



Evaluating an Interpersonal Communication Training Program Based on the Greet-Invite-Discuss (GID) Guideline for Immunization Officers in Tana Toraja District, Indonesia

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Abstract

Introduction: Structured communication training may strengthen immunization education, but it remains limited in resource-constrained settings. Tana Toraja recorded South Sulawesi's lowest full basic immunization coverage in 2024. We evaluated a one-day Greet-Invite-Discuss (GID)-based interpersonal communication training program for district immunization officers.

Methods: A single-group Kirkpatrick Levels 1–2 evaluation enrolled 24 facility-designated representatives through a facility-level census covering all 23 public primary health centers (Puskemas) and one private maternal and child hospital. The 09:00–14:30 program provided 265 contact minutes: 110 minutes of didactic instruction/demonstration, 90 minutes of role-play (didactic-to-role-play ratio, 55:45), and 65 minutes of orientation, reflection, and application planning. A physician investigator delivered expert-reviewed slides, a standardized scenario, and a behaviourally anchored GID checklist under the supervision of two senior medical-education faculty members. Level 1 reactions were assessed post-training and Level 2a knowledge both before and after training. Non-normality (Shapiro-Wilk: pre $W=0.877$, $p=0.007$; post $W=0.834$, $p=0.001$) prompted Wilcoxon analysis. Immediately after training, three observers rated Level 2b video-recorded peer simulations using the 22-item checklist; this post-only assessment measured achievement rather than retention or behavioural change. Approval of the ethics committee was obtained from the Medical and Health Research Ethics Committee, Universitas Gadjah Mada (KE/FK/0302/EC/2026; 13 February 2026).

Results: The mean reaction score was $4.66 \pm 0.29/5.00$. Median knowledge scores increased from 77.50 (IQR 45.00–90.00) to 95.00 (IQR 85.00–100.00; $Z=-4.023$, $p<0.001$, $r=0.82$); all domain scores increased (all $p \leq 0.001$), with a post-test ceiling effect. Post-training skills achievement was 67.80% overall (intraclass correlation coefficient [ICC]=0.831), highest for Greet (80.21%) and lowest for Invite (59.72%; ICC=0.574; 95% CI= 0.020 to 0.838). Knowledge change was not significantly associated with total or domain-specific skills achievement (all $|p| \leq 0.221$; all $p \geq 0.300$).

Conclusion: GID training was well received and associated with increased immediate knowledge, but the single-group design precluded causal attribution. Post-only skills do not establish improvement, retention, or workplace behaviour; these findings provide a baseline for refining the program; however, Invite-domain estimates should be interpreted with caution.

Keywords: Program evaluation, Health personnel, Primary health care, Vaccination hesitancy, Inservice training

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Introduction

Immunization is one of the most cost-effective public health interventions. Yet, vaccine uptake remains below target in many low- and middle-income countries for reasons beyond vaccine supply or access. Communication between health workers and communities also shapes whether parents accept, delay, or refuse vaccination (1). Indonesia's national Expanded Program on Immunization targets 95% full basic immunization coverage, but coverage varies widely between districts (2). In 2024, Tana Toraja District in South Sulawesi reported full basic immunization coverage of only 43.06%, the lowest in the province (3), suggesting that efforts to improve coverage should address not only logistics but also the quality of immunization education provided by frontline health workers.

Interpersonal communication (IPC) is central to immunization education. Health workers are often parents' first source of information, especially when families have concerns about vaccine safety, previous adverse experiences, or conflicting information from their social environment. IPC interventions can improve immunization coverage and reduce vaccine hesitancy in resource-constrained settings (4, 5). However, many primary care workers have limited access to structured communication training. Consequently, immunization counselling often remains information-heavy and one-directional, with limited opportunity to listen to parents' concerns or explore the cultural and emotional factors underlying vaccination decisions (6, 7).

Sociocultural context is important when designing communication training. Relationships between health professionals and patients in Indonesia are often hierarchical, while family and community values strongly influence health decisions. Communication models developed for more egalitarian settings may not, therefore, fully address these interactional patterns (8). The Greet–Invite–Discuss (GID) Guideline, developed by Claramita et al. at Universitas Gadjah Mada, supports two-way, empathic, and partnership-oriented communication in hierarchical and community-oriented Southeast Asian healthcare contexts (9). Greet establishes an empathic and trust-based opening; Invite elicits caregivers' perspectives, concerns, and beliefs; and Discuss facilitates two-way explanation, shared decision-making, and follow-up planning (9, 10). Previous GID studies were conducted primarily in Yogyakarta and Central Java (8, 9). Therefore, its direct transferability to Tana Toraja should not be assumed. This study evaluates the

initial application of GID in a distinct Indonesian sociocultural setting, although formal cross-cultural validation was beyond its scope.

