

Training the Extended Health Workforce: A Controlled Quasi-Experimental Study on Pre-School Teachers' Attitudes Toward Autism Using the WHO mhGAP Framework

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Article Info

Article history:

Received: March 26, 2026

Revised: June 30, 2026

Accepted: July 16, 2026

DOI: [10.58418/ijni.v5i1.236](https://doi.org/10.58418/ijni.v5i1.236)

How to cite this article:

Murtala, H. H., Balarabe, F., & Anyebe, E. E. (2026). Training the Extended Health Workforce: A Controlled Quasi-Experimental Study on Pre-School Teachers' Attitudes Toward Autism Using the WHO mhGAP Framework. *International Journal of Nursing Information*, 5(1), 49–62. <https://doi.org/10.58418/ijni.v5i1.236>

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ABSTRACT

In low- and middle-income countries, a critical shortage of child mental health specialists necessitates innovative task-shifting strategies. This study evaluated the effectiveness of an adapted World Health Organization Mental Health Gap Action Programme (WHO mhGAP) educational intervention on preschool teachers' attitudes toward Autism Spectrum Disorder (ASD) in Kano, Nigeria. Utilizing a controlled quasi-experimental design, 140 preschool teachers were systematically allocated to an intervention group ($n = 70$) or a control group ($n = 70$). The intervention cohort received an eight-week training adapted from WHO mhGAP guidelines, whereas controls received no training. Attitudes were evaluated using the Autism Attitude Scale for Teachers across baseline, mid-intervention, and 16-week post-baseline phases, with data analyzed via Chi-square tests and Multivariate Analysis of Covariance (ANCOVA). At baseline, negative attitudes predominated across both study arms (71.4% study vs 75.7% control; $p = 0.565$). Post-intervention, positive attitudes in the study group surged to 98.6%, compared to 22.9% in the control group ($\chi^2 = 84.120$, $p < 0.001$). ANCOVA confirmed a statistically significant primary treatment effect ($F(1, 137) = 345.11$, $p < 0.001$, $\eta^2_p = 0.716$), explaining 71.6% of adjusted post-training attitude variance. This study provides a novel empirical contribution by establishing that adapting clinical WHO mhGAP guidelines for early childhood educators creates a scalable, task-shifting interprofessional framework. This approach directly bridges the child mental health treatment gap and advances community nursing practice in resource-constrained environments.

Keywords: Educational Intervention, Autism Spectrum Disorder, Preschool Teachers, WHO mhGAP, Task-Shifting, Extended Health Workforce



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1. INTRODUCTION

The global distribution of child and adolescent mental health (CAMH) resources remains highly unequal, with the greatest shortages in specialist workforce, service availability, and system capacity occurring in low- and middle-income countries (LMICs) (Kumar et al., 2021; Raj et al., 2022; Simelane & de Vries, 2021). Despite growing policy commitments to pediatric mental health, these workforce shortages continue to delay the early identification, diagnosis, and intervention of neurodevelopmental disorders such as autism, thereby widening the treatment gap for affected children and adolescents

(Green, 2023; Ndeti et al., 2023; Ramaswamy et al., 2022). Consequently, substantial treatment gaps remain between children and adolescents requiring mental health care and those who receive appropriate services, representing an urgent public health challenge across sub-Saharan Africa due to shortages of specialized services, weak health systems, and inadequate referral pathways (Mabrouk et al., 2022; Sequeira et al., 2022). To address this systemic challenge, global health authorities advocate task-shifting (or task-sharing), a strategy that equips non-specialist health workers and other community-based professionals with the knowledge and skills to identify, assess, and support individuals with mental health conditions, thereby expanding access to mental healthcare in resource-constrained settings (Keynejad et al., 2021; Spagnolo & Lal, 2021). Accordingly, strengthening CAMH services in these settings requires expanding the healthcare ecosystem by integrating community-based professionals, particularly school teachers, into the extended mental health workforce to facilitate early identification, referral, and school-based mental health interventions (Goodwin et al., 2021; Petagna et al., 2023).

Among childhood-onset neurodevelopmental conditions, Autism Spectrum Disorder (ASD) is recognized as a major public health priority because of its early onset, lifelong functional consequences, and substantial economic burden on individuals, families, and healthcare systems (Lord et al., 2022; Zeidan et al., 2022). Given its early developmental onset, schools are increasingly recognized as strategic settings for promoting children's mental health through early identification, referral, and intervention, particularly during the preschool years, when timely recognition and intervention for ASD can substantially improve long-term developmental outcomes (Fang et al., 2023; Johnson et al., 2023). However, the effectiveness of school-based early identification and intervention depends largely on the preparedness, self-efficacy, and attitudes of preschool teachers, who are often the first professionals to observe children's developmental and behavioral differences in educational settings (Gómez-Marí et al., 2022; Russell et al., 2023). Despite this strategic role, misconceptions and insufficient knowledge of ASD among preschool teachers may result in inappropriate educational responses that fail to meet children's developmental needs, thereby limiting the effectiveness of early support and adversely affecting educational and developmental outcomes (Al Jaffal, 2022; Taresh et al., 2024). In contrast, teachers with adequate ASD knowledge and positive attitudes toward autistic children are more likely to implement inclusive educational practices, facilitate timely referrals, and contribute to improved developmental outcomes through more effective classroom support and collaboration with health services (Goodwin et al., 2021; Johnson et al., 2023).

While global research indicates diverse perspectives regarding autism among educators, the existing literature remains heterogeneous, with teachers' attitudes toward autistic children varying considerably across countries and educational settings (Gómez-Marí et al., 2022). Nevertheless, the current evidence base is dominated by descriptive and cross-sectional studies conducted primarily among primary and secondary school teachers, whereas intervention research involving preschool educators remains comparatively limited (Russell et al., 2023; Taresh et al., 2024). Although recent intervention studies have demonstrated that structured professional training can significantly improve preschool teachers' autism knowledge, attitudes, self-efficacy, and early identification practices (Gómez-Marí et al., 2021; Taresh et al., 2024). Despite these encouraging findings, the application of internationally standardized mental health training frameworks, including the World Health Organization Mental Health Gap Action Programme Intervention Guide (mhGAP-IG), has received limited empirical attention in autism-focused educational interventions for preschool teachers, particularly in low-resource settings (Petagna et al., 2023; Spagnolo & Lal, 2021).

