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Original Research Article

Knowledge retention after a single iron and folic acid training session among accredited social health activists in rural West Bengal, India: a quasi-experimental study

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ABSTRACT

Background: Accredited social health activists (ASHAs) distribute iron and folic acid (IFA) tablets and counsel beneficiaries under the Anemia Mukt Bharat strategy, so their knowledge shapes delivery at village level. Training is the usual remedy for knowledge gaps, but how long the gains last is rarely measured. This study assessed a single training session and re-measured knowledge three months later.

Methods: An institution-based, single-group, before-and-after quasi-experimental study was conducted among ASHAs of the rural field practice area of the All India Institute of Hygiene and Public Health, Singur, West Bengal. All 97 ASHAs were approached and 82 completed all three assessments. A pre-tested, investigator-developed 10-item questionnaire was administered immediately before training, immediately after, and at three months. Scores were compared using the Friedman test with Durbin-Conover post hoc comparisons.

Results: Median knowledge rose from 6 (interquartile range, IQR 4-7) before training to 8 (IQR 7-9) immediately afterwards and was 7 (IQR 5-8) at three months; means were 5.50±2.19, 8.00±1.72 and 6.60±1.69. The Friedman test was significant (χ^2=64.55, df=2, p<0.001; Kendall's W=0.394), as were all three pairwise comparisons (p≤0.002). The immediate gain of 2.50 points, a 45.5% improvement, fell by 1.40 points over three months, leaving 44% retained. Baseline knowledge varied by age group (p=0.012) but not by education or length of service.

Conclusions: A single session improved IFA knowledge substantially, but over half the improvement was lost within three months. Periodic refreshers, supportive supervision and job aids are likely needed to sustain the knowledge underpinning IFA distribution.

Keywords: Accredited social health activist, Anemia, Iron and folic acid, Knowledge retention, Quasi-experimental study, Training intervention

INTRODUCTION

Anemia remains one of the most stubborn nutritional problems worldwide. Iron deficiency is its most common single cause, and the World Health Organization has long described iron deficiency anemia as the most widespread nutritional disorder globally, affecting close to a third of the world's population.[1] Reviews of micronutrient status, globally and in India, place iron deficiency among the most prevalent deficiencies.[2,3] The fifth round of the National Family Health Survey set out the burden starkly: 58.6% of children aged 6-59 months, 53.2% of non-pregnant women and 50.4% of pregnant women aged 15-49 years were anemic.[4]

The consequences run across the life course. Iron deficiency impairs erythropoiesis, muscle function, and energy metabolism, and the resulting fatigue, reduced work capacity, and impaired cognition are well documented.[5] In pregnancy it is associated with preterm labor, higher cesarean rates, postpartum hemorrhage, low birth weight, and small-for-gestational-age infants, and it

remains routinely undertreated.[6] In adolescent girls it contributes to poor concentration, reduced physical capacity, and later reproductive risk, and it is easily missed because symptom-based screening performs poorly in this age group.[7,8]

India has responded with a long series of programs, most recently the Anemia Mukt Bharat strategy, which combines prophylactic IFA supplementation, deworming, testing and treatment, and behavior change communication across six beneficiary groups.[9] Reported coverage has improved since its launch, with IFA coverage among pregnant women rising from 78% in 2017-18 to 90% in 2019-20.[10] Coverage is not the same as effect, however. Supply-chain analyses have identified persistent bottlenecks in forecasting, distribution, and last-mile delivery of IFA tablets,[11] and studies from eastern India report that inadequate counselling by health workers is the most common reason women give for not taking the tablets they have been issued.[12]

This is where the ASHA matters. The ASHA is the first point of contact between the rural family and the health system.[13] She hands over the tablets, explains the schedule, warns about the dark stools and mild gastric upset that make people stop, and follows up. Assessments of ASHA knowledge in other program areas have repeatedly found gaps between what the role requires and what the worker knows.[14] If the ASHA cannot explain why the tablet is needed or what to do about its side effects, the tablet is unlikely to be swallowed.