Training programs also require an appropriate evaluation framework. The Kirkpatrick model evaluates training outcomes across four levels: Reaction, Learning, Behaviour, and Results (11). For a single training event, Levels 1–2 provide a feasible starting point for assessing participants' immediate reactions and learning before progressing to workplace behaviour or program-level impact (12). To our knowledge, this is the first published evaluation of GID-based communication training for immunization officers and the first reported integration of Gagné's Nine Events of Instruction into a GID-based training design. The present training operationalized Gagné's framework by progressing from an attention-gaining video, learning objectives, and activation of prior experience to concept presentation, stage-specific demonstrations, guided role-play, feedback, reflection, and application planning (13). The Methods section maps the complete instructional sequence event by event (Table 1).

This study evaluated a one-day GID-based IPC training program for immunization officers in Tana Toraja District, Indonesia. Specifically, the objectives were to 1) describe the participants' reactions to the training (Kirkpatrick Level 1); 2) determine pre-to-post changes in overall and domain-level GID knowledge (Kirkpatrick Level 2a); and 3) describe immediate post-training communication skills achievement across the three GID domains (Kirkpatrick Level 2b). An additional exploratory analysis examined the association between knowledge change scores and post-training skills achievement.

Methods

Study Design and Participants

This primarily quantitative, single-group program evaluation was conducted in Tana Toraja District, South Sulawesi, Indonesia. Kirkpatrick Levels 1 and 2 assessed immediate reactions, pre-to-post knowledge change, and immediate post-training communication skills achievement. Because the study lacked a comparison group, pre-training skills assessment, and follow-up, the evaluation was not designed to establish causal effects, skills improvement, retention, or workplace behavioural change (14).

Sampling was a facility-level census; all 23 Puskesmas and one private maternal and child hospital in the district program each designated one immunization representative. Participants were not randomly selected within facilities.

Table 1. Training agenda mapped to Gagné's Nine Events of Instruction

Time	Activity	Gagné's event	Description
08:00–09:00	Registration, informed consent, pre-test, and formal opening	—	Administrative preparation, baseline knowledge assessment, and formal opening by the Head of the Tana Toraja District Health Office.
09:00–09:10	Instructional orientation	Event 1: Gaining attention	The facilitator introduces the importance of communication in immunization education using a short video and discussion prompt about the effects of miscommunication.
09:10–09:20	Explanation of learning objectives	Event 2: Informing learners of objectives	The facilitator presents the expected competencies and establishes shared learning goals with participants.
09:20–09:50	GID theory presentation	Events 3–4: Stimulating recall and presenting content	Participants' prior communication experiences are connected to two-way communication principles and the GID model.
09:50–10:10	Greet-stage demonstration	Events 4–5: Presenting content and providing learning guidance	The facilitator demonstrates empathic relationship-building through verbal and nonverbal communication.
10:10–10:40	Greet role-play and feedback	Events 6–7: Eliciting performance and providing feedback	Participants practice the Greet stage and receive immediate facilitator feedback.
10:40–11:00	Coffee break	—	Scheduled 20-minute break.
11:00–11:30	Invite-stage demonstration	Events 4–5: Presenting content and providing learning guidance	The facilitator demonstrates open-ended questioning, active listening, and nonjudgmental exploration of caregivers' concerns and beliefs.
11:30–12:00	Invite role-play and feedback	Events 6–7: Eliciting performance and providing feedback	Participants practice the Invite stage and receive immediate facilitator feedback.
12:00–12:30	Lunch and prayer break	—	Scheduled 30-minute break.
12:30–13:00	Discuss-stage demonstration	Events 4–5: Presenting content and providing learning guidance	The facilitator demonstrates plain-language explanation, shared decision-making, and follow-up planning.
13:00–13:30	Discuss role-play and feedback	Events 6–7: Eliciting performance and providing feedback	Participants conduct a two-way discussion simulation and receive immediate facilitator feedback.
13:30–13:45	Reflection and discussion	Event 7: Providing feedback	Participants and the facilitator reflect on the practice sessions and reinforce key communication principles.
13:45–14:15	Integration and application planning	Event 9: Enhancing retention and transfer	The facilitator consolidates learning and supports participants in planning workplace application.
14:15–14:30	Transition and assessment preparation	—	Preparation of five parallel assessment rooms and participant rotation.
From 14:30	Immediate post-training assessments	Event 8: Assessing performance	Knowledge post-test, video-recorded peer simulations, reaction questionnaire, brief closing, and final attendance.

