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Innovative Field Procedures in a Large-scale Survey to Ensure Quality of Data in Pandemic Situation: Evidence from NFHS-5, 2019-21

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Abstract: The survey implementation of the fifth round of NFHS was inordinately affected due to the COVID-19 pandemic, which posed many administrative and field challenges that were never known in the earlier rounds. This paper addresses two critical issues- first, the different innovative approaches adopted by the nodal agency to ensure and maintain data quality, and second, the evidence indicating that these innovations have not compromised the overall quality of data and other survey protocols, even during the COVID-19 pandemic. In the present study, all the process indicators on survey implementation and quality control measures are based on field check tables of NFHS-4 & 5. In contrast, for assessing anthropometric data quality, unit-level data from kids file of different rounds of NFHS (IAKR7ADT.dta) have been used.

NFHS has continually been adopting innovative strategies to enhance the quality of anthropometric data, which ranges from the use of high-quality equipment, regular calibration, and standardization of equipment to adherence to the protocols right from the beginning to the end of the survey. Results on declining variability from NFHS-4 to NFHS-5 across different teams, in terms of selected indicators in most states, indicate a vital component of capacity building of field staff, technological advancement in data quality monitoring on a day-to-day basis, and standard operating procedures developed for the survey in the post-pandemic situation.SOPs developed during the pandemic have contributed significantly to maintaining the quality of anthropometric data, which is validated with the evidence on three prominently used z-scores measured using height-for-age, weight-for-height, and weight-for-age. Results indicate nonsignificant deviation in any of the three indicators in the pre- and post-pandemic surveys. Deviation in the normality in HAZ, WHZ, and WAZ from the WHO normal curve is not significantly different from the earlier rounds of the survey.

Background and Rationale

In recent years, as large-scale surveys have become the primary data source for major demographic, health, nutrition, and development indicators in India, maintaining a high standard in data quality is of utmost importance. However, survey data have suffered traditionally from incomplete and inconsistent reporting(Croft, 2008). Therefore, innovative field mechanisms adopted for data collection to ensure consistency in data, particularly duringpandemics or other disruptions,

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become essential to produce and provide high-quality data with an accurate representation of the study population. To date, five rounds of NFHS have been conducted under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India, with the International Institute for Population Sciences (IIPS), Mumbai, as the nodal agency and technical assistance provided by the United States Agency for International Development (USAID) through ICF Macro (now called ICF). The main objective of each successive round of the NFHS has been to strengthen thedemographic and health database in the country and to provide essential data on health and family welfare and emerging issues in this area. NFHS data have helped set benchmarks and examine progress in the health sector that the country has made over time. Besides providing evidence for the effectiveness of ongoing programs, NFHS data also help identify new interventions and programswith a more area-specific focus.

The NFHS in India was initiated in the early 1990s, with the first round conducted during 1992-93 and the fourth round (NFHS-4) completed in 2015-16. The fifth round of NFHS was initiated in January 2019 and was expected to complete by October 2020. However, the survey was inordinately delayed by about ten months due to the COVID-19 pandemic, which posed many administrative and field challenges never known in the earlier rounds.

This paper focuses on data quality issues in household surveys with large sample sizes covering many topics. Given the ever-expanding contents and coverage of NFHS surveys, there has been growing criticism of the NFHS data quality. Such criticism emanates from uninformed individuals or organizations about the actual NFHS survey protocols and other scientific procedures adopted to address survey design or coverage. The most recent unwarranted criticism came from a paper presented at an international conference to mark the 25 years of NFHS in India, held in New Delhi in 2018, and later published in EPW(Srinivasan and Mishra, 2020). Unaware of the many changes introduced in the last two rounds of NFHS, the authors criticized the NFHS-4 results on many pretexts, which are factually incorrect. The authors of the paper were categorically informed about the inaccuracies in their arguments and analyses at that conference during the discussion session, and their suggested recommendations had already been incorporated into NFHS-4 and NFHS-5. It is a hard reality that, besides the unexpected natural disruptions, the ever-increasing contents and coverage of NFHS posed significant challenges in survey implementation and could potentially negatively affect the data quality. Hence, with every round, innovative mechanisms in survey implementation and rigorous technology-based monitoring and strengthening of supervision have become essential and incorporated to ensure and maintain the high standard of data quality, as achieved in NFHS-4 and NFHS-5.

Needless to say, as in all large-scale surveys implemented worldwide, NFHS alsodeveloped standard manuals and field operational protocols, which are updated every round. The actual field

operations to initiate data collection in various states began after completing a 21-day pre-test workshop on all instruments, including bio-markers and anthropometrics, and necessary corrections or amendments in the instruments and protocols. The workshop is usually followed later by a three-week training of trainers (ToT) to field agencies (FAs) officials in a suitably chosen location. Similarly, once a state is ready to initiate the fieldwork, a month-long state-level training for the selected investigators and supervisors is organized, including rigorous parallel training for the investigators specially recruited to do the clinical, anthropometry, and biochemical (CAB) components. Besides, the nodal agency also conducted comprehensive training for the field project officers (POs) who would be engaged in surveillance and monitoring the fieldwork, as well as all the field team members who shall be canvassing the instruments. NFHS has been following a process of multi-layer fieldwork monitoring to strengthen the data quality,including spot checks, backchecks, debriefing of fieldworkers and revisits in the first week of starting the survey, and continuous supportive supervision of the teams. Implementation of such protocols also focuses on minimizing instrumental, human, and transcription errors, particularly during collecting biomarkers.

In this paper, we address two critical issues — first, the different innovative approaches adopted to ensure and maintain data quality, and second, the evidence indicating that these innovations have not compromised the overall quality of data and other survey protocols, even during the COVID-19 pandemic. Given these two research issues, this paper describes the innovations (various mechanisms) adopted to ensure data quality in the implementation of the fifth round of NFHS and also provides evidence of improved data quality based on field-check tables, despite the increasing contents and coverage of the survey and unit level data on anthropometric measures using a comparative situation of pre and post COVID-19 situation.

Data and Methods

The analysis is based on the process and strategies adopted in survey implementation along with the strategic shifts from one round of NFHS to another to have comprehensive insights on innovations. The evidence of improved data quality is presented with the help of field check tables (FCTs), devised for NFHS by generating data on severalcritical indicators as part of the quality monitoring strategies and feedback mechanism with real-time access to data during the fieldwork. The FCT indicators in NFHS-4 and NFHS-5 have been compared using basic descriptive statistics. While the anthropometric data quality has been analyzed using Kernel Density Estimates on z-scores derived from height-for-age, weight-for-height, and weight-for-age using unit-level data of different rounds of NFHS.

Innovations in the Implementation of NFHS in India

Challenges of expanding contents and coverage of NFHS, along with the COVID-19 pandemic, have resulted in devising innovative mechanisms in data collection and adopting multiple strategies during survey implementation. This section briefly describes those innovations and implementation strategies that have contributed to the overall data quality.

Multi-layer monitoring and supervision of fieldwork

Following the standards of the Demographic Health Surveys (DHS) conducted worldwide, NFHS also provides multi-layer fieldwork monitoring to strengthen the data quality, including spot checks, backchecks, review of field check tables, debriefing of field workers, and continuous supportive supervision. Results obtained daily using inbuilt CAPI programs provided constant feedback and facilitated the adoption of corrective measures on an individual and team basis for various aspects of survey implementation. IIPS field staff conducted spot checks, and backchecks of surveyed households were completedin a minimum of 10 percent of PSUs randomly selected by the IIPS Central Office. Once the errors were identified, the nature of the mistakeswas explained to all the team members, along with the possible reasons for those errors. The team members were required to re-visit those respondents and households before closing the data for those PSUs. The practice of debriefing and revisits in the first week of the survey had been a significant step in improving the data quality, especially in minimizing the missing events due to a communication gap between interviewers and respondents.

Developing nested designs using a modular approach

Given the mandate of NFHS-4 (2015-16) to provide district-level estimates of population, health, and nutrition indicators, a nested design was developed by adopting a modular approach. Some key domains like husband's background and women's work, sexual behaviour, HIV/AIDS, household relations, and women's empowerment, which were not designed to have estimates at the district level, were included in the state module. Thus, the district module was a shorter version of the questionnaire canvassed in all 640 districts (as on March 31, 2014) and 707 districts in NFHS-5 (as on March 31, 2017). The state module, a more extended version of the questionnaire, was canvased in 30% of enumeration areas in each district among 50% of selected households (HHs) in each Primary Sampling Unit, along with several biomarkers and additional sections in women's and men's questionnaires.

