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Mobile health interventions: A policymakers' note on the World's largest Nutrition Surveillance in India

Sumantra Pal¹

Abstract

India's first-generation and short-lived nutrition surveillance pilot (*called* ICDS-CAS) launched in 2018 was dismantled and replaced by a second-generation program (*called* POSHAN 2.0) in 2021. To estimate the relative effectiveness of 18 services provided by the frontline workers using ICDA-CAS, I approach its geographically phased out pilot as a natural experiment, exploiting the quasi-random district-level assignment of ICDS-CAS and interventions. I access the publicly unavailable telephonic survey data collected during spring 2021 from the World Bank. It covers 1100 pregnant women and 3300 lactating mothers in 124 randomly sampled districts from 11 populous Indian states. I find that the adherence to recommended iron supplementation is 33 percentage points higher for pregnant women, who received information, messages, and counselling from the frontline health workers in districts which implemented ICDS-CAS. For lactating mothers, who attended a village health and nutrition day event, the impact on iron supplementation is 9 percentage points greater if they were residing in ICDS-CAS districts. The data suggests that the remaining interventions are not effective. Feature comparison of both the programs suggests that India's second-generation nutrition surveillance is more diligently designed than its predecessor, hence more promising.

Keywords: maternal health, service delivery, mobile phones, India.

JEL codes: I120, I150, O330

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1. Introduction

Over four decades of concerted efforts of the Government of India to reduce the prevalence of malnourishment began in 1975-76 with the Integrated Child Development Services (ICDS) with 33 experimental projects. When in 1993 the ICDS program was expanded to 2765 projects, the first ever National Nutrition Policy (Government of India, 1993) recognized nutrition surveillance as one of the weak spots in the set of indirect policy instruments for long-term institutional and structural changes. An efficient, effective, and equitable design of the national nutrition surveillance system would require internet connectivity across the country and mobile-health technology. With ever shrinking digital divide – a quarter-century later – in 2017, the National Nutrition Strategy (Government of India, NITI, 2017) recommends a national nutrition surveillance system which would ensure real-time geographic information system-based tracking of undernourished children, families, and communities with a network of over 1.4 million Anganwadi workers and implemented in 7075 projects. With an unprecedented commitment and concerted action, the Prime Minister’s Overarching Scheme for Holistic Nourishment (POSHAN) was launched on 08.03.2018 (Government of India, Press Information Bureau, 2018), as a multi-ministerial convergence mission to ensure India is malnutrition free by 2022.

In this paper, I approach ICDS-Common Application Software’s (ICDS-CAS) pilot phase as a natural experiment to identify causal interaction using a design which is akin to a static difference-in-difference strategy, and draw policy lessons (Singh, Scott, George, LeFevre, & Ved, 2021) for India’s large-scale rollout of the second-generation digital health innovation. The World Bank as the financial and technical partner to the Government of India, collects end-line only data which is a cross-section of 4400 women randomly sampled from 11 most-populous states in India telephonically surveyed during March-April 2021—the second wave of covid pandemic. This Poshan Knowledge and Behavior Survey covers 46 districts which rolled out the CAS and 78 non-CAS districts. The first source of difference comes from quasi-randomized roll-out is political, institutional, and administrative variations across India, with reasons including delayed and stumbled procurement of mobile-handsets and degrees of pre-assigned priorities assigned to these districts by federal and subnational governments across their ministerial turf². The second source of difference is receipt status of over 20 ICDS services by the 1100 pregnant women and 3300 lactating mothers—which are otherwise not collected in contemporary nationally representative surveys. Given the sample was drawn from the universe on which both the treatments were administered, I exploit random assignment of the two treatments to identify a causal interaction.

I have two main findings with respect to mothers’ behavior and knowledge outcomes. First, pregnant women who belong to the CAS-implemented districts as well as received information/messaged/counselling from frontline health workers are 33 percentage points more

² At the federal governance, 200 ICDS high burden districts, 162 ISSNIP (ICDS Systems Strengthening and Nutrition Project) districts, both administered by Ministry of Women and Child Development and funded by the World Bank, 184 NHM (National Health Mission) high priority districts under the Ministry of Health and Family Welfare.

likely to consume iron folic supplements for the recommended at least 100 days. This causal interaction estimator is statistically significant at the 5 percent level. Second, the lactating mothers who reside in CAS-implemented districts and attended a village health and nutrition day (VHND) events during the past one year, are 9 percentage points more likely to consume at least 100 days of iron supplements. This effect on lactating mothers is statistically significant at the 10 percent level. In sum, there are two cues that work, namely, information/messages/counselling, VHND, since the remaining interventions had no detectable effect on mother's knowledge and behavior on average. For the policymakers involved in the implementation of the second-generation reforms it is critically important to use these inputs to leverage the relative effectiveness of interventions and deliver improved outcomes and bigger bang for the bucks.

This paper is the first to assess the effects of the first-generation mobile based nutrition surveillance program with exclusive administrative survey data. This study contributes to a broader literature on effectiveness of m-health applications (Shukla & Kapur, 2022, Tomlinson, Rotheram-Borus, Swartz, & Tsai, 2013, Iribarren, Cato, Falzon, & Stone, 2017, Lee, et al., 2016) mostly in the context developing countries which are combating the global burden of malnutrition. Compared to this decade-old literature, with a range of interventions, from text messages to the design aspect of the world's largest³ at-scale m-health policy, I contribute by feature comparison of the design aspects of both the mobile applications and inform policy lessons that could directly impact while redesigning the policy in the coming years.

Within India, this study complements few recent evaluations of POSHAN (Nimmagadda, et al., 2019, Gopalakrishnan, et al., 2020, Dixit, Gupta, Dwivedi, & Coomar, 2018, Dutta & Ghosh, 2016, Mittal & Meenakshi, 2018). My principal contributions to this strand of literature (see for review (Mahumud, Uprety, Wali, Renzaho, & Chiekwe, 2021)) are, first, that I evaluate the POSHAN program at a larger scale. Second, I consider a wide range of incentivized interventions in a systematic way, and third, I do feature comparison of the second-generation POSHAN 2.0 relative to its precursor ICDS-CAS to conjecture the anticipatory outcomes. I draw on insights on patterns of implementation of this well-intended policy (Duflo, 2017) such that its effectiveness can be evaluated in the context and drive real-world impact by informing policymakers on which effective interventions they should refocus and discard ineffective interventions.

The remainder of the paper is organized as follows. Section 2 discusses the background of the POSHAN program, and the ICDS-CAS as a job aid to the anganwadi workers. I describe the data from the World Bank's Poshan Knowledge and Behavior Survey and how the variables used in the analysis are constructed in Section 3, followed by empirical strategy in section 4. Results are presented in Section 5 and the final section concludes.

2. Background

³ As on 25.06.2018, ICDS-CAS had over 1100000 data entry devices with frontline workers in 2575 projects across 7 states in India (Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan, and Uttar Pradesh(<https://pib.gov.in/pressreleaseshare.aspx?PRID=1536456>)).

2.1. POSHAN program

The Prime Minister's Overarching Scheme for Holistic Nourishment (POSHAN) was launched on by the Prime Minister of India on 08.03.2018⁴ for three years to attain the goal of '*Suposhit Bharat*' ('Well-nourished India') as well as '*Kuposhan Mukh Bharat*' (Malnutrition Free India') by 2022. Roughly six months before, the National Nutrition Strategy (Government of India, NITI, 2017) set out a target of 3 percentage point per year reduction in underweight prevalence among children aged (0-3 years) and one-third reduction in prevalence of anemia. The mission aimed to address the intergenerational cycle of undernutrition by introducing five elements in nutrition programming, namely, (i) mobile-based surveillance for improved service delivery and monitoring, (ii) capacity building for ICDS functionaries on electronic mode on incremental learning approach to improve nutrition counselling of pregnant and lactating mothers, (iii) community mobilization⁵ complement nutrition counselling, (iv) performance-based incentives to ICDS functionaries, (v) multi-ministerial⁶ convergent action plans to promote coordinated efforts to reduce malnutrition. The nine strategic dimensions of actions were, (i) governance reform, (ii) leading by example, (iii) convergence, (iv) prioritization, (v) intensification of counselling to reach the critical age group, (vi) continuum of care, (vii) innovative service delivery models, (viii) community-based monitoring, and (ix) enabling actions.

2.2. The workflow at Anganwadis

Owing to their presence in almost every village, apart from the official roles and responsibilities⁷, anganwadi workers and helpers are entrusted with occasional administrative tasks (Parliament of India, Lok Sabha, 2011) including updating of electoral rolls (Sandhyarani

⁴ See Annexure A1 for major milestones and timelines of POSHAN.

⁵ Rashtriya POSHAN Maah (National Nutrition Month) was introduced in the months of September and POSHAN Pakhwada (Nutrition Fortnights) in the months of March.

⁶ Convergence of Janani Suraksha Yojana, PM's Matritva Sahjog Yojana, the Mid-day Meal scheme, National Food Security Mission with the ICDS program, with convergent funding through (a) National Health Mission, (b) National Nutrition Mission, (c) ICDS, (d) Swachh Bharat Mission, and (e) 25% more financial supports as flexible funds for States in implementation of centrally sponsored schemes.

⁷ There are over 20 job items for Anganwadi Workers, including (i) elicit community support and participation, (ii) weigh each child every month and maintain child cards for children below 6 years, (iii) conduct quick survey once a year, (iv)organise non-formal pre-school activities, (v) organise supplementary nutrition feeding for children (0-6 years), (vi) provide health and nutrition education and counsel on breastfeeding, (vii) share information on birth took place during the month, (viii) make home visits, (ix) maintain files and records, (x) assist primary health centre staff in immunization, health check-ups, ante-natal and post-natal checks, (xi) assist auxiliary nurse midwives in administration of iron folic acid and vitamin A and maintain stock , (xii) coordinate with Supervisors to invoke interventions, (xiii) liaison with other institutions (mahila mandals) and involve lady school teachers, (xiv) guide Accredited Social Health Activists (ASHA) in delivery of health care services, (xv) motivate and educate adolescent girls and their parents, (xvi) assist implementation of nutrition program for adolescent girls, (xvii) function as depot holder for disposable delivery kits, administration of drugs and contraceptives, (xviii) identify disability among children during home visits and refer the case to nearest public health centres or district disability rehabilitation centre, (xix) support organizing pulse polio immunization, (x) inform emergency cases, such as, diarrhoea, cholera to Auxiliary Nurse Midwife; Anganwadi helpers does the following, (i)cook and serve food to children, (ii) clean anganwadi premises daily and fetch water, (iii) maintain cleanliness of children, (iv) bring children from village to the anganwadi center. (Ministry of Women and Child Development).

& Rao, 2013). Each anganwadi worker is mandated to maintain 11 registers containing 37 formats⁸. The ICDS-CAS replaces ~8.2 kg of paper registers with a smartphone weighing 173 grams. The idea behind designing the ICDS-CAS is that it captures, digitizes, and automates this complex burden of paper-records and workflows of anganwadi worker into a smart phone mobile application. The ICDS-CAS is one of the main components of POSHAN Abhiyaan. Under the Poshan Abhiyaan Anganwadi Workers and Lady Supervisors have been equipped with Smart Phones/Tablets pre-installed with a Common Application Software. The Software application facilitates the capture of data⁹ by frontline functionaries and a six-tier dashboard ensures the monitoring and intervention mechanism.

