Comparison			Treatment (T3)		Comparison		
	Obs.	Mean	Obs.	Mean	T3-C	Obs.	Mean	Obs.	Mean	T3-C
Child										
Children < 1 year who received weight monitoring ever after birth weight check	771	**0.41**	717	**0.25**	0.16***	903	**0.40**	816	**0.35**	0.05**
Scheduled Caste (SC)	371	**0.38**	316	**0.19**		406	**0.38**	382	**0.32**	
Other Backward Class (OBC)	314	**0.43**	305	**0.28**		397	**0.40**	322	**0.34**	
General	86	**0.48**	96	**0.40**		96	**0.49**	104	**0.47**	
Children < 1 year attended the VHSND at least once	771	**0.69**	717	**0.55**	0.15***	903	**0.30**	816	**0.24**	0.06***
Scheduled Caste (SC)	371	**0.74**	316	**0.52**		406	**0.37**	382	**0.23**	
Other Backward Class (OBC)	314	**0.64**	305	**0.61**		397	**0.28**	322	**0.29**	
General	86	**0.59**	96	**0.47**		96	**0.16**	104	**0.14**	
Children < 1 year who attended VHSND who received weight monitoring	529	**0.20**	395	**0.19**	0.01	275	**0.28**	199	**0.22**	0.06
Scheduled Caste (SC)	276	**0.22**	165	**0.19**		149	**0.26**	88	**0.28**	
Other Backward Class (OBC)	202	**0.18**	185	**0.22**		110	**0.31**	94	**0.15**	
General	51	**0.16**	45	**0.09**		15	**0.27**	15	**0.33**	
Woman										
Women attended the VHSND in the last pregnancy	771	**0.47**	717	**0.33**	0.13***	903	**0.31**	816	**0.22**	0.10***
Scheduled Caste (SC)	371	**0.49**	316	**0.32**		406	**0.38**	382	**0.19**	
Other Backward Class (OBC)	314	**0.49**	305	**0.36**		397	**0.27**	322	**0.27**	
General	86	**0.33**	96	**0.27**		96	**0.21**	104	**0.18**	
Women who attended the VHSND at least once during the last pregnancy who received weight monitoring	567	**0.48**	414	**0.30**	0.17***	282	**0.72**	177	**0.52**	0.20***
Scheduled Caste (SC)	286	**0.50**	194	**0.28**		153	**0.67**	71	**0.49**	
Other Backward Class (OBC)	224	**0.47**	181	**0.29**		108	**0.78**	86	**0.51**	
General	57	**0.40**	39	**0.46**		20	**0.75**	19	**0.68**	

Note: Means of variables by group. *** p<0.01, ** p<0.05, * p<0.1

Child weighing at the VHSND

Although the VHSND attendance fell in both blocks from baseline to midline across social categories, it is interesting to look at the proportion of children who attended a VHSND who were weighed from the baseline to midline. Considering the AWW has a chance to earn a higher magnitude of incentives and received hand holding support from the BCSP programme staff on the VHSND, there could be a higher likelihood of children who attend the VHSND being weighed.

Overall the proportion of children below one year of age who attended the VHSND who received weight monitoring increased in both blocks from baseline to midline. However, in both blocks, less than one third of children who attended the VHSND received weight monitoring. The receipt of weight monitoring for children at the VHSND across social categories increased for both blocks except for the OBC category in the comparison block.

Women's attendance at the VHSND during the last pregnancy

Women's attendance at the VHSND in their pregnancy period is a crucial factor in this analysis because it helps to understand whether the technology augmented intervention (especially the pregnancy care management) attracted pregnant women to the VHSND platform.

As shown in Table 18, less than half of women in both blocks reported attending the VHSND at least once during the last pregnancy. The proportion decreased from baseline to midline in both blocks. Although the T3 block experienced a higher decline, it remains higher than the comparison block at midline. In the T3 and comparison blocks, the decline was highest in the case of the OBC category (-20.45 percentage points and -13.44 percentage points respectively) compared to the other two categories.

Woman's weighing at the VHSND during last pregnancy

The weighing of pregnant women by AWWs is neither directly incentivised nor digitised using the mobile phone application. However, the receipt of weight monitoring during the last pregnancy is a good proxy indicator to understand whether the pregnancy care application prompts the AWW to weigh more pregnant women at the VHSND. The VHSND is a platform where pregnant women turn up to receive ANC check-ups from the ANM and weighing service from the AWW. The MCH card given to the pregnant women at the start of the ANC check-ups also keeps a record of the ANC check-ups, weight monitoring and tetanus injections during pregnancy, and child-related details (birth weight, child immunisation, and weight monitoring) post childbirth.

The VHSND attendance fell for both blocks from baseline to midline. However, the proportion of women who attended the VHNSD in the last pregnancy who received weight monitoring

increased in both blocks. The increase is visible across social categories in both blocks as well. In the T3 block, the increase is highest for the General category and lowest for the SC category. The same pattern is visible in the comparison block as well, but the increase is almost similar in the case of the SC and OBC categories.

Key outcome indicators: child and woman variables for all blocks

Overall, comparing the levels of key outcome indicators between the T3 and comparison group suggest that the comparison group improved or the treatment in T3 block has not achieved the hypothesised improvement. Is this true for the other two blocks which have cash transfer as well? Table 19 presents the levels of each of these indicators for all four blocks. It shows that the indicators related to weighing at child and woman levels improved in the cash transfer blocks. Two indicators, weighing at VHSND for child below one year of age weighing of and women during their last pregnancy showed a steep increase from baseline to the midline in the cash transfer blocks. Moreover, the VHSND attendance indicators in cash transfer blocks did not experience decline like in the T3 and comparison blocks. Table 29 in section 5.7 presents in detail the levels of the key outcome indicators in the cash transfer blocks.

Table 19 Descriptive statistics: child and woman outcome variables for all blocks

Variables	Baseline 2013				Midline 2015			
	T1	T2	T3	C	T1	T2	T3	T1
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Child								
Children < 1 year who received weight monitoring ever after birth weight check	0.4	0.36	0.41	0.25	0.61	0.65	0.40	0.35
Children < 1 year attended the VHSND	0.44	0.54	0.69	0.55	0.47	0.53	0.30	0.24
Children < 1year who attended VHSND who received weight monitoring	0.24	0.17	0.20	0.19	0.73	0.67	0.28	0.22
Woman								
Women attended the VHSND in the last pregnancy	0.61	0.67	0.47	0.33	0.69	0.83	0.31	0.22
Women who attended the VHSND at least once during the last pregnancy who received weight monitoring	0.29	0.37	0.48	0.30	0.48	0.49	0.72	0.52

5.5.2 Regression models

Table 20 and Table 21 present the DID regression models for the key outcome variables with and without covariates.

The DID impact estimator for the first outcome variable 'children below one year of age weighed after the birth weight check-up' is negative and significant. The direction of the DID coefficient,

in this case, suggests that the intervention had a negative impact on children below one year of age ever being weighed after the birth weight check-up.

In the case of child attendance at the VHSND, the DID coefficient is negative and non-significant. The DID coefficient of the third outcome variable, i.e. the proportion of children below one year of age who attended the VHNSD that received weight monitoring is positive and non-significant. Comparing to the DID coefficients without using covariates and the DID coefficients after using covariates, the magnitude of the coefficients slightly increased, but the direction and significance remain the same suggesting that the estimates are robust.

In the case of the VHSND attendance, there has been an overall fall in children attending the VHSND from the baseline to midline in both T3 and comparison block. In the T3 block, this reduction is higher than the reduction seen in the comparison block. As a result, the DID impact estimate that compares the T3 and comparison block is negative but not significant. In the case of children who attended the VHSND that got weighed, it is different. Even when the VHSND attendance of children fell from baseline to midline in both treatment and comparison blocks, the proportion of children weighed at the VHNSD increased in both blocks. This increase is higher in the T3 block than in the comparison block. Although, the DID impact estimator is positive but not significant.

Out of the three child level variables, inclusion of covariates increased the magnitude of the DID estimator of the first variable and decreased the magnitude of the rest.

It is evident from Table 16 and Table 18 that in the majority of household, woman, and child characteristics, the T3 block is slightly better than the comparison block. Although I have controlled for these variables in the regression model, possibility of omitted variables in the regression model could be potentially biasing the regression coefficients. The potential bias in this model could arise from the household's differential awareness about the services at the AWC, latent attitude towards taking up services, intrahousehold decision-making regarding service uptake for the child, and the AWW's ability to utilise the weighing machine and mobile phone. Considering there are no direct variables that measure the awareness and attitude of the household towards the ICDS services and innate ability of the AWW, I have used proxy variables as controls. If these variables were available, they would be positively correlated with the independent variable (s). As no positive estimates were detected, an upward bias would not affect the findings unless the negative and insignificant estimates would have become insignificant. In any case, it is clear that the analysis finds that the intervention had no positive effects. The regression estimates indicate that the intervention had a negative impact on one of

the variables and no impact on the rest. The potential omitted variables could be upwardly biasing the estimates.

Table 20 Impact of AWW treatment (T3) on child level outcome indicators

Variables	1. Children < 1 year who received weight monitoring ever after birth weight check		2. Children < 1 year attended the VHSND		3. Children < 1year who attended VHSND who received weight monitoring	
With covariates?	No	Yes	No	Yes	No	Yes
Time period dummy	0.108***	0.0990**	-0.294***	-0.343***	0.0281	0.0967
	(-0.0321)	(-0.0473)	(-0.0325)	(-0.0453)	(-0.0525)	(-0.0782)
Post-treatment dummy	0.168***	0.156***	0.134***	0.149***	0.00835	0.0135
	(-0.0343)	-(0.0335)	(-0.0418)	(-0.0448)	(-0.0398)	(-0.045)
Difference-in-difference estimator	**-0.116*** **	**-0.164*** **	**-0.0758**	**-0.0666**	**0.0525**	**-0.0116**
	(-0.0414)	(-0.0529)	(-0.0527)	(-0.0628)	(-0.0701)	(-0.0927)
Constant	0.242***	-0.02	0.537***	1.472***	0.191***	0.843*
	(-0.0241)	(-0.458)	(-0.0303)	(-0.446)	(-0.03)	(-0.496)
Observations	3,207	2,444	3,207	2,444	1,398	1,152
R-squared	0.016	0.063	0.128	0.158	0.007	0.038

Note: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

At the woman level, in the case of women's VHNSD attendance during the last pregnancy, the DID estimator is negative and non-significant. However, the DID estimator for the proportion of women who attended the VHSND at least once during the last pregnancy who received weight monitoring is positive and non-significant. These results suggest that the intervention did not have a significant positive impact on selected woman level indicators. The direction of the DID estimator for the women's attendance at the VHSND during their last pregnancy suggest that the fall in VHSND attendance in the T3 block is higher than the comparison block.

Table 21 Impact of AWW treatment (T3) on woman level outcome indicators

Variables	4. Women attended the VHSND in the last pregnancy		5. Women who attended the VHSND at least once during the last pregnancy who received weight monitoring	
With covariates?	No	Yes	No	Yes
Time period dummy	-0.112***	-0.164***	0.223***	0.217***
	(-0.0336)	(-0.0493)	(-0.0593)	(-0.0799)
Post-treatment dummy	0.135***	0.115***	0.183***	0.164***
	(-0.0376)	(-0.0431)	(-0.0445)	(-0.0488)
Difference-in-difference estimator	**-0.0396**	**-0.0205**	**0.0114**	**0.0172**
	(-0.0592)	(-0.0658)	(-0.0737)	(-0.0954)
Constant	0.327***	0.881*	0.297***	0.577
	(-0.0252)	(-0.503)	(-0.0348)	(-0.527)
Observations	3,207	2,444	1,440	1,207
R-squared	0.034	0.055	0.077	0.108

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

To improve the robustness of the DID model, conducting Propensity Score Matching (PSM) analysis could be useful. However, it is not possible in this analysis as the household level data is not a panel, rather a repeated cross-section. PSM analysis across two-time periods can only be done for panelled households (Imbens & Wooldridge, 2009). Although the AWC data is a panel, it is a small sample (55 each for two blocks per time period) inadequate for the PSM level of analysis.

Considering the DID impact estimators for all five indicators show either negative or no significant impact of the intervention, I decided to carry out heterogeneity analysis to understand whether the impact is different for subgroups[73] of social categories and poverty levels. I ran regressions specifically for the poorest (the lowest in the wealth quintile based on the Asset Index) and SC group. Table 22 shows the DID estimator and standard errors for all five indicators for the poverty sub-group and SC sub-group.

As shown in Table 22, the first two child-level indicators for the poorest sub-group is negative and significant–child weighing at 95% and child VHSND attendance at 99% confidence levels. Considering the overall DID estimate children's VHSND attendance was -0.0666 and not significant, the DID estimate for the poorest sub-group is higher in magnitude and significant at the 99% confidence level. This suggests that the reduction in attendance of below one-year-old children from the poorest quintile is sharper in the T3 block than in the comparison block for the

[73] The sample size for sub-group analysis is rather small.

poorest quintile. It also shows that the poorest quintile was in fact adversely affected by the intervention; more so than the average household.

SC families are historically disadvantaged compared to the non-SC groups such as OBC and General categories. Although the sub-group DID estimator for SC is higher in magnitude, the direction and significance remain the same for the first indicator, child weighing. The other child and woman indicators have similar direction and significance compared to the overall DID estimator presented in Table 20 except for the women weighing at the VHSND.

The sub-group level analysis shows that the overall negative impact of the mobile phone technology and monetary incentives intervention has strongly affected the poorest quintile and SC groups especially for the child weighing and child VHSND attendance (only for the poorest).