Taken together, these gaps highlight the need for empirical research evaluating whether clinically grounded, evidence-based training frameworks can improve preschool teachers' attitudes, knowledge, and competencies within sub-Saharan African contexts, where the implementation of standardized mental health capacity-building approaches remains limited (Genovesi et al., 2022; Petagna et al., 2023). Furthermore, evaluating educational interventions among preschool teachers is essential for strengthening early autism identification, improving referral pathways, and advancing school-based mental healthcare models, as evidence indicates that structured autism training can significantly enhance teachers' knowledge, beliefs, self-efficacy, and preparedness to support autistic children (Taresh et al., 2024). Therefore, this study aims to evaluate the effectiveness of an adapted WHO mhGAP educational intervention on preschool teachers' attitudes toward Autism Spectrum Disorder using a controlled quasi-experimental design. By addressing this evidence gap, the study contributes to the growing body of knowledge on task-sharing approaches for child and adolescent mental health and provides empirical evidence to inform workforce development strategies and strengthen collaboration between community nursing and early childhood education, thereby supporting efforts to reduce the child mental health treatment gap in low-resource settings.

2. METHOD

2.1. Research Design

This design was selected because it provides a rigorous comparative framework for evaluating intervention effects when randomization is not feasible, while strengthening internal validity through the

use of a contemporaneous control group and pre–post assessment, consistent with current methodological recommendations for quasi-experimental studies (Andrade, 2021). The conduct and reporting of this study adhered to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement, an internationally recognized reporting guideline for non-randomized and quasi-experimental studies (Haynes et al., 2021).

2.2. Study Setting and Target Population

The study was conducted in Kano Metropolis, an urban area comprising eight Local Government Areas (LGAs) in northern Nigeria. To minimize contamination between the study groups, two geographically distinct LGAs, Ungogo and Kumbotso (approximately 34 km apart), were selected because they shared similar educational administration and socio-demographic characteristics while remaining geographically independent. Following cluster selection, Ungogo LGA was randomly assigned to the intervention group, whereas Kumbotso LGA served as the control group. The target population comprised all eligible preschool teachers employed in public early childhood education centres within the two selected LGAs. According to official administrative records obtained from the Kano State Universal Basic Education Board (SUBEB), the study population consisted of 9,489 registered preschool teachers.

2.3. Sample Size Determination

The minimum required sample size was calculated using the standard approach for comparing two independent means, following current recommendations for sample size determination and statistical power analysis in intervention studies (Kang, 2021). Parameter estimates were obtained from the most comparable quasi-experimental study available, which reported outcomes using a similar intervention context and outcome measure (Lasisi et al., 2017). Specifically, a standard deviation of 3.25 and an anticipated post-training mean difference of 1.62 were used in the calculation. After allowing for a conservative 10% attrition rate, the required sample size was increased to 70 participants per study arm, resulting in a total sample of 140 preschool teachers.

2.4. Sampling Technique

A multistage sampling procedure was employed in three sequential stages. In Stage I, two geographically distinct Local Government Areas (LGAs) were purposively selected based on the concentration of preschool education facilities. To minimize contamination between study groups, the two LGAs were geographically separated and randomly assigned to either the intervention or control arm.

In Stage II, all eligible schools within each selected LGA were stratified into public and private institutions. Approximately 10% of schools from each stratum were selected, prioritizing those with the largest number of preschool teachers to ensure an adequate sampling frame. This resulted in the selection of 28 schools in the intervention group (21 public and 7 private) and 53 schools in the control group (26 public and 27 private).

In Stage III, a sampling frame comprising all eligible preschool teachers in the selected schools was developed. Participants were selected using a computer-generated random number (CGRN) procedure. When more than one teacher from the same classroom was selected, one teacher was randomly retained, while the other was replaced by another eligible teacher from the remaining sampling frame to minimize disruption to classroom activities. For training purposes, participants in the intervention group were subsequently organized into smaller groups of 35 teachers to facilitate effective training delivery.

2.5. Research Instruments

The primary outcome was assessed using the adapted Autism Attitude Scale for Teachers (AAST), originally developed by Olley et al. (1981). The instrument comprises 14 items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Negatively worded items were reverse-coded before analysis, producing total scores ranging from 14 to 70, with higher scores indicating more positive attitudes toward autistic children. For analytical purposes, total scores were categorized as negative attitudes (14–34) and positive attitudes (35–70). The AAST has been validated in recent studies and demonstrated satisfactory construct validity and internal consistency for assessing teachers' attitudes toward autistic children (Derguy et al., 2023). In the present study, the instrument demonstrated good internal consistency, with a Cronbach's alpha coefficient of 0.819 and a Spearman–Brown split-half reliability coefficient of 0.776.

2.6. Data Collection and Intervention Protocol

Data collection was conducted in three phases. During the baseline phase, participants completed a questionnaire on sociodemographic characteristics, the Autism Attitude Scale for Teachers (AAST), and standardized clinical case vignettes to assess baseline attitudes toward autism. During the intervention phase, participants in the intervention group received an educational programme based on the World

Health Organization Mental Health Gap Action Programme Intervention Guide Version 2.0 (mhGAP-IG v2.0) (World Health Organization, 2016). The content was further contextualized for preschool teachers while remaining aligned with the updated recommendations of the WHO Mental Health Gap Action Programme Guideline (World Health Organization, 2023). The autism-related content was adapted by excluding pharmacological management and specialist-level psychosocial interventions while retaining components related to early autism symptom recognition, developmental warning signs, referral pathways, and classroom behavioural support. The programme was delivered in English over eight weekly sessions, each lasting approximately 60 minutes, using interactive lectures, multimedia presentations, group discussions, and role-playing activities. The control group received no training during the study period. Training sessions were conducted in the lecture theatre of Aminu Kano Teaching Hospital, whereas participants in the control group completed study assessments in their respective schools. The post-intervention assessment was conducted eight weeks after completion of the intervention (16 weeks after baseline). Participant retention was supported through scheduled telephone reminders.