Short structured training sessions do improve what frontline workers know. A one-day audiovisual training raised breastfeeding knowledge among ASHAs in Jharkhand with a large effect size, and health education interventions on IFA specifically have improved knowledge, attitude, and compliance among pregnant women in Kenya, Ethiopia, Jordan, and rural Rajasthan.[15-19] What these studies mostly do not report is how long the improvement lasts. The educational literature indicates that unrehearsed knowledge decays over time, with a review of long-term retention reporting that roughly two-thirds to three-quarters of taught material is still held at one year.[20] For a program that depends on the same worker delivering the same message repeatedly over years, the durability of training is arguably as important as its immediate effect, and it is seldom measured in Indian frontline-worker studies. This study measured what ASHAs in one rural block of West Bengal knew about IFA before training, how much that changed after a single structured session, and how much of the change was still present three months later.

METHODS

Study design and setting

This was an institution-based, single-group, before-and-after quasi-experimental study conducted at the Rural Health Unit and Training Centre (RHU and TC), Singur, Hooghly district, the rural field practice area of the All India Institute of Hygiene and Public Health (AIIH and PH), Kolkata, West Bengal. Data were collected between July and October 2025. A concurrent control group was not used. The training formed part of a routine capacity-building activity to which every ASHA in the block was entitled, and withholding it from some workers would have been neither practical nor ethically defensible.

Participants

ASHAs were eligible for inclusion if they were serving on the official roster of the RHU and TC Singur area at the time of the study and had completed at least six months in post, so that they had had the opportunity to distribute IFA tablets and counsel beneficiaries in the course of routine work. All participants were women, since ASHAs are recruited exclusively from among women under the National Health Mission. ASHAs were excluded if they declined to give written informed consent, if they were unable to attend the complete training session, or if they were absent at either the immediate or the three-month post-intervention assessment, since the analysis required paired scores at all three time points. No ASHA was excluded on grounds of age, education, caste, or length of service beyond the six-month minimum.

No sampling was carried out. The study used complete enumeration: every ASHA on the official roster of 97 serving the RHU and TC Singur area was approached, and the training was delivered to all of them so that no one was excluded from benefit. Two ASHAs declined consent. A further 13 did not complete all three assessments, either because they could not attend the full training session or because they were absent at one of the follow-up rounds. The reason for each individual non-completion was not recorded prospectively. Eighty-two ASHAs completed the pre-test, the immediate post-test, and the three-month post-test, and constituted the analytic sample.

Study tool

Knowledge was measured with a pre-designed, pre-tested, structured, self-administered questionnaire in Bengali, developed by the investigators for this study. It comprised 10 single-best-answer multiple-choice items across four domains. The first covered the rationale and clinical basis of IFA supplementation: the purpose of supplementation, the symptoms and signs of anemia, and the group carrying the highest burden in India. The second covered program knowledge under the Anemia Mukt Bharat strategy, namely the beneficiary groups reached across the life course, the weekly prophylactic regimen for adolescents aged 10 to 19 years, the weekly regimen for non-pregnant non-lactating women aged 20 to 49 years, and the daily regimen in pregnancy. The third addressed counselling and adherence support, and the

fourth the management of adverse effects, including when to refer. Each correct response scored one mark and each incorrect or "do not know" response scored zero, giving a total of 0 to 10. The same instrument was administered at all three time points. A separate structured schedule recorded age, religion, caste, socio-economic status, educational status, marital status, family type, and years of service as an ASHA. Socio-economic status was classified using the B. G. Prasad scale, applying the income thresholds updated for 2025 using the consumer price index for industrial workers.[21,22] The questionnaire was pre-tested among a small group of ASHAs from outside the study area and modified for clarity before use.

Intervention

The intervention was a single structured health education session delivered at RHU and TC Singur by the investigators. The module was developed from the Anemia Mukt Bharat operational guidelines and from the knowledge gaps among frontline health workers reported in the published literature, rather than from the baseline data of this study, since the pre-test was administered immediately before the session.[9,14] Faculty of the department of epidemiology, AIIH and PH validated the material, which was prepared in Bengali and pre-tested among a small group of ASHAs from outside the study area before use. The session combined a slide presentation with an interactive lecture-discussion and used posters, flip charts, and printed leaflets. It covered the rationale for IFA supplementation, the correct dose and schedule for each beneficiary group, common side effects and how to counsel around them, adherence support, and dietary diversification. Each participant retained a leaflet.