Table 22 Heterogeneity analysis

Variables	Difference-in-Difference estimator	
	Poorest	SC
Included covariates?	Yes	Yes
Child		
Children < 1 year who received weight monitoring ever after birth weight check	**-0.243****	**-0.249*****
	(0.0926)	**(0.0692)**
Children < 1 year attended the VHSND	**-0.277*****	-0.0997
	(0.101)	(0.0781)
Children < 1year who attended VHSND who received weight monitoring	-0.0242	-0.164
	(0.151)	(0.118)
Woman		
Women attended the VHSND in the last pregnancy	-0.101	0.0114
	(0.102)	(0.0942)
Women who attended the VHSND at least once during the last pregnancy who received weight monitoring	-0.165	-0.0647
	(0.197)	(0.138)

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

In addition to conducting a sub-group level DID analysis, I also estimated the DID estimate for cash transfer blocks (Table 23). In addition to comparing T3 and comparison blocks, I compared T1 and T2; T2 and T3; and T2 and the comparison block. Two interesting comparisons are between —i) T2 vs. T3 i.e. estimating the impact of the cash transfer minus the supply-side intervention and ii) T2 vs. C estimating the bundled impact of the supply-side intervention and cash transfer against no intervention. Although I carried out four DID models, the T1 vs. T2 comparison is not so relevant here as it compares the soft vs. hard conditions.

Table 23 Comparing the DID estimator for all blocks

Variables	Difference-in-Difference estimator							
	Diff T1 (T1 vs. T2)		Diff T2 (T2 vs. T3)		Diff T3 (T3 vs. C)		Diff T5 (T2 vs. C)	
Included covariates?	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Child								
Children < 1 year who received weight monitoring ever after birth weight check	-0.0822 (0.0525)	**-0.0948*** (0.0570)	**0.307***** (0.0415)	**0.339***** (0.0466)	**-0.116***** (0.0414)	**-0.164***** (0.0529)	**0.191***** (0.0454)	**0.168***** (0.0548)
Children < 1 year attended the VHSND	0.0651 (0.0580)	0.0853 (0.0705)	**0.368***** (0.0576)	**0.373***** (0.0695)	-0.0758 (0.0527)	-0.0666 (0.0628)	**0.292***** (0.0515)	**0.285***** (0.0557)
Children < 1year who attended VHSND who received weight monitoring	-0.00312 (0.0600)	-0.0425 (0.0638)	**0.421***** (0.0614)	**0.449***** (0.0698)	0.0525 (0.0701)	-0.0116 (0.0927)	**0.474***** (0.0660)	**0.393***** (0.0924)
Woman								
Women attended the VHSND in the last pregnancy	0.0754 (0.0558)	0.0987 (0.0684)	**0.278***** (0.0609)	**0.264***** (0.0688)	-0.0396 (0.0592)	-0.0205 (0.0658)	**0.239***** (0.0496)	**0.252***** (0.0550)
Women who attended the VHSND at least once during the last pregnancy who received weight monitoring	-0.0892* (0.0516)	-0.0378 (0.0590)	**0.233***** (0.0547)	**0.175***** (0.0638)	0.0114 (0.0737)	0.0172 (0.0954)	**0.244***** (0.0678)	**0.235***** (0.0801)

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

As shown in Table 23, the DID estimator for all indicators in T2 vs. T3 and T2 vs. C are positive and significant. The direction and significance of the DID estimator for T2 vs. T3 suggest that the cash transfer has had a positive and significant impact on the uptake of services. Considering the comparison block did not have any intervention, I expected the DID estimators for T2 vs. C to be higher than that of the T2. vs. T3. However, the results suggest that the magnitude of DID estimators for T2. vs. C is lower for two indicators and similar for the rest to the T2. vs. T3 group. These results are interesting because it in a way suggests the T3 block experienced a much sharper decline in the uptake of services hypothesised to be influenced by the mobile phone technology and monetary incentives bundled intervention. Although the levels of these services have gone down in T3 and comparison blocks, the DID results suggest that a negative push down on service uptake is more visible in the T3 block than in the comparison block. The next section 5.5.3 aims to explain the reasons for the negative impact in the T3 block.

5.5.3 Mechanisms

The overall DID estimation models for T3 vs. C show that the bundled mobile phone technology and monetary incentives intervention had no positive impact on the key outcome indicators. In fact, it had a negative impact in the case of children below one year of age ever being weighed

after having a birth weight check-up. Although the mobile phone technology and monetary incentives bundled intervention did not have any positive impact, the cash transfer has a significant positive impact on these key outcome indicators. Comparing the DID estimates of T2 vs. C and T2 vs. T3 suggests that the mobile phone technology and monetary incentives intervention seems to have made the indicators worse in T3 than in the comparison block.

If I refer to Table 19 which showed the levels of key outcome indicators for all blocks, we can see a fall or not much improvement in the levels of these outcome indicators in T3 and comparison blocks. The VHSND attendance for both children and women fell drastically in T3 and comparison blocks. In assessing the levels of these indicators over time and DID impact estimators together, it seems that fall in T3 is much worse than the fall in comparison block. The cash transfer blocks did not experience a decline in VHSND attendance. In fact, the second cash transfer block rather experienced an increase. Moreover, both the cash transfer blocks experienced an increase in weighing of children and women during the last pregnancy at the VHSND. The reason for no fall in the VHSND attendance in cash transfer blocks could be that the VHSND attendance was one of the cash transfer conditions. Hence, to avail the cash transfers, beneficiaries (pregnant women and mothers of young children) had to attend the VHSND. The cash transfer, therefore, brought a demand-side push in those two blocks. In T3, although AWWs received incentives for reporting service availability on the VHSND, it seems like that a mobile phone technology and monetary incentives intervention alone could not bring an improvement in service uptake as per the cash transfer blocks.

To understand why the AWW treatment did not have a positive impact and for some indicators had a negative impact led me to examine the intensity of the AWW treatment across all three treatment blocks. Table 24 shows that T3 block received a weaker treatment compared to the two cash transfer blocks. AWWs who were participating in the BCSP is higher in the cash transfer blocks than in the T3 block. AWWs who have problems with the phone are also higher in the T3 block. In receiving the support from the BCSP team, the T3 block is far behind the cash transfer blocks. In the cash transfer blocks, an average AWW enrols almost doubled the number of beneficiaries compared to the T3 block. The proportion of AWWs who received any incentive remains considerably lower in the T3 block than in the cash transfer blocks. Moreover, AWWs in the T3 block received substantially less incentives than their colleagues in the cash transfer blocks.

Considering the AWWs in the T3 blocks received less incentives compared to the cash transfer blocks, they might not have felt motivated to attract more beneficiaries for VHSNDs and weight monitoring. Also, Table 24 suggests that these AWWs received reduced support from the BCSP and faced more problems in using the mobile phone compared to the cash transfer block. This

could have meant that, to ease the use of mobile phone application, AWWs might have reduced the caseload at the VHSND.

Table 24 Intensity of the AWW treatment by programme blocks

Programme participation indicators	T1	T2	T3
	N=54	N=55	N=53
	Mean	Mean	Mean
AWWs who are participating in the BCSP	0.98	0.96	0.85
AWWs who have problems with the BCSP mobile phone app	0.35	0.27	0.41
AWWs who receive any support regarding the BCSP	0.90	0.88	0.60
Average number of beneficiaries enrolled in the BCSP	0.31	0.24	0.16
AWWs ever received incentive payment from the BCSP	0.82	0.67	0.49
Average amount received as the incentive	594	605	367

Although Table 24 explains the low intensity of the mobile phone technology and monetary incentives intervention in the T3 block, it does not fully explain the reason behind the negative impact– i.e. that the T3 block fell behind the comparison block where there was no intervention (at least for two variables). This negative impact could be due to the spillover effect of the cash transfer programme on the T3 block where there was no cash transfer for the beneficiaries. AWWs in the two cash transfer blocks and the treatment block were given mobile phones and performed similar activities. The beneficiaries from the treatment block were not receiving cash compared to their counterparts in the cash transfer blocks. These blocks are also adjacent to each other. A negative spillover effect of the cash transfer programme might have influenced the utilisation of the ICDS services in the T3 block due to making beneficiaries avail services which were accompanied by an incentive.

Improvements in the comparison block due to other factors not related to the BCSP could also have influenced the AWW effort and improved the levels of household service uptake in the comparison block. This would mean a violation of the parallel paths assumption. As evident from Table 17, the AWC infrastructure has drastically improved in the comparison block. Although I have controlled for these factors in the DID regression models, unobservable factors the survey did not cover could also have improved the conditions in the comparison block. For example, the SWD, government of Bihar, formally launched the *Bal Kuposhan Mukt Bihar* (BKMB) or the Child Malnutrition Free Bihar campaign on August 15, 2014, to address the high level of child under-nutrition (SWD, 2015a). This initiative organised additional training for AWWs, provided equipment and supplies to AWCs, carried out information and education sessions for beneficiaries (e.g. street plays, videos and films) at the community and district level. Considering these initiatives happened across the state, the BCSP evaluation design expected it to be of same

intensity across blocks. Hence, the effect cancels out in a DID estimation. However, due to unavailability of data on block-wise activities under the BKMB, it is difficult to assess whether one specific improvement in the comparison block might have caused the negative or no impact of the intervention.

To conclude, the bundled intervention did not have a positive impact either due to singular or the combined effect of i) the weaker intensity of the treatment, ii) a negative spillover effect of the cash transfer, and iii) unknown ICDS related improvements occurring in the comparison block.

5.6 Discussion and conclusion

As described in Chapter 2, within the emerging fields of m-Health and m-Nutrition, no studies so far have reported a combined intervention like the mobile phone and monetary incentives intervention I studied in this thesis. Moreover, the literature on the m-Health and m-Nutrition interventions targeted at CHWs have not reported the influence of interventions on the uptake of services at the household level. Hence, to discuss my quantitative research findings with the literature, I needed to depend on studies that i) examined the influence of m-Health and m-Nutrition interventions targeted at households (not via CHWs) to improve service uptake and behavioural change practices and ii) explored the influence of monetary incentives for CHWs on service uptake and household level outcomes.

A systematic review of mobile health interventions on coverage and use of ANC, postnatal care (PNC), and childhood immunisations in low- and middle-income countries could only find a handful of studies that examined the topic. The studies emphasise some evidence on changing behaviours at the household level (Watterson et al., 2015). Two studies, one in Zanzibar and one in Kenya, that explored the effectiveness of text message reminders and information delivered to pregnant women's mobile phones found evidence of statistically significant increases in ANC in their intervention groups relative to their non-intervention groups (Fedha, 2014; Lund et al., 2014). Although the findings of my quantitative analysis do not corroborate with the available evidence on the effectiveness of m-Health programmes on population-level service uptake, it could be because the intervention was routed via the community-level worker. The intervention is at the AWW level means which that the intervention's acceptability and effectiveness at her level could be influencing the outcomes at the population level. The findings of Chapter 4 highlight the nuanced ways in which various factors at the individual, programmatic, community, and organisational level influence AWWs.

One of the interesting lessons from studying the impact of the mobile phone and monetary incentives intervention is that, when coupled with cash transfer, the household level uptake of

services significantly increased. This finding leads to two implications. First, it emphasises the importance of taking into account beneficiary interest. When the beneficiaries and AWWs were incentivised and the AWW received technology assistance for real-time monitoring, the household uptake of services saw a significant improvement. This also underlines the findings of Chapter 4 which emphasised the beneficiary's interest for product-oriented services. Second, this finding in a way suggests the potential of mobile phone-based real-time monitoring for social protection interventions like the cash transfers. Because the evaluation design did not have a treatment with cash transfer and no mobile phone technology- monetary incentives intervention, it is hard to be conclusive about the impact of the cash transfer without the mobile phone technology intervention. However, it could be one of the future areas of research examining the role of mobile phone technology for CHWs in delivering cash incentives to improve household uptake of health and nutrition services.

As described earlier, because the intervention is a bundle, it is difficult to tease out the effect of the mobile phones and monetary incentives. However, the review of the intensity of the treatments across blocks highlighted that in T3, AWWs received the lowest amount of monetary incentives and faced challenges due to the phone. The challenges in using the phone might have impacted the AWWs in earning more incentives. The few studies that examined the influence of worker level monetary incentives found that it improves household uptake of services. A study by (Kosec et al., 2015) in Bihar among ASHAs and AWWs found that monetary incentives even improved the uptake of counselling services. One of the few studies that used an RCT design to estimate the impact of providing monetary incentives in the form of pay-for-performance reported that it improved the nutritional outcomes of children (Singh & Masters, 2016). However, this study incorporated a demand-side intervention, i.e. more information and education of mothers. Although it is difficult to conclude from my findings on the singular effect of monetary incentives, engaging with the available (limited) evidence on the influence of monetary incentives on AWWs also highlight that if worker level interventions are to succeed, significant beneficiary engagement needs to be ensured using demand-side interventions.

One of the limitations of my quantitative analysis is that it uses the midline data of a programme. Using the data that is collected after the completion of the programme could provide a complete picture of the intervention. However, in the BCSP context, due to financial limitations, the endline did not collect data from the comparison block. This made it impossible to tease out the impact of the mobile phone and monetary incentives intervention alone after the completion of the programme. Another limitation of my analysis stems from the unavailability of AWW level data to quantitatively measure the impact of the intervention at the AWW level due to the small

sample size. I anticipate the qualitative research will help in overcoming this limitation and help to provide a comprehensive picture on the role of technology augmented intervention and AWW performance. This is the subject of Chapter 6. Moreover, the inability to test the parallel paths assumption remains as a limitation of my analysis.

Do the findings presented in this chapter lead to lessons on the scale-up of the intervention? I would reserve that question for the last chapter after discussing the qualitative research findings on the technology augmented intervention's influence at the AWW level in Chapter 6.