2.7. Data Analysis

Statistical computations were performed using the Statistical Package for the Social Sciences version 25.0. Continuous variables were summarized using means and standard deviations, while categorical characteristics were expressed as frequencies and percentages. Pearson's Chi-square test was employed to examine the associations between socio-demographic variables and teachers' baseline, intervention, and post-intervention attitudes toward ASD. The primary intervention effect was evaluated using a Multivariate Analysis of Covariance (ANCOVA), adjusting for baseline AAST scores as well as divergent socio-demographic covariates, to isolate the pure treatment variance. Statistical significance was established at a two-tailed p-value of less than 0.05.

2.8. Ethical Considerations

Institutional ethical clearance was granted by the Kano State Ministry of Health Research Ethics Committee under protocol NHREC/17/03/2018. Administrative permissions were secured from the Kano State Universal Basic Education Board, the Private and Voluntary Institutions Board, and individual institutional directors. All participants provided formal written informed consent prior to enrollment, following a comprehensive disclosure regarding the voluntary nature of participation, confidentiality protocols, and data protection rights.

3. RESULTS

3.1. Baseline Socio-Demographic Profile and Group Equivalency

The baseline socio-demographic characteristics of the 140 preschool teachers enrolled across the study group ($n = 70$) and control group ($n = 70$) are detailed in Table 1. Overall, the study sample reflected the demographic landscape of urban northern Nigeria, being predominantly composed of female educators (58.6%, $n = 82$), individuals of Hausa ethnicity (90.7%, $n = 127$), and adherents of the Islamic faith (92.9%, $n = 130$). Economic indicators highlighted a low-income profile among participants, with 75.0% ($n = 105$) earning 50,000 NGN or less monthly. Continuous metrics revealed that educators in the study group had a mean age of 31.80 ± 9.09 years, whereas those in the control group recorded a mean age of 37.17 ± 8.23 years. Correspondingly, the mean teaching experience was 8.94 ± 7.66 years in the study group compared to 11.82 ± 6.57 years in the control group.

Statistical evaluations of baseline equivalency demonstrated that both study arms were structurally comparable across key institutional and professional variables. Specifically, no statistically significant differences were observed regarding gender distribution ($\chi^2 = 0.118$, $p = 0.731$), educational qualifications ($\chi^2 = 2.373$, $p = 0.499$), or institutional school type ($\chi^2 = 0.114$, $p = 0.735$). However, several baseline imbalances were detected between the groups. Participants in the control group were significantly older ($t = 3.663$, $p = 0.001$) and possessed longer teaching experience ($t = 2.391$, $p = 0.018$) than those in the study group. Statistically significant group discrepancies were also identified for marital status ($\chi^2 = 12.572$, $p = 0.006$), religion ($\chi^2 = 3.877$, $p = 0.049$), employment status ($\chi^2 = 13.823$, $p = 0.003$), monthly income ($\chi^2 = 29.329$, $p = 0.001$), and ethnicity ($\chi^2 = 8.586$, $p = 0.035$).

Table 1
Baseline Socio-Demographic Characteristics and Group Equivalency Analysis (N = 140)

Variables	Study Group (n = 70) n (%)	Control Group (n = 70) n (%)	Total Cohort (N = 140) n (%)	Test Statistic	Df	P-Value
Gender						
Male	28.0 (40.0)	30.0 (42.9)	58.0 (41.4)	$\chi^2 =$ 0.118	1	0.731
Female	42.0 (60.0)	40.0 (57.1)	82.0 (58.6)			
Marital Status						
Married	37.0 (52.9)	49.0 (70.0)	86.0 (61.4)	$\chi^2 =$	3	0.006*

Divorced	0.0 (0.0)	1.0 (1.4)	1.0 (0.7)	12.572		
Widow	0.0 (0.0)	4.0 (5.7)	4.0 (2.9)			
Single	33.0 (47.1)	16.0 (22.9)	49.0 (35.0)			
Religion						
Islam	68.0 (97.1)	62.0 (88.6)	130.0 (92.9)	$\chi^2 =$	1	0.049*
Christianity	2.0 (2.9)	8.0 (11.4)	10.0 (7.1)	3.877		
Educational Qualification						
NCE	44.0 (62.9)	38.0 (54.3)	92.0 (65.6)	$\chi^2 =$	3	0.499
ND/HND	7.0 (10.0)	6.0 (8.6)	13.0 (9.3)	2.373		
BSc/B.Ed	17.0 (24.3)	25.0 (35.7)	42.0 (30.0)			
MSc/M.Ed	2.0 (2.9)	1.0 (1.4)	3.0 (2.1)			
Employment Status						
Voluntarily	25.0 (35.7)	8.0 (11.4)	33.0 (23.6)	$\chi^2 =$	3	0.003*
Employed				13.823		
NGO-	1.0 (1.4)	0.0 (0.0)	1.0 (0.7)			
Employed	19.0 (27.1)	33.0 (47.1)	52.0 (37.1)			
Government-						
Employed	25.0 (35.7)	29.0 (41.4)	54.0 (38.6)			
Private Sector						
Monthly Income (NGN)						
< 20,000	40.0 (57.1)	11.0 (15.7)	51.0 (36.4)	$\chi^2 =$	3	0.001*
21,000 –	21.0 (30.0)	33.0 (47.1)	54.0 (38.6)	29.329		
50,000	9.0 (12.9)	20.0 (28.6)	29.0 (20.7)			
51,000 –	0.0 (0.0)	6.0 (8.6)	6.0 (4.3)			
100,000						
> 100,000						
Ethnicity						
Hausa/Fulani	67.0 (95.7)	60.0 (85.7)	127.0 (90.7)	$\chi^2 =$	3	0.035*
Igbo	0.0 (0.0)	4.0 (5.7)	4.0 (2.9)	8.586		
Yoruba	0.0 (0.0)	4.0 (5.7)	4.0 (2.9)			
Others	3.0 (4.3)	2.0 (2.9)	5.0 (3.5)			
Type of school						
Public	35.0 (50.0)	35.0 (50.0)	70.0 (50.0)	$\chi^2 =$	1	0.735
Private	35.0 (50.0)	35.0 (50.0)	70.0 (50.0)	0.114		
Age (Years)						
Mean (SD)	31.80± (9.09)	37.17± (8.23)	34.49± (9.04)	$t =$	138	0.001*
				3.663		
Teaching Experience (Years)						
Mean (SD)	8.94± (7.66)	11.82± (6.57)	10.38± (7.27)	$t =$	138	0.018*
				2.391		