Paradigm shifts in the data collection process with the introduction of CAPI

Since the 2015-16 round, NFHS has adopted Computer Assisted Personal Interviewing (CAPI), which helps strengthen the data quality and saves time. CAPI software provides real-time results, which are easily exportable to other formats. The CAPI data entry and editing program is designed with numerous checks and strategies to ensure high data quality. The inbuilt algorithm in the CAPI program automatically handles skip patterns, filters, and eligibility for questionnaires. The process of data collection using CAPI has an excellent provision of synchronizing data from the interviewer's CAPI computer to the supervisor's CAPI computer, which provides an opportunity for a piece of back-checking information to improve data quality. An inbuilt mechanism partially saves incomplete questionnaires to offer opportunities to complete the interview in multiple sessions and minimize respondents' fatigue even in surveys with lengthy questionnaires, which Srinivasan and Mishra, 2019 have criticized. Using innovative SyncCloud technology improves the data synchronization from the supervisor's CAPI to the Central Office, which gives access to real-time data from anydevice or computer. In this process, NFHS assigns a unique code to each investigator within a state, which helps in tracking the progress and performance of the investigators and providing timely individual-level feedback.

Using field-check tables (FCTs): an opportunity for real-time access to data and immediate feedback

NFHS has developed a protocol for accessing real-time data daily using the SyncCloud data streaming system. Continuous data evaluation through field-checktables and regular feedback to field teams avoids errors and improves the data quality. The CAPI programs help generate field-check tables on critical indicators daily, which are reviewed by the Quality Assurance Team (QAT) in the central office to allow individual-level feedback to be communicated to the teams working in different parts of the country. NFHS-5 (2019-21) used 51 indicators as part of the FCTs covering various aspects of data quality, including completion rates, age displacement, birth displacement, and skips associated with multiple questions. Those FCTs helpedinproviding feedback on the data quality. Moreover, Skype interactions with the core team of the Field Agency (FA) and the IIPS field POs once every two weeks by the quality assurance team members in the NFHS office also ensured data quality regularly. All these innovative measures have significantly contributedto tracking and monitoring the daily field operations of NFHS, notably to boost the morale of underperforming teams/interviewers and motivate them with the performance of other groups.

Developing error messages in the data collected from a PSU by the supervisor

For the first time in NFHS-5 (2019-20), the provision for generating Artificial Intelligence (AI) based application of error messages was introduced to ensure internal inconsistency in the data

with immediate corrections. IIPS and ICF have developed and implemented this application to reduce the burden of secondary editing after the completion of data collection. This application has been designed in such a way that any inconsistencies in the responses of a completed interview get highlighted. The team supervisor may ask the interviewer about the discrepancies and make the necessary corrections. The interviewer may be instructed to revisit the respondent if required for any clarification of those issues. Hence, the error messages were a handy tool to ensure data quality in NFHS-5 before the survey team left the completed PSU.

Generating Project Officer's Query Report (POQR) on selected indicators for each PSU

It is worth mentioning that backchecks are an integral part of the quality control mechanism adopted in all large-scale surveys. However, there are two questions generally raised on the issue of backchecks. First, how to select the households to revisit? And how to incorporate the changes required after that? NFHS-5 (2019-21) developed and used an AI-based algorithm called the Project Officer's Query Report (POQR) on the Supervisor's CAPI instrument to address these issues. Once the data collection is completed in a PSU and data are synchronized on the supervisor's CAPI, the IIPS project officer, using a specific login and password, can run the query tool to view a list of households having some potential gaps and inconsistencies in the information. After running POQR, the IIPS PO revisits the household and backchecks the information, maintaining gender sensitivity. Thus, the application of POQR in NFHS-5 has helped in reviewing a subsample of interviewed households to ensure accuracy and reliability of the information, and if there is any problem identified, the verified information entered in the interviewer's CAPI before resynchronizing the data on the supervisor's CAPI.This application was applied throughout the survey with a relatively more significant emphasis during post-pandemic survey implementation.

Standard Operating Procedure (SOP) in the survey implementationpost-pandemic situation

Keeping the COVID-19 situation into account, with the resumption of the survey, several protective measures were taken into consideration for survey teams and respondents to prevent COVID-19 infection, as well as notto affect the accomplishments of the overall hard work of every member involved in the NFHS team. At the team and surveyor level, insurance coverage was ensured centrally from IIPS. All core team members and survey teams were mandated to install the AarogyaSetu App on their phones. Physical distancing was maintained during the interview, ensuring the privacy and confidentiality of respondents. In addition, allteams were educated to check for the well-being of each team member every morning before leaving for fieldwork with thermal screening, which IIPS provided. If any memberdeveloped symptoms, the team stopped the fieldwork, after which the member was diagnosed, and fieldwork was initiated only if the member was found to be COVID-19 negative with self-declaration notice from all the team members that they were fit to go to the field daily.

At the community level, all the teams were mandated to contact the headman of the village/frontline workers to get the COVID-19 status of the selected household members before the interviews were initiated. Thermal screening of community people who were willing to be screened by Health Investigators of the survey team on the first day of the visit was carried out while distributing specially designed leaflets to the community members as a part of COVID-19 awareness added a lot of conducive environment for the survey teams at PSU level. Another intervention was providing masks, sanitizers and COVID-19 brochures to all the selected households, where each respondent was given a new mask during an interview and for CAB investigations. The compulsory thermal screening was done for all the members of selected households. If any member was found to have a fever, the survey was temporarily suspended in the household. A revisit was done to reassessthe status over the next three or four days.

The health investigators were instructed and encouraged to use additional protective equipment for the CAB investigations, like face shields, aprons, goggles, etc. Updated guidelines from the government were adhered to and adopted from time to time. The team members were directed to use sanitizer/soap and water to clean their hands frequently during fieldwork which could be preferably done at the beginning and end of CAB investigations of each respondent. The CAB investigations were done with minimum contact with respondents. The protocol of using a new set of gloves for each respondent and disposal of bio-hazardous waste daily was strictly adhered to.Further, the CAB equipment was mandated to be cleaned/sanitized after completion of each household. If the household has any member practicing isolation (very young or old members, and for whom the respondents demand), equipment was made to be cleaned before use for that member.

Results and Discussion

A comparative result of changes in the completion rate of household, women's, and men's interviews across all the states over the two rounds, i.e., NFHS-4(2015-16) and NFHS-5(2019-21), is presented in Table 1. Out of the total 30 states (including Delhi and Jammu and Kashmir), among those states surveyed in pre-pandemic times (18 states), almost all of them have experienced an increase in the completion rate of household interviews, except for Bihar,down by 4-percentage points from NFHS-4, followed by Kerala and Sikkim by three percentage points. Maharashtra and Meghalaya show the maximum improvement, an increaseof6 percentagepoints from NFHS-4, followed by Himachal Pradesh and Nagaland (5 percentage points each). The women's interview completion rate changes show a reasonably advanced level since the NFHS-4, with Andhra Pradesh and Telangana topping the charts in the first phase of NFHS-5. The difference in the completion rates of men's interviews shows a remarkable variation (especially in Meghalaya, Maharashtra, Andhra Pradesh, and Telangana), and states like Kerala and Jammu and Kashmir show a slight decrease since NFHS-4.

Table 1: Comparative completion rates (in %) across selected States/Union Territories of India from the two rounds of National Family Health Survey-4 (2015-16) and NFHS-5 (2019-20).