To conclude, the findings suggest that the mobile phone technology and monetary incentives intervention did not have any positive impact on children below one year of age being weighed after the birth weight check-up. Neither did it impact on children below one year of age's VHSND attendance. Rather, it negatively influenced (statistically significant) the weighing of children below one year of age. Although the impact of the intervention on the proportion of children below one year of age who attended the VHSND who received weight monitoring remains positive, it is not statistically significant. The reasons for the lack of impact and negative impact could be because of i) the weak intensity of treatment received by AWWs in T3 block compared to the other two cash transfer treatment blocks and ii) possibility of a negative spillover effect due to the proximity of the T3 block to two other treatment blocks (where beneficiaries received cash transfers). This contrasts to the significant positive effects detected when the mobile phone technology and monetary incentives intervention is combined with a cash incentive for the beneficiary.

5.7 Supplementary tables

Table 25 Sample size for T1 and T2 blocks

Data	Sample size					
	Baseline 2013 (July to September 2013)			Midline 2015 (August to October 2015)		
	Treatment (T1)	Treatment (T2)	Total	Treatment (T1)	Treatment (T2)	Total
Household	1558	1534	3092	1506	1579	3085
Woman	1558	1534	3092	1488	1566	3054
Children	1616	1575	3191	1447	1532	2979
Anganwadi	55	55	110	51	54	105
Community (PSU)	54	54	108	55	55	110

Table 26 Descriptive statistics: household, woman, and child characteristics (T1 and T2 blocks)

Variables	Baseline 2013					Midline 2015				
	Treatment (T1)		Treatment (T2)		T1-T2	Treatment (T1)		Treatment (T2)		T1-T2
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Household										
Male headed	0.96		0.97		0.00	0.90		0.89		0.02
Household Head's education										
No education	0.52	0.50	0.51	0.50	0.01	0.49	0.50	0.49	0.50	0.01
Primary	0.14	0.35	0.16	0.37	-0.02	0.17	0.37	0.19	0.39	-0.02*
Middle	0.15	0.36	0.14	0.34	0.01	0.11	0.32	0.11	0.32	0.00
Secondary	0.12	0.32	0.12	0.33	-0.01	0.13	0.34	0.12	0.32	0.01
Higher secondary	0.05	0.21	0.04	0.19	0.01*	0.06	0.23	0.06	0.23	0.00
Graduate	0.02	0.15	0.03	0.17	-0.01	0.03	0.18	0.04	0.18	0.00
Post-graduate	0.00	0.06	0.00	0.04	0.00	0.00	0.06	0.00	0.04	0.00
Religion										
Hindu	0.94	0.24	0.93	0.25	0.00	0.94	0.23	0.94	0.24	0.01
Islam	0.06	0.24	0.07	0.25	0.00	0.05	0.23	0.06	0.24	-0.01
Caste										
Scheduled caste (SC)	0.40	0.49	0.49	0.50	-0.09***	0.42	0.49	0.52	0.50	-0.10***
Other Backward Class (OBC)	0.52	0.50	0.36	0.48	0.16***	0.49	0.50	0.36	0.48	0.12***
General	0.08	0.28	0.15	0.36	-0.07***	0.09	0.29	0.12	0.32	-0.03**
Access to ***agricultural land***	0.56		0.41		0.15***	0.53		0.40		0.14***
Access to ***drinking water facility***	0.96		0.97		-0.01	0.93		0.97		-0.04***
Access to ***toilet facility***	0.10		0.16		-0.06***	0.13		0.18		-0.05***
Asset Index	2.99	1.43	3.19	1.44	-0.20***	2.93	1.41	3.15	1.42	-0.23***
Woman										
Age	25.74	5.05	25.65	4.76	0.09	25.28	5.08	24.80	4.67	0.47***
Education										
No education	0.68	0.47	0.65	0.48	0.02	0.60	0.49	0.58	0.49	0.02
Primary	0.10	0.31	0.11	0.31	-0.00	0.14	0.35	0.12	0.33	0.02
Middle	0.10	0.30	0.10	0.30	0.00	0.09	0.28	0.09	0.29	0.00
Secondary	0.06	0.25	0.07	0.26	-0.01	0.09	0.29	0.09	0.28	0.00
Higher secondary	0.03	0.18	0.04	0.20	-0.01	0.06	0.23	0.08	0.26	-0.02**
Graduate	0.01	0.11	0.02	0.13	-0.01	0.02	0.14	0.04	0.20	-0.02***
Post-graduate	0.00	0.04	0.00	0.05	0.00	0.00	0.03	0.00	0.00	0.00
Age at marriage	14.83	3.21	15.13	3.37	-0.30***	14.95	2.81	15.45	2.94	-0.50***
Number of children	2.91	1.75	2.83	1.70	0.08	2.94	1.78	2.78	1.67	0.16**
Employment: non-HH work	0.14		0.12		0.02	0.28		0.28		0.00
Received ***at least one tetanus injection*** *during last pregnancy*	0.92		0.93		-0.01	0.87		0.91		-0.04***
Had ***institutional delivery*** *in for last childbirth*	0.56		0.62		-0.06***	0.65		0.72		-0.07***
Child										
Age	13.73	6.80	13.24	6.71	0.49**	10.83	6.61	11.34	6.53	-0.51**
Sex: Girl	0.47	0.50	0.50	0.50	-0.03	0.50	0.50	0.48	0.50	0.02
Moderate ***stunting***	0.46		0.50		-0.04**	0.43		0.42		0.01
Moderate ***underweight***	0.46		0.51		-0.05***	0.44		0.43		0.01
Moderate ***wasting***	0.27		0.27		0.00	0.26		0.26		0.00
N=	1616		1575			1561		1671		

Note: Means of variables by group *** p<0.01, ** p<0.05, * p<0.1

Table 27 Descriptive statistics: HH, Woman, and Child : Test for equivalence (C vs. T3; T2 vs. T3; T2 vs. T1)

Variables	Baseline 2013			Midline 2015		
	T1-T2	T2-T3	T3-C	T1-T2	T2-T3	T3-C
Household						
Male headed	0.00	0.00	0.00	0.02	-0.03***	0.00
Household Head's education						
No education	0.01	0.01	-0.06***	0.01	0.03*	-0.08***
Primary	-0.02	0.03**	-0.01	-0.02*	0.02	0.01
Middle	0.01	0.00	0.03**	0.00	0.00	0.01
Secondary	-0.01	-0.03**	0.04***	0.01	-0.04***	0.05***
Higher secondary	0.01*	-0.01	0.00	0.00	0.00	0.00
Graduate	-0.01	0.00	0.00	0.00	0.00	0.00
Post-graduate	0.00	0.00*	0.00*	0.00	0.00	0.00*
Religion						
Hindu	0.00	-0.04***	0.00	0.01	-0.02***	0.00
Islam	0.00	0.04***	0.00	-0.01	0.02***	0.00
Caste						
Scheduled caste (SC)	-0.09***	0.02	0.02	-0.10***	0.06***	0.00
Other Backward Class (OBC)	0.16***	-0.06***	-0.01	0.12***	-0.07***	0.03
General	-0.07***	0.04***	-0.01	-0.03**	0.02	-0.03***
Access to ***agricultural land***	0.15***	0.00	-0.04**	0.14***	0.00	-0.04**
Access to ***drinking water facility***	-0.01	-0.02***	0.09***	-0.04***	-0.02***	0.15***
Access to ***toilet facility***	-0.06***	0.05***	0.04***	-0.05***	0.04***	0.03**
Asset Index	-0.20***	0.17***	0.15***	-0.23***	0.06	0.47***
Woman						
Age	0.09	-0.47***	0.14	0.47***	-0.05	-0.58***
Education						
No education	0.02	-0.02	-0.05***	0.02	-0.01	-0.05***
Primary	-0.00	0.01	0.00	0.02	0.00	0.01
Middle	0.00	0.01	0.01	0.00	0.00	0.01
Secondary	-0.01	-0.01	0.04***	0.00	0.00	0.02**
Higher secondary	-0.01	0.01	0.00	-0.02**	0.01	0.01
Graduate	-0.01	0.00	0.00	-0.02***	0.01	0.00
Post-graduate	0.00	0.00	0.00	0.00	0.00	0.00
Age at marriage	-0.30***	0.41***	0.51***	-0.50***	0.06	0.22**
Number of children	0.08	-0.09	0.00	0.16**	-0.01	-0.09
Employment: non-HH work	0.02	-0.01	-0.01	0.00	-0.01	-0.02
Received ***at least one tetanus injection*** *during last pregnancy*	-0.01	-0.03***	0.05***	-0.04***	0.02*	0.07***
Had ***institutional delivery*** *in for last childbirth*	-0.06***	0.06***	0.11***	-0.07***	0.07***	0.12***
Child						
Age	0.49**	-0.33	-0.33	-0.51**	-0.47**	0.14
Sex: Girl	-0.03	-0.02	0.01	0.02	0.02	-0.02
Moderate ***stunting***	-0.04**	-0.06***	-0.02	0.01	0.01	0.02
Moderate ***underweight***	-0.05***	0.01	-0.01	0.01	-0.02	0.00
Moderate ***wasting***	0.00	0.03*	0.02	0.00	-0.03	0.00

Note: Means of variables by group *** p<0.01, ** p<0.05, * p<0.1

Table 28 Descriptive statistics: AWC, AWW and PSU characteristics (T1 and T2 blocks)

Variables	Baseline 2013					Midline 2015				
	Treatment (T1)		Treatment (T2)		T1-T2	Treatment (T1)		Treatment (T2)		T1-T2
	Obs.	Mean	Obs.	Mean		Obs.	Mean	Obs.	Mean	
AWC										
AWC is functioning in a pucca building	54	0.76	54	0.65	0.11	37	0.84	41	0.90	-0.06
AWC has own building	54	0.57	54	0.46	0.11	51	0.55	54	0.43	0.12
AWC has a functional toilet	54	0.28	54	0.09	0.19**	37	0.24	41	0.29	-0.05
AWC has potable drinking water facility	54	0.63	54	0.43	0.20**	37	0.81	41	0.59	0.23**
AWC has functional weighing machine(s)	54	0.67	53	0.49	0.18*	47	0.94	50	0.92	0.02
AWW										
Age (years)	53	0.36	52	0.35	0.02	51	0.37	54	0.37	0.00
Experience (years)	53	0.11	52	0.08	0.03***	50	0.13	53	0.10	0.02**
Education										
Middle	53	0.06	52	0.00	0.06	51	0.00	54	0.04	-0.04
Secondary	53	0.34	52	0.37	-0.03	51	0.45	54	0.37	0.08
Higher secondary	53	0.47	52	0.46	0.01	51	0.33	54	0.43	-0.09
Dip/certificate	53	0.00	52	0.00	0.00	51	0.00	54	0.00	0.00
Graduate	53	0.09	52	0.15	-0.06	51	0.20	54	0.13	0.07
Post graduate	53	0.04	52	0.02	0.02	51	0.02	54	0.04	-0.02
Caste										
Scheduled Caste (SC)	53	0.25	52	0.31	-0.06	51	0.14	54	0.28	-0.14*
Other Backward Class (OBC)	53	0.62	52	0.42	0.20**	51	0.75	54	0.48	0.26***
General	53	0.13	52	0.27	-0.14*	51	0.12	54	0.24	-0.12
PSU										
Average PSU population	54	1175	54	1282	-107.15*	54	1234	55	1331	-97.9
ASHA resides in the PSU	54	0.87	54	0.83	0.04	54	0.78	55	0.78	0.00
Village headman resides in the PSU	54	0.28	54	0.28	0.00	54	0.22	55	0.24	0.01

Note: Means of variables by group *** p<0.01, ** p<0.05, * p<0.1

Table 29 Descriptive statistics: child and woman outcome variables (T1 and T2 blocks)

Variables	Baseline'2013					Midline'2015				
	Treatment (T1)		Treatment (T2)			Treatment (T1)		Treatment (T2)		
	Obs.	Mean	Obs.	Mean	T1-T2	Obs.	Mean	Obs.	Mean	T1-T2
Child										
Children < 1 year who received weight monitoring ever after birth weight check	**765**	0.4	**782**	0.36	**0.04***	**979**	0.61	**999**	0.65	**0.04***
Children < 1 year attended the VHSND	**765**	0.44	**782**	0.54	**-0.10*** **	**979**	0.47	**999**	0.53	**0.06*** **
Children < 1year who attended VHSND who received weight monitoring	**335**	0.24	**421**	0.17	**0.07****	**465**	0.73	**530**	0.67	**-0.06*** **
Woman										
Women who had their weight checked at least once during their last pregnancy, if they had received at least one antenatal check-up	**431**	0.61	**373**	0.67	**-0.07****	**832**	0.69	**866**	0.83	**0.14*** **
Women attended the VHSND in the last pregnancy	**765**	0.29	**782**	0.37	**-0.08*** **	**979**	0.48	**999**	0.49	**0.02**
Women who attended the VHSND at least once during the last pregnancy who received weight monitoring	**422**	0.48	**476**	0.45	**0.03**	**466**	0.84	**491**	0.91	**0.07*** **

Note: Means of variables by group *** p<0.01, ** p<0.05, * p<0.1

Chapter Six: Anganwadi workers' perceptions and experiences in using the mobile phone technology and monetary incentives intervention

6.1 Introduction

The findings of the previous chapter indicate that the technology augmented intervention could not make improvements in the household uptake of services despite incentives and job aids appearing as factors affecting performance in the overall conceptual framework. How did AWWs perceive the intervention? Did they perceive the intervention to be useful in their daily job responsibilities? To provide a comprehensive picture of the technology augmented intervention's influence, in this chapter, I present findings of the qualitative research that explored the influence of the intervention at the AWW level. As described earlier, the qualitative research explored AWWs' perceptions and experiences in using the intervention via semi-structured interviews.