2.3. ICDS-CAS

The Integrated Child Development Scheme-Common Application Software (ICDS-CAS) (Ministry of Women and Child Development) aimed to (a) improve the efficiency and effectiveness of Anganwadi workers as a job aid, (b) track each children's nutrition status, (c) automate growth chart generation, (d) automate ICDS registers, (e) monitor timeliness and quality of services delivered, (f) provide real-time reports, alerts and dashboards to all the six-tiers of nutrition governance¹⁰ and enable prompt action for decision supports. There were eight modules in the ICDS-CAS. Inside each module, the anganwadi worker fills different forms as before, but now in a digital mode. These modules were, (i) household management (maintains updated information on children, women and other members), (ii) daily feeding (records daily attendance for children aged 3-6 years and tracks their activities and meals at AWC), (iii) Home visit scheduler (plans home visits to pregnant women, lactating mothers, and children younger than 2 years), (iv) growth monitoring (records height and weight of children), (v) Take home ration (records distribution of ration), (vi) Due list (enlists beneficiaries to be mobilized for upcoming VHSND and records vaccination data during VHSND), (vii) AWC management (records infrastructure details, VHSND survey, visitor books, video library), and (viii) MPR/ASR (generates monthly progress report and annual survey reports).

3. Data

3.1. World Bank's POSHAN Knowledge and Behavior Survey

The World Bank and Government of India signed a project on May 17, 2018 (World Bank, 2018), to assist the Government of India implementing the Integrated Child Development

⁸ The register names and the formats are (i) family details, (ii) supplementary food stocks, (iii) supplementary food distribution, (iv) pre-school education, (v) pregnancy and delivery, (vi) immunization and VHND, (vii) vitamin A bi-annual rounds, (viii) home visits planner, (ix) referrals, (x) summaries(monthly and annual), and (xi)weight records of children.

⁹ It enables growth monitoring of children with the help of auto plotting of growth chart on the mobile application; Auto-generates task list and home visit scheduler for enabling AWW to focus on the beneficiaries based on priority. System generated SMS alerts are sent to beneficiaries and stakeholders. The data is available on a real time basis and can be viewed by different functionaries at block level, district level, state level and national level through dynamic dashboard using credentials.

¹⁰ (i) Anganwadi worker, (ii) Supervisor, (iii) Block, (iv) District, (v) State/Union Territory, (vi) Central Project Management Unit.

Services (ICDS) Systems Strengthening and Nutrition Improvement Project (ISSNIP) to all Indian districts over a three-year period. The annual surveys were envisioned, and an RFP was issued, but was cancelled and put on hold. Therefore, neither the baseline nor midline data are collected and available. The World Bank collected cross-section data through a telephonic survey conducted during March 6 to April 22, 2021. The survey instrument was designed to be completed in 15 to 20 minutes. Within 11 states¹¹, the first stage stratification was based on whether a district within a state has implemented the ICDS-Common Application Software¹²(ICDS-CAS). In October 2020, five states¹³ had entirely rolled out ICDS-CAS across all its districts, Karnataka had completed relevant procurements, and the remaining five states¹⁴ had made no progress. This first stage comprises 16 strata. Within each stratum, six to eight districts were selected with probability proportion to population size using the 2011 census data. The second stage of sampling involves simple random sampling of five to ten Anganwadi Centers (AWCs) from the register of all AWCs in each district selected at stage one. The third stage involved simple random sampling of beneficiaries from the register of all beneficiaries registered at the AWCs selected in the second stage, until the prespecified sample size¹⁵ of 4400 (with 400 observations in each of the 11 states) is met for pregnant women (n=1100) and mothers with children younger than 5 months (n=1100), and mothers with children aged 6 to 23 months (n=2200).

3.2. Outcome variables

For the pregnant women, I partition the outcome variables into two categories. First, the program inputs and interventions which are directly linked to the knowledge of pregnant women, namely, (i) of recommended 100 IFA consumption¹⁶, (ii) of recommended four ANC visit¹⁷, and (iii) of recommended breastfeeding within first hour of birth¹⁸. Second, the program inputs or interventions that impacts the observed behavior of pregnant women, namely, (iv) on timeliness of the first ante-natal care (ANC) visit¹⁹, (v) on at least four ANC visits during

¹¹ Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, and Uttar Pradesh.

¹² A mobile-based job support application introduced through POSHAN Abhiyaan.

¹³ Tamil Nadu, Maharashtra, Andhra Pradesh, Bihar, and Gujarat (see CAS and non-CAS districts in Annexure A2) .

¹⁴ Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan, and Uttar Pradesh (see Annexure A2).

¹⁵ From the 880 AWCs sampled at the second stage, the beneficiary contacts was available for 745 AWCs. From the gross list of 20244 mobile numbers of beneficiaries, 16145 were randomly selected for contact. About 55 percent (8874) of these mobile numbers were not in service, switched off, or calls went unanswered. The remaining 7271 contacts were successfully connected. From this set of respondents, 1258 were unavailable for telephonic interview, 454 were not eligible for the survey, and 164 declined to participate (see sampling strategy at Annexure A3).

¹⁶ The survey question was: ‘For how many days a pregnant woman should take the Iron Folic Acid (IFA) tablets or syrup during pregnancy?’

¹⁷ The survey question was: ‘How many ANC check-ups a pregnant woman should get during the pregnancy period?’

¹⁸ The survey question was: ‘How soon should a recently delivered woman breastfeed the baby after birth?’

¹⁹ The survey question was: ‘How many months pregnant were you when you first received antenatal care (ANC check-up) for this pregnancy?’

pregnancy²⁰, (vi) on at least 100 IFA tablet consumption²¹. For the lactating mothers, the observed behaviors are the outcome variables. These are, (i) timeliness of the first ANC visits²², (ii) at least 4 ANC visits²³, (iii) at least 100 IFA consumption²⁴, (iv) ever breastfed²⁵, (v) breastfeeding within the first hour of birth²⁶, and (vi) exclusive breastfeeding for the first six months²⁷.

3.3. Interventions

The questionnaire surveys eight interventions — re-coded as binary variables — for pregnant women. These interventions are whether the pregnant woman, (i) received any information/messages/counselling on nutrition²⁸, (ii) received mother and child protection card²⁹, (iii) received health checkups³⁰, (v) received health and nutrition education³¹, (vi) received home visits³² by AWW/ASHA/ANM, (vii) attended village health and nutrition day (VHND)/ village health sanitation and nutrition day (VHSND)³³, and (viii) attended community-based events³⁴. For the lactating mothers with living children younger than two years, there were twelve interventions which can be identified in the survey. These interventions are whether the lactating mother, (i) received any information/messages/counselling on nutrition³⁵, (ii) received mother and child protection card³⁶, (iii) received health checkups³⁷, (iv) received health and nutrition education³⁸, (v)

²⁰ The survey question was: ‘How many times did you receive antenatal care (ANC check-up) during this pregnancy?’

²¹ The survey question was: ‘For how many days did you take the Iron Folic Acid (IFA) tablets or syrup during this pregnancy?’

²² The survey question was: ‘When you were pregnant, how many months pregnant were you when you first received antenatal care?’

²³ The survey question was: ‘How many times did you receive antenatal care during entire pregnancy?’

²⁴ The survey question was: ‘During pregnancy, for how many days did you take the Iron Folic Acid tablets or syrup?’

²⁵ The survey question was: ‘Did you ever breastfed?’

²⁶ The survey question was: ‘How long after birth did you start breastfeeding?’

²⁷ The survey question was: ‘For how many months did you breastfeed?’ and ‘Did/do you feed anything other than breastmilk, such as water etc. when he/she was/is less than 6 months?’

²⁸ The survey question was: ‘Since your pregnancy, have you received any information/messages/counselling on nutrition?’

²⁹ The survey question was: ‘Did you receive a Mother and Child Protection card?’

³⁰ The survey question was: ‘Did you receive health check-up services from the anganwadi centre?’

³¹ The survey question was: ‘Did you receive health and nutrition education from the anganwadi centre?’

³² The survey question was: ‘Did Anganwadi workers(AWW)/Accredited Social Health Activists(ASHA)/Auxiliary Nurse Midwife (ANM) visit your home in the past one month (number of visits)?’

³³ The survey question was: ‘Have you attended the village health and nutrition day (VHND)/village health sanitation and nutrition day (VHSND) in the last one month?’

³⁴ The survey question was: ‘Have you ever attended any community based event organised at the AWC- for example, annaprasan diwas, godbharai diwas etc.?’

³⁵ The survey question was: ‘When you were pregnant, did you receive any information/messages/counselling on nutrition?’

³⁶ The survey question was: ‘When you were pregnant, did you receive a Mother and Child Protection card?’

³⁷ The survey question was: ‘Did you receive health check-ups from the Anganwadi during last pregnancy?’

³⁸ The survey question was: ‘Did you receive health and nutrition education from the Anganwadi during last pregnancy?’

received home visits³⁹ by AWW/ASHA/ANM, (vi) received growth monitoring in past 12 months⁴⁰, (vii) received immunization in past 12 months⁴¹, (viii) received health checkups in past 12 months⁴²(ix) received health and nutrition education in past 12 months⁴³, (x) attended VHND/VHSND in the last month⁴⁴, (xi) ever attended any community-based events⁴⁵. These interventions are re-coded as binary variables, too.

3.4. Balancing test and threats to internal validity

For unbiased estimation of the program effect, pregnant women and lactating mothers should be similar in respect of outcome variables and observable characteristics. In Table 1, such assertion holds good in a balancing test. There are no significant differences in outcome variables between pregnant women and lactating mothers in CAS and Non-CAS districts. For the observable characteristics, except for the present age and education, the randomly sampled treatment and control population are similar as there are no statistically significant differences in age at marriage, incidence of poverty, and family size.

Table 1: Balancing test

Variable(s)	Control mean	Treatment mean	Difference	p-value
A. Covariates				
Age at present	24.79	24.51	0.280	0.0251
Age at marriage	19.90	19.84	0.060	0.5334
Education	9.26	8.94	0.318	0.0137
Below Poverty Line	0.58	0.57	0.011	0.4843
Family size	1.59	1.56	0.030	0.3639
B. Interventions on Pregnant women				
Received information/messages/counselling	0.79	0.81	-.024	0.3366
Received Mother and Child Protection Card	0.86	0.87	-.006	0.7730
Received health checkup	0.66	0.72	-.059	0.0431
Received Health and Nutrition information	0.67	0.72	-.051	0.0827
Received home visits	0.66	0.65	0.011	0.7193
Attended VHND/VHSND	0.48	0.54	-.058	0.0766
Attended community events	0.38	0.41	-.032	0.3206
C. Interventions on Lactating mothers				
Received information/messages/counselling	0.82	0.82	-.003	0.8309
Received Mother and Child Protection Card	0.97	0.96	.012	0.0518
Received health checkup during last pregnancy	0.72	0.80	-.079	0.0000
Received Health and Nutrition information	0.74	0.80	-.055	0.0003

³⁹ The survey question was: ‘How many times did Anganwadi workers(AWW)/Accredited Social Health Activists(ASHA)/ Auxiliary Nurse Midwife (ANM) visit your home while you were pregnant?’