States/Union Territories (UTs)	Household			Women			Men		
		NFHS-5			NFHS-5			NFHS-5	
	NFHS-4	Pre Pandemic	Post Pandemic	NFHS-4	Pre Pandemic	Post Pandemic	NFHS-4	Pre Pandemic	Post Pandemic
Andhra Pradesh	93.1	94.5	-	88.9	97.4	-	80.4	92.7	-
Arunachal Pradesh*	85.7	-	96.0	86.2	-	98.1	79.5	-	96.0
Assam	95.9	98.8	-	94.3	97.6	-	87.4	94.0	-
Bihar	99.3	95.2	-	96.6	96.5	-	93.6	90.2	-
Chhattisgarh*	97.2	-	98.4	95.6	-	97.0	93.3	-	93.6
Goa	94.7	97.9	-	98.4	98.2	-	97.4	96.0	-
Gujarat	94.2	96.4	-	92.7	97.6	-	86.9	94.8	-
Haryana*	98.7	-	93.3	98.3	-	94.6	97.0	-	81.4
Himachal Pradesh	91.9	96.6	-	93.3	96.6	-	82.8	91.3	-
Jammu & Kashmir	97.2	98.0	-	96.9	96.7	-	92.0	88.4	
Jharkhand*	92.5		95.3	92.1		97.0	86.6		90.2
Karnataka	94.6	95.6		91.8	97.6		86.0	93.9	
Kerala	98.9	95.6		98.1	96.8		94.7	89.9	
Madhya Pradesh*	97.7		89.8	95.4		94.4	93.2		86.5
Maharashtra	88.7	95.1	-	89.2	97.3	-	83.0	94.6	-
Manipur	96.2	94.7	-	95.3	97.0	-	90.7	93.0	-
Meghalaya	94.3	99.8	-	93.5	98.9	-	83.1	97.0	-
Mizoram	95.4	98.2	-	97.7	98.8	-	94.4	98.0	-
Nagaland	94.9	99.7	-	95.3	99.8	-	91.3	99.6	-
NCT of Delhi*	83.6	-	95.8	81.5	-	96.4	53.9	-	90.0
Odisha*	96.2	-	96.1	94.1	-	97.8	86.1	-	94.6
Punjab*	98.1	-	91.5	97.5	-	92.8	93.3	-	78.7
Rajasthan*	97.1	-	97.4	96.3	-	97.5	94.5	-	94.3
Sikkim	98.4	95.6		97.7	96.4		96.1	94.8	-
Tamil Nadu*	97.2		95.3	98.2		98.8	95.3		96.6
Telangana	93.1	95.4	-	88.9	97.6		80.4	91.8	-
Tripura	95.8	97.6	-	95.1	97.3		89.7	93.0	-
Uttar Pradesh*	94.3	-	94.4	94.3	-	95.4	90.1	-	85.9
Uttarakhand*	94.0	-	94.8	94.0	-	94.8	85.4		84.1
West Bengal	95.5	98.5	-	93.9	98.8	-	87.0	96.4	-

Among states surveyed in post-pandemic (12 states), three states have shown a drop in the completion rates of household interviews from NFHS-4 - Madhya Pradesh and Punjab have been affected the most, followed by Haryana (5 percentage points). While in women's interview completion rates, Punjab and Haryana show a decline. The rest of the states have minor changes, with Delhi showing the most increase, followed by Arunachal Pradesh for all the categories of interview completion rates.

Regarding completion rates of men's interviews, Haryana and Punjab have shown notable differences since NFHS-4.Even though there were many unavoidable hurdles within the states, such as COVID-19 pandemics, farmer's protests, natural calamities, etc., IIPS has attempted to maintain survey data quality in both the phases (pre and post-pandemic). The innovative attempts included organizing multiple debriefing sessions after identifying possible solutions for any inconsistencies, both interview-wise and team-wise every week, in collaboration withconcerned Field Agencies as well as with field POs of IIPS. In the post-COVID-19 situation, IIPS developed field protocols by following guidelines for COVID-19 of the concerned state government, such as provisions for wearing PPE dresses, maintaining social distancing while taking interviews, wearing masks, etc.

NFHS5 IIPS has adopted extensive data quality monitoring protocols using software applications for generating error messages and POQR to detect intentional skipping of questions, which may affect the numerators and denominators of various indicators. Besides the technical inputs, along with consistent cross-checks of FCT and back/spot checks, the timely support of the Ministry of Health and Family Welfare, the field preparedness within existing strict government Covid protocols, and the cooperation of the field agencies and the community have helped in improving and maintaining data of NFHS-5.

Figure 1: Age ratio for women across states of India surveyed during pre-and-post pandemic phases, National Family Health Survey, 2015-21

Figure 1a: Comparative age ratio for women across States of India surveyed in pre-pandemic phase, NFHS 4 & 5

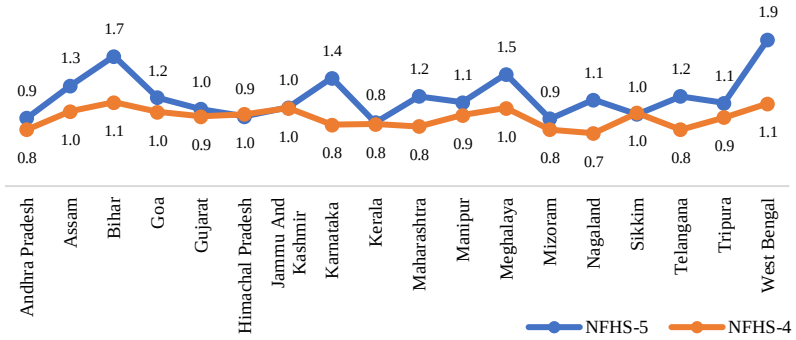


Figure 1a: Comparative age-ratio for women across different states of India surveyed in post pandemic, NFHS-4 & 5

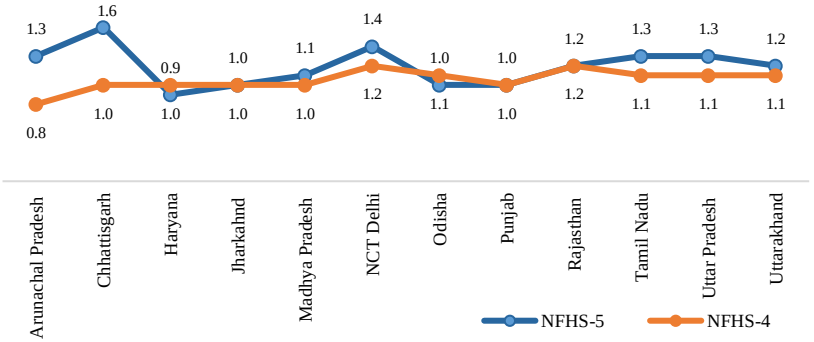


Figure 2: Age ratio for men across states of India surveyed during pre-and-post pandemic phases, National Family Health Survey, 2015-21

Figure 2a: Comparative age ratio for men across States of India surveyed during pre-Covid-19 pandemic phase, NFHS-4 & 5

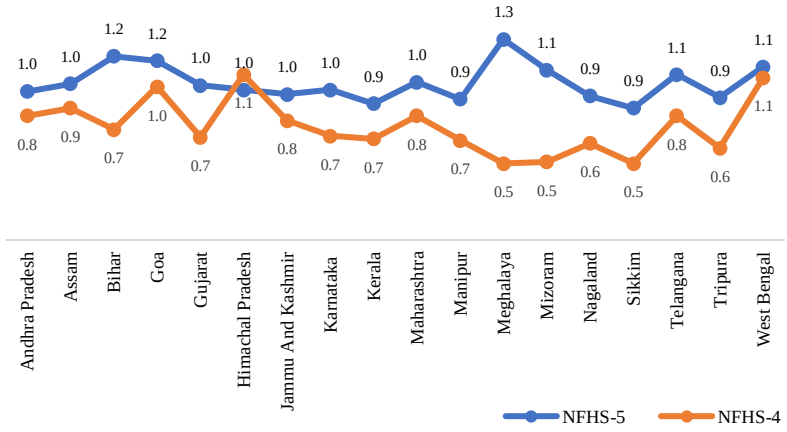
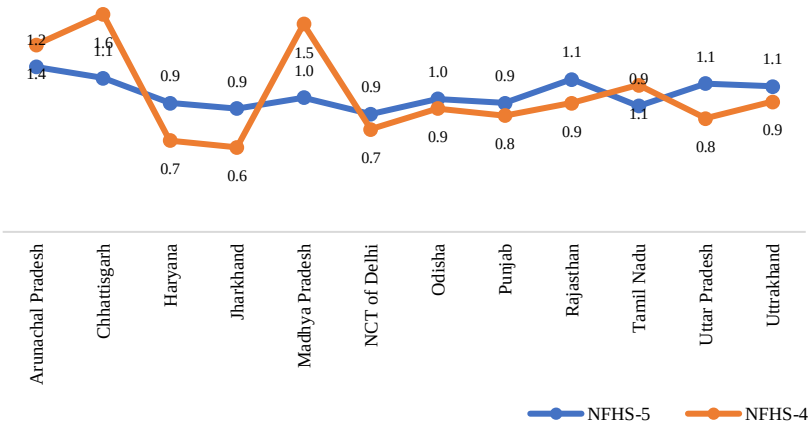


Figure 2b: Comparative age ratio for men across States of India surveyed during post-Covid-19 pandemic phase, NFHS-4 & 5



Figures 1 and 2present the age displacement measured in the age ratio (15 years/14 years) among women and men for all the states from the pre-pandemic and post-pandemic phases. Survey protocols in terms of filters and skips are an essential part of any large-scale survey to ensure the applicability of questions to eligible respondents. In some instances, these provisions are likely to be misused by some of the investigators to reduce their workload. Hence, they are one of the most critical factors affecting data quality. The eligible age for an interview for men and women in NFHS is 15-54 and 15-49 years, respectively. Values close to 1 may show a smaller degree of displacement, while values less than one may indicate a downward displacement of the age of women. With the existing age-sex composition of the population, the age ratio may vary from 0.90 to 1.1, so the values of the ratio in this range are well accepted. It is observed that the age displacement at the lower end of the age spectrum was higher in NFHS-4 than in NFHS-5 in the case of both women and men.