The chapter is structured as follows. This introduction section is followed by a background section 6.2, which recaps the empirical context and discusses the analytical framework used in this analysis. The third sub-section 6.3 presents the findings and the penultimate section 6.4 discusses the relevance, generalizability, implications for the policy and practice, and limitations of the findings. The last section, Error! Reference source not found., concludes the chapter with a s ummary of conclusions from the findings.

6.2 Background

As discussed in Chapter 1 and 3, I conducted qualitative fieldwork which informs two different chapters with separate objectives. This chapter focuses entirely on AWWs' perceptions and experiences in using the technology augmented intervention from the block where the mobile phone technology and monetary incentives intervention was active. This is based on 15 interviews from the T3 block.

The BCSP considers AWWs as the fulcrum of the programme. AWWs are the sole agents of the programme, and a great degree of discretionary power is vested in them. The BCSP is designed in such a way that two types of service reporting (weight data and VHSND service availability) are monetarily incentivised, but using the mobile phone to manage the pregnancy care services and counselling services is not monetarily incentivised. The incentive structure is also different based on the type of reporting. The weight monitoring incentive is cumulative, but the VHSND form submission is a monthly fixed bonus. Within this unique incentive and technology context, AWWs could behave differently. They may comply with the tasks which are incentivised to maximise incentives or use the technology for incentivised and non-incentivised tasks because it helps them

as job aid. To thoroughly explore the AWW's perceptions, experiences, strategies, opportunities, and challenges using the phone, I decided to use the qualitative method of inquiry. I used semi-structured interviews to understand whether the mobile phone has become part of the AWW's day-to-day practice and to explore the underlying avidity or apathy regarding the intervention and reasons for it.

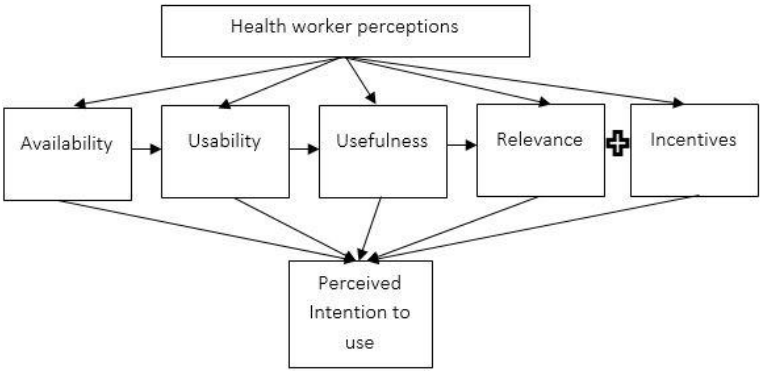
6.2.1 Analytic framework

In the overall thesis, I define AWW performance as 'AWWs making services accessible to the required number of beneficiaries with adequate quality' (i.e. adhering to guidelines). Understanding the influence of the mobile phone and monetary incentives bundle on an AWW's perceived performance means exploring what an AWW feels the overall opportunities and challenges in using the bundle are particularly in conducting services such as weight monitoring, VHSND organisation, and counselling activities.

Previous studies that looked at CHW or frontline health worker perceptions in using the mobile phone technology in their jobs used adapted versions of conceptual frameworks such as Davis' Technology Acceptance Model (TAM) (Blanas et al., 2015; Davis, 1989; Goodhue & Thompson, 1995) or the Task-Technology Fit (TTF) model (Mwendwa, 2016). In my analysis, I used an adapted version of the TAM by Blanas et al. (2015) to organise the emerging findings from my research. The initial version of the adapted TAM combined with an additional incentive component is given in Figure 12. I used this model to help me contextualise my findings and further develop it for studies integrating a mobile phone and monetary incentives bundle for workers such as the AWWs.

The TAM was developed by Davis in 1985. He proposed perceived usefulness and perceived ease of use as fundamental determinants of user acceptance of technology especially in the case of computers. Later, Davis himself and others refined the TAM to study the acceptance of different various emergent technologies including mobile wireless technology, mobile phones etc. TAM still remains as the most cited model by studies that assess technology acceptance in multiple fields. In the field of m-Health, studies have used models like TAM to test the validity of the model in the health sector, to develop m-Health interventions, and as an analytic framework to understand technology acceptance of m-Health interventions by health professionals. I found the adapted version of TAM by Blanas et al. (2015) useful because they developed it to design the intervention and to analyse community-level health professionals' perceptions in using the technology which is similar to my research objectives. Although Blanas et al. (2015) used the revised TAM to design their study, I only use it in the analysis–i.e. to analytically organise findings from the research.

Figure 12 Mobile phone and incentives adaptation of the mobile phone acceptance model



Source: Adapted from (Blanas et al., 2015; Davis, 1989; Kim & Garrison, 2009)

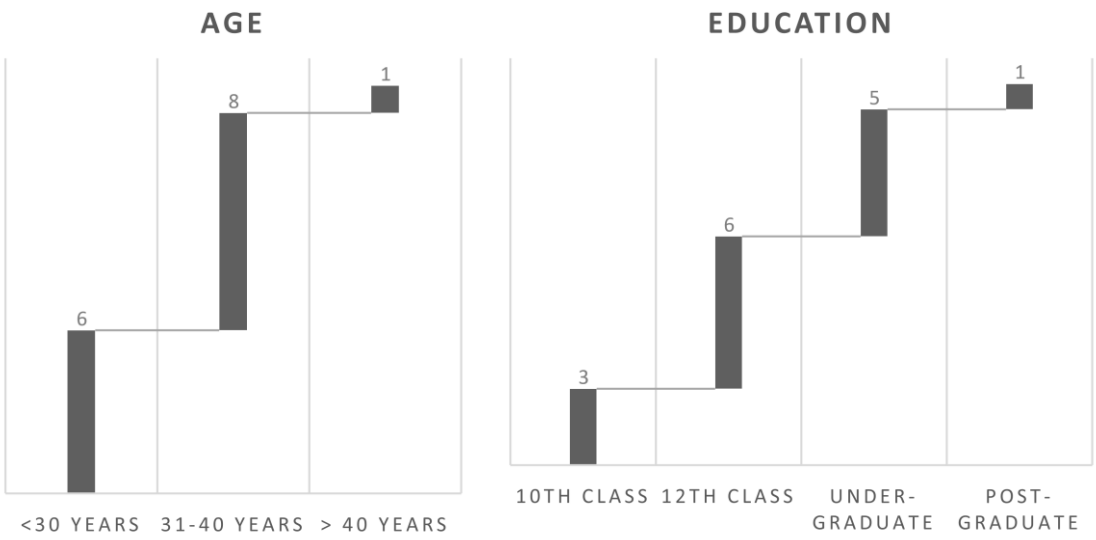
6.3 Findings

I present the findings with a summary of demographic characteristics of AWWs. The findings are presented as five sub-sections based on the analytical framework as availability, usability, usefulness, relevance, and incentives.

6.3.1 AWWs' characteristics

The group of fifteen AWWs I interviewed in the intervention (T3) block belonged to varied age, education, religious, and caste categories.

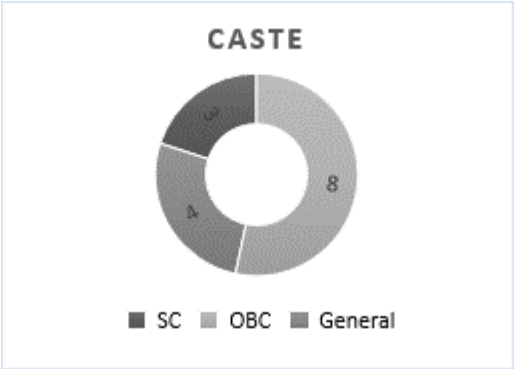
Figure 13 Age and education background of interviewed AWWs



The participants included eight AWWs who are between thirty-one to forty years of age and six below thirty years of age. Only one AWW was above forty years of age. Within this group, six

AWWs completed twelve years of education and five completed an undergraduate degree. While three AWWs met the minimum education criteria to be selected as an AWW (ten years of education), one of them even possessed a post-graduate degree.

Figure 14 Caste categories of interviewed AWWs



The majority (eight) of AWWs belonged to OBC; four belonged to the General category and three from the SC. Except one, all others (fourteen) practised Hinduism. One AWW practised Islam and served a predominantly Muslim community.

AWWs were using Nokia ASHA 206 phones with a Subscriber Identity Module (SIM) card. They received money in their bank accounts to buy the phone. The BCSP implementation team facilitated in providing group SIM cards for AWWs of the same block. The group SIM package came with free call facility among the group members (i.e. AWWs of the same administrative block) and a pre-paid internet data allowance to upload the data to the cloud-based Management Information System (MIS). AWWs registered pregnant women using the CommCare application case management tool at the fourth of pregnancy. As described earlier, the application is designed to facilitate AWWs follow-up pregnant women during their pregnancy period. Once the child is born, AWWs follow-up with the child's immunisation schedule and monthly weight monitoring. On the day of the VHSND, AWWs used the CommCare application to fill out the service availability form. The service availability form contains YES or NO questions on the availability of equipment (weighing machine), personnel (ANM and ASHA), and medicines (IFA tablets and measles vaccination). Once connected to the internet, the data transmits to the cloud, and the MIS gets updated. The MIS is monitored by the BCSP team at the district headquarters. AWWs received monetary incentives in their bank accounts monthly. AWWs received training in batches from September to November 2014. The training lasted for one week, and each batch had twenty-seven to thirty-two AWWs. They also received two days of refresher training in July

2015. In the training, the AWWs were taught to use the phone, local language (Hindi) typing, and use of the CommCare application. The Technical Support Officer (TSO) for the programme block facilitated the installation of the mobile application. During implementation, the TSO helped AWWs troubleshoot any issues, monitored phone use during the implementation, and processed AWW's monetary incentives. A Programme Manager managed the programme along with a Technology Manager at the district level.

6.3.2 Availability and access to mobile phone technology among AWWs

Lack of availability of technology (in this case a functional mobile phone and SIM card) emerged in the interviews as a critical factor influencing AWWs' use of technology. The literature on health cadre general acceptance of technology highlights the importance of the availability of the technology as a crucial factor leading up to perceived intention to use and actual use of the technology (Blanas et al., 2015). Findings of this chapter suggest that the availability of the technology is varied.

One third of the AWWs (five) faced technical challenges and hence did not use the mobile phone at the time of the fieldwork. Two of the AWWs discussed having issues related to their SIM cards; one AWW did not receive the phone due to her recent re-appointment in the centre[74]; and two of them had phone related issues (one dropped the phone in the water, and the second one's phone had issues from the start and was now waiting for a new one). Though the network coverage, especially the 3G access is also a crucial factor for the BCSP participation, the interviewed AWWs did not discuss challenges in connecting to the internet to submit the data

.

> *"… under BCSP program we have to organise the nutrition day via mobile. Earlier we use to call the mothers, pregnant women, adolescent girls and used to tell them about new topics like on vaccination day, on cleanliness, on pregnancy, on mothers and like that we used to explain to them. But now on mobile we do it but my mobile is out of order since the past 2-3 months."*
>
> *(AWW Interview)*

As discussed above, in selecting the AWWs I did not use any BCSP specific selection criteria to select participants to avoid any programme bias eclipsing the perceptions and experience of AWWs on the influence of the monetarily incentivised use of mobile phones. This strategy proved

[74] She was suspended a few years back for non-compliance of AWC rules. She fought a case and got back her position a few months prior to this fieldwork.

helpful in understanding one of the main challenges AWWs face in using the mobile phone technology—i.e. availability of mobile phones and functional SIM cards. Although the ICDS and the BCSP teams emphasised that all AWWs used the mobile phone in the block, this random selection of AWWs revealed the availability issues AWWs encountered. The technical challenges revealed in this analysis seem to be crucial in realistically understanding the magnitude of change the intervention can bring in the working lives of AWWs. The experiences of AWWs not currently using the phone suggest that they either did not receive the phone (two cases) or problems related to the phone or SIM card emerged while they were using it (three cases). One reason for the delays in repairing the SIM cards and phones or making the new phone available is related to the use of government procurement systems, as the BCSP used existing government systems (application, approval, and procurement) for replacement and repair. This suggests that the issues related to the newly introduced technology are identical to other equipment (such as weighing machines) and supply (growth charts, medicines, etc.) barriers evidenced in the literature as limiting the AWW (Biswas & Verma, 2009; HUNGaMA, 2011; Nayak & Saxena, 2006; NIPCCD, 2009a, 2009b; Saxena & Srivastava, 2009). Thus, the lack of availability of technology due to unresponsive existing government procurement channels limits the AWW in using the mobile phone in her work.

6.3.3 Usability

The perceived ease of use concerning the technology is another factor that emerged from the perceptions and experiences of AWWs as affecting performance. The perceived ease of use is identified as one of the founding elements in the TAM and evidenced in the literature on health cadre general acceptance of technology as influential in intention to use the technology (Blanas et al., 2015; Mwendwa, 2016). I define perceived ease of use in this analysis as the extent to which using the mobile phone technology is perceived as consuming time, energy, and effort (Blanas et al., 2015). The interviews suggest that the perceived ease of use of the mobile phone varied among participants primarily due to their varied levels of proficiency in using the phone. Not surprisingly, the majority of AWWs who perceived that the mobile phone application is easy to use tended to use the phone in their work compared to the ones found it difficult.

The diverse views on perceived ease of use emerged in the interviews are summarised in the following quotes.