⁴⁰ The survey question was: ‘During the last 12 months, has your youngest child received growth monitoring services from the anganwadi centre?’

⁴¹ The survey question was: ‘During the last 12 months, has your youngest child received immunization services from the anganwadi centre?’

⁴² The survey question was: ‘During the last 12 months, has your youngest child received health checkup services received from the anganwadi centre?’

⁴³ The survey question was: ‘During the last 12 months, has your youngest child received health and nutrition education from the anganwadi centre?’

⁴⁴ The survey question was: ‘Have you attended the village health and nutrition day (VHND)/village health sanitation and nutrition day (VHSND) in the last one month?’

⁴⁵ The survey question was: ‘Have you ever attended any community based events organized at the AWC, for example, Annaprasan Diwas, Godbharai Diwas, etc.?’

Received home visits	0.78	0.80	-0.022	0.1413
Received Health and Nutrition education	0.65	0.72	-0.064	0.0002
Attended VHND/VHSND	0.38	0.53	-0.13	0.0000
Attended community events	0.40	0.50	-0.10	0.0000
Received growth monitoring in past 12 months	0.73	0.80	-0.59	0.0001
Received immunization in past 12 months	0.83	0.89	-0.57	0.0000
Received health checkup in past 12 months	0.63	0.71	-0.79	0.0000
Received health/nutri. edu. in past 12 months	0.65	0.72	-0.064	0.0002

Notes: The p-values are corrected for clustering at the AWC levels. AWC abbreviates for Anganwadi Center.

4. Empirical strategy

To identify the causal effects of two binary treatments on the outcome variable, I assume that both treatments are administered to the same population of subjects. All subjects are assigned to both the distinct treatment such that some subjects receive neither, some receive one or the other, and some subjects receive both. For example, C represents being assigned to a district that has implemented the Common Application Software (CAS) and T represents being assigned to a condition where one receives an intervention. The binary outcome variable is denoted with Y, and Y_{ct} is the counterfactual where C is set to c and T is set to t. For the binary treatments there are two levels for C and T which I denote as 0 and 1. The two treatments C and T are said to interact if the following condition holds:

$$E[Y_{11}] - E[Y_{01}] \neq E[Y_{10}] - E[Y_{00}]$$

The causal interaction captures the case where the joint effect of both the treatments is different from the singular effect of either of the two treatments. In this context, a causal interaction is present, if the joint effect of CAS implementation (C) and intervention (T) is different from the separate effects of CAS implementation and intervention. With the binary outcome variable (Y), I denote the conditional probability for Y as $Y_{ct}=P [Y=1 | C=c, T=t]$. The causal interaction between C and T on Y is

$$(p_{11} - p_{00}) - [(p_{10}-p_{00}) + (p_{01}-p_{00})] \Rightarrow p_{11} - p_{10} - p_{01} + p_{00},$$

which is the estimate of a causal interaction capturing the extent to which the joint effects of the two treatments exceeds the effects of individual treatments. When both C and T are set to 0, the subjects are exposed to a placebo. When both C and T are set to 1, subjects are exposed to both the active treatments, which is why $p_{11} - p_{10} - p_{01} + p_{00}$ represents the joint effects of both the two treatments. This joint effect of both the treatments can be decomposed into three elements,

$$p_{11} - p_{00} = (p_{10} - p_{00}) + (p_{01} - p_{00}) + (p_{11} - p_{10} - p_{01} + p_{00}) \quad (1)$$

In this equation, $(p_{10}-p_{00})$ is the effect of C alone, $(p_{01} + p_{00})$ is the effect of T alone, and $(p_{11} - p_{10} - p_{01} + p_{00})$ is the joint effect of C and T. In the causal interaction analysis, $(p_{11} - p_{10} - p_{01} + p_{00}) > 0$ implies the joint effects of the two treatments (C and T together) is larger than the individual treatment effects (C or T). If $(p_{11} - p_{10} - p_{01} + p_{00})$ is negative, it implies that the joint effect of two treatments together reduces the overall effect more than the individual treatment effects.

With Y , C and T as binary variables, I specify a saturated linear model with a multiplicative interaction term which has direct correspondence to each element in equation (1) above,

$$y_{ircawd} = \alpha_0 + \alpha_1 C_d + \alpha_2 T_i + \beta C_d T_i + A_r + B_c + E_w + \gamma X_i + \varepsilon_{ircawd}, \quad (2)$$

where y is an outcome, C an indicator for assignment of ICDS-CAS, T is an indicator for assignment of treatment, A , B , E are fixed effects, and X is a vector of control variables. Indices denote individual i belonging to religion r , social class c , residing in Anganwadi a in ICDS-project w in district d . The outcome variable (y_{ircawd}) is a binary variable measuring if an individual possesses the desired nutrition knowledge or nutrition appropriate behavior, and zero otherwise. C_d is an indicator variable that takes a value one for districts which rolled out ICDS-CAS, and zero otherwise. T_i is an indicator variable that takes the value one for an individual who received an intervention, and zero otherwise. A_r is the religion's fixed effects. B_c is the social class fixed effects. E_w is the ICDS project fixed effects. There are four covariates (X), namely, present age, age at marriage, education levels, below poverty level indicator, and family size (number of living children), which I use as control variables. I cluster standard errors (ε_{ircawd}) at the level of Anganwadis.

The correspondence between equation (1) and (2) is as follows: $\alpha_0 = p_{00}$, $\alpha_1 = (p_{10} - p_{00})$, $\alpha_2 = (p_{01} - p_{00})$, and $\beta = (p_{11} - p_{10} - p_{01} + p_{00})$. To elaborate, β estimates the joint effects of CAS and an intervention received by an individual. If β is positive, the joint effect of two treatments together is larger than the individual treatment effects. If β is negative, the joint effect of the two treatments together reduces the overall effect more than the individual treatment effects.

The identification of causal interaction term, β depends on random assignment of both the treatments, which I ascertain. The first treatment (C) of a subject is drawn from a district that implemented the common application software is random since the program implementation depends on administrative and political process. The random draw of the second treatment (T) comes from the random sampling and the randomness of the subjects chosen to participate in the telephone survey. Since both the treatments are randomly assigned to the subjects, it is possible to identify the causal interaction.

5. Results

5.1 Main results

I first document the program's impacts of information/messages/counselling⁴⁶ on the knowledge and behavior of pregnant women and then turn to the observed behavior of lactating mothers regarding iron supplementation. The only result for the former is set out in Table 2. While both the estimates (column (1) and (6) in Table 2) have the expected positive sign, the largest impact occurs for the observed behavior of the pregnant women, regarding

⁴⁶ The 10 information/messages/counselling covers, (i) essentiality of IFA tablet after dinner, (ii) intake of IFA tablet for at least 100 days, (iii) daily consumption of green/yellow/orange colored fruits/vegetables and milk, (iv) increased quantity of food during pregnancy, (v) take 5 to 6 small meals in case the pregnant woman cannot eat full 3 meals, (vi) recommended rest of 1 to 2 hours a day, (vii) include non-vegetarian items in the diet, (viii) feed first thick yellowish milk/colostrum secreted immediately after birth, (ix) breastfeed within one hour of birth, and (x) exclusive breastfeed till 6 month.

recommended consumption of at least 100 IFA consumed, the likelihood that a pregnant mother has received targeted information/ messages/counselling from the Anganwadi services, which increases by 33 percentage points. This result is statistically significant at the 5% level. The menu of 10 information/messages/counselling packages conveys in the beginning the essentiality of IFA tablet consumption daily after dinner and then reiterates the recommended intake of IFA tablets for at least 100 days. This topic-specific interpersonal communications (Ganjoo, et al., 2022) mediates the intervention effect on antenatal iron supplementation by reinforcing the message in the beneficiary’s mind, enhances the knowledge of IFA consumption, and are reflected in the appropriate behavior change (Martin, et al., 2017) leading to adherence to 100 days IFA consumption. Investment in capacity building of frontline health workers (Kurzawa, et al., 2021) can positively influence IFA adherence, which is a relevant policy lesson given its cost-effectiveness.

Table 2: Effects of information/messages/counselling on nutrition received on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st at least ANC visits during pregnancy	4 at 100 IFA taken
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.175 (0.196)	-0.030 (0.109)	0.119 (0.239)	-0.176*** (0.047)	-0.160* (0.089)	-0.145 (0.094)
Information/messages/counselling received	-0.308** (0.151)	0.054 (0.116)	-0.103 (0.131)	0.051 (0.114)	-0.080 (0.122)	-0.218 (0.138)
ICDS-CAS implemented X Information/messages/counselling received	0.247 (0.195)	-0.087 (0.163)	0.016 (0.160)	-0.105 (0.135)	0.104 (0.171)	0.334** (0.163)
Observations	814	970	759	973	973	1,032
R-squared	0.653	0.651	0.648	0.569	0.572	0.546
mean (dependent variable)	0.518	0.495	0.775	0.941	0.387	0.320

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General),and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 reports the impact of attendance of the village health and nutrition day (VHND) by the lactating mothers with living children younger than 2 years on several behaviors of them. The coefficients of all the dependent variables have the expected positive sign, with largest effects on iron supplementation, which is statistically significant at the 10 % level. As a result of attendance at VHND the likelihood of lactating mothers undertaking the recommended iron supplementation by 0.01 percentage points (column (3) in Table 3c). Despite this significant point estimate in improvement of iron supplementation, I find no statistically significant effects for recommended ante-natal care and breastfeeding behavior (columns (1), (2), and (4) to (6) in Table 3). The AWC management module in the ICDS-CAS application tracks the growth and malnutrition status of every child over time and a sub-module runs the VHSND survey that records mothers who attended the VHSND and the services that were provided to the beneficiaries.

Table 3: Effects of Attendance at Village Health and Nutrition Day/Village Health Sanitation and Nutrition Day on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit (within 16wks)	recommended at least 4 ANC visits	recommended 4 at least IFA	ever 100 Breastfed	immediate/within 1hr Breastfeeding	exclusive Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.095 (0.087)	0.327* (0.190)	0.108 (0.084)	-0.011 (0.014)	-0.029 (0.035)	-0.302*** (0.095)
Attendance at VHND/VHSND	-0.015 (0.040)	-0.037 (0.054)	-0.024 (0.052)	0.004 (0.010)	0.038 (0.046)	-0.016 (0.059)
ICDS-CAS implemented X Attendance at VHND/VHSND	0.042 (0.044)	0.070 (0.061)	0.099* (0.060)	0.001 (0.011)	0.029 (0.054)	0.070 (0.067)
Observations	2,998	2,995	3,012	3,120	3,064	3,064
R-squared	0.334	0.454	0.394	0.142	0.251	0.194
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

5.2. The null effects

I now focus on whether the remaining inputs and interventions of POSHAN also improve knowledge and behavior of pregnant women. Since none other than the two interventions carry any statistically significant impacts, I render those results in the Appendix (Table 2(ii) to 2(viii)). These null effects are useful to inform policymakers as to which interventions they should deprioritize. These statistically insignificant results are much smaller in magnitude, and therefore, the policymakers should not diffuse attention on those relatively ineffective interventions and devolve greater resource allocations, focus on the relatively more effective interventions.