Data collection

The pre-test was administered immediately before the session began. The same questionnaire was re-administered immediately after the session ended, and a third time three months later during a routine block-level meeting. Each participant received a unique code at enrollment, and the three sets of responses were linked by that code. Participants were asked not to consult books, colleagues or the internet while answering.

Statistical analysis

Data were entered in Microsoft Excel 2021 (Microsoft Corporation, Redmond, WA, USA) and analyzed in Jamovi 2.6 (The Jamovi Project, Sydney, Australia). Continuous variables are summarized as mean±standard deviation together with the median and interquartile range, and categorical variables as frequencies and percentages. Normality was examined with the Shapiro-Wilk test; knowledge scores at all three time points departed significantly from normal, and the outcome is an ordinal count on a 10-point scale, so non-parametric methods were used throughout. Because the same participants were assessed at three related time points, the Friedman test was used as the omnibus test, with Kendall's coefficient of concordance (W) as the effect size, followed by Durbin-Conover post hoc comparisons for the three pairwise contrasts. This procedure controls the comparison-wise error rate internally and no further correction was applied. The matched-pairs rank-biserial correlation is also reported for each pairwise contrast, and mean differences are accompanied by 95% confidence intervals derived from the paired t-distribution to convey the magnitude of change on the original scale. Baseline scores were compared across independent groups using the Mann-Whitney U test for two categories and the Kruskal-Wallis test for more than two. A p value below 0.05 was taken as significant.

Ethical approval

The study was approved by the Institutional Ethics Committee of the All India Institute of Hygiene and Public Health, Kolkata (Protocol ID IEC/2025(2)/197), and administrative permission was obtained from the officer-in-charge, RHU and TC Singur. Written informed consent was obtained from every participant after the study had been explained in Bengali, and responses were identified only by code.

RESULTS

Eighty-two ASHAs were analyzed. Their mean age was 42.3±7.9 years (median 44, range 25-54), and 44 (53.7%) were between 41 and 50 years old. Seventy-eight (95.1%) were Hindu and 51 (62.2%) belonged to the general category. Fifty-one participants (62.2%) fell in the lower-middle socio-economic stratum. Educational attainment was higher than is often assumed for this cadre: 36 (43.9%) were graduates and 28 (34.1%) had completed higher secondary school, with none educated below secondary level. Most were married (91.5%) and lived in nuclear families (69.5%). Median length of service was 12 years (mean 11.2±4.9, range 1-19), and 52 ASHAs (63.4%) had served for more than 10 years. Table 1 gives the full profile.

Median knowledge before training was 6 out of 10 (IQR 4-7; mean 5.50±2.19). Immediately after the session the median was 8 (IQR 7-9; mean 8.00±1.72), and at three months it was 7 (IQR 5-8; mean 6.60±1.69). The Friedman test confirmed a significant difference across the three time points (χ^2=64.55, df=2, p<0.001), with Kendall's W of 0.394 indicating a moderate effect (Table 2).

Table 1: Socio-demographic and service profile of the participating ASHA workers (n=82).

Characteristics	Category	N (%)
Sex	Female	82 (100.0)
Age (years)	Mean±SD	42.3±7.9
	Median (IQR)	44 (37-48)
Age group (years)	≤30	9 (11.0)
	31-40	18 (22.0)
	41-50	44 (53.7)
	>50	11 (13.4)
Religion	Hindu	78 (95.1)
	Muslim	4 (4.9)
Caste	General	51 (62.2)
	Other backward class	9 (11.0)
	Scheduled caste	17 (20.7)
	Scheduled tribe	5 (6.1)
Socio-economic status	Upper middle	7 (8.5)
	Middle	16 (19.5)
	Lower middle	51 (62.2)
	Lower	8 (9.8)
Educational status	Secondary	18 (22.0)
	Higher secondary	28 (34.1)
	Graduate	36 (43.9)
Marital status	Married	75 (91.5)
	Widowed	7 (8.5)
Family type	Nuclear	57 (69.5)
	Joint	25 (30.5)
Years of service	Mean±SD	11.2±4.9
	Median (IQR)	12 (8-15)
	≤10 years	30 (36.6)
	>10 years	52 (63.4)