Amongst the pre-pandemic states, in NFHS-4, the biasness by the investigators in reporting the age of young women was observed in six states, namely; Andhra Pradesh, Karnataka, Kerala, Maharashtra, Mizoram, Telangana had a ratio of 0.8, and a slightly more undesirable ratio was noticed in Nagaland (0.7) whereas, in NFHS-5. However, most of the states have shown improvement, and four states offer unexpectedoutcomes - Karnataka (0.4), Meghalaya (0.5), Bihar (1.7), and West Bengal (1.9).

In the case of age-displacement of women, amongst the post-pandemic states, the NFHS-4 indicates biasness in four states, viz., Arunachal Pradesh (0.8), Tamil Nadu and Uttar Pradesh (1.3, each), and Chhattisgarh (1.8). In contrast, in NFHS-5, only two states, i.e., Arunachal Pradesh (0.8) and NCT Delhi (1.3), showed biased results for young women's age. For men, all the states in NFHS-5 show progress since NFHS-4.

Table 2 shows displacement in age among women, birth displacement of children, and lack of privacy while interviewing eligible women. Some of the investigators attempt to lessen their workload by displacing the age of women at the lower or upper end of the eligibility age range so that women might become ineligible for an interview. For example, a respondent age 15 or 16 may be reported as 14, or at the upper end, a woman age 48 or 49 may be reported as age 50 by the investigator. During the pre-pandemic, states like Telangana, West Bengal, Assam, Nagaland, Karnataka, Meghalaya, Sikkim, and Maharashtra show displacement, whereas among post-pandemic states; Madhya Pradesh, Chhattisgarh, Arunachal Pradesh, Tamil Nadu, Rajasthan, Uttar Pradesh, Uttarakhand, and Jharkhand.

Displacement of the date of birth of children under five years of age for NFHS-4 and NHFS-5 is another critical issue. The birth displacements were computed as the ratio of the total number of live births reported from 2010 to 2009 for NFHS-4. For NFHS-5, displacements were calculated as the ratio of the year 2014 to 2013. The value of this ratio should be close to one in the absence of

displacement of date of birth, given the existing demographic transition in the country. Table 2 portrays negligible birth displacement in the two rounds of NFHS included in the analysis. Besides, NFHS-5 had a further reduction in birth displacement over NFHS-4. The investigator's biasness may be observed lesser in the case of Assam(pre-pandemic) and Uttarakhand(post-pandemic).It is evident that despite the increasing sample size and Covid-related situation, multiple innovations to strengthen the survey implementation and technology-driven monitoring and supervision successfully control investigator bias in reporting the children's birth date.

Table 2: Age displacement among Women and Birth displacement of Children across states in India, National Family Health Survey, 2015-16 and 2019-21.

States	Age displacement among women			Birth Displacement		
	NFHS-4	NFHS-5 (Pre Pandemic)	NFHS-5 (Post Pandemic)	NFHS-4	NFHS-5 (Pre Pandemic)	NFHS-5 (Post Pandemic)
Andhra Pradesh	0.8 (0.4)	1.1 (0.7)		1.0 (0.4)	1.0 (0.3)	
Arunachal Pradesh	0.9 (0.4)		1.5 (1.0)	1.0 (0.5)		1.3 (0.6)
Assam	1.0 (0.3)	1.9 (3.1)		0.9 (0.2)	1.0 (0.3)	
Bihar	1.2 (0.7)	1.9 (1.0)		1.1 (0.2)	1.0 (0.3)	
Chhattisgarh	1.9 (0.8)		1.6 (1.0)	1.2 (0.4)		1.0 (0.3)
Goa	1.0 (0.3)	1.2 (0.2)		0.9 (0.1)	0.9 (0.2)	
Gujarat	0.9 (0.3)	1.0 (0.3)		0.9 (0.2)	0.9 (0.2)	
Haryana	1.0 (0.4)		1.0 (0.5)	1.1 (0.4)		1.1 (0.4)
Himachal Pradesh	1.0 (0.4)	1.0 (0.4)		1.0 (0.2)	0.9 (0.3)	
Jharkhand	1.0 (0.4)		1.2 (0.5)	1.0 (0.7)		1.2 (0.4)
Karnataka	0.8 (0.4)	1.7 (1.1)		1.1 (0.8)	1.0 (0.3)	
Kerala	0.9 (0.3)	0.9 (0.4)		1.0 (0.2)	1.0 (0.3)	
Madhya Pradesh	1.3 (0.6)		1.7 (1.0)	1.2 (0.3)		1.2 (0.6)
Maharashtra	0.9 (0.3)	1.3 (0.6)		1.0 (0.3)	1.0 (0.2)	
Manipur	1.0 (0.3)	1.1 (0.3)		1.1 (0.2)	1.0 (0.3)	
Meghalaya	0.9 (0.6)	1.7 (0.8)		1.0 (0.4)	1.0 (0.2)	
Mizoram	0.8 (0.4)	0.9 (0.3)		1.0 (0.2)	1.0 (0.3)	
Nagaland	1.3 (2.4)	1.8 (1.6)		1.0 (0.1)	1.0 (0.3)	
NCT of Delhi	1.2 (0.6)		1.0 (0.5)	1.0 (0.2)		1.0 (0.4)
Odisha	1.2 (0.8)		1.2 (0.7)	1.2 (0.6)		1.0 (0.5)
Punjab	1.5 (2.2)		1.2 (0.8)	1.0 (0.3)		1.0 (0.3)
Rajasthan	1.2 (0.3)		1.4 (0.5)	1.0 (0.2)		1.0 (0.2)
Sikkim	1.0 (0.2)	1.4 (1.1)		1.0 (0.2)	1.0 (0.5)	
Tamil Nadu	1.4 (0.6)		1.5 (1.1)	1.2 (0.3)		1.1 (0.4)
Telangana	-	2.2 (1.1)		-	1.1 (0.4)	
Tripura	1.0 (0.4)	1.2 (0.6)		0.9 (0.1)	0.9 (0.2)	
Uttar Pradesh	1.5 (0.6)		1.4 (0.8)	1.1 (0.7)		1.0 (0.3)
Uttarakhand	1.0 (0.3)		1.4 (0.8)	1.0 (0.1)		1.1 (0.4)
West Bengal	1.3 (1.0)	2.2 (1.1)		1.1 (0.3)	1.1 (0.4)	
Total	1.2 (0.8)	1.4 (1.1)		1.1 (0.4)	1.0 (0.4)	

There is a tendency by investigators to curtail women's interviews, as it consumes more time than usual interviewing, by deliberately selecting responses like "privacy not available," "respondent refused," etc. A check on such issues has been possible as IIPS made all possible improvements, like introducing POQR code for IIPS's field POs to monitor the results on the spot and continuous sessions with the NFHS-5 PI's along with the central staff of FAs. It has helped bring better results in the fifth round of NFHS despite a break of almost eight months due to the COVID-19 pandemic.