5.3. A closer look at iron supplementation

The 6x6x6 strategy of the Anemia Mukht Bharat (Government of India, 2022) identifies 6 beneficiaries, namely, (a) children aged 6-59 months, (b) children aged 5-9 years, (c) adolescent children aged 10-19 years, (d) women in reproductive age of 20-24 years, (e) pregnant women, and (f) lactating mother with children aged 0-6 months. The last two categories are covered in this paper. The 6 interventions are, (a) prophylactic iron folic acid supplementation, (b) deworming, (c) intensified year-round behavior change communication campaign, (d) texting of anemia using digital methods and points of care treatment, (e) mandatory provision of IFA fortified foods in public health programs, (f) Addressing non-institutional causes of anemia in endemic pockets, with special focus on malaria, hemoglobinopathies, and fluorosis. The data suggests that the third intervention through the VHND/VHSND has had a large impact on adherence to the first intervention on IFA supplementation. Another enabler is information intervention that strengthens IFA supplementation. The behavioral barriers that lessen IFA adherence have been identified and the intervention tools that help overcome the barriers are available in the government's premier thinktank (Behavioral Insights Unit of India, NITI Aayog, 2022).

6. Conclusions

In this paper, I investigate the effects of the 3-year long abruptly ended pilot of the world's largest mobile-based nutrition surveillance program implemented in India during 2018-2021 with technical and financial partnership of World Bank. Overall, I find that the program has improved iron supplementation among both the currently pregnant women and lactating mothers. Notwithstanding this, the limited geographical scope of the survey data and relatively small sample size puts limitations on the precision of these estimates.

What lesson can be unboxed from the ICDS-CAS (2018-2021) for its successor POSHAN 2.0, which has been launched in 2021? The major differences between the two are, (a) replacement of ICDS-CAS with Poshan Tracker with explicit change in the design, (b) complement the program with budgetary provisions for ungraded Anganwadi (Saksham Anganwadis), (c) National scale ranking of all sub-national governments based on 6 key performance indicators (KPIs). Since the data is collected precisely at the juncture of transition from ICDS-CAS to POSHAN 2.0, it is possible to extrapolate the consequential outcomes in POSHAN 2.0. Comparative evidence from nationally representative surveys, suggest that the impact of POSHAN 2.0 on mothers' iron supplementation will be of similar magnitude to the impacts documented for ICDS-CAS.

Besides, a significant amount of plumbing effort (Duflo, 2017) are underway to eliminate possibilities of leakages, enable intra-state movement of beneficiaries across India, and disable manipulative tampering of nutrition surveillance. For example, in its latest version 15.2.1(107) of the Poshan Tracker introduces beneficiary cards which will also enable to 'migrate beneficiary' from one anganwadi to another anganwadi based on their Aadhar number. The latest update prevents tampering of date and time of the mobile devices, and the mobile application throws an error if the date and time of the handset are not synchronized with real date and time. Further, it also prevents imputing delivery dates unless the pregnancy duration measured from the last menstrual period date is longer than six months.

My impression of POSHAN 2.0 is more optimistic than the earlier evaluation of the program based on feature comparison I carry out between the two mobile applications. Evidence in this paper suggests that Indian policymakers have learned from the experiences with its earlier version and designed POSHAN 2.0 more diligently by expanding the data coverage of over 200 parameters. A higher impact can be expected given the interventions are delivered with coverage, continuity, intensity, and quality (Wagt, et al., 2019).

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Table A2a: Effects of Health and Nutrition Education received on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st visits during pregnancy	at least 4 ANC IFA taken at least 100 pregnancy
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.117 (0.212)	-0.056 (0.128)	0.055 (0.263)	-0.144 (0.097)	0.035 (0.200)	-0.083 (0.092)
Health and Nutrition Information received	0.092 (0.169)	-0.010 (0.115)	-0.155 (0.159)	-0.055 (0.080)	0.108 (0.095)	0.067 (0.087)
ICDS-CAS implemented X Health and Nutrition Education received	-0.096 (0.192)	0.035 (0.137)	0.113 (0.193)	-0.010 (0.095)	-0.069 (0.115)	0.001 (0.111)
Observations	814	970	759	973	973	1,032
R-squared	0.650	0.651	0.650	0.572	0.574	0.540
mean (dependent variable)	0.518	0.495	0.775	0.941	0.387	0.320

Notes: Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A2b: Effects of Mother and Child Protection Card received on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st visits during pregnancy	at least 4 ANC IFA taken at least 100 pregnancy
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.145 (0.222)	-0.038 (0.167)	-0.097 (0.331)	-0.186 (0.121)	0.084 (0.224)	-0.104 (0.098)
Mother and Child Protection Card received	0.061 (0.170)	0.073 (0.176)	-0.283 (0.198)	-0.146 (0.110)	0.278** (0.133)	0.085 (0.061)
ICDS-CAS implemented X Mother and Child Protection Card received	-0.032 (0.206)	-0.011 (0.198)	0.366 (0.236)	0.084 (0.137)	-0.162 (0.155)	0.004 (0.103)
Observations	814	970	759	973	973	1,032
R-squared	0.649	0.652	0.656	0.575	0.579	0.540
mean (dependent variable)	0.518	0.495	0.775	0.941	0.387	0.320

Notes: Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A2c: Effects of Health Checkups on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st visits during pregnancy	at least 4 ANC IFA taken at least 100 pregnancy
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.141 (0.214)	-0.066 (0.119)	0.124 (0.240)	-0.132** (0.058)	-0.000 (0.199)	-0.081 (0.085)
Health Checkups	0.115 (0.149)	-0.037 (0.171)	-0.003 (0.158)	-0.101 (0.070)	0.022 (0.117)	0.105 (0.084)
ICDS-CAS implemented X Health Checkups	-0.120 (0.164)	0.119 (0.180)	-0.099 (0.187)	0.064 (0.090)	-0.109 (0.136)	-0.128 (0.106)
Observations	814	970	759	973	973	1,032
R-squared	0.650	0.652	0.649	0.574	0.573	0.540
mean (dependent variable)	0.518	0.495	0.775	0.941	0.387	0.320

Notes: Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A2d: Effects of Attendance at Village Health and Nutrition Day/Village Health Sanitation and Nutrition Day on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st visits during pregnancy	atleast 4 ANC IFA taken at least 100 days
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.169 (0.204)	-0.083 (0.109)	0.154 (0.210)	-0.127* (0.070)	-0.059 (0.165)	-0.111 (0.081)
Attendance at VHND/VHSND	-0.065 (0.181)	-0.063 (0.108)	-0.140 (0.150)	-0.024 (0.038)	-0.020 (0.093)	-0.098 (0.150)
ICDS-CAS implemented X Attendance at VHND/VHSND	0.053 (0.201)	0.089 (0.127)	0.058 (0.163)	-0.027 (0.050)	0.128 (0.110)	0.075 (0.163)
Observations	791	940	736	941	941	1,000
R-squared	0.631	0.649	0.682	0.551	0.584	0.521
mean (dependent variable)	0.518	0.495	0.775	0.941	0.387	0.320

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A2e: Effects of Homevisits by Anganwadi Workers/Accredited Social Health Activist/Auxiliary Nurse Midwife on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st visits during pregnancy	atleast 4 ANC IFA taken at least 100 days
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.259 (0.219)	-0.027 (0.131)	0.027 (0.233)	-0.150** (0.076)	-0.033 (0.199)	-0.042 (0.101)
Home visits by AWW/Asha/ANM	-0.076 (0.134)	0.067 (0.127)	-0.185 (0.121)	-0.013 (0.039)	0.057 (0.103)	0.093 (0.093)
ICDS-CAS implemented X Home visits by AWW/ASHA/ANM	0.217 (0.156)	-0.009 (0.140)	0.142 (0.161)	0.034 (0.060)	0.018 (0.118)	-0.114 (0.113)
Observations	814	970	759	973	973	1,032
R-squared	0.654	0.652	0.652	0.567	0.573	0.539
mean (dependent variable)	0.518	0.495	0.775	0.941	0.387	0.320

Notes: Notes: Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A2f: Effects of Community Events(annaprashan/Godbharai etc.) on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st visits during pregnancy	atleast 4 ANC IFA taken at least 100 days
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.134 (0.219)	-0.081 (0.113)	0.185 (0.223)	-0.117* (0.069)	-0.004 (0.191)	-0.073 (0.091)
Attendance at community events	0.108 (0.146)	0.110 (0.096)	0.053 (0.098)	0.029 (0.042)	0.077 (0.118)	0.095 (0.094)
ICDS-CAS implemented X Attendance at community events	-0.030 (0.183)	-0.039 (0.131)	-0.117 (0.119)	-0.005 (0.065)	-0.063 (0.141)	-0.109 (0.116)
Observations	774	920	722	918	918	974
R-squared	0.635	0.660	0.684	0.552	0.592	0.538

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General),and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A2g: Effects of Community Events(annaprashan/Godbharai etc.) on Pregnant Women's

Dependent variables	Knowledge of			Behaviour on		
	recommended IFA for 100 days	recommended 100 4 ANC visits	recommended Breastfeeding within 1hr of delivery	timely ANC visit	1st visits during pregnancy	at least 4 ANC during IFA taken
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	-0.134 (0.219)	-0.081 (0.113)	0.185 (0.223)	-0.117* (0.069)	-0.004 (0.191)	-0.073 (0.091)
Attandance at community events	0.108 (0.146)	0.110 (0.096)	0.053 (0.098)	0.029 (0.042)	0.077 (0.118)	0.095 (0.094)
ICDS-CAS implemented X Attandance at community events	-0.030 (0.183)	-0.039 (0.131)	-0.117 (0.119)	-0.005 (0.065)	-0.063 (0.141)	-0.109 (0.116)
Observations	774	920	722	918	918	974
R-squared	0.635	0.660	0.684	0.552	0.592	0.538

