

## Evaluation of Digital Decision-support Tool for Child Nutritional Monitoring: a Cluster Randomized Controlled Trial in Urban and Semi-Urban Areas in Indonesia

NCT Number: NCT07027384

### Variable Description

Variables		Description
Low education		Indicator for respondents having completed primary education or lower (no completed education)
Unemployed		Indicator for respondents being unemployed (a stay-at-home parents)
Low SES		Indicator for respondents having self-reported monthly income below the regional minimum wage (~Rp5.000.000)
Variables		Description
<b>Primary outcomes</b>		
On-schedule Visitations	At least one on-time visitations	<p>The proportion of U5 children's visitation cycles in which CHWs completed at least the first required home visitation according to the app-generated schedule. For each cycle, a score of 1 is coded if the assigned CHW completes the first required visitation within the scheduled time window, and 0 if the first visitation is late or not completed.</p> <p>The final proportion is calculated as the number of cycles coded 1 in proportion to the total number of visitation cycles assigned to the CHW.</p>
	Full completion	<p>The proportion of U5 children's visitation cycles in which CHWs completed all required visitations within their respective scheduled time windows, as specified by the app-generated schedule. For each cycle, a score of 1 is coded if every required visitation within a cycle is completed on time, and 0 if any required visitation is late or not completed.</p> <p>The final proportion is calculated as the number of cycles coded 1 in proportion to the total number of visitation cycles assigned to the CHW.</p>
	Proportion of on-time visitation	The measure captures the proportion of required visits that were completed on time for each child's visitation

Variables		Description
		cycle. Within each cycle, visits conducted within the recommended time window were assigned a score of 1. The total number of on-time visits for each child was calculated by summing the score. The final proportion was calculated by dividing the score of actual on-time visits by the total number of required visits.
<b>Secondary Outcomes</b>		
<b>CHWs' Outcomes</b>		
CHWs' knowledge and attitudes	Knowledge of Children's Nutritional Matters	<p>This variable measures CHWs' general knowledge of basic child nutrition concepts and nutrition-related issues. Knowledge is assessed using a 10-item multiple-choice scale with four options provided per item. Each correct answer is coded as 1, the total knowledge score is calculated by summing the number of correct responses provided by each CHW. Higher scores indicate better knowledge of child nutrition-related matters.</p> <p>The knowledge scale includes items covering development-related time windows (e.g., <i>"What is the recommended duration for exclusive breastfeeding?"</i>), nutritional needs and services (e.g., <i>"How many doses of Vitamin A are recommended for a one-year-old?"</i>), and basic interpretation of child anthropometric measurements (e.g., <i>"If a child's mid-upper arm circumference is 13 cm, what does it indicate?"</i>).</p>
	Knowledge of GEDSI-related concept and services	<p>This variable measures CHWs' knowledge on best practices in providing an inclusive primary care services, including questions about the condition of disability (e.g. <i>"Which of the following options is not considered as visible disability?"</i>), and steps in providing disability-sensitive services (e.g., <i>"What should CHWs provide when someone with hearing disability participate in Posyandu activities?"</i>).</p> <p>It is measured using a multiple-choice 10-item knowledge scale. Four choices are presented for each item, with every correct answer recorded as 1. The final score of knowledge is calculated by summing the total number of correct answers. Higher score indicated better knowledge of GEDSI-related concept for inclusive services.</p>
	Attitudes towards	Index composite score measured using the Attitudes

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	people with disability	and Perspectives Toward Persons With Disabilities (APPD) <sup>[18]</sup> . Consists of 14 items measured using a 6-point Likert scale where 1 refers to strong disagreement and 6 refers to strong agreement. Final scores were standardized to have a value between 0 and 1, with higher scores indicating more negative attitudes towards persons with disability.
	Attitudes towards inclusive primary care services	Index score of CHWs' attitudes towards provision of inclusive service, measured using the adapted version of an attitude scale on malnutrition <sup>[19]</sup> consisting of 8 items measuring perceived ability in providing inclusive service, the importance of primary care services, and the rights to receive equal primary care services. Measured using a 6-point Likert scale where 1 refers to strong disagreement and 6 refers to strong agreement. Final scores were standardized to have a value between 0 and 1, with higher scores indicating more positive attitudes.
Digital Tools Utilization	Real-time Usage	The extent of CHWs real-time engagement with the app, measured by the proportion of CHW-reported activities that were submitted with zero time-gap between the activity timestamp and the report timestamp. Each activity is coded as 1 if submission is made on the same day and 0 if submitted late. The score is calculated as the number of real-time reports to the number of submissions, with higher values indicating more consistent real-time reporting behavior.
	Responsiveness	The proportion of notifications opened by the CHW out of all notifications sent to them, including notifications on confirmed nutritional cases and reminders for upcoming home visit schedules. Higher scores indicate greater responsiveness and stronger engagement with the digital tool's prompts.
Technology Acceptance	Perceived Usefulness	Index composite score measured using a 6-point Likert-scale that assesses task efficiency, decision-making support, and service delivery facilitation by the technology use. Final scores were standardized to have a value between 0 and 1, with higher scores indicating higher perceived usefulness by the users.
	Perceived Ease of Use	Index composite score measured using a 6-point Likert-scale that assesses instructions clarity, features' simplicity, and overall user experiences. Final scores were standardized to have a value between 0 and 1,