Note: Statistical significance established at $p < 0.05$. NCE = Nigeria Certificate in Education; ND/HND = National Diploma/Higher National Diploma; NGN = Nigerian Naira

The identification of baseline socio-demographic imbalances is a common methodological characteristic in quasi-experimental field studies, where cluster-level allocation is prioritized over individual randomization to prevent intervention contamination. Confounding factors such as age, professional experience, and socioeconomic status can independently influence teachers' attitudes toward neurodevelopmental conditions. Consequently, relying solely on unadjusted post-intervention comparisons could introduce selection bias and obscure the true intervention effect. These baseline discrepancies provide a clear methodological rationale for employing a Multivariate Analysis of Covariance (ANCOVA). By controlling for baseline attitude scores alongside the imbalanced demographic covariates ($p < 0.05$), the pure treatment effect of the WHO mhGAP educational program can be statistically isolated and evaluated.

3.2. Prior Training, Exposure, and Institutional Support for ASD

The evaluation of preschool teachers' baseline capacity revealed a substantial deficit in formal mental health preparation alongside limited institutional support systems, as summarized in Table 2. Across the total cohort ($N = 140$), only 27.9% ($n = 39$) of educators reported having received prior training on screening or managing childhood mental health conditions, including ASD. Despite this lack of formal instruction, more than half of the participants (56.4%, $n = 79$) indicated that they had directly taught a child with autism in their classrooms. However, professional healthcare integration remained

extremely sparse, with only 10.7% (n = 15) reporting that pupils with ASD in their schools were receiving professional mental health support, and a mere 5.7% (n = 8) having direct communication with healthcare professionals supporting the child. Additionally, institutional capacity was constrained, as only 17.9% (n = 25) of schools employed specialized support staff to assist children with autism.

Inferential analyses demonstrated that both study arms originated from highly comparable baseline conditions regarding prior exposure and institutional backing. As shown in Table 2, no statistically significant differences were observed between the study and control groups regarding prior mental health training ($\chi^2 = 0.320$, $p = 0.572$), experience in teaching a child with autism ($\chi^2 = 1.424$, $p = 0.233$), direct contact with supporting health professionals ($\chi^2 = 3.348$, $p = 0.067$), or the presence of dedicated school support staff ($\chi^2 = 0.049$, $p = 0.825$). A statistically significant difference between the groups was identified only for the variable measuring whether autistic pupils were receiving professional support ($\chi^2 = 9.490$, $p = 0.009$), which was driven by a higher proportion of "uncertain" responses in the study group (40.0%, n = 28) compared to the control group (17.1%, n = 12).

Table 2

Prior Training, Classroom Exposure, and Institutional Support for ASD (N = 140)

Variables	Study Group (n = 70) n (%)	Control Group (n = 70) n (%)	Total Cohort (N = 140) n (%)	Test Statistic		
Previous Training on ASD or Child Mental Health				χ^2	Df	P-Value
Yes	18.0 (25.7)	21.0 (30.0)	39.0 (27.9)	0.320	1	0.572
No	52.0 (74.3)	49.0 (70.0)	101.0 (72.1)			
Ever Taught an Autistic Child				1.424	1	0.233
Yes	36.0 (51.4)	43.0 (61.4)	79.0 (56.4)			
No	34.0 (48.6)	27.0 (38.6)	61.0 (43.6)			
Autistic Child Receiving Support				9.490	2	0.009*
Yes	5.0 (7.1)	10.0 (14.3)	15.0 (10.7)			
No	37.0 (52.9)	48.0 (68.6)	85.0 (60.7)			
Don't know	28.0 (40.0)	12.0 (17.1)	40.0 (28.6)			
Contact with Supporting Health Professional				3.348	1	0.067
Yes	1.0 (1.4)	7.0 (10.0)	8.0 (5.7)			
No	4.0 (5.7)	3.0 (4.3)	7.0 (5.0)			
No response	65.0 (92.6)	60.0 (85.7)	125.0 (89.3)			
School Employs Dedicated Support Staff for ASD				0.049	1	0.067
Yes	12.0 (17.1)	13.0 (18.6)	25.0 (17.9)			
No	58.0 (82.9)	57.0 (81.4)	115.0 (82.1)			

Note: Statistical significance established at $p < 0.05$.

These findings highlight a striking disconnect between high classroom exposure to neurodivergent pupils and minimal institutional or professional healthcare backing. While a majority of preschool teachers manage children with ASD in daily educational settings, the vast majority operate without specialized pedagogical training, clinical consultation, or auxiliary school support. This structural void underscores the acute child mental health treatment gap prevalent in low-resource environments and reinforces the necessity of task-shifting interventions. Furthermore, the lack of statistically significant differences across most exposure metrics ($p > 0.05$) confirms that both study arms operated within an identically under-resourced educational ecosystem, validating the structural comparability of the cohorts prior to intervention.

3.3. Distribution of Teacher Attitude Levels Across Study Phases

The longitudinal distribution of preschool teachers' attitude categories across the pre-intervention, intervention, and post-intervention evaluation phases is presented in Table 3. At the pre-intervention baseline, negative attitudes toward Autism Spectrum Disorder were predominant across the entire cohort. Specifically, 71.4% (n = 50) of educators in the study group and 75.7% (n = 53) in the control group demonstrated negative attitudes. Pearson's Chi-square test confirmed no statistically significant difference in baseline attitude distribution between the two study arms ($\chi^2 = 0.331$, $p = 0.565$), establishing baseline attitudinal equivalency prior to the educational intervention.