Notes: Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is currently pregnant woman. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General),and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3a: Effects of information/messages/counselling on nutrition received on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit (within 16wks)	recommended at least 4 ANC visits	recommended 4 at least 100 IFA	ever Breastfed	immediate/wit hin Breastfeeding	exclusive 1hr Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.107 (0.083)	0.265 (0.201)	0.118 (0.084)	-0.019 (0.023)	-0.073 (0.056)	-0.172 (0.139)
Information/messages/counselling received	0.090** (0.044)	0.078 (0.069)	0.111* (0.063)	0.006 (0.021)	0.063 (0.052)	0.008 (0.063)
ICDS-CAS implemented X Information/messages/counselling received	-0.035 (0.055)	-0.014 (0.079)	-0.000 (0.072)	0.004 (0.024)	0.086 (0.063)	-0.123 (0.078)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.319	0.451	0.407	0.133	0.254	0.193
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3b: Effects of Mother and Child Protection Card received on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit (within 16wks)	recommended at least 4 ANC visits	recommended 4 at least 100 IFA	ever Breastfed	immediate/wit hin Breastfeeding	exclusive 1hr Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.237 (0.178)	0.222 (0.260)	0.180 (0.141)	-0.015 (0.020)	0.023 (0.129)	-0.101 (0.196)
Mother and Child Protection Card received	0.213 (0.157)	-0.144 (0.159)	0.106 (0.109)	-0.008* (0.004)	0.250** (0.117)	0.050 (0.138)
ICDS-CAS implemented X Mother and Child Protection Card received	-0.162 (0.173)	0.045 (0.174)	-0.079 (0.127)	-0.002 (0.007)	-0.074 (0.133)	-0.138 (0.160)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.319	0.451	0.403	0.133	0.254	0.191
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3c: Effects of Health Checkups received during last pregnancy on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit (within 16wks)	recommended at least 4 ANC visits	recommended 4 at least 100 IFA	ever Breastfed	immediate/wit hin Breastfeeding	exclusive 1hr Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.087 (0.079)	0.294 (0.198)	0.104 (0.085)	-0.016 (0.023)	-0.045 (0.059)	-0.224 (0.136)
Health Checkups received during last pregnancy	0.043 (0.038)	0.061 (0.063)	0.058 (0.053)	0.009 (0.015)	0.033 (0.056)	-0.012 (0.056)
ICDS-CAS implemented X Health Checkups received during last pregn:	0.014 (0.047)	-0.041 (0.074)	0.031 (0.067)	0.001 (0.018)	0.030 (0.065)	-0.025 (0.069)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.317	0.451	0.405	0.134	0.250	0.191
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3d: Effects of Health and Nutrition Information received on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit (within 16wks)	recommended at least 4 ANC visits	recommended 4 at least 100 IFA	recommended ever 100 Breastfed	immediate/wit hin 1hr Breastfeeding	exclusive Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.078 (0.083)	0.317* (0.191)	0.161** (0.074)	-0.009 (0.021)	-0.021 (0.050)	-0.210 (0.136)
Health and Nutrition Information received	0.052 (0.044)	0.114** (0.056)	0.186*** (0.054)	0.017 (0.015)	0.136** (0.053)	-0.041 (0.057)
ICDS-CAS implemented X Health and Nutrition Information received	0.023 (0.053)	-0.092 (0.068)	-0.063 (0.066)	-0.013 (0.018)	0.001 (0.063)	-0.061 (0.075)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.319	0.452	0.414	0.134	0.258	0.193
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3e: Effects of Growth monitoring as Anganwadi services on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit (within 16wks)	recommended at least 4 ANC visits	recommended 4 at least 100 IFA	recommended ever 100 Breastfed	immediate/wit hin 1hr Breastfeeding	exclusive Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.033 (0.094)	0.314 (0.205)	0.116 (0.095)	-0.007 (0.021)	-0.049 (0.064)	-0.283** (0.141)
Growth monitoring as Anganwadi services	-0.010 (0.052)	0.080 (0.050)	0.091** (0.046)	0.001 (0.009)	0.068 (0.044)	-0.250*** (0.055)
ICDS-CAS implemented X Growth monitoring at Anganwadi services	0.068 (0.062)	-0.064 (0.062)	0.014 (0.058)	-0.015 (0.013)	0.041 (0.059)	0.000 (0.067)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.317	0.451	0.407	0.134	0.253	0.219
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3f: Effects of Immunization as Anganwadi services on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit (within 16wks)	recommended at least 4 ANC visits	recommended 4 at least 100 IFA	recommended ever 100 Breastfed	immediate/wit hin 1hr Breastfeeding	exclusive Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.127 (0.099)	0.240 (0.205)	0.140 (0.104)	-0.027 (0.026)	-0.071 (0.075)	-0.316** (0.145)
Immunization as Anganwadi services	0.085 (0.055)	0.006 (0.048)	0.012 (0.072)	-0.014 (0.018)	0.034 (0.059)	-0.289*** (0.077)
ICDS-CAS implemented X Immunization at Anganwadi services	-0.026 (0.063)	0.027 (0.061)	-0.040 (0.081)	0.010 (0.019)	0.058 (0.074)	0.026 (0.088)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.319	0.450	0.403	0.133	0.250	0.215
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3g: Effects of Homevisits by Anganwadi Workers/Accredited Social Health Activist/Auxiliary Nurse Midwife on Lactating Women

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit at (within 16wks)	recommended least 4 ANC visits	recommended 4 at least IFA	ever 100 Breastfed	immediate/wit hin 1hr Breastfeeding	exclusive Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.148* (0.084)	0.298 (0.202)	0.077 (0.088)	-0.017 (0.021)	-0.005 (0.068)	-0.255* (0.136)
Homevisits by AWW/ASHA/ANM	0.118*** (0.044)	0.064 (0.053)	0.017 (0.053)	0.004 (0.010)	0.116 (0.071)	-0.004 (0.054)
ICDS-CAS implemented X Homevisits by AWW/ASHA/ANM	-0.080 (0.053)	-0.052 (0.067)	0.057 (0.065)	0.000 (0.013)	-0.018 (0.079)	0.031 (0.068)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.322	0.450	0.404	0.133	0.254	0.190
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3h: Effects of Health and Nutrition Education as Anganwadi services on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit at (within 16wks)	recommended least 4 ANC visits	recommended 4 at least IFA	ever 100 Breastfed	immediate/wit hin 1hr Breastfeeding	exclusive Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.087 (0.081)	0.262 (0.199)	0.141* (0.074)	-0.012 (0.019)	-0.043 (0.050)	-0.283** (0.140)
Health and Nutrition Education as Anganwadi services	0.041 (0.041)	0.012 (0.048)	0.113** (0.052)	0.006 (0.012)	0.083* (0.048)	-0.169*** (0.063)
ICDS-CAS implemented X Health and Nutrition Education as Anganwad	0.014 (0.050)	-0.006 (0.058)	-0.029 (0.061)	-0.011 (0.014)	0.081 (0.059)	0.036 (0.073)
Observations	3,087	3,087	3,105	3,215	3,158	3,158
R-squared	0.318	0.450	0.408	0.133	0.259	0.202
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Table A3i: Effects of Attendance at Community events(annaprashan/Godharai etc.) on Lactating Women's

Dependent variables	Behaviour on					
	timeliness of 1st ANC visit at (within 16wks)	recommended least 4 ANC visits	recommended 4 at least IFA	ever 100 Breastfed	immediate/wit hin 1hr Breastfeeding	exclusive Breastfeeding (until 6mo)
	(1)	(2)	(3)	(4)	(5)	(6)
ICDS-CAS implemented	0.021 (0.060)	0.301 (0.195)	0.088 (0.075)	-0.012 (0.019)	-0.074 (0.055)	-0.252* (0.137)
Health checkups	-0.010 (0.034)	0.101** (0.048)	0.018 (0.040)	0.014* (0.008)	-0.025 (0.065)	-0.054 (0.052)
ICDS-CAS implemented X Attendance at community events	0.044 (0.042)	-0.047 (0.058)	0.025 (0.050)	-0.006 (0.009)	0.106 (0.071)	-0.032 (0.060)
Observations	2,903	2,900	2,923	3,017	2,965	2,965
R-squared	0.348	0.454	0.398	0.143	0.271	0.207
mean (dependent variable)	0.898	0.620	0.552	0.980	0.698	0.443

Notes : Standard errors clustered at the Anganwadi Centre levels in parenthesis. An observation is lactating woman with children below 6 months/Women with children below 2 years. Additional control variables included but the estimates are not presented: respondent's current age, age at marriage, highest educational attainments, below poverty line status, number of living children, number of children younger than 24 months. Fixed effects for religion(s), social categories (SC/ST/OBC/General), and ICDS project(s) are applied. Data source: World Bank's Telephonic Survey on Poshan Knowledge and Behavior. *** p<0.01, ** p<0.05, * p<0.1.

Supplementary materials

A1. Timeline of Prime Minister's Overarching Scheme for Holistic Nourishment (POSHAN)

Date(s)	Policy action(s) and communication(s)
01.09.2017	Nourishing India - National Nutrition Strategy, National Institution for Transforming India (NITI), Government of India.
01.12.2017	Federal Cabinet approves setting up of National Nutrition Mission(NNM).
18.12.2017	Administrative approval for setting up of NNM with a 3 year budget
26.02.2018	Administrative guidelines of NNM
08.03.2018	Prime Minister of India launches the POSHAN at Jhunjhunu, Rajasthan.
05.04.2018	Flexi funds guidelines for States and Union Territories
27.09.2018	Incentive guidelines for Anganwadi Workers and Helpers
04.01.2019	Guidelines for innovation under POSHAN Abhiyaan
15.12.2020	Instructions to the State/UT governments to leverage the existing physical registers for reporting on service delivery provided under Anganwadi services.
13.01.2021	Advisory to state governments to ask all AWW to download the new Poshan Tracker App and state governments to procure Android 6 and above smartphones within a price ceiling of INR 8000 from Government e-Marketplace.
02.02.2021	CSC-SPV (Common Service Center-Special Purpose Vehicle) nodal contacts at the state/union territory levels were identified to extend technical support to resolve issues regarding downloading of the new Poshan tracker app and its functioning.
	Request to State/UT governments not to undertake any further training on any component related to erstwhile ICDS-CAS.
	Technical specification of smartphone, tablets and power bank with device and battery warranty of 2 years.
	Request to State/UT government not to send any device for any compatibility to any private agency including either BMGF or Dimagi as ICDS-CAS is no longer operational.
01.03.2021	Direction to State/UT governments to provide admissible data plants for Anganwadi workers as admissible under the scheme guidelines.
06.03-22.04.2021	The World Bank's Poshan Knowledge and Behavior Survey.
24.05.2021	Request to State/UT governments to upload data anganwadi services in Poshan Tracker.
03.06.2021	Clarification and reiteration of the cost-ceiling (13.01.2021).
01.11.2021	Incentive guidelines for Anganwadi Workers and Helpers
23.06.2022	Aadhar seeding of beneficiaries + Universal Anganwadi Services

Notes: Author's compilation from Ministry of Women and Child Development, Government of India. The grey rows are policy actions taken during ICDS-CAS regime, and the rest are during implementation and transition of Poshan 2.0.