All times are reported in local time (Central Indonesia Time, UTC+8).

Thus, 24 facility-designated officers were enrolled, ensuring representation of every facility but not necessarily reflecting within-facility variation or overall communication capacity.

Eligibility required active involvement in immunization services, a formal institutional assignment letter, willingness to complete all procedures, and written informed consent. We excluded officers who participated in formal communication training or communication-focused continuing education within the previous six months. The participants who did not complete a primary evaluation component were excluded from analysis; all 24 completed the evaluation and were analysed.

Training Program

The one-day, face-to-face program was conducted at the Tana Toraja District Health Office on 11 April 2026. Registration, informed consent, the knowledge pre-test, and the formal opening took place from 08:00 to 09:00 local time (UTC+8). The 09:00–14:30 core block provided 265 contact minutes: 110 minutes of didactic instruction and facilitator demonstration, 90 minutes of structured role-play, and 65 minutes of orientation, reflection, feedback, and application planning. The didactic/demonstration-to-role-play ratio was 55:45. The block also included a 20-minute coffee break, a 30-minute lunch and prayer break, and approximately 15 minutes for transitions and post-

training assessment preparation.

The program was an introductory district-level workshop, not a course intended to establish mastery in one session. The principal investigator, a physician with a master's degree in Medical and Health Professions Education, facilitated the training under the academic supervision of two senior medical-education faculty members. Before implementation, medical-education and clinical-communication experts reviewed the slides, knowledge test, reaction questionnaire, role-play scenario, and GID checklist.

Materials comprised an attention-gaining video, expert-reviewed slides, a standardized printed role-play scenario, and a behaviourally anchored GID checklist. The curriculum covered IPC principles, the GID Guideline, cultural sensitivity in immunization education, vaccine hesitancy, and shared decision-making. Gagné's Nine Events were operationalized through attention gaining, clarification of objectives, activation of prior experience, concept presentation, stage-specific demonstration, guided role-play, feedback, reflection, and application planning (Table 1).

The standardized scenario, "MR Immunization Education for a Hesitant Mother," presented a caregiver concerned about measles–rubella vaccination after hearing that a neighbour's child developed a fever, alongside her husband's doubts and concern that her child might become fussy. Peers portraying caregivers received the same written brief and response prompts; they were not trained as standardized patients.

Data Collection and Instruments

Level 1 (Reaction): A 20-item, five-point Likert questionnaire assessed training content and role-play, the facilitator, training implementation, and workplace applicability. Five open-ended questions collected descriptive feedback. Internal consistency was high (Cronbach's $\alpha = 0.905$). The questionnaire was administered immediately post-training.

Level 2a (Knowledge): A 20-item multiple-choice test assessed GID principles, IPC, cultural sensitivity, vaccine hesitancy, and shared decision-making. Correct responses received 1 point, and incorrect responses received 0 points; the total score was calculated as (correct responses/20) $\times$ 100. The validated blueprint comprised five Greet, five Invite, and ten Discuss items, with raw maxima of 5, 5, and 10. Discuss contained more items because its blueprint covered broader content, but all items retained equal one-point weighting. Domain percentage was calculated as (correct responses

in the domain/domain items) $\times$ 100. Two medical education and clinical communication specialists completed two rounds of content validation. Corrected item–total correlations ranged from 0.310 to 0.645, and Cronbach's α was 0.846. The same test was administered immediately before the core training and during the post-training assessment beginning at 14:30.

Level 2b (Communication Skills): Skills were assessed once, immediately after the core training, through video-recorded peer simulations conducted from 14:30 in five parallel rooms. A pre-training video assessment was infeasible within the one-day field schedule and recording logistics; therefore, the outcome represents immediate post-training achievement, not improvement, retention, or workplace behaviour.

Three trained observers independently rated each recording using a 22-item checklist: Greet (6 items; maximum 12), Invite (8 items; maximum 16), and Discuss (8 items; maximum 16), giving a maximum total score of 44. Item-specific behavioural anchors defined 0 as not demonstrated, 1 as attempted but incomplete, unclear, or inconsistent, and 2 as correctly and completely demonstrated. For example, a fully performed open-ended-question item required a genuinely open question eliciting the caregiver's perspective; a partially open question or one without appropriate follow-up received 1.