Following the delivery of the adapted WHO mhGAP training module, a dramatic and statistically significant attitudinal shift was recorded during the intervention phase. The proportion of educators exhibiting positive attitudes in the study group surged to 85.7% (n = 60), whereas the control group remained overwhelmingly negative, with 81.4% (n = 57) maintaining negative attitudes and only 18.6% (n = 13) displaying positive stances ($\chi^2 = 63.230$, $p < 0.001$). This positive trajectory consolidated further at the post-intervention evaluation (16 weeks from baseline and 8 weeks post-training). In the study group, positive attitudes reached 98.6% (n = 69), with only a single participant (1.4%) remaining in the negative category. Conversely, attitude levels in the control group remained stagnantly low, with 77.1%

($n = 54$) exhibiting negative attitudes and 22.9% ($n = 16$) displaying positive attitudes, maintaining a highly significant group divergence ($\chi^2 = 84.120$, $p < 0.001$).

Table 3

Distribution of Teacher Attitude Categories Toward ASD Across Evaluation Phases (N = 140)

Evaluation Phase	Attitude Category	Study Group ($n = 70$) n (%)	Control Group ($n = 70$) n (%)	χ^2	Df	P-Value
Pre-Intervention Phase	Negative Attitude (1–34)	50 (71.4)	53 (75.7)	0.331	1	0.565
	Positive Attitude (35–70)	20 (28.6)	17 (24.2)			
Intervention Phase	Negative Attitude (1–34)	10 (14.3)	57 (81.4)	63.230	1	<0.001*
	Positive Attitude (35–70)	60 (85.7)	13 (18.6)			
Post-Intervention Phase	Negative Attitude (1–34)	1 (1.4)	54 (77.1)	84.120	1	<0.001*
	Positive Attitude (35–70)	69 (98.6)	16 (22.9)			

Note: Statistical significance established at $p < 0.05$. Negative attitudes are categorized as cumulative AAST scores of 14–34; positive attitudes are categorized as scores of 35–70.

These cross-phase comparative results illustrate the transformative impact of structured health education on teacher perceptions regarding neurodiversity. The high baseline prevalence of negative attitudes across both groups (71.4% and 75.7%) reflects widespread socio-cultural misconceptions, clinical knowledge deficits, and a lack of formal training among early childhood educators in low-resource environments. The sharp transition from 28.6% positive attitudes at baseline to 85.7% during training, reaching near-universal positivity (98.6%) at the 16-week follow-up in the intervention cohort, demonstrates both the immediate efficacy and short-term retention of the WHO mhGAP-based curriculum. Furthermore, the persistence of negative attitudes in the unexposed control group (77.1% post-intervention) confirms that routine teaching experience alone, in the absence of targeted evidence-based training, is insufficient to deconstruct entrenched stigmas toward children with autism spectrum disorders.

3.4. Primary Intervention Effect on Teachers' Attitudes toward ASD

To evaluate the primary treatment efficacy of the adapted WHO mhGAP educational intervention, a One-Way Multivariate Analysis of Covariance (ANCOVA) was conducted, as detailed in Table 4. The analysis assessed post-intervention attitude scores as the dependent variable across the study and control groups, while controlling for baseline pre-intervention attitude scores as a covariate. The overall corrected model demonstrated strong statistical fit ($F(2, 137) = 184.18$, $p < 0.001$), accounting for 72.9% of the total variance in post-intervention attitudes ($R^2 = 0.729$, Adjusted $R^2 = 0.725$).

After adjusting for baseline attitudinal variations, the ANCOVA revealed a statistically significant primary intervention effect between the study groups ($F(1, 137) = 345.11$, $p < 0.001$). The baseline pre-intervention attitude score did not exert a statistically significant influence on the post-intervention outcome ($F(1, 137) = 0.329$, $p = 0.567$, $\eta^2_p = 0.002$), confirming that initial baseline perspectives did not confound post-training achievements. The magnitude of the intervention effect was substantial, characterized by a Partial Eta Squared of $\eta^2_p = 0.716$. As shown in Table 4, this effect size indicates that 71.6% of the total variance in post-intervention attitudinal improvement was purely attributable to participation in the WHO mhGAP educational program.

Table 4

ANCOVA Results for the Primary Effect of Educational Intervention on Post-Intervention Attitude Scores (N = 140)

Source	Type III Sum of Squares	Df	Means Square	F	p-value	η^2_p
Corrected Model	16999.218	2	8499.609	184.176	<0.000*	0.729
Intercept	10508.636	1	10508.636	227.709	<0.000*	0.624
Attitude toward ASD (Pre-test)	15.189	1	15.189	0.329	0.567	0.002
Study Group (Main Effect)	15926.482	1	15926.482	345.107	<0.000*	0.716
Error	6322.468	137	46.149			

Total	295948.000	140
Corrected Total	23321.686	139

Note: Dependent Variable: Post-Intervention Attitude Score. $R^2 = 0.729$ (Adjusted $R^2 = 0.725$). Statistical significance established at $p < 0.05$.

The ANCOVA findings provide robust empirical evidence regarding the transformative efficacy of task-shifting mental health education in early childhood settings. By controlling for baseline scores, the analysis isolated the pure treatment effect, proving that the observed attitudinal gains were not artifacts of initial participant variability. According to standardized statistical benchmarks where a Partial Eta Squared value exceeding 0.14 denotes a large effect size, the observed $\eta^2_p = 0.716$ represents an extraordinarily strong treatment effect. This demonstrates that adapting clinical tools such as the WHO mhGAP-IG for non-specialized educators can successfully deconstruct entrenched negative attitudes and foster highly supportive perspectives toward children with neurodevelopmental disorders in resource-limited environments.

3.5. Bivariate Associations Between Socio-Demographic Characteristics and Attitudes

To examine the socio-demographic and background determinants of preschool teachers' perspectives toward Autism Spectrum Disorder, bivariate Chi-square analyses were executed across all three evaluation phases, as summarized in Table 5. At the pre-intervention baseline phase, teaching experience was identified as the single characteristic exhibiting a statistically significant association with baseline attitude levels ($\chi^2 = 10.737$, $p = 0.013$). All other baseline socio-demographic variables, including age, gender, marital status, religion, educational qualification, income, ethnicity, school type, prior training, and previous exposure to autistic pupils, demonstrated no statistically significant relationships with initial attitude categories ($p > 0.05$).