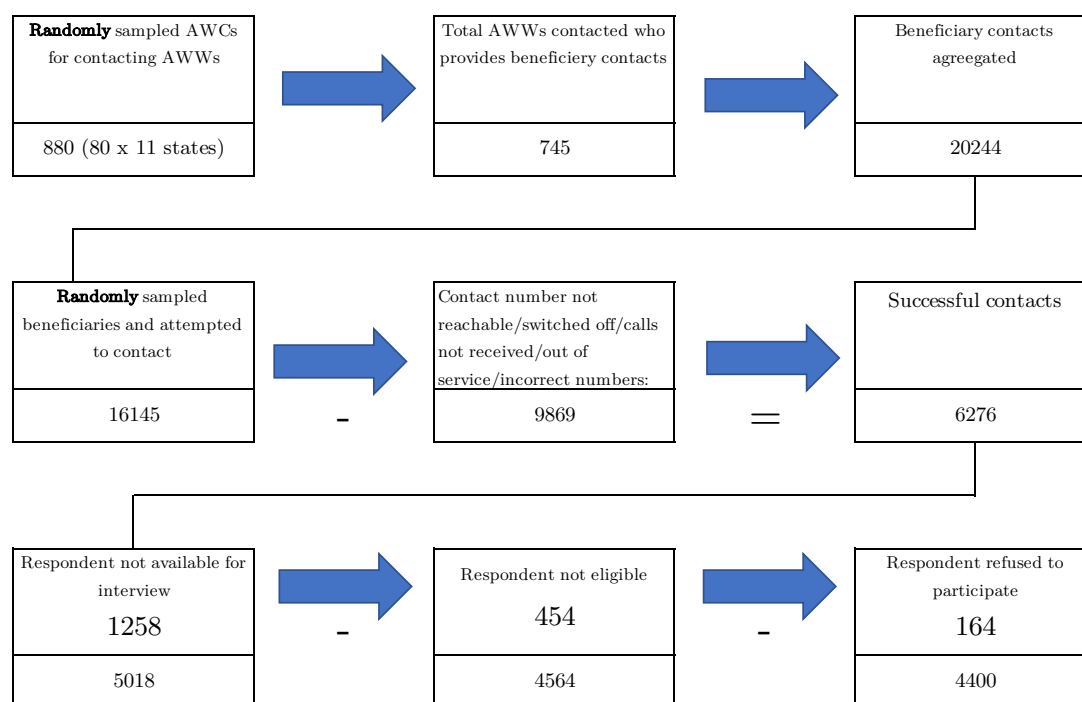
A2. District list by Common Application Software Implementation

Non-CAS Districts	Number of Observations	CAS districts	Number of Observations
1. Allahabad ¹	17	1. Ahmedabad	28
2. Bagalkot	65	2. Ajmer ^{1,3}	25
3. Balaghat ¹	36	3. Alwar ^{1,3}	12
4. Ballia	24	4. Ananthapur	35
5. Balrampur ²	32	5. Aurangabad ²	60
6. Belagavi	49	6. Bahraich ²	25
7. Bengaluru Urban	47	7. Balod	30
8. Bharatpur	62	8. Banaskantha ²	49
9. Bikaner ¹	19	9. Banka	28
10. Bilaspur ²	40	10. Bemetara	31
11. Chatra ¹	21	11. Budaun ²	29
12. Chikkamagaluru	68	12. Burhanpur	20
13. Deoria	31	13. Chhotaudepur	43
14. Dhar	18	14. Chittoor ³	22
15. Dharwad	50	15. Chittorgarh ^{1,3}	45
16. Dungarpur ^{1, 2, 3}	12	16. Churu ^{1, 3}	33
17. East Singhbhum	18	17. Coimbatore	54
18. Godda ²	23	18. Damoh ^{1,2,3}	26
19. Gorakhpur	33	19. Darbhanga ^{1,3}	39
20. Gwalior	41	20. Datia ^{1,3}	30
21. Hazaribagh	54	21. Dhanbad ^{1,3}	19
22. Jalor ²	16	22. Dumka ^{1,2,3}	5
23. Janjgir-Champa	28	23. Durg ^{1,3}	33
24. Jashpur ^{1, 2, 3}	14	24. East Godavari ³	40
25. Kalaburagi	53	25. Erode	59
26. Kanpur Nagar ¹	33	26. Etah ²	24
27. Korba ¹	30	27. Gadchiroli ^{1,2,3}	42
28. Mandla ²	18	28. Gariyaband	29
29. Mandsour ¹	32	29. Giridih ^{1,3}	39
30. Mathura	18	30. Gonda ²	20
31. Mysuru	53	31. Gopalganj ^{1,3}	48
32. Pakur ^{2, 3}	26	32. Guntur ¹	82
33. Pratapgarh	14	33. Jaipur ^{1,3}	2
34. Raigarh	9	34. Jodhpur ^{1,3}	26
35. Rajnandgaon	32	35. Junagadh	62
36. Ranchi	25	36. Kabirdham ^{1,3}	16
37. Sagar ²	20	37. Kannauj	17
38. Saraikela ²	22	38. Khandwa ^{1,3}	14
39. Satna ²	14	39. Koderma ^{1,3}	36
40. Sehore	21	40. Kota ^{1,3}	45
41. Sikar	49	41. Krishna	95
42. Sultanpur	30	42. Lakhisarai ^{1,3}	93
43. Surguja ²	15	43. Latehar ^{2,3}	19
44. Tonk ^{1,3}	42	44. Latur	52
45. Tumakuru	15	45. Loherdaga ^{2,3}	45
46. West Singhbhum ^{1,2,3}	11	46. Lucknow ^{1,3}	36
Total	1400	47. Madurai ²	47
		48. Mahasamund ^{1,3}	30
		49. Mehsana	64
		50. Morena ^{1,3}	24
		51. Muzffarpur ^{1,3}	26
		52. Nagpur ^{1,3}	53

53. Nashik ^{1,3}	63
54. Palamau ^{2,3}	37
55. Porbandar	58
56. Prakasam ³	67
57. Pune	19
58. Purnia ^{1,2,3}	55
59. Raipur ^{1,3}	31
60. Rajgarh ^{1,3}	24
61. Salem	62
62. Sant Kabir Nagar ^{1,2,3}	11
63. Saran	54
64. Shajapur ^{1,3}	27
65. Sitapur ²	38
66. Solapur	51
67. Srikakulam ^{1,3}	39
68. Surat	25
69. Thiruchirapalli ²	43
70. Thoothukudi	44
71. Tiruppur	47
72. Udaipur ^{1,2,3}	12
73. Ujjain ^{1,3}	35
74. Vadodara	71
75. Vaishali ³	57
76. Villupuram	44
77. Visakhapatnam ^{2,3}	20
78. Wardha ^{1,3}	60
Total	3000

Notes: ¹ICDS high burden districts, ² National Health Mission High Priority Districts, ³ ISSNIP Districts.

A3. Sampling strategy



A4. Roles and responsibilities of functionaries of ICDS-CAS

Functionary	Roles and Responsibilities
Anganwadi worker	Select desired personal PIN to use for her application. Login using personal PIN and logout once done.
Supervisor	Select a desired personal PIN to use for her application. Login using personal PIN and logout once done.
Block helpdesk	Ensure each device has a username linked to it. Troubleshoot username and password issues Coordinate with the district helpdesks to manage username and passwords
District helpdesk	Unbox mobile devices and initial setup of phone settings along with username and password Coordinate with state/UT and block helpdesks to manage usernames and passwords.
State/UT helpdesk	Ensure accuracy of AWC details Ensure usernames and passwords are distributed across districts and clocks Coordinate with district helpdesks
Central helpdesk	Creates and uploads username and passwords in excel sheet for both mobile and dashboard users for each state and union territories. Coordinate and support helpdesks in state and union territories for resolution of username and password issues.

Notes: Sourced from ICDS-CAS manual, MWCD.

A5(i). ICDS-CAS login and interface.

Log into the application, sync with server and view all eight modules on the modules screen



- Type Anganwadi username;
- Type password;
- If you have for gotten the username or password, contact the helpdesk.



- Enter/Exit Application from this screen.
- Sync with server and upload the completed forms.

A5(ii). ICDS-CAS Modules (Household management, Daily feeding, Home-visit scheduler, Growth monitoring).

What is a module?

A module is a lot like a register. Just like a register, inside each module, there are different forms to fill about a specific subject area. This application has eight modules. Each module has a different purpose.



Household Management

Collect the information about children, women and other members of all the households in the feeder area of Anganwadi. Maintain these information and keep them updated.

Daily Feeding

Record daily attendance for children 3-6 years old. Do keep track of their activities and meals at the AWC.

Home Visit Scheduler

Plan home visits to pregnant and lactating women, and children up to 2 years of age.

Growth Monitoring

Record the weight of children. The app shows underweight status automatically.

A5(iii). ICDS-CAS modules (Take home ration, Due list, AWC management, MPR)

The screenshot shows the ICDS CAS - AWW app interface. It features a grid of six icons: Home Visit Scheduler, Growth Monitoring, Take Home Rations, Due List, AWC Management, and MPR Lists. Blue arrows point from each icon to a corresponding text box on the right.

- Take Home Ration**
Record the distribution of rations
- Due List**
Creates a list of beneficiaries to be mobilized or notified for an upcoming VHSND to provide certain services.
Record vaccination data during VHSND day.
- AWC Management**
 - Record infrastructure details, VHSND survey and visitor book details.
 - Watch video library
- MPR List**
See Monthly Progress Report (MPR).

A5(iv). Household management module 1.

HOUSEHOLD MANAGEMENT

Part- 1: Add a household

The first screenshot shows a list of existing households with columns for Name and Date Registered.

Name	Date Registered
Kethal	02/05/16
Kumar	02/05/16
Seher	02/05/16
Suki	29/04/16
Trilok	02/05/16
Tukaram	02/05/16

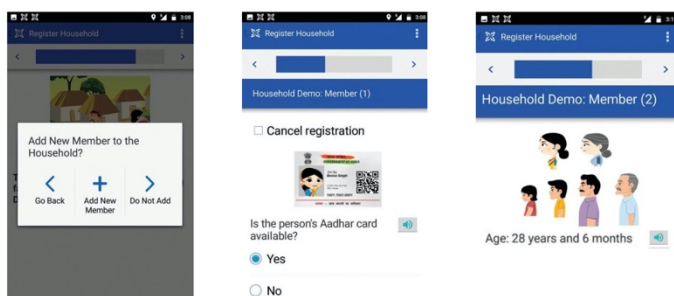
The second screenshot shows the 'Register Household' screen with an illustration of a family and a text prompt: 'Enter a tag for this household so that it is easy to find this family on your application Kumar family'.

The third screenshot shows the 'Register Household' screen with a question: 'Are you at the physical location of the household?' and radio button options for 'Yes' and 'No'.

In Part-1: Scroll through the existing households before adding a new household. Record the religion, caste poverty level and capture the GPS coordinates of the home.

A5(v). Household management module 2.

Part- 2: Add family members

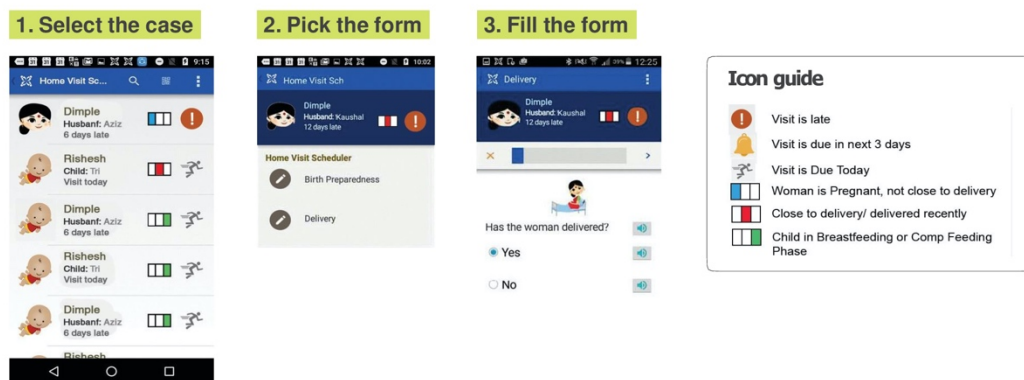


In Part-2: Press the plus button to add each family member; their age, sex, marital and disability status. Scan an Aadhaar card to prepopulate key questions, if available.

A5(vi). Home visit scheduler module.



Plan home visits for pregnant women, lactating women and children



Use the Home Visit Scheduler to track visits due for pregnant women and young children. Visit types include birth preparedness, delivery, post-natal care, exclusive breastfeeding and complementary feeding.