We averaged the three observers' scores for each participant. Domain achievement was calculated as (mean domain score/domain maximum) $\times$ 100, and overall achievement as (mean total score/44) $\times$ 100. We interpreted these percentages descriptively, not as evidence of improvement or mastery.

Observer Training and Calibration

The three observers had backgrounds in medicine and medical or health professions education. They received structured instruction on checklist domains, behavioural anchors, confidentiality, and scoring only observable behaviour. Calibration used five practice videos excluded from the 24-recording analytic sample. Average measures, two-way mixed-effects, absolute-agreement ICCs were 0.809 overall, 0.868 for Greet, 0.598 for Invite, and 0.842 for Discuss. Given the five-video sample, these estimates guided calibration rather than providing definitive evidence of reliability. Because Invite agreement was lowest, observers clarified its more inferential items in a consensus meeting, then independently rated all study recordings, with no more than three recordings per observer per day to reduce fatigue.

Data Analysis

Frequencies, percentages, means, standard deviations, medians, interquartile ranges, 95% confidence intervals, and ranges were reported as appropriate. Mean-based 95% CIs for Level 1 and Level 2b scores used the *t*-distribution ($df=23$). We reviewed open-ended responses descriptively to contextualize quantitative findings; we did not conduct formal qualitative analysis or triangulation.

Knowledge scores were non-normally distributed (Shapiro–Wilk pre-test: $W=0.877$, $p=0.007$; post-test: $W=0.834$, $p=0.001$); therefore, we summarized them primarily using medians and interquartile ranges and analysed them using the Wilcoxon signed-rank test. Effect size was $r=Z/\sqrt{N}$, with $N=24$ paired observations. All observations were retained, individual change directions were tabulated, and potential ceiling restriction was examined from the post-test distribution and proximity to the scale maximum. We also performed paired analyses for each GID domain.

Inter-rater reliability for total and domain skills scores was assessed with 95% CIs using an average-measures, two-way mixed-effects, absolute-agreement ICC [ICC(A,3)], reflecting the mean ratings of three observers. Following Koo and Li (15), point estimates <0.50 , 0.50 to <0.75 , 0.75 – 0.90 , and >0.90 indicated poor, moderate, good, and excellent reliability, while CI width informed precision. We treated achievement estimates with ICCs <0.75 as descriptive and hypothesis-generating. We also calculated exploratory post-hoc item-level ICCs, particularly for Invite, without replacing the primary total- and domain-level analyses. Associations between knowledge change and total and domain skills achievement were examined using Spearman's rank correlation. Tests were two-sided with $p<0.05$, using IBM SPSS Statistics version 25 and Microsoft Excel.

Ethical Considerations

The Medical and Health Research Ethics Committee, Faculty of Medicine, Public Health, and Nursing, and Universitas Gadjah Mada approved the study (No. KE/FK/0302/EC/2026; 13 February 2026), and the Tana Toraja

District Health Office granted administrative authorization. Participants provided written informed consent covering all procedures, including video recording.

To protect psychological well-being, we presented peer simulations as supportive learning evaluations rather than employment appraisals, and participants were informed that scores would not affect employment or institutional evaluations. The research team pseudonymized data and recordings, stored them on password-protected media accessible only to the research team and designated observers, and excluded them from employment or institutional reports.

Results

Participants' Characteristics

All 24 participants completed the training and evaluation components (100% retention), representing all facilities in the sampling frame: 23 Puskesmas and one private maternal and child hospital. Eighteen were women (75.0%); 13 (54.2%) were aged 30–39 years, and eight (33.3%) were aged 40–49 years. Their mean age was 39.25 years (range 27–58). Sixteen participants were nurses (66.7%), and eight were midwives (33.3%); none had previously attended structured communication training.

Level 1: Participants' Reaction

The mean overall reaction score was 4.66 ± 0.29 (95% CI 4.54–4.78; scale 1–5; Table 2). All components scored above 4.00; training content and role-play received the highest rating (4.70 ± 0.36), and training implementation had the lowest rate (4.60 ± 0.35).