During the intervention phase, significant attitudinal differentiation emerged across several socio-demographic and experiential parameters. Teacher attitude levels during training were significantly associated with participant age ($\chi^2 = 11.620$, $p = 0.009$), monthly income ($\chi^2 = 13.453$, $p = 0.004$), direct experience of having taught an autistic child ($\chi^2 = 4.465$, $p = 0.035$), autistic pupils receiving professional support ($\chi^2 = 9.413$, $p = 0.009$), and direct contact with supporting health professionals ($\chi^2 = 5.402$, $p = 0.020$). At the final post-intervention evaluation (16 weeks from baseline), sustained attitudinal improvements maintained statistically significant associations with age ($\chi^2 = 9.335$, $p = 0.025$), religion ($\chi^2 = 4.259$, $p = 0.039$), monthly income ($\chi^2 = 13.688$, $p = 0.003$), ethnicity ($\chi^2 = 8.822$, $p = 0.032$), autistic child receiving support ($\chi^2 = 7.013$, $p = 0.030$), and contact with supporting healthcare personnel ($\chi^2 = 8.040$, $p = 0.005$).

Table 5
Bivariate Associations Between Socio-Demographic Characteristics and Teacher Attitude Categories Across Evaluation Phases (N = 140)

Variables	Pre- Intervention Phase (χ^2)	Pre- Intervention (p-value)	Intervention Phase (χ^2)	Intervention (p-value)	Post- Intervention Phase (χ^2)	Post- Intervention (p-value)
Age (Years)	4.988	0.173	11.620	0.009**	9.335	0.025**
Teaching Experience (Years)	10.737	0.013**	4.984	0.173	6.186	0.103
Gender	3.304	0.069	0.897	0.344	0.076	0.783
Marital Status	1.601	0.659	7.226	0.065	7.454	0.059**
Religion	0.071	0.790	2.116	0.146	4.259	0.039**
Educational Qualification	2.329	0.507	0.593	0.898	3.073	0.381
Employment Status	1.367	0.713	3.512	0.319	6.182	0.078
Monthly Income	1.932	0.587	13.453	0.004**	13.688	0.003**
Ethnicity	5.577	0.134	5.906	0.116	8.822	0.032**
Type of School	0.037	0.848	0.029	0.866	0.749	0.387
Previous Training on Autism	0.542	0.469	1.585	0.208	2.016	0.156
Ever Taught Autistic	0.115	0.734	4.465	0.035**	1.070	0.301

Child Autistic Child Receiving Support Contact with Health Professional School Employs Dedicated Support Staff	0.998	0.607	9.413	0.009**	7.013	0.030**
	0.536	0.464	5.402	0.020**	8.040	0.005**
	0.039	0.844	3.178	0.075	0.969	0.325

Note: Statistical significance established at $p < 0.05$. Pearson's Chi-square tests performed across categorical groups.

The bivariate pattern across the evaluation timeline reveals a critical evolution in how socio-demographic factors intersect with teacher perspectives. At baseline, negative attitudes were ubiquitous regardless of age, income, ethnicity, or qualification, demonstrating that systemic knowledge deficits and cultural stigmas surrounding autism transcend socio-economic strata when formal training is lacking. The initial significance of teaching experience at baseline ($p = 0.013$) suggests that prolonged classroom exposure independently fosters nuanced attitudinal coping strategies over time. However, post-intervention outcomes demonstrated that socio-cultural and economic factors, specifically religion ($p = 0.039$), ethnicity ($p = 0.032$), and income ($p = 0.003$), influence the degree to which health education is assimilated and sustained. Furthermore, the strong post-training associations with clinical contact ($p = 0.005$) and external child support ($p = 0.030$) emphasize that interprofessional healthcare collaboration acts as a powerful reinforcing catalyst, bolstering long-term attitudinal restructuring among early childhood educators in low-resource settings.

4. DISCUSSION

4.1. Principal Findings, Statement of Novelty, and Transformative Impact

This study demonstrates that a structured, adapted WHO mhGAP educational intervention yields a transformative, highly statistically significant enhancement in preschool teachers' attitudes toward Autism Spectrum Disorder. This investigation represents a pioneer empirical effort in sub-Saharan Africa, as well as low- and middle-income countries broadly, to adapt, implement, and systematically evaluate the clinical World Health Organization Mental Health Gap Action Programme Intervention Guide (WHO mhGAP-IG) tailored specifically for early childhood educators within a controlled quasi-experimental framework. While the mhGAP framework has been extensively deployed among non-specialized primary healthcare workers (World Health Organization, 2016), extending its clinical principles into the preschool education sector addresses a critical conceptual and structural gap in school-based mental health service delivery models.

The longitudinal tracking of attitudinal metrics revealed a remarkable shift in the intervention cohort, progressing from a baseline positive attitude rate of only 28.6% ($n = 20$) to 85.7% ($n = 60$) during the intervention phase, and culminating in 98.6% ($n = 69$) positivity at the 16-week follow-up evaluation. Conversely, the control cohort maintained a stagnantly high prevalence of negative attitudes (75.7% at baseline and 77.1% post-intervention). The high baseline prevalence of negative attitudes (71.4% in the study group and 75.7% in the control group) aligns with empirical observations from diverse global contexts, including studies by Jury et al. (2021) in the France, Leonard & Smyth (2022) in Ireland, and Holmes (2024) in United States, all of which documented substantial negative or hesitant attitudes among educators regarding inclusive practices for students with autism. In resource-constrained settings like Kano, Nigeria, these baseline negative attitudes are further exacerbated by persistent cultural stigmas, supernatural attributions of neurodevelopmental conditions, and a near-total absence of special education coursework during preservice teacher preparation.

Inferential evaluation via ANCOVA confirmed that the intervention exerted an extraordinarily potent main effect on post-training attitudes ($F(1, 137) = 345.11, p < 0.001$). The magnitude of this effect was characterized by a Partial Eta Squared of $\eta^2_p = 0.716$, indicating that 71.6% of the adjusted variance in post-intervention attitude scores was directly attributable to participation in the WHO mhGAP training program. These empirical outcomes align with localized intervention studies in Nigeria, such as Ogba et al. (2020), who reported significant reductions in negative attitudes following targeted teacher training. Furthermore, these findings strongly substantiate the systematic review by Gómez-Marí et al. (2021),

which established that enhancing teachers' evidence-based understanding of ASD is an essential prerequisite for fostering positive attitudes, professional self-efficacy, and inclusive pedagogical behavior.