Table 3: Descriptive Statistics [Mean (S.D.)] for 'Skip' indicator for selection across states in India, National Family Health Survey, 2015-16 and 2019-21

State	Not currently using contraception			Not received antenatal care		
	NFHS-4	NFHS-5 (Pre Pandemic)	NFHS-5 (Post Pandemic)	NFHS-4	NFHS-5 (Pre Pandemic)	NFHS-5 (Post Pandemic)
Andhra Pradesh	33.2 (5.4)	24.6 (5.8)		2.2 (2.2)	2.9 (7.9)	
Arunachal Pradesh	62.6 (9.3)		36.8 (10.1)	54.7 (29.1)		24.9 (10.6)
Assam	37.7 (8.0)	29.2 (6.8)		10.0 (8.3)	4.2 (4.9)	
Bihar	64.1 (6.6)	26.6 (10.0)		45.3 (10.9)	14.4 (10.8)	
Chhattisgarh	33.0 (4.6)		19.8 (6.9)	4.3 (3.6)		5.8 (9.4)
Goa	52.9 (6.2)	24.9 (3.9)		3.7 (3.0)	1.1 (2.4)	
Gujarat	42.6 (11.0)	26.3 (7.6)		15.6 (10.8)	5.6 (5.9)	
Haryana	26.1 (4.7)		18.0 (4.8)	16.8 (9.8)		4.2 (4.4)
Himachal Pradesh	33.5 (10.7)	16.4 (6.9)		7.9 (4.6)	8.6 (8.2)	
Jharkhand	48.7 (9.7)		24.9 (4.9)	27.1 (18.5)		9.7 (8.2)
Karnataka	38.4 (8.9)	23.3 (5.4)		7.4 (8.9)	1.7 (2.9)	
Kerala	35.4 (6.7)	30.7 (8.5)		0.5 (0.9)	1.4 (1.4)	
Madhya Pradesh	39.3 (9.2)		20.4 (6.2)	23.8 (12.4)		8.9 (8.2)
Maharashtra	32.4 (8.7)	25.3 (6.7)		9.3 (8.6)	5.1 (4.9)	
Manipur	55.8 (7.4)	28.4 (5.7)		12.6 (5.4)	10.1 (5.8)	
Meghalaya	53.8 (7.2)	50.9 (7.6)		26.8 (20.1)	12.3 (8.2)	
Mizoram	46.7 (7.9)	46.8 (7.1)		9.8 (8.9)	9.8 (7.5)	
Nagaland	52.2 (8.5)	31.5 (6.2)		56.3 (16.3)	31.0 (15.4)	
NCT of Delhi	34.9 (9.9)		18.1 (3.7)	9.1 (4.6)		8.9 (6.7)
Odisha	41.5 (9.2)		18.7 (5.9)	8.3 (8.4)		1.9 (2.2)
Punjab	16.6 (4.1)		26.7 (12.8)	2.9 (2.7)		5.4 (4.2)
Rajasthan	30.9 (6.8)		18.9 (4.4)	14.2 (8.4)		6.4 (6.8)
Sikkim	36.7 (9.5)	12.5 (4.3)		4.7 (3.1)	6.0 (6.7)	
Tamil Nadu	38.7 (9.5)		25.2 (6.0)	8.2 (9.8)		3.9 (7.2)
Telangana	--	20.2 (4.7)		--	5.3 (5.7)	
Tripura	29.9 (10.4)	25.5 (5.8)		7.8 (4.6)	15.8 (12.6)	
Uttar Pradesh	37.4 (11.3)		25.2 (6.1)	22.7 (11.5)		7.6 (5.8)
Uttarakhand	32.5 (3.5)		18.9 (5.5)	23.2 (5.9)		11.4 (8.3)
West Bengal	26.4 (6.2)	20.2 (4.6)		10.1 (12.4)	5.2 (5.7)	
Total	39.0 (13.4)	24.5 (9.2)		17.1 (17.2)	7.5 (8.9)	

A woman's questionnaire is designed with relatively larger numbers of questions, where several questions may not be applicable for those not using any method of contraception and not given any live birth in the last five years. This enhances the chances of skips which may also invite a possibility of intentional skips to reduce the number of women interviewed by the female investigator. The variations in skips reported for selected indicators across all the states are presented in Table 3 for three significant indicators. It is evident from the table that the proportion with a response of "NO" to the current use of family planning has declined in almost all the states in NFHS-5 over NFHS-4, except in Punjab (post-pandemic state). However, the decline has been the lowest in Meghalaya and Mizoram, the two states where the general use of family planning has also declined over the past four years (values not shown).

Further, Table 3 presents descriptive statistics providing interstate and intra-state (between field teams) variation in the percentage of interviews with skips in the indicator included in the analysis in terms of mean and standard deviation (SD) between NFHS-4 and NFHS-5. A

low SD indicates that the average skip by various teams working in a state is very close to the mean value of skips by all the teams; a high standard deviation indicates that the data points show a considerable variation across teams. It is evident from Table 3 that in the case of the current use of family planning, the average skips have declined from 39.0 percent in NFHS-4 to 24.5 percent in NFHS-5, along with the decline in SD from 13.4 to 9.2 percent. The state-level reductions in average skips between NFHS-4 and NFHS-5 are the maximum in Bihar (37 percentage points), followed by Goa and Manipur (28 percentage points each), Sikkim (24 percentage points), and Nagaland (20 percentage points) in the pre-pandemic surveyed states. Similarly, among the states completed after the pandemic, states with utmost improvementare Arunachal Pradesh (26 percentage points), Jharkhand (24 percentage points), and Odisha (23 percentage points). However, survey teams that worked in Bihar and Arunachal Pradesh portray greater heterogeneity in skipping 'the current use of contraception than the teams working in other states.

Another indicator is the "NO" for antenatal care (ANC) during the most recent pregnancy in the last five years, which shows a substantial decline between NFHS-4 and NFHS-5 in all the states except Tripura from pre-pandemic states. Despite the decrease in the skips, the levels are still high in Chhattisgarh and Punjab from post-pandemic states, and slight negligible changes in Sikkim, Himachal Pradesh, and Kerala, which were surveyed in pre-pandemic, in NFHS-5. The NFHS team explored the reasons for higher reporting of "NO" responses to ANC and found that recent floods in Kerala in the last three years might have affected this critical component of maternal care and increased women migration from backward states left unserved in the state. While in the case of Tripura, an increased number of districts from four to eight might have changed the compositional aspects of the population, especially in the tribal-dominated areas. Further, average skips due to non-use of ANC in the case of last pregnancy during the five years preceding the survey has declined from 17 percent in NFHS-4 to 8 percent in NFHS-5.

Quality of Anthropometric Data in Pandemic Situation

Malnutrition among children under five continues to be a significant public health challenge in India and many developing countries. Malnutrition in children results in an increased risk of mortality, delayed mental development, poor school performance, and reduced intellectual capacity(WHO, 2010),affecting their earning ability and, eventually, the nation's productivity(World Bank, 2006). Given the necessity of alleviating childhood malnutrition for the sustainable development of a country, the UN Sustainable Development Goals (SDGs) aimto eliminate malnutrition by 2030(Department of Economic and Social Affairs, 2016).

Population-based household surveys with vital anthropometry components are primarydata sourceson child malnutrition. The advantage of integrating anthropometry into household surveys provides various sociodemographic factors associated with malnutrition across the country. As these

data, particularly NFHS, are utilized for policy decisions, programmatic interventions, and tracking progress, it becomes essential to study the quality of anthropometry data in these surveys.

In the case of India, there are considerable variations in the prevalence of malnutrition across states and regions, more so atthe district level. Also, the programmatic decision-making and execution happen at the state and district levels. So to mount effective interventions toachieve improvement, it is important to have robust population-based estimates of malnutrition and ensure their reliability even at the regional level (state or district). Previous research on anthropometry data quality has compared the data quality of NFHS 3 and 4 at the country level and concluded that the quality does not affect the prevalence estimates(Assaf, Kothari, and Pullum, 2015;Finaret and Hutchinson, 2018;Harkare, Corsi, Kim, Vollmer, and Subramanian, 2021). In this paper, we attempted a more granular analysis at the state level to highlight where the estimates are credible, identify issues, if any, with others, and offer solutions.

National Family Health Survey has a reputation for collecting high-quality biomarker/ CAB (Clinical Anthropometry and Biochemical) data for India. It continuously thrivesonraising the bar of data quality by innovations in survey implementations and design, efficient quality assurance and quality control mechanisms, appropriate use of the latest technology, and multi-tier monitoring and supervision systems. The protocols for collecting CAB data have been developed with international standards, comparable with other DHS surveys, with suitable modifications through developing standard operating procedures (SOP) during the pandemic.

Since NFHS-4 witnessed a tremendous increase in sample size to provide estimates at the district level, there has been a change in thefield training of health investigators (HIs). In NFHS-4, integrated training of trainers (ToT) for CAB components was organized along with ToT for the survey questionnaire. In this model, an extensive dedicated CAB training for three weeks is given to trainers of field agencies by international experts along with good in-house and field practices. The same model is replicated in the training of health investigators at the state level training and only those HI who can carry out biomarker collection as per the standards, perform satisfactorily in written exams, and meet the stringent criteria of standardization exercise, are involved in fieldwork.