Recurring comments in the open-ended responses included appreciation for role-play, direct practice, and engaging facilitation. Participants requested improved pacing, more Invite practice, and greater room capacity, and considered GID relevant to daily immunization practice, particularly for parental hesitancy. Reported barriers to sustained application included time constraints, high caseloads, language diversity, and variable community receptiveness. We reviewed these responses descriptively rather than through formal qualitative analysis.

Table 2. Level 1 reaction scores by evaluation component (n=24)

Evaluation component	Items (n)	Mean $\pm$ SD	95% CI	Median	Min–Max
Training content and role-play	5	4.70 $\pm$ 0.36	4.55–4.85	4.80	4.00–5.00
Facilitator	5	4.67 $\pm$ 0.36	4.52–4.82	4.80	4.00–5.00
Training implementation	5	4.60 $\pm$ 0.35	4.45–4.75	4.60	4.00–5.00
Workplace applicability	5	4.69 $\pm$ 0.38	4.53–4.85	4.80	3.80–5.00
Overall reaction score	20	4.66 $\pm$ 0.29	4.54–4.78	4.73	4.05–5.00

Scores are reported on their original 1–5 scale; The 95% CIs were calculated using the *t*-distribution ($df=23$); SD=standard deviation.

Level 2a: Knowledge Change

Knowledge scores were non-normally distributed (Shapiro–Wilk pre-test: $W=0.877$, $p=0.007$; post-test: $W=0.834$, $p=0.001$). Median scores increased from 77.50 (IQR 45.00–90.00) to 95.00 (IQR 85.00–100.00); corresponding means were 67.71 ± 22.51 and 92.29 ± 8.21 . The Wilcoxon signed-rank test indicated a significant difference ($Z=-4.023$, $p<0.001$, $r=0.82$), with a mean change of 24.58 ± 20.53 points (median 22.50; IQR 8.75–36.25).

Twenty-one participants had higher post-test scores, two decreased by five points, and one was unchanged. Scores clustered near the maximum, indicating a ceiling effect and restricted post-test variability; therefore, the effect-size estimate should be interpreted cautiously. All three GID knowledge domains also showed significant pre-post differences (all $p\leq0.001$; Table 3).

Level 2b: Communication Skills Achievement

Because skills were assessed only once after training, these findings represent immediate post-training achievement rather than improvement or retention. Mean overall achievement was 67.80% of the checklist maximum (95% CI 60.1–75.5%; Table 4), with the highest achievement for Greet (80.21%), followed by Discuss (66.58%) and Invite (59.72%).

Average-measures inter-rater reliability was good overall (ICC=0.831), excellent for Greet (ICC=0.936) and Discuss (ICC=0.927), and

moderate for Invite (ICC=0.574). The Invite estimate was lower than those of the other domains and had a wide 95% CI (–0.020 to 0.838); consequently, its achievement percentage should be treated as descriptive and hypothesis-generating rather than precise.

Item-level achievement was highest for eye contact and body posture (89.58%), partnership posture (88.89%), and vocal quality (88.89%) in Greet and adapting explanations (81.94%) in Discuss. Teach-back and exploring information sources had the lowest achievement (49.31% each), followed by exploring reasons for delay (51.39%) and paraphrasing or mirroring (52.08%; Table 5).

The exploratory post-hoc analysis indicated heterogeneous reliability within Invite. Active listening had poor reliability (ICC=0.288) despite relatively high achievement, whereas paraphrasing or mirroring had good reliability (ICC=0.832) despite low achievement. Exploring concerns (ICC=0.745) and exploring information sources (ICC=0.718) had moderate reliability. Thus, lower agreement was not uniform across Invite items and may have been concentrated partly in active listening. Given the post-hoc analysis and sample of 24, these findings are exploratory.

Knowledge change was not significantly associated with total skills achievement (Spearman's $\rho=-0.090$, $p=0.675$) or with Greet ($\rho=0.071$, $p=0.741$), Invite ($\rho=-0.221$, $p=0.300$), or Discuss achievement ($\rho=-0.087$, $p=0.687$).