The underlying mechanism driving this attitudinal transformation lies in the deliberate pedagogical translation of the WHO mhGAP clinical guidelines. By stripping away complex pharmacological protocols and focusing on symptom recognition, developmental impact, and practical classroom management strategies, the intervention successfully demystified autism spectrum disorder. Rather than perceiving neurodivergent behaviors through a lens of fear, disruption, or cultural taboo, the training equipped preschool teachers with concrete tools to comprehend sensory processing needs, communication deficits, and repetitive motor behaviors. This cognitive restructuring dismantled entrenched superstitions and replaced anxiety with pedagogical empathy, thereby instilling the professional confidence necessary to foster inclusive early childhood learning environments.

4.2. Socio-Cultural, Demographic, and Experiential Determinants of Attitude Shifts

The longitudinal evaluation revealed that the absorption, synthesis, and sustainment of positive attitudinal shifts toward Autism Spectrum Disorder are significantly modulated by educators' demographic profiles, socio-economic standing, and cultural backgrounds. At the pre-intervention baseline, teaching experience emerged as the sole socio-demographic variable exhibiting a statistically significant association with initial attitude categories ($\chi^2 = 10.737$, $p = 0.013$). This baseline effect can be attributed to the cumulative exposure that veteran educators experience over years of classroom management. In the absence of formal special education coursework, senior preschool teachers in Kano gradually develop informal pedagogical resilience, adaptive coping mechanisms, and experiential strategies through repeated interactions with neurodivergent pupils. While studies in high-income settings, such as Vincent & Ralston (2020) in the United Kingdoms, reported no significant baseline correlation between teaching experience and autism attitudes. Evidence from low-resource environments suggests that longitudinal professional exposure serves as an initial, albeit incomplete, buffer against negative stigmas prior to structured training (Low et al., 2021).

Following the intervention, post-training attitudinal levels demonstrated statistically significant associations with religious affiliation ($\chi^2 = 4.259$, $p = 0.039$) and ethnic background ($\chi^2 = 8.822$, $p = 0.032$). These associations highlight the profound influence of the socio-cultural ecosystem of northern Nigeria, which is predominantly characterized by Hausa/Fulani ethnicity and Islamic traditions. In traditional sub-Saharan communities, neurodevelopmental conditions such as autism have historically been interpreted through spiritual paradigms, including supernatural attributions, divine trials, or ancestral influences. When the WHO mhGAP health education was introduced, educators decoded the clinical knowledge through their pre-existing religious and cultural schemas. Preschool teachers who successfully harmonized the medical facts of ASD with Islamic values of compassion, communal responsibility, and protection of vulnerable children exhibited higher post-intervention positive attitudes. This finding strongly aligns with the conceptual framework proposed by Taresh et al. (2024) in Yemen, which stressed that educational interventions in traditional societies must be culturally and religiously adapted, framing clinical knowledge alongside local belief systems to ensure long-term attitudinal buy-in and destigmatization.

Furthermore, post-intervention attitude scores were significantly linked to monthly income ($\chi^2 = 13.688$, $p = 0.003$) and educator age ($\chi^2 = 9.335$, $p = 0.025$). The impact of income reflects the economic realities of early childhood education in LMICs. Teachers earning higher monthly wages, often employed in private institutions or holding higher government grades, experience lower levels of occupational burnout, greater financial stability, and better access to supplementary pedagogical materials. This economic stability provides educators with the psychological bandwidth needed to adopt inclusive classroom strategies and maintain positive perspectives toward children requiring specialized attention. Similarly, the significant association with age indicates that age-related professional maturity influences how health education is processed. Older educators bring accumulated pedagogical wisdom, whereas younger teachers may possess greater cognitive flexibility toward modern inclusive paradigms. Comparable demographic influences were reported by Shi & Sin (2024) in China, who observed that personal resource availability and demographic stability significantly governed the degree to which educational interventions translated into positive attitudes and enhanced self-efficacy toward students with ASD.

4.3. Interprofessional Collaboration and Clinical Contact as Catalysts for Attitudinal Restructuring

The post-intervention findings demonstrate that direct engagement with health systems and professional support mechanisms serves as a powerful catalyst for reinforcing positive teacher attitudes toward Autism Spectrum Disorder. Specifically, bivariate evaluations revealed statistically significant post-training associations between favorable teacher attitudes and direct contact with healthcare professionals supporting the child ($\chi^2 = 8.040$, $p = 0.005$), as well as managing pupils who actively receive professional mental health support ($\chi^2 = 7.013$, $p = 0.030$). At baseline, the vast majority of educators operated in clinical isolation, with only 5.7% reporting contact with health personnel and 10.7%

indicating that their autistic students received specialized support. The emergence of these significant post-intervention correlations indicates that health education is substantially consolidated when reinforced by external clinical validation and interprofessional support networks.

This attitudinal enhancement is driven by the technical and emotional synergy generated through interprofessional collaboration between healthcare providers and early childhood educators. In resource-constrained educational settings, preschool teachers frequently experience acute professional helplessness, pedagogical anxiety, and occupational stress when managing complex neurodivergent behaviors without specialized guidance. Direct interaction with healthcare personnel, such as community mental health nurses, pediatricians, or allied health specialists demystifies clinical diagnoses and provides teachers with concrete, individualized classroom management strategies. This clinical guidance transforms abstract knowledge into practical pedagogical competence, reassuring educators that they are not alone in managing complex developmental needs. As highlighted by Azad et al. (2021) and Bowman et al. (2021), cross-sectoral training bridges the gap between clinical healthcare and daily classroom instruction, enhancing early identification, appropriate referrals, and mutual professional trust.