The standardization exercise for trainers and investigators is conducted to ensure the required precision and accuracy in the measurements. Only those investigators demonstrating required skills in anthropometry measurements, as reflected in standardization, are allowed to join fieldwork. In addition, HIs are monitored closely in the field in real-time with the help of field check tables (FCT) for each health investigator, starting in NFHS-4. Field check tables enable almost real-time monitoring of each investigator's performance, continuous evaluation of data collected, and timely feedback on specific issues. Field check tables also allowobservation of investigators' performances

on a large scale basis and find any systemic patterns of deviations over time, as well as the effectiveness of feedback and subsequent improvement. They are vital in monitoring the primary indicator for data quality, i.e., the respondent's participation in the survey, age heaping, and digit preference.

In every round, NFHS has used standard, self-calibrating equipment having the latest technologies to ensure minimum instrumental errors. The equipment is also standardized periodically during fieldwork using standard weights and rods of fixed length to ensure the accuracy of the measurements. In addition, there are various mechanisms by which NFHS ensures good participation of the selected households and their members in the survey like proper advertisement, involvement of influential local people, adequate training of investigators in interview techniques, dos and don'ts in field work, and multiple strategies mentioned in the SOPs in the pandemic situation. These startegies have helped the survey team better participatein anthropometric measurements and blood collection in women, men, and children, which was impossible without physical contact between HIs and subjects. It is evident from the completion rate of anthropometric measures that there is no deviance in the completion of anthropometric measurements,i.e., height and weight of the subjects in pre and the post-pandemic situation in NFHS-5 (2019-21) as a comparison to NFHS-4(2015-16). Almost similar results are evident in the case of collection of the blood sample from women and children (6-59 months) across selected States/UTs in the pre-and post-pandemic situation in NFHS-5 (2019-21) as compared to NFHS-4 (2015-16) [figures 1c, d, e, f and Table presented in Appendix)

Anthropometric measurement is an integral part of NFHS. However, during the pandemic situation, social distancing became a norm. As the fifth round of NFHS was completed partly before the pandemic and partly after a gap of almost eight months in a post-pandemicsituation, accuracy in anthropometric datamay be debatable due to COVID-19 protocols of maintainingsocial distancing. Fig. 3 provides evidence of the data quality of three prominently used z-scores measured using anthropometric variables, height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ). The figure highlights that no significant deviation was observed in any of the three indicators over time.Deviation in the normality in HAZ,WHZ, and WAZ from the WHO normal curve is not significant in the case of observationstaken in pre-as well as the post-pandemic situation. The mean value ofthe HAZ score was only marginally different in post-pandemic observations (-1.35) compared topre-pandemic values (-1.32). However, both the values portray better congruence in HAZ scores than those based on NFHS-4 (-1.48), NFHS-3 (-1.87), and NFHS-2(-1.99). These values indicate constant improvement in anthropometric data quality measured in terms of HAZ score. This result is also justified by the values of WHZ and WAZ scores. In addition, the skewness should lie between (-3 and +3), while kurtosis should lie in the range (-10 to +10) (Kallner, 2014). Considering this rule, we may conclude that skewness and kurtosis for HAZ, WHZ, and WAZ, lie in the acceptable range, with no major deviation between the rounds of NFHS.

Fig 3: Kernel density curves for A. HAZ, B. WHZ and C. WAZ scores among under-five children in India, National Family Health Survey, 1998-2021

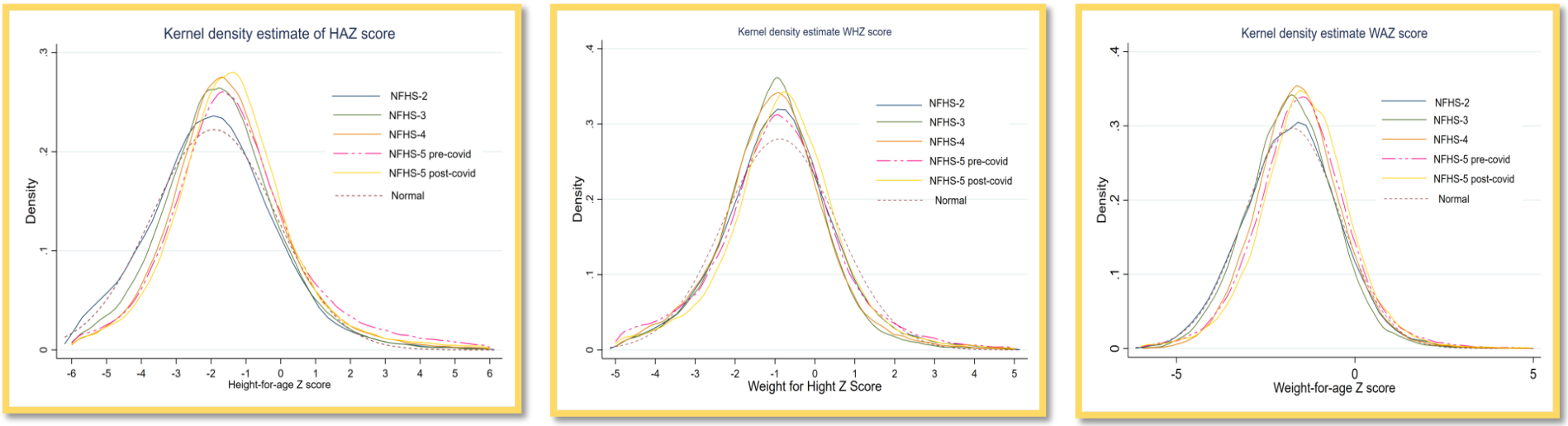


Table 4: Descriptive statistics for anthropometric z-scores for under-five children, National Family Health Survey, 1998-2021

Descriptive Statistics	National Family Health Survey														
	Height-for-Age z-score (HAZ)					Weight-for-Height (WHZ)					Weight-for-Age z score (WAZ)				
				2019-21					2019-21					2019-21	
	1998-99	2005-06	2015-16	Pre-COVID	Post-COVID	1998-99	2005-06	2015-16	Pre-COVID	Post-COVID	1998-99	2005-06	2015-16	Pre-COVID	Post-COVID
Mean	-1.99	-1.87	-1.48	-1.32	-1.35	-0.88	-1.78	-1.03	-0.89	-0.78	-1.76	-1.78	-1.57	-1.47	-1.40
SD	1.76	1.66	1.67	1.85	1.67	1.42	1.23	1.36	1.53	1.41	1.34	1.23	1.20	1.32	1.28
Skewness	0.40	0.40	0.50	0.67	0.57	0.21	0.14	0.16	0.17	0.09	0.16	0.14	0.22	0.19	0.07
Kurtosis	3.72	3.78	4.10	4.29	4.58	3.78	3.42	3.90	3.79	4.07	3.38	3.42	3.57	4.07	4.14

Discussion and Conclusions

Despite the unavoidable hurdles prevailing mainly during the second phase of the NFHS-5 like pandemics, farmer's protests, natural calamities, etc., IIPS hadmade every effort to maintain the quality of the survey in both the phases; pre and post-COVID-19 pandemic. As mentioned earlier, the existing quality assurance mechanisms of NFHS and other innovative measures introduced have ensured data quality. For instance, by maintaining rigorous multiple debriefing sessions after identifying possible solutions for any inconsistencies, both interview-wise and team-wise, every week, and cooperation from the Field Agencies as well as with PO of IIPS. The most negligible impact of COVID fear on data quality is evident in the states where the survey was implemented, mainly in the post-covidscenario. This was primarily due to effective implementation of SOPs and stringently following guidelines for COVID-19, such as maintaining social distance while taking interviews, wearing masks, community level rapport building, prior recording of casesin the selected households, etc.

NFHS has developed extensive data quality monitoring protocols using software applications for generating error messages and POQR to detect intentional skipping of questions, which may affect the numerators and denominators of various indicators. Consistent cross-checks of FCT and back checks have helped in improving data in NFHS-5 quite widely.

It is evident that despite increasing sample size, and COVID-19-related dilemmas, multiple innovations to strengthen the survey implementation and technology-driven monitoring and supervision could successfully control the likely investigator bias in reporting the children's birth date.