Table 3. Pre- and post-test knowledge scores by GID domain (n=24)

Variable	Pre-test mean $\pm$ SD	Pre-test median [IQR] or (range)	Pre-test % of maximum	Post-test mean $\pm$ SD	Post-test median [IQR] or (range)	Post-test % of maximum	Z	p
Total score (0–100)	67.71 $\pm$ 22.51	77.50 [45.00–90.00]	67.71	92.29 $\pm$ 8.21	95.00 [85.00–100.00]	92.29	–4.023	<0.001
Greet (0–5)	3.33 $\pm$ 1.37	3.50 (1–5)	66.6	4.67 $\pm$ 0.48	5.00 (4–5)	93.4	–3.573	<0.001
Invite (0–5)	3.88 $\pm$ 1.19	4.00 (2–5)	77.6	4.83 $\pm$ 0.48	5.00 (3–5)	96.6	–3.247	0.001
Discuss (0–10)	6.33 $\pm$ 2.48	7.00 (1–10)	63.3	9.00 $\pm$ 1.18	9.00 (6–10)	90.0	–3.836	<0.001

The total score is reported as median [IQR], whereas domain raw scores are reported as median (minimum–maximum). Percentage scores were calculated as the mean raw domain score divided by the domain maximum $\times 100$. The test comprised five Greet, five Invite, and ten Discuss items, each weighted equally at one point. Wilcoxon signed-rank tests were used because the total pre- and post-test distributions were non-normal. For the total score, $r=0.82$, calculated as $Z/\sqrt{N}$.

Table 4. Post-training communication skills achievement by GID domain (n=24)

GID domain	Max score	Mean $\pm$ SD	95% CI	Median	ICC ^a	Achievement (%)	Achievement 95% CI (%)
Greet	12	9.63 $\pm$ 2.26	8.68–10.58	10.33	0.936	80.21	72.3–88.2
Invite	16	9.56 $\pm$ 2.84	8.36–10.76	10.00	0.574 ^b	59.72	52.3–67.2
Discuss	16	10.65 $\pm$ 3.87	9.02–12.28	11.83	0.927	66.58	56.3–76.8
Total GID	44	29.83 $\pm$ 8.06	26.43–33.23	31.67	0.831	67.80	60.1–75.5

Post-training performance-based assessment only; no pre-training skills baseline was collected. ^aICC(A,3) indicates a two-way mixed-effects, absolute-agreement ICC based on the mean ratings of three observers. ^bModerate inter-rater reliability, although lower than that of the other domains; the Invite achievement estimate should be interpreted cautiously. Achievement percentage = mean score/maximum possible score $\times 100$. The 95% CIs were calculated using the t-distribution (df=23).

Table 5. Item-level post-training communication skills achievement and reliability (n=24)

Domain	Assessment item	Mean score ^a	Achievement (%)	ICC(A,3) ^b
Greet	Greeting and self-introduction	1.50	75.00	0.964
	Partnership posture	1.78	88.89	0.929
	Eye contact and body posture	1.79	89.58	0.915
	Vocal quality	1.78	88.89	0.850
	Inquiring about wellbeing	1.67	83.33	0.905
	Empathic response	1.11	55.56	0.889
Invite	Open-ended questions	1.24	61.81	0.642
	Active listening	1.61	80.56	0.288 ^c
	Paraphrasing/mirroring	1.04	52.08	0.832
	Exploring concerns	1.28	63.89	0.745
	Non-verbal cues	1.26	63.19	0.696
	Exploring beliefs/values	1.11	55.56	0.635
	Exploring information sources	0.99	49.31	0.718
	Exploring reasons for delay	1.03	51.39	0.635
Discuss	Adapting explanation	1.64	81.94	0.923
	Relevant analogy	1.24	61.81	0.916
	Benefits and risks	1.56	77.78	0.748
	Teach-back	0.99	49.31	0.932
	Involving the caregiver in decision-making	1.39	69.44	0.829
	Respecting the caregiver's decision	1.38	68.75	0.872
	Providing an opportunity to ask questions	1.24	61.81	0.937
	Closing and follow-up planning	1.24	61.81	0.923

^aMean of three observer ratings; 0=not performed, 1=partially performed, and 2=fully performed. Maximum item score=2.00.

^bTwo-way mixed-effects, absolute-agreement, average-measures ICC based on three observers. ^cLowest item-level reliability in the checklist.

Given the small sample and restricted post-test knowledge variability, the absence of statistical significance should not be interpreted as evidence that knowledge change and skills achievement are unrelated.

Discussion

This study evaluated a one-day GID-based IPC training program for immunization officers in Tana Toraja, which reported South Sulawesi's lowest full basic immunization coverage in 2024. Participants reported positive immediate reactions; knowledge scores were significantly higher after training, and the post-only assessment described immediate communication skills achievement. However, the single-group design precludes causal attribution, the absence of a skills baseline prevents estimation of improvement, and the lower reliability of Invite limits domain-specific interpretation.