> *"If we learn [how to use the mobile phone application] then it is easy. Otherwise, it is burdensome."*
>
> *(AWW Interview)*

> *"The change due to [this] mobile is that I can save some time now. The work has become easy, and I like working. Time is saved because there is no paperwork. That is why I like it".*
>
> *(AWW Interview)*

As the two quotes depict, the perceived ease of use varied depended on the level of proficiency of the AWW. The first quote also suggests that a steep learning curve is associated with the mobile phone application. If an AWW can learn or attain a good level of proficiency, then the mobile phone can help her. Otherwise, it adds to her existing high workload. Two AWWs with low perceived level of proficiency shared this view about using the phone. However, they both were happy that the mobile phone did not involve any *writing*. What influences the level of proficiency is a crucial question here. Age, education and prior familiarity in using technology are three factors identified as important for acceptance of mobile phone applications as an aid for CHWs in an earlier study (Barnett, et al., 2016). However, in this analysis, I could not find evidence that the age and education influenced the level of proficiency in using the phone, as AWWs who found difficulty in using the phone varied in age and education. The one AWW who was below thirty and an AWW with a post-graduate degree found it difficult to use the phone application and used it only to comply with the minimum programme responsibilities. AWWs who found difficulties in using the phone application also mentioned having received additional training and day-to-day support from the BCSP team and the TSO. Out of the ten AWWs with a functional phone, three AWWs who found using the mobile phone application difficult took assistance from the TSO. Two others possessed basic skills and complied with the minimum programme requirement and the remaining five used the phone for programme tied activities (the VHSND reporting and weight monitoring) and non-programme tied activities (behavioural change counselling).

The varied levels of proficiency with the mobile phone application existed due to the difference in the 'period of use' or the familiarity with the new technology among AWWs. AWWs who became familiar with the phone application over time valued its role in their work (discussed in the next section). The implementation documents suggest that AWWs in the intervention block received mobile phones in batches, and all batches received the phone by January 2015 (i.e. nine months before the fieldwork[75]). However, only a few interviewed AWWs mentioned that they received the phone four months to one year before the fieldwork. AWWs who found it difficult to use the phone either received the phone a few months ago, or experienced phone and SIM related issues, or missed the training session, thus were not familiar with the new technology.

[75] The fieldwork was conducted in August- September 2015

6.3.4 Perceived usefulness

The perceived usefulness, the degree to which workers believe the mobile phone technology will help them do their job, is another key theme that emerged from AWWs' perceptions and experiences as influential in their performance. The majority of AWWs who use the phone found it useful in reducing workload (preparing and sending reports), improving communication (peers and supervisors), and enticing beneficiaries, thus directly influencing their motivation and overall performance.

Reduced workload

AWWs felt the mobile phone is useful in reducing their workload due to the ease in preparing (less writing) and sending (immediate reporting) reports. Most of the AWWs mentioned that they felt an ease in preparing and sending reports using the mobile phone. With the mobile phone application, case management of women (and children after delivery) was made possible and it reduced the writing AWWs had to do. Even the AWWs who found the phone difficult to use appreciated the fact that their writing responsibility reduced due to the phone.

> *"Earlier we did not have Baal Samarthan [the BCSP]. Now we have started that is why we have got a mobile. With the mobile, we send names of the pregnant women under Baal Samarthan [the BCSP]. Then we ask them to register the name when they deliver the child. With the mobile, we also register their names, this way we maintain our register also".*
>
> *(AWW Interview)*

AWWs also felt it was easier to send reports through the phone indicating the immediate reporting made possible due to the phone. Most of them mentioned that before using the mobile phone, the details (pregnancy records, growth data of children) used to be in their registers and never reached upwards. AWWs appreciated the immediate reporting due to faster transmission of data from their levels to supervisors.

> *"It feels good. Earlier we had to fill the forms and submit, now I have just to send a message, and they get the information".*
>
> *(AWW Interview)*
>
> *"On immunisation day, I do my reporting that there were this many mothers, children, etc. Now because of the negligence of the CDPO, Gram Sevikas they took the report and kept it in their drawers. Now when the CDPO asks again, I have to give it again. So once again I get punishment. Now I can send it to you directly, and you get it through the net. So, I submitted the report*

directly to you that these many are pregnant women, these many mothers, these many malnourished, severely malnourished and these many children, and pregnant women were weighed. Now nothing is going wrong. There is no punishment also. So, this mobile is very useful thing".

(AWW Interview)

As the above quote illuminates, one AWW considered repeated requests for filling up formats due to the supervisor's negligence as a punishment[76]. The phone gave her an opportunity to avoid these kinds of issues and experience a sense of agency over her reporting activity as she felt connected to an external supervisory level above her. The feeling of a sense of autonomy in bypassing the supervision weakness seems to positively contribute to AWW motivation.

Overall, the sense of reduced workload motivated AWWs to use the phone and directly influence the quality of services such as pregnancy care and VHSND preparation.

Improved communication

All AWWs mentioned that the mobile phone has now made communication between their peers and supervisors easier. They felt that, because of the 'free' call service between themselves they talk to each other more for discussing doubts with regard to administrative procedures. One AWW mentioned that they talked about Anganwadi matters, not home matters on the phone.

"Suppose I do not know something then I can talk to a Sevika in the Panchayat and ask her. I can also talk to the Madam (supervisor), and if Madam is not able to come and she is busy in some work, then I can talk to her. So, it is useful for communication".

(AWW Interview)

The improved communication between peers and supervisors seem to directly influence the overall performance of AWWs.

Enticed beneficiaries

Another factor that contributed to the usefulness of the mobile phone and directly influenced AWW performance in counselling is the perception that beneficiaries are attracted by the phone. A few AWWs expressed this belief and mentioned that beneficiaries had come to ask about the phone and see videos on the phone. AWWs felt that the beneficiaries understood the videos better than the face-to-face counselling. Although the quotes below support the fact that AWWs

[76] AWW used this exact English word in the interview.

perceive that it is easier to entice beneficiaries using the phone, it could also be due to the 'novelty effect' a new gadget brings in village settings. It could also be that the AWW herself is demonstrating her modest pride in possessing a new gadget.

> *"Even yesterday 2-4 women asked about mobile. It quite allures them".*
>
> *(AWW Interview)*
>
> *"This has impacted a lot. Women from village get so excited just to see in mobile. Madam, they like it a lot when we make then understand through pictures in the mobile".*
>
> *(AWW Interview)*

Interviews with the AWWs suggests that phone is useful as the beneficiaries are enticed by the phone. This seems to positively influence AWW motivation and to some extent the quality of counselling conducted by them.

6.3.5 Relevance

The interviewed AWWs found the mobile phone useful and relevant for carrying out specific tasks such as weight monitoring, pregnancy care, and counselling of beneficiaries. However, it pose challenges for convincing beneficiaries to attend the VHSND. Although the theme of relevance may seem to be identical to usefulness, it specifically means the degree to which the technology in question will assist the worker in carrying out particular responsibilities they have been tasked as workers (Blanas et al., 2015). Technology that is available, easy to use, and potentially useful might not be used be by the worker if it is not related to their work. In the case of the CommCare application, it was envisaged to directly improve services AWWs needed to carry out and the majority of AWWs felt that the mobile phone application helped them. However, in the case of VHSND attendance, AWWs faced unintended adverse effects due to the cash transfer operational in the other two blocks.

Weight monitoring

AWWs felt that the weight grading of children was easier with the mobile phone because it was simpler and quicker. The mobile phone application automatically calculated the grade when the AWW entered it on the phone. AWWs felt it eased their efforts; otherwise, they needed to use growth charts, which most of them found difficult to use. They also felt the instant grade calculation helped them communicate the status of the child to his or her mother. Earlier, AWWs used to guess the grade of the child to communicate with the mother and fill the growth chart

later at home. The usefulness and relevance of using the mobile phone to undertake weight monitoring was appreciated more by AWWs who were well-versed with the mobile phone and application than the ones found it difficult. However, AWWs who faced difficulty in using the phone also found the growth chart difficult, and still preferred the phone.

Although AWWs felt ease in conducting the weight monitoring service, they did not conduct all weight monitoring using the phone. The phone was used to register all pregnant women at the start of the programme and women who got pregnant afterwards. AWWs only conducted weight monitoring of children of these women—which is a small group compared to the existing beneficiary cohort. AWWs used mobile phone weight monitoring for children born after the start of the programme (roughly from the start of 2015) and continued using paper growth charts for children who were born before the programme (i.e. monthly weighing of children who are below three years of age and quarterly weighing of children between three and six years of age). This was because the mobile phone application could only register women who are pregnant and then follow-up their children after birth. Directly adding children was not possible with the application. Moreover, the limitations due to lack of quality weighing machines still existed. Thus, mobile phone weight monitoring did not seem to have influenced the number of children weighed, rather it improved the motivation of the AWW to conduct the weight monitoring service and the quality of the service by improving the accuracy and responsiveness of the AWW in AWCs with access to weighing machines.

> *In that suppose, we want to know the weight. We ask the question and then after that press the button, we get to know from the information that appears whether the child is malnourished. So, it is easy for us. Earlier we had to weigh, [fill] the chart, plot it on the graph and then calculate. However, with the mobile it has become easy.*
>
> *[…...] The growth chart is big. We have to take it out then match it and write at the bottom and put a mark. After that, we can tell that the child is coming in this particular grade. On the mobile, we get to know instantly and can then inform the mother in which grade the child is falling. We can tell by seeing the mobile".*
>
> *(AWW Interview)*

Pregnancy care and counselling services

AWWs felt motivated using videos during counselling sessions (individual) and following the pre-set questions in the application while registering pregnant women. These features of the mobile

phone to an extent improved the perceived quality of services (case management of pregnant women and behavioural change counselling).

> *"We have also become aware due to this [the BCSP] …Like, I am a Sevika I learned to operate the mobile. I like it very much. After that on nutrition day the number of questions that are there I was not able to ask all questions before. Now it has become easy to ask questions on the POSHAN day (the VHSND), and I can get the information about children just by asking questions. Also, we can automatically get to know the grade of the child".*
>
> *(AWW Interview)*
>
> *"The change is that these things were not there before. When they [beneficiaries] used to come for immunisation and we used to write in the register. Now via the mobile, we have to send. We sit with them. We make them listen to what all they have to do, first we play songs for them on the mobile. That is why they understand fast. Earlier they were quiet".*
>
> *(AWW Interview)*

AWWs who used videos in counselling felt the videos communicated effectively with the beneficiaries better than words—they were understood better by beneficiaries. They felt the beneficiaries showed a keen interest in viewing the videos during counselling sessions. One AWW mentioned that while registering pregnant women, the set of questions on the phone helped them to stick to all relevant information (such as last menstrual period, birth preparedness, and so forth) and it was more effective than before. AWWs who possessed decent levels of proficiency reported using the phone in counselling services.

VHSND attendance

Although improved VHSND attendance was one aim of the intervention, the interviews with AWWs suggest that they face difficulties in convincing beneficiaries to turn up for the VHSND. AWWs attribute this to the presence of the cash transfer programme in adjacent blocks as part of the wider BCSP. AWWs said beneficiaries in their block took vaccines and attended the VHSND in expecting to receive Rs. 250 per month. Beneficiaries complained that in other AWCs (in other blocks) pregnant women got money, but in their centres, AWWs were not giving them money. These beneficiaries were aware of the presence of the cash transfers in the neighbouring blocks and demanded their share. This strained the trust between beneficiaries and AWWs. AWWs needed to put in extra efforts to convince them about the absence of the programme in their block and assure that if the money comes for them, then she will pay. This factor also can impact

on beneficiary attendance at the VHSND. This spillover effect affects the trust between the AWW and beneficiaries and negatively influences the AWW motivation and service uptake. This is in line with negative spillover detected in Chapter 5.

> *"So, in their mind, they feel that they are not getting 250 rupees, and Didi (Anganwadi Sevika) pocketed it. They say 'is [the name of the block] second (step child)'? Yes, [the block] is. However, I say see, the state of health/nutrition is good here. Children, there are weak. There are weak children here too, but compared to another block there it is less. [….] If it comes from up (government) then the money will go to everyone's account. Why will we keep your money? The day we get 250 rupees that day you will get it".*
>
> *(AWW Interview)*

6.3.6 Incentives

The incentive component is an added element unique to the intervention. Although the monetary incentives were hypothesised to directly improve AWW performance by positively influencing the access element of the weight monitoring service (performance outcome at the AWW level) and motivate AWWs (performance output at the AWW level), it did not improve both.

AWWs did not demonstrate any explicit motivation or demotivation to receive incentives (Rs. 100 per month for filling the VHSND service availability form and Rs. 5 per child for weight monitoring). They admitted to receiving incentives (mainly the Rs. 100 per month), but they were quite modest in opening up about their feeling in receiving the extra money. Although AWWs complained about the extra work they were asked to do (discussed in Chapter 4) such as the distribution of health insurance cards and election related responsibilities, they did not complain about the BCSP responsibilities. In effect, reporting through the phone was an additional responsibility that AWWs were not complaining about potentially suggesting that the extra work does not demotivate them due to the incentives effect.

One AWW illuminated the issue further, in providing the example of how they collectively refused to fill a format for the health department because it was the ASHA and ANM's work and they get paid for it. For the BCSP they felt they are getting paid for sending the report and got the mobile phone. In the context of monetary incentives, one feature positively influenced AWWs is the ease in getting the money. The below quote underlines that—

> *"Feels good, just message and the money comes in the account Rs. 100."*
>
> *(AWW Interview)*

One reason AWWs did not demonstrate explicit motivation could be due to the low magnitude of incentives they receive.

Although the majority of AWWs received Rs. 100 per month multiple times in their bank account by sending the VHSND service availability form, they did not receive a significant amount of money through weighing children. Most of them did not even remember how much they earned by weighing children because it was not much. This could be because of three reasons—

i. The programme beneficiary registration barrier

ii. The programme emphasis on the VHSND

iii. The levels of proficiency

The programme beneficiary registration barrier: The programme only allowed registering pregnant women from the start of the programme and weighing children born after that. This meant, during the time of the fieldwork only a few programme children had been born and AWWs only weighed a few children. The number was not enough to generate the critical amount of money that could make a significant influence on AWW motivation. The payment details (as part of the clarifications asked the programme team) suggest that until September 2015, the maximum amount an AWW earned in the whole block is Rs. 25 (i.e. weighed five children). Thus, AWWs not receiving a sizeable amount of money because they are unable to unlock the full potential of the incentive opportunity due to the programme design features could be one of the reasons for AWWs not being motivated due to the monetary incentives. AWWs not weighing more children due to monetary incentives mean that it has not been able to positively influence the access[77] element of the weight monitoring service as well.