Regarding the high reporting of "NO" responses to any ANC during the most recent pregnancy, it was found that recent floods in Kerala in the last three years might have affected this critical component of maternal care, and an increased number of women migrated from backward states left unserved in the state. While in the case of Tripura, an increased number of districts from four to eight might have changed the compositional aspects of the sample population, especially in the tribal-dominated areas, as the sampling has been done at the district level.

NFHS has been using standard, self-calibrating equipment having the latest technologies to ensure minimum instrumental errors across the surveys. There are various mechanisms by which NFHS ensures good participation of the selected households and their members in the study, like proper advertisement, involvement of influential local people, adequate training of investigators in interview techniques, dos and don'ts in field work, and surveying in a professional manner. The pandemic scenario observed no significant quality deviation for anthropometric measures.

These results reveal that the innovations in technology-driven monitoring and supervision of fieldwork using various applications and regular online (virtual) interactions with the core team of

FAs have substantially improved the overall quality of fieldwork in NFHS-5. NFHS has been striving to continuously increasing quality assurance mechanisms, including SOPs for the pandemic situation, which is validated by the evidence with temporality in the data quality of three prominently used z-scores measured using anthropometric variables, height-for-age (HAZ), weight-for-height (WHZ) and weight-for-age (WAZ). Results indicate no significantdeviation in any of the three indicators over time. Deviation in the normality in HAZ,WHZ, and WAZ from the WHO normal curve is notsignificant in the case of obsrvatios taken in pre as well aspost-pandemic situations. In addition, other findings indicate that the results of key indicators based on the shorter and longer version of questionnaires do not differ significantly, which may be attributed to the quality assurance mechanisms.

Given the extensive use of NFHS results in tracking progress in various government-sponsored programs and initiatives on population, health, and nutrition in the country, data quality is of utmost importance. That is why data users need to know the extent of innovations in survey implementation and technology-driven monitoring mechanisms and the implications for data quality. FCTs of NFHS-4 and NFHS-5 show that newer approaches to survey performance have resulted in a pronounced increase in data quality, despite increasing content and coverage of the survey and the nature of field agencies. Any attempt to relate implications of innovations in the survey implementation process with output indicators generated through FCTs is seldom able to establish causal linkages. Therefore, this paper has primarily focused on specific indicators of data quality that are likely to be affected significantly by technology-based monitoring mechanisms. Findings reveal an impressive increase in the proportion of interviews completed through multiple visits, a substantial reduction in age displacement, birth displacement, and skips of questions. In most states, declining variability from NFHS-4 to NFHS-5 across different teams, in terms of selected indicators, indicates a vital component of capacity building of field staff and technological advancement in data quality monitoring on a day-to-day basis. However, survey teams that worked in Bihar and Arunachal Pradesh show more heterogeneity in skipping the current use of contraception than the teams working in other states. The NFHS team at IIPS would further strengthen the data quality control mechanism in subsequent rounds of NFHS primarily by adopting three prone strategies- first, by utilizing an additional feature in syncCloud that has a provision of randomly recording the interaction between interviewer and respondent for a couple of minutes any time during their interaction within the ethical guidelines. Second, workload-based estimation of working days might be a better strategy than a fixed number of days for the teams working in district and state module PSUs. Lastly, a shift from individual to team-based movements of POs for more effective data quality monitoring. It was found that the provisions of re-interviews and data matching helped ensure data quality in the survey, especially in post-pandemic situations.

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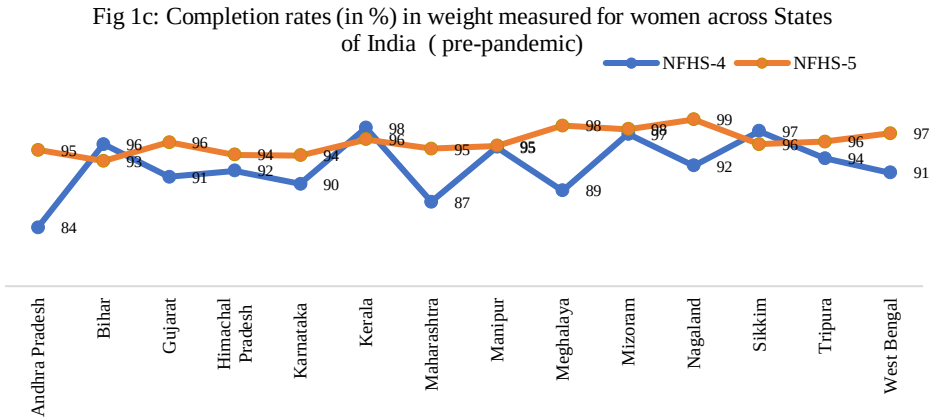
Appendix

Figure 1c: Completion rates of weight measurement for women across states of India during pre-and-post pandemic, scenario, National Family Health Survey, 2015-21.



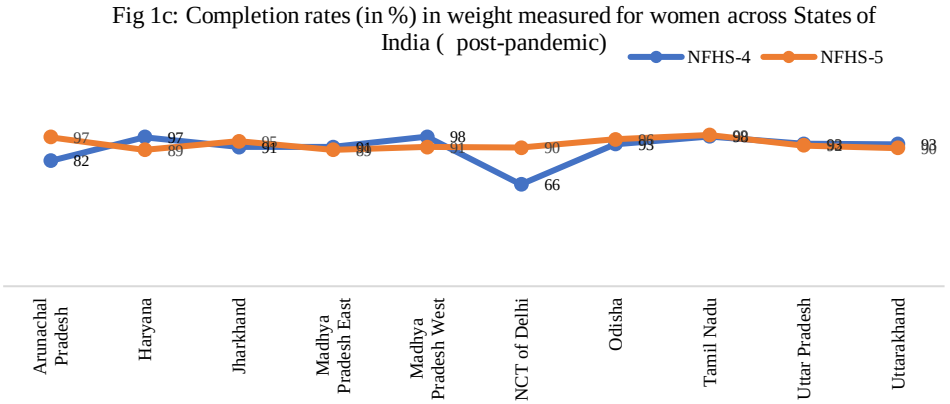
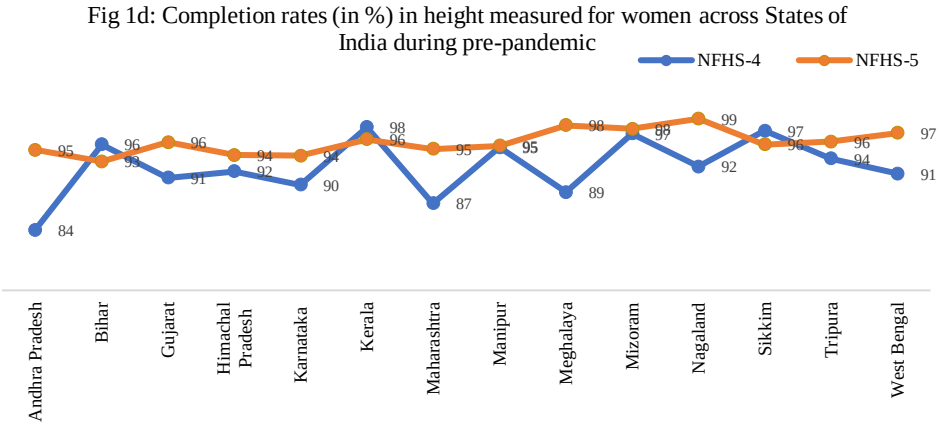


Figure 1d: Completion rates of height measurement for women across states of India during pre-and-post pandemic, scenario, National Family Health Survey, 2015-21.