The mean reaction score of 4.66/5.00 is consistent with evidence that adult learners value practical, participatory activities relevant to their work (16-18). Participants particularly appreciated role-play and direct practice, supporting the importance of experiential learning, feedback, and reflection in communication training (19). The relatively lower training-implementation rating and requests for more practice suggest that future sessions need improved pacing and

additional guided Invite practice. Nevertheless, immediate reactions indicate acceptability, not learning, retention, or workplace effectiveness.

Median knowledge scores increased from 77.50 to 95.00, with a Wilcoxon effect size of $r=0.82$, comparable to pre-to-post differences reported after communication- and immunization-related training in Indonesia and Ghana (20, 21). Differences occurred across all GID domains, including the conceptually broader Discuss domain. However, post-test scores clustered near the maximum (median 95.00; IQR 85.00–100.00), restricting variability and potentially distorting the effect-size magnitude. Thus, $r=0.82$ should not be interpreted as an unbiased estimate of training effectiveness. Twenty-one scores increased, two decreased by five points, and one was unchanged; the study was not designed to explain these individual differences.

Immediate skills achievement was highest for Greet (80.21%), followed by Discuss (66.58%) and Invite (59.72%). Observable Greet behaviours, such as eye contact, posture, and vocal quality, can be modelled directly during a brief workshop, whereas Invite requires pausing, active listening, and exploration of concerns before offering advice. Such interactional skills generally require repeated practice, feedback, and varied scenarios (22-24). Each GID stage received approximately 30 minutes of role-play; this provided introductory

exposure, but its adequacy for complex Invite behaviours was not established. Future programs should test repeated scenarios, feedback cycles, and follow-up practice rather than assume that one workshop establishes mastery.

The higher achievement in Discuss than in Invite may appear counterintuitive because, within the GID sequence, discussion should be informed by the caregiver's perspectives and concerns elicited during Invite. One plausible explanation is that participants' routine work as immunization officers may have provided greater familiarity with explaining vaccine information than with eliciting concerns and negotiating decisions. This interpretation is consistent with relatively high achievement in adapting explanations (81.94%) and explaining benefits and risks (77.78%). In contrast, teach-back (49.31%), involving caregivers in decision-making (69.44%), and respecting caregivers' decisions (68.75%) were less consistently demonstrated. Discuss performance might, therefore, have reflected familiar information-provision behaviours more than consistently implemented shared decision-making, with some participants potentially proceeding to explanation without first sufficiently exploring caregivers' perspectives. Because pre-training communication skills and the mechanisms underlying this pattern were not assessed, this explanation remains hypothesis-generating.

Teach-back and exploring information sources had the lowest item-level achievement (49.31% each). Teach-back supports assessment of understanding and clearer communication (25), while information sources are relevant because vaccination decisions may be shaped by family, community narratives, social media, and previous experiences (26). These scores may reflect limited familiarity, insufficient practice, scenario characteristics, or culturally shaped interaction. In Tana Toraja's clan-based, community-oriented context, exploring private beliefs and information sources may require locally appropriate wording and relationship-building. Because these mechanisms were not tested, they remain hypotheses rather than established explanations.

The Invite-domain ICC point estimate was moderate (ICC=0.574) under the specified thresholds (14), but it was lower than those for Greet and Discuss and had a wide 95% CI (-0.020 to 0.838). Consequently, the 59.72% achievement estimate is imprecise and may partly reflect inter-rater measurement error rather than actual performance; it should be treated as hypothesis-generating, not definitive evidence of poorer

competence. Post-hoc findings suggested that uncertainty was not uniform: active listening had poor reliability (ICC=0.288) despite relatively high achievement, whereas paraphrasing or mirroring and exploring information sources showed higher reliability despite low achievement. However, the small sample and exploratory analysis limit firm conclusions.

Several factors may have reduced agreement. Invite items require judgments across an interaction rather than identification of a discrete action, which is challenging in video-based assessment (27). Peers rather than trained standardized patients portrayed caregivers; portrayal consistency was not formally evaluated, and calibration used only five videos. Before definitive domain-level interpretation, the Invite checklist requires revision and revalidation with clearer behavioural anchors, more extensive calibration, and more standardized caregiver portrayals.