> *"Yes, we get payment, when we send the report about children, and pregnant women, and it reaches them then we get 100 rupees every month. This is the policy of Bal Bihar Samarthan (BCSP)".*
>
> *(AWW Interview)*

The programme emphasis on the VHSND: The majority of AWWs emphasised that they use the phone on the VHSND. This could be because the programme provides additional monitoring support that day and AWWs can earn a significant amount (almost a day's wage) of money by sending the service availability form. However, weighing children just that day is not enough to generate a critical amount of money through weight monitoring. For an AWW to earn more money from weight monitoring, she needs to weigh children on other days as well to cover all

[77] AWW making the weight monitoring service accessible for more number of beneficiaries.

eligible children. Considering immunisation is the key activity on the VHSND, children eligible for weighing but do not have scheduled immunisation might not come for the day. In the interviews, the majority of AWWs primarily identified the mobile phone as something they use on the VHSND and not necessarily on other days—especially the ones who have basic or average levels of proficiency. The emphasis on the VHSND could also be hindering an AWW's potential to expand the incentive opportunity and to an extent explain the lack of motivation towards monetary incentives.

> *"Poshan (the VHSND) day we have to do it. Immunisation is done once a month, and we have to make an entry on our mobiles about pregnant women who have given birth. We are told how to do it and that we will get Rs.5 for making one entry per child, and we do Poshan day (the VHSND) once a month, and for that, we are told we will get Rs.100".*
>
> *(AWW Interview)*

The levels of proficiency posed a hindrance to AWWs in earning further monetary incentives. AWWs with basic levels of proficiency faced a steep learning curve in using the mobile phone. They were not able to send reports without assistance, and thus didn't receive incentives so far (i.e. until September 2015). This vicious circle (the steep learning curves→no incentives→ low motivation) meant that incentives were not able to act as a motivating factor for AWWs with basic levels of proficiency.

> *"They said you do the work; you will get 100 rupees. However, we are not able to do all the work that is why we are saying that we have not got the money. They say that when you have not done the work how can we give the money".*
>
> *(AWW Interview)*

6.4 Discussion and conclusion

By exploring AWWs' perceptions and experiences in using the mobile phone and receiving monetary incentives, I found that the majority of the AWWs perceived the mobile phone technology to be easy to use. They also found it useful in reducing workload related to reporting, improving communication between peers and supervisors, and attracting beneficiaries. However, barriers to the smooth availability of the phone and SIM card, reduced relevance in specific tasks due to programme limitations, and no influence of the monetary incentives on AWW motivation and performance limit the influence of the bundle on AWW performance. Hence, the mobile

phone technology bolstered with monetary incentives intervention has mixed influence on AWW performance.

Table 30 Summary of findings

Domains	How were the phone and incentives influenced?	Why?
Availability	Varied availability influencing usage of phone application	Due to using existing government procurement
Usability	Varied ease of use of phone application	Varied levels of proficiency due; partly due to differential periods of use
Usefulness	Found useful in reduced workload, improved communication and attracted beneficiaries	Reduced workload due to ease of preparing and sending reports Improved communication with peers and supervisors Videos in the phone attract beneficiaries
Relevance	Relevant in weight monitoring, pregnancy care, and counselling but limited by programme barriers Unexpected negative influence on VHSND attendance	The BCSP registration barriers in including all young children and pregnant women VHSND attendance negatively influenced by AWW's identity linked to the cash transfer
Incentives	No motivation or demotivation for AWWs	The low magnitude of incentives and the BCSP programme registration barriers

Table 30 provides a summary of findings. The findings of this chapter emphasise that the availability of the technology leads to usability (perceived ease of use). AWWs who found the application easy to use identified its usefulness quickly. If the technology is available, easy to use, useful, and relevant to task performance, an AWW seems to use it in her day-to-day work. Although interviewed AWWs found the application useful, issues in availability and varied usability limited the magnitude of usefulness reported by AWWs. Programme registration barriers and beneficiaries identifying the AWW with the cash transfer adversely influenced the relevance of the technology in specific services. The incentive component was designed to motivate the technology acceptance of an underpaid worker like the AWW. However, due to the low magnitude of incentives and programme registration barriers, the intervention missed a crucial opportunity to motivate an underpaid worker to take up the technology and earn more money through increasing weight monitoring.

The studies that examined m-Health and m-Nutrition interventions used by CHWs report technological challenges. The majority of technological issues are related to disruptions in the mobile network, unavailability of power for charging, small size of the screen, and local language incompatibility of the mobile software (Barnett & Gallegos, 2013; Barnett, et al., 2016; Berg et al., 2009; Blaschke et al., 2009; Braun et al., 2013; Smith et al., 2013). Surprisingly, none of these issues emerged in my qualitative research context. This could be because the intervention was designed based on the existing evidence available in the m-Health and m-Nutrition fields. However, using the existing government procurement systems for hardware (Phone and SIM card) replacement created barriers in availability. This reason for the delay did not emerge in other contexts as the majority of studies were pilots and may not have used government channels of procurement.

Other studies also report the varying levels of proficiency of CHWs in using the mobile technology (Barnett & Gallegos, 2013; Barnett, et al., 2016; Berg et al., 2009; Blaschke et al., 2009; Braun et al., 2013; Smith et al., 2013). However, the majority of them attribute it to the age and education of the CHWs and the inadequate training they received. The findings of this chapter suggest a differential period of use as the reason for varying levels of proficiency. The later beginners were still coping with the learning curve associated with mobile technology interventions, a finding which is also in line with other studies.

The findings on usefulness of the mobile phone technology in reducing the workload related to reporting, improving communication with peers and supervisors, and attracting beneficiaries using videos; are in line with existing empirical evidence (Alam et al., 2010; Barnett, et al., 2016; Blanas et al., 2015; Bogan et al., 2009; Mwendwa, 2016; Ramachandran et al., 2010; Rotheram-Borus et al., 2012). Although Blanas et al. (2015) underscored the importance of task relevance of mobile phone technology as a key factor in the take up of the technology, these chapter findings explain how the programme limitations and contextual factors limit the task relevance of the intervention. The finding related to the incentives component of the intervention is unique to this research context as no other studies have examined the combined influence of mobile phone technology and monetary incentives.

As described in Chapter 5, I found no positive impact of the intervention at the household level. The quantitative analysis in Chapter 5 suggested the weak intensity of the treatment and negative spillover effect of the cash transfer intervention due to the proximity of the cash transfer blocks as the possible reasons for the lack of positive impact of the technology augmented intervention on the household level uptake of services. As shown in the quantitative analysis, AWWs in the T3 block received less training, hands-on support, and monetary incentives compared to AWWs in

T1 and T2 blocks. The qualitative findings presented in this chapter confirm these reasons and explain why the service uptake at the household level did not improve as expected. This chapter findings suggest that a minority of AWWs have difficulty in using the phone due to a shorter period of use (individual and institutional barrier). One third of AWWs discussed issues in the availability of phone and SIM cards related to the existing system related bottlenecks (institutional barriers) and overall did not show visible motivation in receiving monetary incentives; a factor likely due to the size of the incentives. More importantly, the interviewed AWWs reported that due to the cash transfer being active in two adjacent blocks, beneficiaries demanded cash from AWWs. For the beneficiaries in the T3 block, AWWs in the adjacent cash transfer blocks and their block must have seemed similar as they all used mobile phones and identified themselves as part of the BCSP. The only difference beneficiaries could point out must have been the absence of cash for themselves in attending the ICDS services in the T3 block. Considering corruption is a commonly identified phenomenon in the service delivery landscape of Bihar and social welfare programmes, beneficiaries suspected that they did not receive the cash because the AWWs embezzled it. This may explain the negative spillovers detected in Chapter 5.

By combining the findings of the quantitative and qualitative research, this chapter also demonstrates a comprehensive view on the influence of the mobile phone technology and monetary incentives intervention at the AWW and household levels. The findings of this qualitative chapter help to understand the findings of the earlier quantitative chapter. The quantitative method could only measure the average effect of the intervention; it could not formally test different hypothesis why this average effect was insignificant. The qualitative findings clearly demonstrate how the existing programmatic and contextual barriers have moderated the effect of the intervention in achieving its expected impact in a way that quantitative findings alone could not explain. Although these chapters can seem separated by methods, the integration of findings of these two chapters enhances the mixed methods approach used in this thesis.

Considering the introduction of the mobile phone technology with monetary incentives bundle is new for the AWW context and CHW contexts in general, the reasons for its mixed influence stem from existing structural and contextual barriers. The findings of this chapter also suggest that technology-related innovations in improving CHW performance cannot solve all fundamental existing barriers. The technology's availability, ease of use, utility, and relevance can improve specific task related performance, but its potential is limited if the existing system related problems continue.

One of the main factors that limits my research is the short intervention exposure and the on-going feature of the programme. As revealed in the interviews, AWWs face a steep learning curve in using the mobile phone in early stages. Thus, understanding the influence of the intervention can be underestimated in my research because AWWs have not used the mobile phone long enough and unlocked the extended opportunities the phone has to offer. Furthermore, few children had been born by the time of the fieldwork limiting the potential to receive incentives.

In the next chapter, I discuss the overall findings from my qualitative and quantitative research and highlight the main argument this thesis raises.

Chapter Seven: Discussion and conclusion

7.1 Introduction

This thesis seeks to contribute towards deepening the understanding of factors that influence AWW performance, especially after a technology augmented intervention has been implemented. In this chapter, I aim to bring together the findings from earlier chapters to demonstrate how the overall findings make significant contributions towards the conceptual and empirical knowledge base on the performance of workers like AWWs (section 7.2). I also discuss the implications of the findings for policy and practice at the state, national, and global contexts (section 7.3). I present a reflective discussion on the overall doctoral study limitations in section 7.4. Finally, I conclude the thesis with a concluding discussion in section 7.5.

7.2 Summary and discussions of the findings: what this thesis reveals about performance of workers such as AWWs

Whilst each chapter of this thesis has a specific focus to allow in-depth analysis, a synthesis of findings from all chapters helps present a bigger and more complete picture of AWW performance in the context of Bihar. I recap the findings and contributions of each chapter individually, and then identify the contributions and themes that emerge across chapters.

At the start of this thesis, there was no study available to provide a comprehensive view on the performance of AWWs both conceptually and empirically. Chapter 2 makes two key contributions. First, it analytically integrates conceptual and empirical studies that looked at performance of AWWs, and of facility and community-based health workers across the world, consulting sources across the disciplines of public health, organisational management, and economics. Secondly, it presents a first-ever comprehensive conceptual framework on AWW performance, which I then used to guide the primary qualitative research. It suggests a clear definition of AWW performance and establishes a rationale for defining performance at the AWW level rather than service utilisation which is kept as a level above AWW's performance. I have revisited the conceptual framework and presented the revised version in Figure 15.

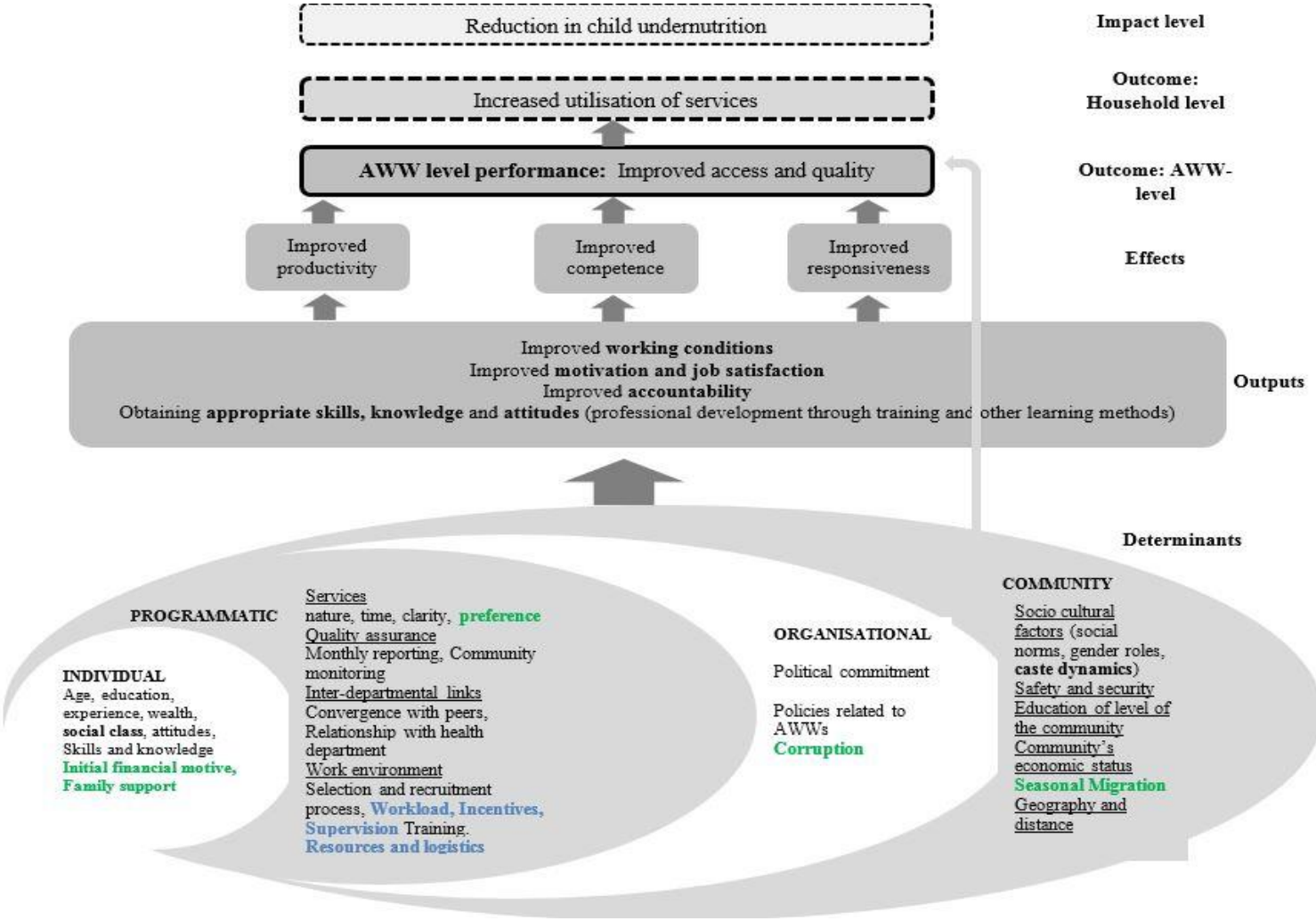
Chapter 4 examines and finds evidence that individual factors including the initial financial motive and family support; programmatic factors including beneficiaries' and AWWs' service preference and work environment; community factors including caste relationships of AWWs and the community and seasonal migration; and organisational factors including individualised and institutional corruption influence AWW performance. The chapter makes three prominent contributions.