ASHA: accredited social health activist; SD: standard deviation; IQR: interquartile range. All participants were women, as ASHAs are recruited exclusively from among women under the National Health Mission. Socio-economic status classified using the B. G. Prasad scale with income thresholds updated for 2025.

Table 2: Distribution of IFA knowledge scores across the three assessment time points (n=82).

Assessment	Mean±SD	Median (IQR)	Range	Friedman test
Pre-test	5.50±2.19	6 (4-7)	0-10	χ^2=64.55
Immediate post-test	8.00±1.72	8 (7-9)	2-10	df=2
Three-month post-test	6.60±1.69	7 (5-8)	2-10	p<0.001

IFA: iron and folic acid; SD: standard deviation; IQR: interquartile range. Kendall's coefficient of concordance (W)=0.394.

Table 3: Pairwise comparison of knowledge scores using the Durbin-Conover post hoc test (n=82).

Comparison	t	Mean difference (95% CI)	r	P value
Pre-test versus immediate post-test	10.03	+2.50 (1.92 to 3.08)	0.85	<0.001
Pre-test versus three-month post-test	3.19	+1.10 (0.66 to 1.53)	0.61	0.002
Immediate versus three-month post-test	6.85	−1.40 (−1.72 to −1.09)	−0.90	<0.001

CI: confidence interval; r: matched-pairs rank-biserial correlation. Degrees of freedom for all Durbin-Conover comparisons=162. Mean differences are on the original 10-point scale, with confidence intervals from the paired t-distribution.

All three Durbin-Conover pairwise comparisons were significant. Scores rose between the pre-test and the immediate post-test (t=10.03, p<0.001), a mean gain of 2.50 points (95% CI 1.92 to 3.08) equivalent to a 45.5% relative improvement, with a rank-biserial correlation of 0.85. Scores at three months remained above baseline (t=3.19, p=0.002; mean difference 1.10, 95% CI 0.66 to 1.53; r=0.61), so part of what was learned persisted. They were nonetheless significantly below the immediate post-test (t=6.85, p<0.001; mean difference −1.40, 95% CI

−1.72 to −1.09; r=−0.90), indicating a real loss over the interval. Of the 2.50-point gain achieved on the day, 1.10 points, or 44%, remained at three months (Table 3).

Baseline scores differed across age groups (Kruskal-Wallis H=10.89, p=0.012). ASHAs older than 50 years recorded the lowest median pre-test score, at 3, against a median of 6 in both the 31-40- and 41-50-year groups. None of the other characteristics examined was associated with baseline knowledge. A difference by religion reached nominal significance (Mann-Whitney U=262.0, p=0.021), but with only four Muslim participants this comparison is unstable and is not interpreted further. Neither the immediate gain nor the net change at three months varied by education, length of service, or age group (all p>0.05). Table 4 presents the full comparison.

Table 4: Baseline IFA knowledge score by socio-demographic and service characteristics (n=82).

Characteristics	Category	N	Median pre-test score (IQR)	Test statistic	P value
Age group (years)	≤30	9	5 (3-6)	H = 10.89	0.012
	31-40	18	6 (5-7)		
	41-50	44	6 (5-7)		
	>50	11	3 (2-6)		
Educational status	Secondary	18	6 (4-8)	H = 1.08	0.584
	Higher secondary	28	6 (4-7)		
	Graduate	36	6 (5-6)		
Years of service	≤10 years	30	6 (4-7)	U = 765.5	0.891
	>10 years	52	6 (4-7)		
Caste	General	51	6 (4-7)	H = 2.35	0.502
	Other backward class	9	6 (5-6)		
	Scheduled caste	17	6 (4-8)		
	Scheduled tribe	5	6 (5-6)		
Socio-economic status	Upper middle	7	7 (6-7)	H = 7.45	0.059
	Middle	16	6 (3-6)		
	Lower middle	51	6 (4-6)		
	Lower	8	7 (6-8)		
Religion	Hindu	78	6 (4-7)	U = 262.0	0.021
	Muslim	4	3 (3-4)		
Marital status	Married	75	6 (4-7)	U = 203.0	0.319
	Widowed	7	6 (6-8)		
Family type	Nuclear	57	6 (4-7)	U = 786.0	0.455
	Joint	25	6 (4-6)		