A5(vii). Daily feeding module.

DAILY FEEDING

Daily form to track AWC open status, attendance and meal Distribution

1. Center open

2. Attendance

3. Hot meal

4. Activities

5. Take picture

Use the PSE Form to register daily attendance for children between three and six years old, track activities and meal distribution at the AWC

A5(viii). Growth monitoring module.

GROWTH MONITORING

Track the growth and malnutrition status of every child over time

1. GM case list

2. Enter weight

3. Nutrition status calculated

4. Weight to Age automatically graphed

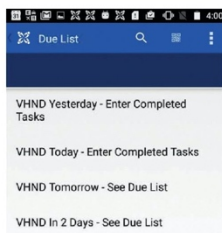
In the growth monitoring case list, children are displayed with boxes representing their four most recent weight indicators. Green indicates that their weight is 'normal' according to age, yellow as 'moderately malnourished' and red as 'severely malnourished.'

Every weight recorded is mapped on a child's growth chart, accessible in the child's case details.

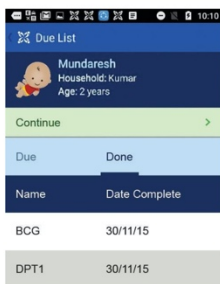
A5(ix). Due list module.



1. Pick the due list



2. View due and done



3. Note the new immunization given



View beneficiaries due for immunizations today, tomorrow, in 2 days, etc.

A5(x). Take home ration module.

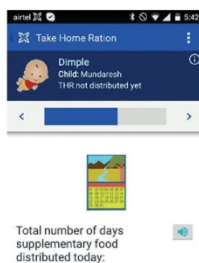


Track the growth and malnutrition status of every child over time

1. THR case list



2. Days' worth of THR distributed



AWWs must note the number of days' worth of THR they distribute at any given point in time. This number will display in Case Details, helping AWWs keep track of who is eligible for more THR each month.

A5(xi). AWC management module.

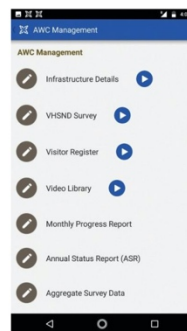


Track the growth and malnutrition status of every child over time

AWWs can record/view the following information in this module:

- Infrastructure details:** Record infrastructure details regarding the AWC like availability of functional toilet, availability of clean drinking water, etc.
- VHSND survey:** Record details regarding people who attended the last VHSND and the services that were provided to the beneficiaries
- Visitor register:** Record visits conducted by supervisors/officials
- Video library:** AWWs can use this section to show counselling videos to beneficiaries or go through application training videos for self-learning and understanding
- MPR (Monthly Progress Report):** Displays monthly report for date range 1st - 30th of the month
- ASR (Annual Status Report):** Displays the annual report based on records entered by the AWW in the application
- Aggregate data:** Displays aggregate data for various indicators based on records entered by AWW in the application since the first day of usage till present

AWC Management

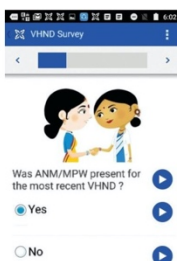


Infrastructure Details



A5(xii). VHSND Survey, Visitor register, Video library, Monthly Progress Report, Annual Survey Report.

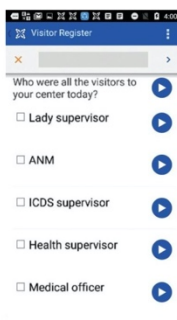
VHSND Survey



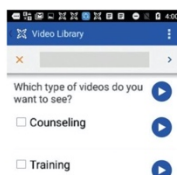
Aggregate Data



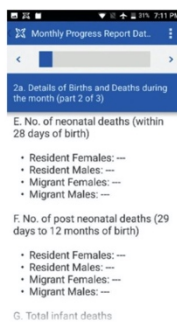
Visitor Register



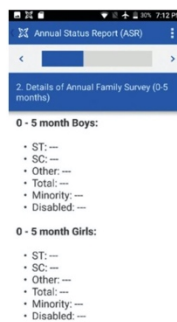
Video Library



MPR



ASR



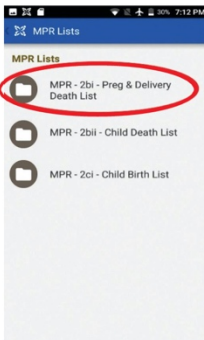
A5(xiii). Monthly Progress Report List.

MPR (MONTHLY PROGRESS REPORT) LIST

Track the growth and malnutrition status of every child over time

The MPR List module displays an exhaustive list for mother and child deaths in the Anganwadi worker's catchment area for the past 30 days. The module also captures details of child births in the catchment area for the past 30 days. This module helps the Anganwadi worker in tracking the infant and maternal mortality rate for her catchment area on a monthly basis.

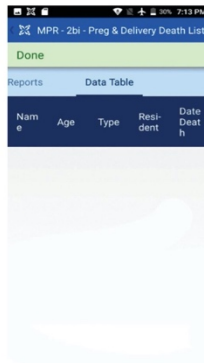
Pregnancy and Delivery Death List



Reports

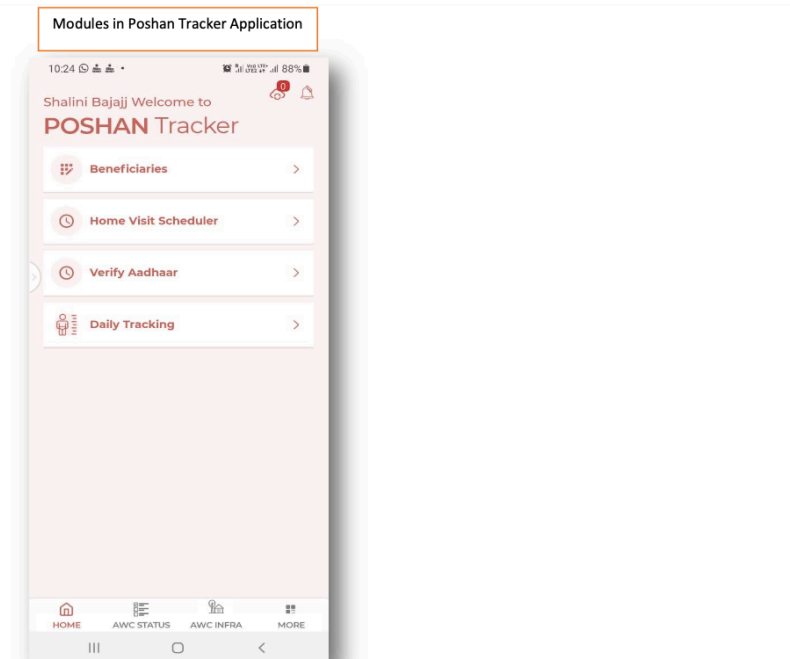


Data Table

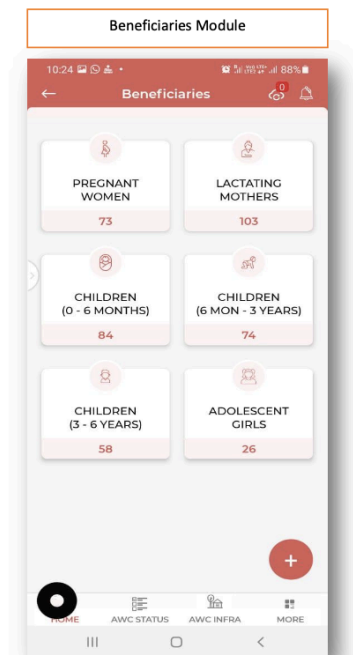


A6. Poshan Tracker interface

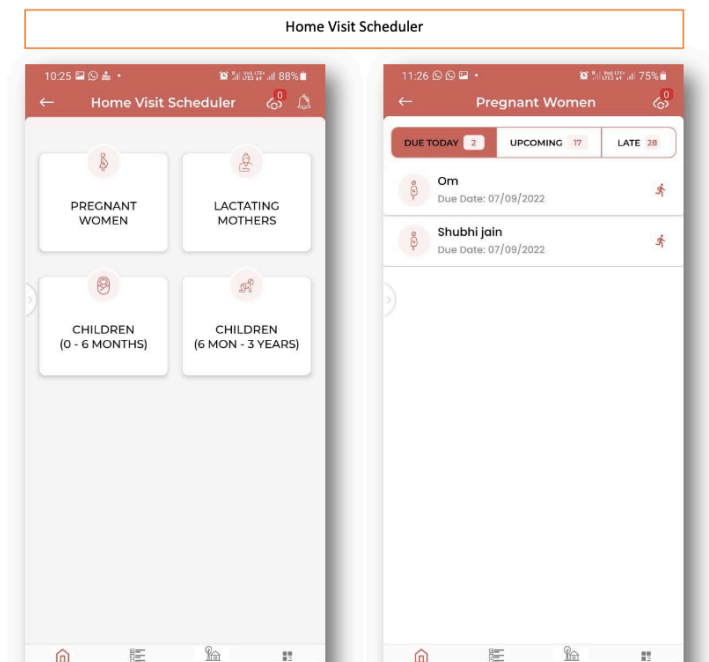
A6(i). All modules in Poshan tracker



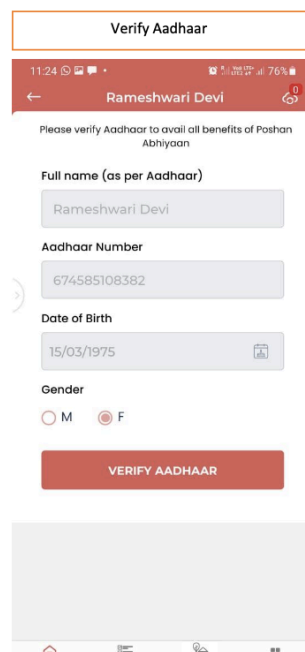
A6(ii). Poshan tracker beneficiary module



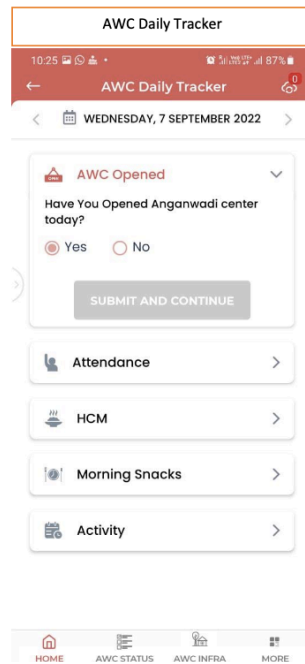
A6(iii). Home visit scheduler module in Poshan tracker



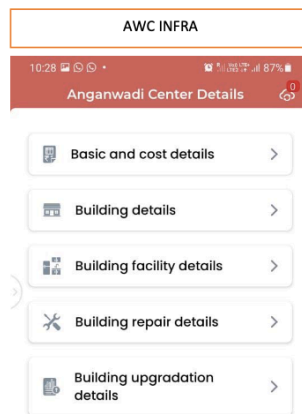
A6(iv). Aadhar verification module in Poshan tracker