First, the chapter contributes four new factors—family support, perceived service preference of beneficiaries and AWWs, seasonal migration, and corruption practices—towards the existing empirical knowledge on factors that influence performance of workers such as the AWWs. Although the financial motive of the AWW and community caste dynamics are factors identified by the existing literature, Chapter 4 demonstrates the nuanced ways in which these factors implicitly and explicitly influence AWW performance. I have represented the conceptual framework on AWW performance in Figure 15with the new factors identified in this thesis.

Second, by highlighting the mechanisms by which factors influence AWW performance, the Chapter 4 findings recognise the nuanced link between the community's expectations and AWW performance. The beneficiary's preference for product-oriented services helps prioritise the delivery of product-oriented services over information-oriented services. The caste dynamics at the community level and migratory patterns of low income households coupled with resource targeting impede AWW performance as the AWW could never satisfy all caste groups with the limited resources available. These findings underscore the ways in which community expectations influence performance of AWWs even at her level (i.e. making services accessible with adequate quality) and seek to challenge the dominant view in the public health literature that worker performance is primarily dependent on her skills and knowledge.

Thirdly, the chapter finds evidence that the AWW's initial financial motive (for an income) and the community's expectations (for product-oriented services) act as key drivers of performance (at least ensuring the bare minimum levels of service delivery) even when her motivation is low. This finding contributes to the knowledge of the relationship between motivation and performance by demonstrating a different perspective - that a demotivated community level worker continues in her job due to her income needs and prioritises satisfying the community's expectations for tangible products.

Figure 15 Revised conceptual framework on AWW performance



Chapter 5 examines the influence of a unique technology augmented intervention combined with a monetary incentive component for AWWs on service uptake at the household level. In the emerging fields of m-Health and m-Nutrition, this analysis adds much needed empirical evidence for two reasons. Firstly, it examines a unique intervention which combines mobile phone technology and monetary incentives for an underpaid worker—one of the first experiments of its kind. Secondly, it estimates the impact of the intervention at the household level, unlike the majority of studies that evaluated the impact of worker level mobile technology interventions only at the worker level.

The analysis found no significant positive impact of the intervention on the utilisation of services by households. I examined the weighing of children and women and attendance of children and women at VHSNDs. However, the same intervention coupled with cash transfer for beneficiaries led to improvements in the utilisation of services by the households. Therefore the technology augmented intervention that only focused on improving the AWW's skills, knowledge, effort and motivation did not materialise improvements at the household level but achieved positive impact when coupled with a beneficiary level intervention which satisfied their tangible product expectations (also found in Chapter 4). The findings of Chapter 5 contribute to empirical knowledge by providing an objective assessment of the extent to which a technology augmented intervention can achieve improvements at the household level services uptake without a beneficiary level incentive.

Chapter 6 makes an empirical contribution towards identifying the ways in which technology augmented interventions influence AWW performance. It also highlights how structural and contextual factors limit a technology augmented intervention's full potential. The chapter found that the majority of the interviewed AWWs perceived the mobile phone technology easy to use and found it useful in reducing their workload related to reporting and attracting beneficiaries. However, barriers to the smooth availability of the phone and SIM card reduced its relevance in specific tasks, and the low magnitude of incentives limit the influence of the intervention on AWW motivation and performance. The findings of Chapter 6 emphasise that even when AWWs are supportive of the introduction of a new technology, the existing system bottlenecks adversely affect intervention impact.

Some contributions and cross-cutting themes also emerge from the findings across chapters.

First, the findings of the three chapters converge to offer a coherent narrative on AWW performance and the role of technology-augmented interventions. Using the conceptual framework on AWW performance, which is derived from the literature, implementers of the

intervention may have expected it to have an impact, even though it wasn't the primary intervention, as it provided a job aid and incentives which were identified as key drivers of performance. Although the integrated findings of Chapters 5 and 6 suggest that the programmatic and fundamental contextual barriers limited the intervention, one of the new factors identified to add to the framework – beneficiary and worker preferences – could provide an enhanced explanation of why the intervention has not worked. Moreover, the other three new factors identified in Chapter 4 strongly mediate AWW performance as well.

The thesis findings showed that beneficiaries prefer product oriented services over information oriented services, and AWWs demonstrate more of a preference to pre-school focused services. The intervention only sought to enhance the delivery of information oriented services related to nutrition (weighing and counselling). This is not a priority for either the beneficiary of the AWW, and helps explain why the intervention was not successful. The intervention was successful when a cash transfer for beneficiaries was overlayered onto it as this meant that a product was bundled with the information. This is perhaps the key contribution of the thesis, that one key "new" factor is the primary determinant of the failure of an intervention that would, under existing frameworks, have been expected to be successful.

Second, among thematic findings, Chapters 2 and 4 highlight conceptual lessons to understand AWW performance. Although the framework envisaged the interconnectedness of individual, programmatic, community, and organisational factors, the findings of Chapter 4 further emphasis the dynamic interconnectedness of factors and sub-factors. Moreover, these findings do not fully support the linear relationship of outputs (especially motivation, job satisfaction, and self-esteem) to performance outcomes (access and quality). Some factors directly affect outputs but not outcomes (e.g. initial financial motive, high workload, and low honorarium); others affect outcomes not outputs (e.g. family support, helper, and seasonal migration).

Third, the findings from Chapter 5 and 6 also contribute to a comprehensive understanding of the concept of AWW performance by laying emphasis on examining performance from different levels of service delivery (i.e. both the AWW level and the beneficiary level). Beneficiary level analysis enabled understanding of the impact of the intervention; analysis at the AWW level enabled understanding of how and why the intervention did not translate into household level impacts. Both were required for a holistic understanding.

Fourth, the combined findings of Chapters 5 and 6 also raise a crucial point towards understanding how existing local perceptions such as corruption influence the implementation of a programme. Moreover, the implementation of programme in one of the treatment blocks

without cash in fact reinforced the existing local perceptions of corruption among AWWs. This unintended effect is an important lesson from my research beneficial in designing and implementing interventions in a real-world setting.

Fifth, Chapters 2 and 6 demonstrate how using a specialised analytical framework provides granular analysis of an intervention's influence on AWW performance. To obtain a granular view of the influence of specific factors (in this case the combined influence of two programmatic factors- job aids and monetary incentives), I used an intervention specific analytic framework — an adapted version of widely used TAM. The analytical framework supplemented the broader conceptual framework on AWW performance. In fact, combining the analytical guidance from both enabled me to understand performance comprehensively by demonstrating the dynamics of existing structural contextual factors and the barriers they pose to AWW performance. It contributes to the understanding that interventions do not impact performance in isolation, they are mediated by several factors, and hence, the comprehensive understanding is crucial.

Finally, in understanding the influence of a technology augmented intervention, I found the use of combining quantitative and qualitative research methods necessary. Although I presented quantitative and qualitative findings separately, I used the qualitative research findings of Chapter 6 to explain the quantitative research findings in Chapter 5. The integration of findings from these two chapters provided a comprehensive explanation of the intervention's influence on the utilisation of services at the household level. The quantitative method could only measure the average effect of the intervention; it could not formally test why this average effect was insignificant. Using qualitative methods to understand the influence of the intervention at the AWW level provided valuable perceptions of AWWs which clearly explain the opportunities and challenges of a technology augmented intervention and how it could not improve service uptake at the household level.

7.3 Implications for policy and practice

As I stated at the start of this thesis, understanding how AWWs negotiate existing limitations within their low resource settings and emerging opportunities offered by technology remained as my personal and academic motivation. By pursuing this motivation, I intend to draw implications from the thesis findings to contribute towards intensifying supporting AWWs' battle against child undernutrition especially in a context like Bihar. The overall findings of this thesis suggest the following implications for policy and practice at the state and national contexts:

To enable the AWWs to fight against child undernutrition, firstly, the state and national governments should significantly focus on improving the work environment of AWWs. The

resource limitation and inadequate monetary incentives seem to be a recurring theme in studies that examined performance of workers like the AWWs. Every single study that explored the ICDS identified limited resources and inadequate monetary incentives for AWWs as hindering factors of the implementation of the programme. This thesis also confirms that work environment factors such as workload, incentives, supervision, and resources limit an AWW's motivation and performance. Although they continue to work due to income needs, in order to maximise their effort and performance, it would be crucial to address the root of their demotivation which is their income needs. As with the majority of studies on the ICDS, this thesis also confirms the severe resource gaps which exist for the AWWs and the service more generally. More importantly, the thesis clearly demonstrates how this gap hampers the relationship of the AWW and the community when the AWW does not have the resources to provide services to everyone. This relationship is shaped by caste dynamics, seasonal migration, and perceptions of corruption. In the context of Bihar, the resource gap and targeting of beneficiaries further complicates the AWW and community relationship leading to incidents of physical violence and closure of services. Hence, addressing the financial motives of the AWWs and providing them adequate programmatic means to deliver their work not only remain crucial in their performance but in ensuring basic provision of health and nutrition services at the village level.

Secondly, other than highlighting the income needs of an AWW, this thesis also contributes towards understanding the identity clash AWWs continue to feel against the programme expectations of them. They do not perceive themselves as honorary workers and continue to raise their demands for a minimum wage for their job. They also self-identify as preschool teachers more than as nutrition workers. Although a few studies on the ICDS mentioned the identity clashes AWWs feel, the majority of the studies only marked the lack of monetary incentives and role clarity without exploring the identity clashes behind it. Addressing the identity of the AWW by aligning the workers' and programme expectation is surely needed to achieve programme goals.

Thirdly, the findings of this thesis suggest that even for the AWW to make the range of health and nutrition service accessible with adequate quality, beneficiary preferences matter. To intensify the efforts to reduce child undernutrition, either the service basket needs to take the beneficiary preference for the product-oriented services into account or enable AWWs by providing them local levers to satisfy the product need of the beneficiary.

Finally, the technology intervention studied in this thesis suggests that a technology intervention alone could not improve service delivery at the AWW level or at the household level because it did not overcome beneficiary and AWW preferences against information-oriented nutrition

services. The incentive component of the technology augmented intervention missed the opportunity to satisfy the income needs of the AWWs. However, technology seems to be useful when combined with the widely tested model of cash transfers for beneficiaries. Hence, in reducing child undernutrition, technology interventions coupled with interventions to engage beneficiaries would be more beneficial than just an intervention at the AWW level to improve her performance.

Other than the above mentioned broader policy implications, the findings of this thesis suggest a few Bihar specific policy and practice implications.

The ICDS services, especially food distribution, are universal across the rest of India. Bihar remains as the only state that practices targeting of beneficiaries (Kosec et al., 2015). The findings from this thesis suggests that the targeting not only hampers the AWW's service specific performance, but it also hampers her community relationships. The relationships shaped by caste, seasonality induced migratory patterns, and the perception of beneficiary preference towards products put strain on the AWW. Although the food distribution poses a multitude of challenges, the perception of beneficiary preference for products suggest that the AWWs will continue to need tangible products (food or non-food) to sustain beneficiary interest.

The research findings suggest that the seasonal migratory patterns of low-income families to brick kilns and elsewhere hampers AWW performance. This happens due to the strict targeting of resources at the AWC level. However, this finding also implies that the low-income families - especially those belonging to lower caste groups - seem to miss out the health and nutrition services while they migrate out. The interviews with the AWWs also suggest that these groups often need the services the most. Due to their migration, they stop receiving services from their villages and the strict catchment area demarcations prohibits them from accessing services from AWCs near the brick kilns. Considering these households continue to experience poor standard of living and limited access to health systems, the state government needs to invest in concentrated efforts towards improving their lives. To better link them to AWC services, these families can be catered to using a mobile AWC services or make provisions for them to register in AWCs near their workplaces.

7.4 Limitations of my thesis

As discussed in each analytical chapter, several factors limit this thesis. Taking a reflective view on the research inquiry I conducted to answer my research questions, I find two types of limitations in this thesis—conceptual and methodological.