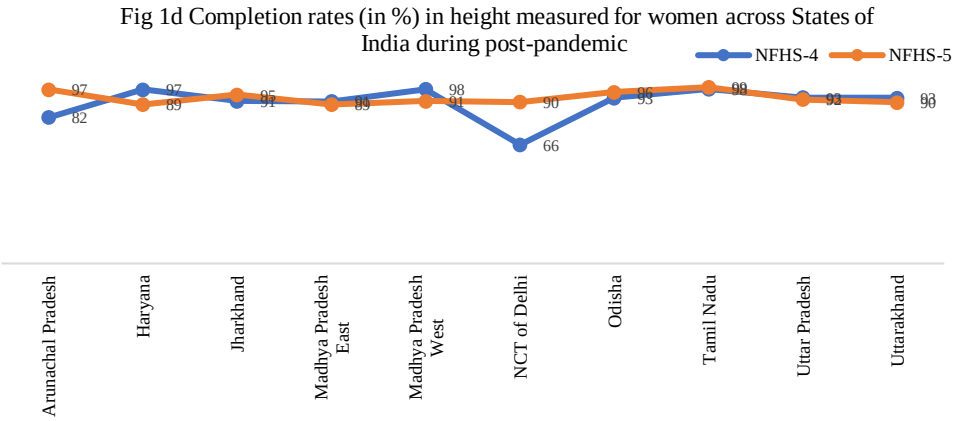
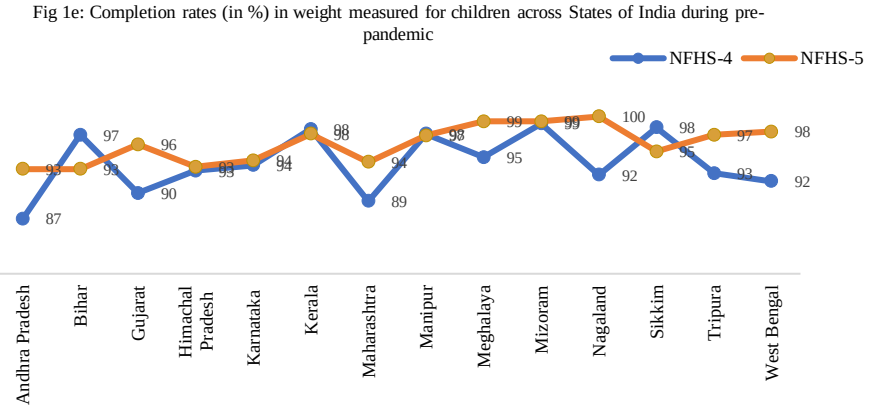


Fig 1e: Completion rates of weight measurement for children across states of India during pre-and-post pandemic, scenario, National Family Health Survey, 2015-21.



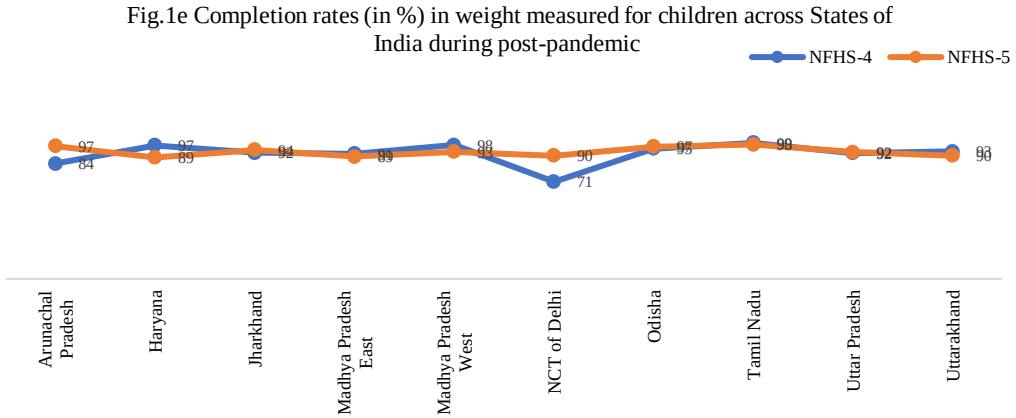
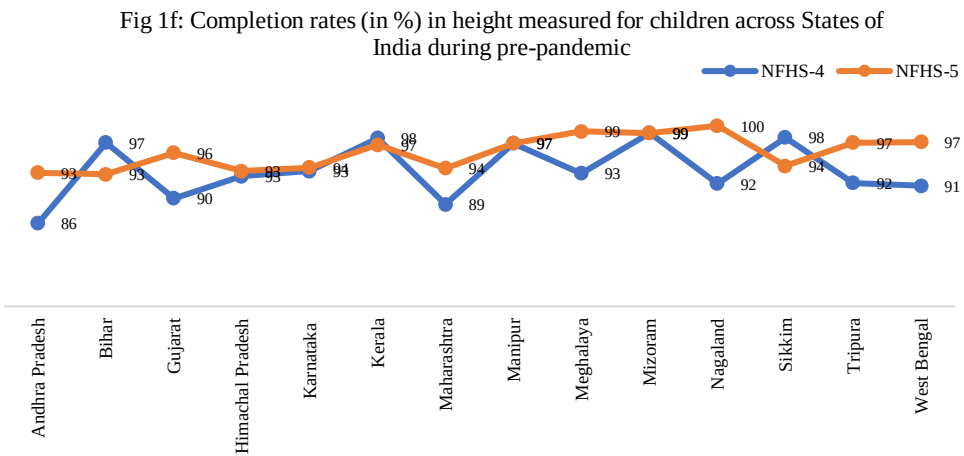


Fig 1f: Completion rates of height measurement for children across states of India during pre-and-post pandemic, scenario, National Family Health Survey, 2015-21.



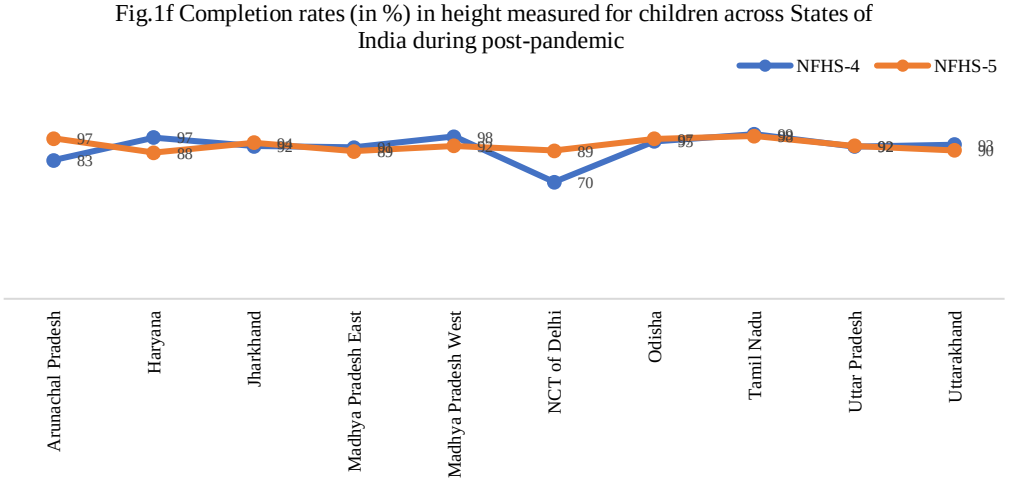


Table: Collection of Blood sample from women and child (6-59 months) (in %) across selected States/Union Territories of India in NFHS-4 (2015-16) and NFHS-5 (2019-20).

States/Union Territories (UTs)	Women Anaemia		Child Anaemia	
	NFHS-4	NFHS-5	NFHS-4	NFHS-5
Pre-Pandemic				
Andhra Pradesh	82.2	93.4	88.2	95.1
Assam	91.8	94.4	93.5	95.7
Bihar	95.3	92.3	98.4	97.3
Goa	97.2	94.7	97.2	96.9
Gujarat	90.0	95.4	94.9	97.4
Himachal Pradesh	91.3	93.6	94.4	99.3
Jammu& Kashmir	95.6	93.6	97.0	98.9
Karnataka	89.1	93.1	95.9	97.1
Kerala	96.5	94.6	95.7	95.3
Maharashtra	86.7	95.2	96.3	96.6
Manipur	95.0	94.4	98.2	98.9
Meghalaya	86.7	97.0	82.1	97.4
Mizoram	96.9	97.3	98.4	96.5
Nagaland	91.8	97.5	90.3	99.7
Sikkim	97.1	91.8	95.4	91.8
Telangana	94.0	92.7	92.0	92.4
Tripura	92.2	95.3	93.4	98.4
West Bengal	90.5	95.9	93.1	96.9
Post-Pandemic				
Arunachal Pradesh	74.7	98.0	74.7	98.0
Chhattisgarh	94.3	97.3	99.5	97.3
Haryana	98.7	92.9	98.7	92.9
Jharkhand	98.6	94.8	98.6	94.8
Madhya Pradesh East	98.5	92.7	98.5	92.7
Madhya Pradesh West	99.2	94.1	99.2	94.1
NCT of Delhi	77.8	89.7	77.8	89.7
Odisha	93.6	98.1	93.6	98.1
Punjab	96.2	90.9	95.7	90.9
Rajasthan	95.3	97.0	99.0	97.0
Tamil Nadu	98.6	98.0	98.6	95.0
Uttar Pradesh	97.0	92.1	97.0	92.1
Uttarakhand	97.3	92.9	97.3	92.9