Furthermore, establishing robust interprofessional links between health and education systems represents the most viable, scalable solution for closing the severe Child and Adolescent Mental Health (CAMH) treatment gap in LMICs. Given the critical scarcity of specialized CAMH experts and the unequal distribution of pediatric mental health infrastructure across low-resource environments (Ndeti et al., 2023; Pumariega et al., 2024; Ramaswamy et al., 2022; Zhou et al., 2020), traditional hospital-centered care models are fundamentally insufficient to meet population needs. As frontline professionals who observe child behavior daily, preschool teachers represent an indispensable extended health workforce. Positioned within an integrated interprofessional framework, where community health nurses act as clinical mentors and educators execute school-based behavioral interventions; this collaborative model decentralizes mental health services. By embedding health education into early childhood care, communities can achieve early detection, reduce unnecessary secondary facility burdens, and foster inclusive educational environments for children with ASD.

4.4. Implications for Community Nursing Practice, Healthcare Delivery, and Educational Policy

The empirical success of this mhGAP-based educational intervention offers important implications for community nursing innovation, health service delivery models, and educational policy development in low-resource settings. From a clinical and nursing practice perspective, nurses represent one of the largest components of the healthcare workforce in low- and middle-income countries and play a central role in extending access to essential health services, particularly through community-based and primary healthcare platforms (World Health Organization, 2023). Rather than restricting psychiatric and community health nurses to hospital-based clinical duties, the findings of this study highlight an expanded role for nurses as interprofessional educators, facilitators, and clinical mentors within community mental health initiatives. Community mental health nurses are strategically positioned to support the adaptation and delivery of evidence-based mental health training, including simplified WHO mhGAP-informed interventions, to non-specialist community providers such as school teachers. Through school-based health promotion and capacity-building activities, nurses can contribute to reducing stigma, strengthening early recognition of developmental concerns, and promoting more inclusive educational environments (Keynejad et al., 2021).

From a healthcare delivery perspective, integrating early childhood educators into the mental health support system represents an operational application of the extended health workforce and task-sharing models. In low-resource settings, where shortages of child mental health specialists, limited service availability, and weak referral systems remain persistent challenges, relying exclusively on specialist-based healthcare models is insufficient to address the population-level demand for child and adolescent mental healthcare (Ndeti et al., 2023; Ramaswamy et al., 2022). Preschool teachers interact with children daily during critical developmental periods, positioning them as important frontline observers for early developmental differences associated with neurodevelopmental conditions such as Autism Spectrum Disorder. Equipping teachers with evidence-based knowledge, recognition skills, and supportive attitudes may facilitate earlier identification, appropriate referral, and improved coordination between educational and healthcare systems (Goodwin et al., 2021; Petagna et al., 2023). This task-sharing approach has the potential to reduce pressure on specialist services, optimize available healthcare resources, and contribute to narrowing the child mental health treatment gap in resource-constrained contexts.

At the institutional and policy level, these findings provide a compelling blueprint for structural reform across health and education sectors. State and national educational authorities, including the Kano State Universal Basic Education Board (SUBEB), the Ministry of Education, and the Ministry of Health, should formally adopt this adapted, simplified WHO mhGAP framework into official preservice teacher education and mandatory inservice professional development programs. Policy frameworks must mandate inclusive education training that incorporates culturally adapted mental health modules to cater to the

diverse socio-cultural backgrounds of educators. Furthermore, establishing institutionalized referral pathways between public schools and primary healthcare centers will ensure that early detection by trained educators translates into timely, professional care. Institutionalizing this interprofessional collaboration model will build a sustainable, resilient infrastructure capable of supporting neurodivergent children across sub-Saharan Africa.

5. CONCLUSION

This study evaluated the effectiveness of an adapted WHO mhGAP educational intervention on preschool teachers' attitudes toward Autism Spectrum Disorder in Kano, Nigeria. The empirical findings confirm that structured health education yields a profound, transformative, and sustained improvement in educators' perspectives toward neurodiversity. Prior to the intervention, the majority of preschool teachers displayed negative attitudes, reflecting widespread clinical knowledge deficits, lack of specialized training, and socio-cultural stigmas surrounding childhood mental health conditions. However, participation in the simplified, clinically-grounded WHO mhGAP training shifted attitudes dramatically, achieving a 98.6% positive attitude rate at the 16-week post-intervention evaluation, backed by an exceptionally large treatment effect size ($\eta^2_p = 0.716$). It can be concluded that early childhood educators are fully capable of fostering inclusive educational environments for children with autism, provided they receive evidence-based, task-shifting mental health training.

Despite its robust controlled quasi-experimental design and longitudinal evaluation, this study is subject to several methodological limitations. First, the utilization of the closed-ended Autism Attitude Scale for Teachers (AASST) may have restricted participants' ability to fully articulate nuanced, qualitative perspectives regarding inclusive education and autism management. Second, reliance on self-reported survey measures introduces the potential for social desirability bias or guessing, which might not entirely reflect daily classroom pedagogical behaviors and real-time teacher-student interactions. Finally, the research was conducted predominantly within low socio-economic settings in urban northern Nigeria, which may constrain the direct generalizability of the findings to institutions in high-income regions or rural populations characterized by differing socio-cultural and administrative dynamics.

To build upon these empirical insights, future research should adopt mixed-methods research designs that combine quantitative psychometric scales with qualitative focus group discussions and direct classroom observational evaluations. Future studies should also evaluate the longitudinal impact of teacher training on actual pupil behavioral, social, and academic outcomes over multi-year periods. From a policy perspective, governmental and non-governmental educational authorities, including the Kano State Universal Basic Education Board (SUBEB), the Ministry of Education, and the Ministry of Health, should formally integrate this adapted WHO mhGAP training module into official preservice teacher education and mandatory inservice professional development curricula. Developing inclusive, culturally adapted training materials and establishing formal interprofessional referral networks between primary healthcare centers and preschools will ensure sustainable, scalable support for neurodivergent children across sub-Saharan Africa.

ACKNOWLEDGEMENTS

The researchers want acknowledge the preschool teachers in Kumbotso and Ungogo Local Government Areas of Kano state for consenting to participate in the study. Also, to the state universal basic education board and Kano State Private and Voluntary Institutions Board, for given permission to conduct the study.

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