This thesis is one of the first comprehensive studies of factors that influence the performance of AWWs from their perspective. The novelty also meant that I needed to derive a definition of performance and a framework to study the concept from a conceptually underdeveloped literature space. During my research unravelling the factors influencing AWW performance, I found that the concept or the word performance seems to be a judgemental concept–i.e. it is a concept that is used to evaluate individuals, organisations, societies, or nations. The measurement of the concept of performance meant drawing a line within the broad spectrum of performance and using it to categorise 'good' and 'bad' performance. However, in the context of AWWs, I found there was no study exploring the concept of performance—i.e. no study even discussed the characteristics of the spectrum of performance. In addition, no studies comprehensively looked at the factors influencing performance or captured the perspectives and viewpoints of AWWs on factors influencing their performance. Keeping these gaps in mind, I chose to focus on factors influencing performance and not on the levels of performance. I needed to take this approach because, first, I wanted to contribute empirical evidence towards understanding factors influencing performance, before drawing the threshold of performance.

It is envisaged in the conceptual framework on AWW performance that some factors such as incentives influence performance by changing the levels of effort. In this thesis, I do not measure efforts of AWWs towards achieving a level of performance. Considering AWWs deliver a multiple services basket, measuring the levels of effort means conducting detailed time use studies based on direct observations. Due to this limitation I cannot fully assess the transmission mechanisms between factors and performance. I consider it as the next step for future research on performance of workers such as the AWWs.

In earlier chapters, I have discussed the possibility of interviewer bias in conducting the qualitative research. During fieldwork, I took steps to mitigate this bias by making sure I heard interviews conducted by the female research assistant and de-briefed as a team to discuss ways to improve the quality of interviews. Another limitation of the qualitative research could be the small sample of interviews. As discussed earlier, presenting generalizable findings was never the aim of my qualitative research. However, by making sure I talked to AWWs from various caste and education backgrounds, this provided me rich accounts of AWWs' experiences. The findings on caste,

migration, and corruption reassures that even from a small sample my thesis has been able to capture varied views and perspectives on performance.

The limitations of my quantitative analysis—the lack of availability of a RCT design, the live status of the intervention, and the lack of AWW level data to measure the impact of the intervention at the worker level were described in detail in Chapter 5. Here, the strategy to overcome such limitations incorporated several elements. First, although not an RCT, using the quasi-experimental data I employed a valid and robust empirical strategy to improve my analysis although the parallel path assumption remains. Moreover, the analysis offers valuable and much needed empirical evidence on the impact of a unique intervention. Second, using the midline data meant estimating the impact even when the programme was still active in the block. Considering the fact that the evaluation that provided the data did not collect data from the comparison block (C) in the endline, my decision to go ahead with the analysis using the midline data was the best possible decision to seize a valuable analytical opportunity. Finally, the small size of the AWW data and the unavailability of detailed AWW level data on effort closed the opportunity to estimate the impact of the intervention at her level. I overcame this by supplementing the quantitative analysis with qualitative research that explored the influence of the intervention on AWW performance. Moreover, the qualitative research helped to explain the reasons for null effect of the intervention at the household level.

7.5 Concluding discussion

This thesis found multiple, interrelated factors that affect AWW performance at the individual, programmatic, community and organisational levels. These are: individual factors including initial financial motive and family support; programmatic factors including beneficiaries' and AWWs' service preference and work environment; community factors including caste relationship of AWWs and community and seasonal migration; and organisational factors including individualised and institutional corruption practices. The findings confirm existing conceptual and empirical frameworks for CHW performance that show a range of factors at individual, programmatic, community and organisational levels impact on AWW performance. It reinforced that these factors are dynamically interconnected and act in a non-linear way, with some impacting on outputs not outcomes, and others on outcomes but not outputs. The thesis identified four new factors to add to existing framework: family support, beneficiary and AWW service preferences, seasonal migration, and corruption.

The technology augmented intervention examined in this thesis—– a mobile phone based job aid combined with worker incentives–would have been expected to be successful based on the

existing frameworks for CHW performance. However, no positive impact on household level service delivery outcomes was detected (chapter 5). The qualitative findings of Chapter 6 suggest that at the AWW level, AWWs perceived the mobile phone technology useful for their work and easy to use but they faced damage to the phone and SIM card and did not fully unlock the potential of monetary incentives. The integrated findings of Chapters 5 and 6 confirm that the programmatic and fundamental contextual barriers have limited the intervention in reaching its impact. However, one of the new factors identified in this thesis (Chapter 4) – beneficiary and AWW service preferences – offers an enhanced perspective on this issue. The intervention sought to strengthen information-oriented nutrition services (weighing and counselling) but this was not a preference for either the beneficiaries (who prefer product-oriented services) or AWWs (who prefer education related services due to their self-identification as pre-school teachers) and as such did not lead to impact.

This has implications for the understanding of the motivation and performance of AWWs and similar CHWs and the design of interventions aimed at improving their performance.

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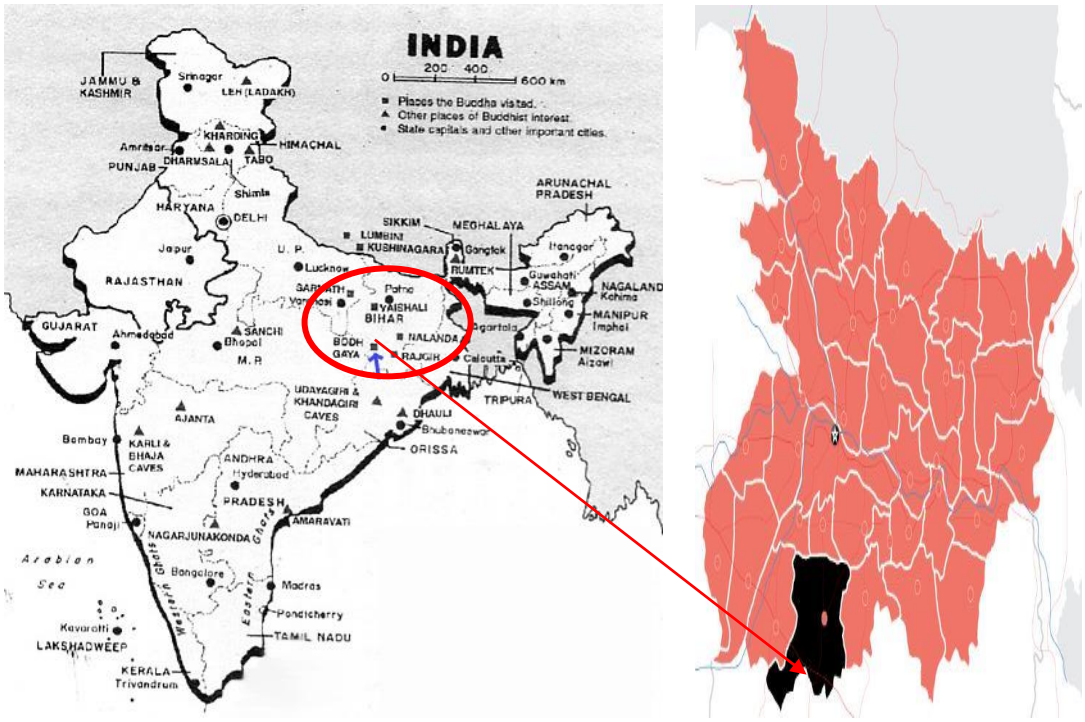
Annexes

Annex A: Geographical maps of Bihar and Gaya



Annex B: Brief history of donor assistance to ICDS in Bihar[78]

As mentioned in Chapter 1, the ICDS programme was launched in 1975 in 33 administrative blocks. Out of these, only 2 blocks (i.e. 277 AWCs) belonged to Bihar (SWD, 2015a). In 1993, the undivided Bihar received financial assistance from the World Bank to expand the ICDS programme (knows as ICDS II Project) to 589 blocks across 56 districts (SWD, 2015a). In the bifurcation of undivided Bihar, the state of Bihar lost a major share of its AWCs to the state of Jharkhand. In 2000, only 35 million out of the 85 million population (approx. 42%) was served by the ICDS. Later in 2001–02, Bihar received further sanctions for AWCs and financial assistance from the World Bank and expanded the ICDS programme coverage. In addition to funding AWCs, the World Bank assisted ICDS–III project also focused on improving the quality of services by improving infrastructure of the training centres, capacity of trainers, and improving the overall training quality. After four decades of the ICDS programme, Bihar now has 91,677 sanctioned AWCs serving 4.5 million children, 1 million women, and 0.75 million adolescent girls in 38 districts (SWD, 2015a). Over the years, the government of Bihar undertook initiatives to improve the ICDS implementation with assistance from its development partners. In addition to the World Bank support, the government of Bihar also receives support from development partners and non-governmental organisations such as CARE, BBC Media Action, the BMGF, the DFID, Save the Children, UNICEF and USAID (Alive and Thrive, 2014). A few initiatives the government of Bihar undertook with the help of these organizations to improve the ICDS implementation are:

Table 31 Donor led initiatives in improving the ICDS implementation in Bihar (Source: (SWD, 2015a)**)**

Name of the project	Geographic scope	ICDS focused initiatives	Timeline	Donors involved
Ananya	Eight districts	Multimedia communication for AWWs to improve frontline worker coordination and monitoring. It also implemented a trial to understand the impact of non-financial incentives for AWWs to improve health and nutrition behaviour at the household level	2010-15	CARE and BMGF
Bal Kuposhan Mukth Bihar (BKMB) Campaign	All districts	A campaign to bring long term changes in the ICDS by prioritising evidence based nutrition interventions. E.g. introduction of egg in the food menu, provision of new weighing scales, focus on hand washing, introduction of multi-media communication, two days of training for all AWWs	2013-14	Partial support from DFID's Bihar state programme SWASTH and the World Bank's ISSNIP funds

[78] Source: The ICDS Annual Implementation Plan 2015-16 (SWD, 2015a).

Bihar Child Support Programme (BCSP)	Two blocks in one district	A maternal and child conditional cash transfer programme for ICDS beneficiaries. AWWs received mobile phone technology and monetary incentives as well.	2013-2017	DFID
ICDS System Strengthening and Improvement Programme (ICDS ISSNIP)	Nineteen districts	A system strengthening programme to revamp the ICDS. E.g. strengthening of monitoring systems, supervision, and outreach activities by AWWs.	2012- present	World Bank
Indira Gandhi Matritva Sahyog Yojana (IGMSY)	Two districts	A central government initiated conditional cash transfer for ICDS beneficiaries. AWWs involved in the implementation	2012- 2015	None
Integrated Performance Management System (IPMS)	Four districts	Mobile phone based technology to improve the top-down and bottom-up communication between different ICDS functionaries and beneficiaries	2013-present	DFID
Nodal AWCs and Udeepika	Nine districts	One AWC in one Panchayat designated as the Nodal AWC with renewed building and other facilities. An additional worker Uddeepika is also recruited at the nodal AWC to provide additional supervisory support to AWWs	2012-2016/17	DFID

Annex C: The BCSP evaluation sampling procedures and data quality checks[79]

The evaluation strategy of the BCSP finalized a sample size of 6000 households (1500 per block) per survey round. The sample size was estimated to provide a Minimum Detectable Effect (MDE) of 5 percentage points or more for the key impact indicators. The MDE was calculated using the design effects reported in the NFHS-3. Table 32 shows the BCSP evaluation sample size considerations (OPM, 2014, 2016)

The AWC was the PSU for the survey. A list of functional AWCs from all four blocks were compiled at the baseline stage. From each block, 55 AWCs were randomly sampled. Within each AWC catchment are, a detailed household listing was carried out to identify households with at least one child below two years of age. From the eligible number of households per PSU, a random sample of 30 households were aimed to be surveyed.

If a household had multiple mothers with target children, then a mother was selected at random. All children of this selected mother who were below two years of age were included in the sample.

Table 32 Minimum Detectable Effects for various sampling scenarios at the baseline stage (OPM, 2016)

Sample Size with a pure control block	6400	6400	6000
% children Height for Age <-2SD	4.8%	4%	5%
% children Weight-for-Age <-2SD	4.6%	3.8%	4.8%
BMI % Women 15-49 <18.5	4.6%	3.8%	4.8%

During the fieldwork, the BCSP evaluation surveys ensured the highest quality data possible by adhering to the following procedures:

- A survey team consisted of four female enumerators to conduct the household level interviews. Each enumerator completed a maximum of 3-4 interviews per day. One female and male health investigator per team carried out the anthropometric measurements of women and children. One supervisor oversaw the monitoring of the team and worked as the first point of quality assurance by cross checking the data collected by the enumerators. The supervisor also completed the AWW and PSU interviews.

[79] Source: The BCSP baseline, midline and endline reports (OPM, 2014, 2016, 2017).

- Field team supervisors were closely monitored by the Survey Manger through Field Work Coordinators. The two Field Work Coordinators were responsible for the daily logistics and support to field team supervisors.
- Daily team meetings were held to discuss the day's experiences and to resolve any problems encountered. The team supervisors sent daily reports of completion of interviews to the Survey Manager.
- Daily a Data Manager compiled and transferred the data to the data processing team to check for inconsistent and unlikely data points.
- 10% of interviews were spot checked by the Field Coordinators and Survey Manager. The enumerators and supervisors were expected to be available to answer any queries related to data collected.
- OPM staff members oversaw the overall data collection process and gave regular feedback to ensure data quality, and support to weaker enumerators.
- The household listing used tablets and the main survey used the Computer Assisted Personal Interviewing (CAPI) method using laptops. The CAPI software was built with strict checks to prevent errors such as outlier values, inconsistencies between different questions, etc. After several rounds of pilots, the software was finalised, and the enumerators were meticulously trained to use it. The Data Manager was present at the survey sites to trouble shoot any issues related to the CAPI software.

Initial data checks were carried out during the data collection phase itself. Whilst the Data Manager compiled and uploaded data every day to the New Delhi HQ, OPM staff members carried out further cleaning using statistical software such as STATA. They sent daily error reports to the Data Manager and supervisor highlighting the nature of the error and details of the enumerators responsible. This further enabled the supervisors to provide personalised support to enumerators to avoid such errors.