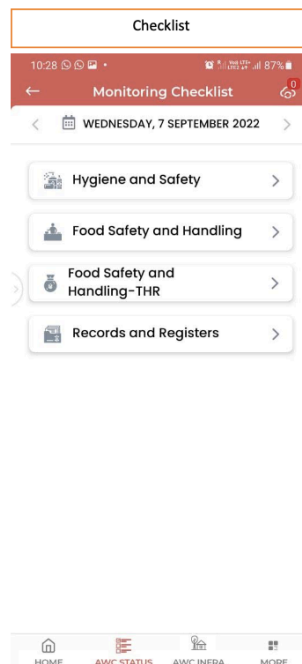
A6(v). AWC daily tracker module in Poshan Tracker



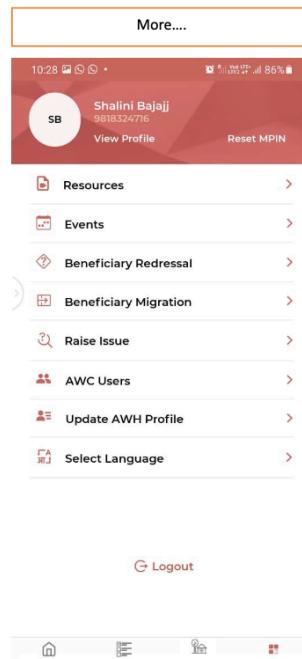
A6(vi). Anganwadi Center infrastructure module in Poshan tracker



A6(vii) Monitoring checklist module in Poshan tracker



A6(viii) Checklist module in Poshan tracker



A6. Feature comparison between ICDS-CAS and Poshan Tracker

ICDS-CAS mobile application		Poshan Tracker mobile application	
Fields	Value	Fields	Value
Module 1: Hh management		Module1: Pregnant women	
Beneficiary's name	Text	Beneficiary's name	Text
Religion/Caste	Dropdown	Husband's name	Text
Aadhar(available)	Yes/No	Aadhaar (verifiable)	12-digit number
x	x	Health ID	14-digit number
x	x	Date of birth	Date
GPS coordinate	Capture	Mobile (verifiable)	10-digit number
Birth preparedness	Checkbox	Pregnancy duration	number
x	x	If, first pregnancy	Yes/No
x	x	Prior miscarriage	Yes/No
x	x	Last menstrual period	Date
x	x	Deceased beneficiary	Yes/No
x	x	Abortion <20 weeks	Checkbox
x	x	Abortion >20 weeks	Checkbox
x	x	Still birth	Checkbox
Delivered	Yes/No	Miscarriage	Checkbox
Delivery visit	Checkbox	Delivery date	Date
x	x	Health tracking	
x	x	Height (cm)	76.2cm<Height<304.8cm
x	x	Weight (kg)	30k<Weight<300k
x	x	Hemoglobin (g/dL)	5dL<Hg<30dL
		Received SNP	Folic acid/iron/vita/calcium
THR distribution	Module	Provided THR	Checkbox
THR distribution	Module	THR days	Max 30 days
x	x	Health service type	Allopath/Homeopath/Ayush
Module 1: Hh management		Module2: Children (0-6 months)	
Child's name	Text	Child's name	Text
Group picture	Upload	Child's Aadhar	12-digit number
x	x	Child's Aadhar	Yes/No
x	x	Child's health ID	14-digit number
x	x	Sex	Male/Female
x	x	Father's name	Text
Mother's name	Text	Mother's name	Text
x	x	Mobile (verifiable)	10-digit number
x	x	Birth weight	
x	x	Birth height	
x	x	Deceased beneficiary	Checkbox
Breastfeeding	Icons	Received SNP	
Comp. feed	Icons	On solid foods	
x	x	Hemoglobin (g/dL)	5dL<Hg<30dL
x	x	Health service type	Allo/Homeo/Ayush
x	x	Current height (cm)	30.48cm<height<76.2cm
Weight (kg)	number	Current weight (kg)	0.5kg<weight<8kg
x	x	Vaccination	

Module 1: Hh management		Module 3: Children (6mo-3years)	
Child's name	Text	Child's name	Text
x	x	Child's Aadhar	12-digit number
x	x	Child's Aadhar	Yes/No
x	x	Child's health ID	14-digit number
x	x	Sex	Male/Female
x	x	Father's name	Text
Mother's name	Text	Mother's name	Text
x	x	Mobile (verifiable)	10-digit number
Module	Module	Birth weight	
x	x	Birth height	
x	x	Deceased beneficiary	Checkbox
x	x	Received SNP	
x	x	On solid foods	
x	x	Hemoglobin (g/dL)	5dL<Hg<30dL
x	x	Health service type	Allo/Homeo/Ayush
Weight (kg)		Current height (cm)	30.48cm<height<76.2cm
x	x	Current weight (kg)	0.5kg<weight<8kg
x	x	Vaccination	
Module 1: Hh management		Module 4: Children (6mo-3years)	
Child's name	Text	Child's name	Text
x	x	Child's Aadhar	12-digit number
x	x	Child's Aadhar	Yes/No
x	x	Child's health ID	14-digit number
x	x	Sex	Male/Female
x	x	Father's name	Text
Mother's name	Text	Mother's name	Text
x	x	Mobile (verifiable)	10-digit number
x	x	Birth weight	
x	x	Birth height	
x	x	Deceased beneficiary	Checkbox
x	x	Received SNP	
x	x	Solid foods given	
x	x	Hemoglobin (g/dL)	5dL<Hg<30dL
x	x	Health service type	Allopath/Homeopath/Ayush
x	x	Current height (cm)	30.48cm<height<76.2cm
Weight (kg)	Number	Current weight (kg)	0.5kg<weight<8kg
x	x	Vaccination	
x	x	Module 5: Adolescent girls	
x	x	Name	Text
x	x	Aadhar	12-digit number
x	x	Health ID	14-digit number
x	x	Date of birth	Date
x	x	Father's name	Text
x	x	Mother's name	Text
x	x	Mobile	10-digit number
x	x	Deceased beneficiary	checkbox
x	x	Received SNP	Folic acid/iron/vit./calcium
x	x	Menstrual cycle	Yes/No

	x	x	Take home ration	Checkbox
	x	x	THR days received	Number
	x	x	Iron level (%)	Per cent
	x	x	Hemoglobin (g/dL)	5g/dL<Hg<30g/dL
	x	x	Health service type	Allopath/Homeopath/Ayush
	x	x	Height (cm)	76.2 cm <height<304.8cm
	x	x	Weight (kg)	15kg <weight < 300kg
x	x		Module 6: AWC status	
x	x		Premise cleaned	Yes/No
Clean toilet facility	Checkbox		Toilet cleaned	Yes/No
x	x		Storage cleaned	Yes/No
x	x		Storage compliance	Yes/No
x	x		Disinfectants/pesticide	Yes/No
x	x		Separate fuel storage	Yes/No
Clean drinking water	Checkbox		Potable water	Yes/No
x	x		Cooking area clean	Yes/No
x	x		Utensils clean	Yes/No
x	x		Quality standards	Yes/No
x	x		Oil	Yes/No
x	x		Iodized/fortified salt	Yes/No
x	x		Condiments	Yes/No
x	x		Fresh vegetables	Yes/No
x	x		Pulses	Yes/No
x	x		Sugar/jaggery	Yes/No
x	x		Personal hygiene	Yes/No
x	x		Personal behavior	Yes/No
x	x		Clean plates/bowls	Yes/No
x	x		Waste disposal	Yes/No
x	x		Cleaned after work	Yes/No
x	x		Intact packing	Yes/No
x	x		Labeling	Yes/No
x	x		Stock records	Yes/No
x	x		Hot cooked meal	Yes/No
x	x		Local purchase	Yes/No
x	x		Received from FCI	Yes/No
x	x		Received from proc.units	Yes/No
x	x		cleaning agents purchase	Yes/No
x	x		Disinfectants purchased	Yes/No
x	x		Basic and unit details	
x	x		AWC code	16-digit number
x	x		Building ownership	Yes/No
x	x		Community building	Yes/No
x	x		Rented building	Yes/No
x	x		New building sanctioned	Yes/No
x	x		Building type	Kutcha/Pukka/Tiled
x	x		Site availability	Yes/No
x	x		Site handed over to dept.	Yes/No
x	x		Storeroom	Yes/No
x	x		Storeroom space	Yes/No

x	x	Kitchen	Yes/No
x	x	Plants	Yes/No
x	x	Plants space	Yes/No
x	x	Balanehi Paining	Yes/No
x	x	Paint required	Yes/No
x	x	Drinking water connection	Yes/No
x	x	Water filter available	Yes/No
x	x	Motor installed	Yes/No
x	x	Solar facility	Yes/No
x	x	Playground	Yes/No
x	x	Kitchen garden	Yes/No
x	x	Solar light	Yes/No
x	x	Electric light	Yes/No
x	x	Compound	Yes/No
x	x	Balvatika	Yes/No
x	x	Plates	Yes/No
x	x	Glasses	Yes/No
x	x	Utensils	Yes/No
x	x	Mats	Yes/No
x	x	Television	Yes/No
x	x	Air conditioner	Yes/No
x	x	Pressure cooker	Yes/No
x	x	Cooker type	Yes/No

		Weighing scale (Women)	Yes/No
		Weighing scale (Infants)	Yes/No
		Weighing scale (Children)	Yes/No
		Functional weighing scale	Yes/No
		Gas connection	Yes/No
		Cylinder number	1/2/3/4/5
		Toilet	Yes/No
		Sanction of new toilet	Yes/No
		Water connection	Yes/No
		Infantometer	Yes/No
		Functional Infantometer	Yes/No
		Stadiometer	Yes/No
		Functional stadiometer	Yes/No
		Building repaired	Yes/No
		Building needs repair	Yes/No
		Building upgraded	Yes/No
		Building needs upgrade	Yes/No
		Module: AWW profile	
		Aadhar number	12-digit number
		Name	Text
		Sex	Male/Female
		Email	Text
		Mobile	10-digit number
		Experience (Years)	Number
		Highest education	Pri/Secon./Bach./Master/Doc

		AWC	
		AWC code	16-digit number
		Name(asin Bank account)	
		IFSC	
		Bank name	
		Bank account number	
		Confirm account number	
		Module: AWH profile	
		Aadhar number	
		Name	
		Sex	
		Email	
		Mobile	
		Experience (Years)	
		Highest education	
		AWC	
		AWC code	
		Name(asin Bank account)	
		IFSC	
		Bank name	
		Bank account number	
		Confirm account number	
		Module: Events	
		Yoga day	
		AWC code	
		Event date	
		Participating preg.women	
		Participating lact.women	
		Participating children(3-6y)	
		Participating adol.girls	
		Participating AWWs	
		Participating AWHs	
		Participating ANMs	
		Participating ASHAs	
		Participating lady.supervisor	
		Participating CDPOs	
		Village Health Sanitation and Nutrition Day(VHSND)	
		Organized current month	
		Community Based Events(CBEs)	
		Organized current month	
		Training	
		Update homevisit planner	
		Plan CBEs	
		Identify weak newborns	
		Complementary diet diversity	
		Anemia prevention-women	

		Growth monitoring-children	
		Ensure improved comp.feeding	
		Ensure excl. breastfeeding	
		Timely initiation of comp.feed	
		Identify and prevent SAM	
		Support breastfeeding issues	