IFA: iron and folic acid; IQR: interquartile range. Two-group comparisons by Mann-Whitney U test; comparisons across three or more groups by Kruskal-Wallis test. The test statistic and p value are shown once per characteristic.

DISCUSSION

Median knowledge rose from 6 to 8 out of 10 on the day of training. Short interactive sessions have produced similar immediate gains among frontline workers elsewhere in India and in comparable settings, so this in itself breaks no new ground.[15,16,19] What the three-month assessment showed is the more useful part.

By three months the median had slipped to 7, and in mean terms fewer than half the points won on the day survived. Scores stayed above baseline, so the session was not wasted. The rate of loss is what gives pause. A review of long-term retention found that roughly two-thirds to three-quarters of taught material is usually still held after a year; our participants shed more than half their gain in a quarter of that time.[20] Practically, an ASHA trained in one quarter may be working from noticeably degraded information by the next round of antenatal registrations.

The characteristics that failed to predict baseline knowledge are instructive. Education showed no association with pre-test score, and neither did years in post. Schooling and seniority are poor proxies for knowing a particular national supplementation protocol, so the common assumption that better-educated or longer-serving workers need less attention during training does not hold here. Age was the exception. ASHAs over 50 began with a median score of 3, half that of their younger colleagues. They gained and retained as much as anyone once trained, which points to extra reinforcement for the most senior workers rather than a different training design.

None of this argues against training; it argues against training delivered once. Knowledge that must be used week after week for years is poorly served by a single event, however well run. Short refreshers, a few knowledge questions folded into the monthly block meeting, supervision by the auxiliary nurse midwife or block facilitator that revisits the content, and durable job aids such as a laminated dose card kept in the ASHA kit would each rehearse the same material at modest cost. Since poor counselling is repeatedly named as a leading reason women stop taking IFA, and supply-side coverage has already risen under Anemia Mukt Bharat even as distribution bottlenecks persist, the counselling capacity of the last-mile worker looks like a sensible place to seek further gains.[10-12]

Several limitations qualify these findings. Without a concurrent control group, we cannot formally rule out change arising from outside the intervention, though the short interval and the specificity of the content make a large external effect improbable. The outcome was knowledge measured on a questionnaire rather than observed counselling or actual tablet distribution, and better knowledge does not automatically become better practice. The immediate post-test was administered at the end of the same session, which may capture short-term recall rather than durable learning. The instrument was developed by the investigators and, although pre-tested, has not been formally validated. Retention was measured at a single point, so we can state that decay occurred by three months but not describe its shape or where it settles. Fifteen of the 97 ASHAs did not complete all three assessments, and this attrition may not be random: workers who missed a session may differ systematically from those retained, and the direction of any resulting bias cannot be determined. Socio-demographic and service characteristics were self-reported and were not verified against employment records. Finally, the study was confined to one rural block and one cadre, which limits generalizability.

CONCLUSION

A single structured session lifted IFA knowledge among ASHAs in a rural block of West Bengal by 45.5%, but three months later over half that gain had disappeared. Baseline knowledge bore no relation to education or years of service, though ASHAs over 50 started well behind their younger colleagues and then gained and held as much as anyone. Training given once therefore looks insufficient to sustain the knowledge that IFA distribution and counselling rest on.

Folding periodic reinforcement into the supervisory and meeting structures that already exist, and putting job aids in the hands of the workers themselves, would likely serve better than repeating stand-alone sessions, and would add little to the cost of the Anemia Mukt Bharat package.

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