Knowledge change was not significantly associated with total or domain-specific skills achievement. Given the small sample and restricted post-test knowledge variability, this should not be interpreted as evidence that knowledge and skills are unrelated. Although scores from different instruments cannot be compared directly, near-ceiling knowledge scores alongside lower skills achievement are consistent with the distinction between acquiring declarative knowledge and translating it into observable performance. Communication behaviours require deliberate practice, feedback, and repetition before becoming fluent and consistent (22-24). The training may, therefore, have supported conceptual understanding without providing sufficient practice for stable performance; habit formation and workplace transfer require longitudinal assessment at Kirkpatrick Level 3.

Communication training should be one component of a broader immunization strategy. Tana Toraja's 43.06% coverage cannot be attributed to communication alone and requires concurrent attention to vaccine supply, service access, outreach, data quality, and community engagement. GID offers a culturally informed starting point because it was developed for hierarchical, community-oriented relationships in Indonesia and Southeast Asia (8, 9). Still, its transferability to Tana Toraja has not been formally validated.

Previous GID research linked training with improved doctor-patient communication and clinical outcomes in chronic-disease care (9). This study extends GID toward preventive service delivery, specifically immunization as specific

protection within primary prevention. However, chronic-disease findings cannot be extrapolated directly, and the pathway from GID training to caregiver trust or vaccine uptake remains theoretical. Stronger studies using patient-, behavioural-, and coverage-level outcomes are required. This first reported district-level application in Tana Toraja, therefore, provides preliminary information for program refinement rather than evidence of effectiveness.

Reported barriers, including time constraints, high caseloads, language diversity, and variable community receptiveness, require practical responses. A simplified bilingual Indonesian–Torajan GID job aid could be co-developed and culturally tested with local health workers and community representatives. Brief practice, case discussions, peer coaching, and checklist-based feedback could be integrated into existing monthly supervision meetings to avoid increasing workload. Collaboration with community health workers and influential family, clan, community, or religious figures may improve cultural adaptation and receptiveness.

This evaluation involved 24 non-randomly selected representatives from one district, and one participant per facility could not capture within-facility variation. The single-group design, immediate knowledge testing, ceiling effect, and greater representation of Discuss items limited causal, effect-size, and retention inferences. Post-only skills assessment measured achievement rather than improvement, retention, or workplace behaviour. Peer caregivers, five-video calibration, lower and imprecise Invite reliability, and an instructional dose not validated for complex skills further limited interpretation. Reaction ratings remained susceptible to social desirability despite confidentiality and non-employment assurances, while open-ended responses underwent descriptive rather than formal qualitative analysis. Future studies should evaluate Kirkpatrick Level 3 through observed workplace GID use and Level 4 through vaccine acceptance, uptake, missed opportunities, and coverage, using baseline and follow-up measurements, comparison groups where feasible, and adjustment for concurrent system interventions.

Conclusion

The one-day GID-based IPC training was well received and was associated with a significant immediate pre-to-post increase in knowledge across all three GID domains. However, the single-group design, immediate assessment, and post-test ceiling effect preclude causal attribution and limit interpretation of

effect magnitude and retention. Overall post-training skills achievement was 67.80%; because no pre-training skills baseline was collected, this finding represents immediate achievement rather than improvement. Achievement was highest for Greet and lowest for Invite although the Invite estimate should be treated as hypothesis-generating because its moderate inter-rater reliability was lower than that of the other domains and limits precise interpretation. Future training should provide repeated practice in teach-back, paraphrasing, and exploring caregivers' information sources and reasons for hesitancy, while revising the Invite checklist and strengthening observer calibration. These findings do not establish retention, workplace behavioural transfer, or improved vaccine uptake. Longitudinal comparative studies incorporating baseline skills assessment should evaluate workplace behaviour at Kirkpatrick Level 3 and immunization outcomes at Level 4.

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Conflict of Interest

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Declaration of AI

Artificial intelligence-based language tools were utilized to facilitate translation, improve textual structure, and increase clarity during the preparation and editing of this manuscript. These tools were not involved in study conception, data collection, statistical analysis, data interpretation, or the generation of research findings. All outputs produced by these tools were comprehensively reviewed, critically revised, and approved by the authors, who assume full responsibility for the manuscript's content and accuracy.

Authors' Contribution

MA.I conceived and designed the study, prepared and coordinated the training, collected and analyzed the data, interpreted the findings, and drafted the manuscript. TS.P contributed to study supervision, evaluation design, methodological refinement, interpretation of findings, and critical revision of the manuscript. M.C contributed to the GID framework, study supervision, methodological refinement, interpretation of findings, and critical revision of the manuscript. All authors approved the final manuscript and agreed to be accountable for the work.

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