Variables		Description
		with higher scores indicating higher perceived ease of use by the users.
	Behavioral Intention to Use	Index composite score measured using a 6-point Likert-scale that assesses the likelihood of sustained use of the app. Final scores were standardized to have a value between 0 and 1, with higher scores indicating higher perceived ease of use by the users.
<b>Caregivers' Outcomes</b>		
Knowledge On Children's Nutrition	General knowledge on children nutritional-related matters	Index score of caregivers' basic knowledge of children nutritional needs and condition, measured using 10-item multiple-choice questions. Four choices were presented for each question. Each correct answer is coded as 1 and the final score is calculated by summing all correct answers.
Perception of Primary Care Services	Perceived quality of primary care services	Index variable constructed from responses to questions on perception of the available primary care services, including the accessibility, urgency, trust, and perceived impact. Scale used consisted of 7 items with a 6-point Likert scale, where 1 refers to strong disagreement and 6 refers to strong agreement. Final scores were standardized to have a value between 0 and 1, with higher scores indicating more positive attitudes.
	Perceived satisfaction towards healthcare workers (CHWs)	Index variable constructed from responses to questions on satisfaction towards Kader services, including their communication, perceived capacity (trust), inclusivity, and general satisfaction. Scale used consisted of 18 items with a 6-point Likert scale, where 1 refers to strong disagreement and 6 refers to strong agreement. Final scores were standardized to have a value between 0 and 1, with higher scores indicating more positive attitudes.
Attitudes Towards Primary Care Services	Participation in Posyandu	Proportion of attendance in Posyandu activities over the last 3 months, measured based on self-reported attendance.
<b>Children's Outcomes</b>		
Nutritional Status	Children's Anthropometric	Endline measurement of children's anthropometry, including weight, height, and upper arm circumference. A child's anthropometric measurement will be an indicator for health outcomes, determining the nutritional status of the child.

Variables		Description
	Completion of Immunization	Proportion of children with complete immunization in relation to their age.

### Analysis Plan

Statistical analysis will be performed using a statistical analyses tool (R) to assess the app's impact on our outcome of interest. The analysis will use an estimate of the Intent-to-Treat (ITT) approach. Each outcome will be compared between the three groups at the endline. Heterogeneity analyses will also be conducted in addition to the primary analyses.

### CHW Analysis Population

Because the intervention was delivered at the Posyandu level, all Community Health Workers (CHWs) affiliated with participating Posyandu were exposed to the assigned intervention regardless of whether they were sampled during baseline data collection. During implementation, additional CHWs who were not included in the baseline survey participated in intervention activities, including application use, GEDSI training, and visitation towards children. To address potential missing data, endline data collection will include both CHWs who were sampled and those who were not but were exposed to the intervention and carried out the activities as intended.

Baseline information on CHWs' secondary outcomes (e.g., knowledge and attitudes) is only available for a subset of CHWs sampled on baseline. CHWs' sociodemographic information, such as age, educational attainment, employment, and years of experience, were also not directly collected during baseline but can be obtained from the program database. As such, analyses that adjust for baseline values of CHW-level outcomes will be restricted to the CHWs sampled at baseline. Treatment effects for CHWs' secondary outcome will be estimated using two analyses for two different groups: (1) sampled CHWs, and (2) CHWs without baseline information.

### Estimation Equations

We estimate a few specifications. We begin with our baseline specification estimating pooled treatment effects, where we combine both treatment arms into a single indicator, comparing all mobile-app clusters against the web-based control. The following estimation aims to address whether the shift from web to mobile delivery improves service delivery that will include all CHWs participated in the intervention, regardless of the availability of their baseline information. In this specification, treatment effects reflect differences in CHW outcomes at endline between treated and control Posyandu, rather than changes from pre-intervention levels.

$$Y_{ic} = \alpha + \beta \cdot AnyTreat_c + X_c^I \gamma + \epsilon_{ic} \quad (1)$$

where  $Y_{ic}$  is the outcome for individual  $i$  in Posyandu  $c$ ,  $AnyTreat_c$  equals one if Posyandu  $c$  was assigned to either mobile-app arm and zero for the web-based control, and  $X_c$  is a vector of

Posyandu and individual (Kader and caregiver) covariates. The coefficient  $\beta$  captures the average effect of mobile app delivery relative to the web baseline.

To estimate changes in baseline and endline attributable to intervention exposure, a separate estimation that includes only the subset of CHWs sampled in baseline is specified in the following:

$$Y_{ic} = \alpha + \beta \cdot AnyTreat_c + \delta Y_{ic} + X_c^I \gamma + \epsilon_{ic} \quad (2)$$

where  $\delta Y_{ic}$  indicates the coefficient of baseline outcome in CHWs.

To separate the effect of mobile features from the incremental contribution of GEDSI training, we estimate a separate specification:

$$Y_{ic} = \alpha + \beta_1 \cdot Mobile_c + \beta_2 \cdot MobileTraining_c + X_c^I \gamma + \epsilon_{ic} \quad (3)$$

where  $Mobile_c$  indicates assignment to the mobile app arm and  $MobileTraining_c$  indicates assignment to the mobile app plus GEDSI training arm, with the web-based control as the omitted category. The coefficient  $\beta_1$  captures the effect of mobile delivery—app format, push notifications, and vulnerability screening—relative to the web control. The coefficient  $\beta_2$  captures the combined effect of mobile delivery plus GEDSI training relative to control. The difference  $\beta_1 - \beta_2$  measures the incremental contribution of GEDSI training conditional on mobile app receipt.