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Comparative analysis of the use of Community Health Workers while deploying the Attractive Targeted Sugar Bait (ATSB) for malaria control in Western Province, Zambia

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Abstract

Background Community Health Workers (CHWs) play a crucial role in malaria control efforts, yet their contributions to large-scale field trials remain understudied. This research examined the management of CHWs recruited to support a phase III trial of Attractive Targeted Sugar Baits (ATSBs) in Western Zambia. The study aimed to understand the extent to which CHW involvement in the trial aligned with best practices and challenges faced by CHWs implementing health promotion activities.

Methods A literature review, review of Zambia Ministry of Health Guidelines, and review of WHO guidelines was conducted to identify best practices and common challenges for CHWs contributing to the delivery of malaria interventions. Subsequently ATSB trial documents were reviewed to compare CHW involvement and CHW challenges experienced during the ATSB trial from 2021 to 2023. A comparative analysis was utilized to assess the involvement of CHWs in the ATSB trial against literature review findings, specific to CHW recruitment, training, supervision, incentivization, and community support.

Results Five best practices for CHW delivery of interventions were identified: participatory and gender equitable recruitment and selection; comprehensive training; incentivization for enhanced motivation and performance; high quality supportive supervision; and fostering community support. Five common challenges for involving CHWs in programme delivery were identified: inadequate and poor-quality supervision of CHWs; low compensation and motivation; logistical constraints; workload and multiplicity of roles, and community challenges. The analysis found that ATSB trial practices largely aligned with literature best practices and established guidelines, particularly in training and incentive structures. However, challenges were identified in achieving gender balance (32% female CHWs in year 2), community involvement in CHW selection, and coordination between CHWs and research team members. CHW involvement was a key factor towards successfully implementing the trial protocol.

Conclusions Experiences with CHWs involvement in the ATSB trial in Zambia suggest that some facets of field research readily facilitate adherence to best practices for CHW recruitment and management. Additionally, field

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research that is adequately funded and characterized by rigorous implementation may avoid some of the common challenges faced by CHWs implementing health promotion activities. Nonetheless, some CHW cadre challenges appear universal to programmatic and research contexts, including an imbalance in gender representation favouring male participation in CHW opportunities. More documentation of research experiences may be needed to understand CHW involvement and experiences in field research outside of randomized controlled trials.

Keywords Attractive Targeted Sugar Baits, Community engagement, Community Health Workers, Malaria, Vector control

Background

Community Health Workers (CHWs) are lay individuals who play a vital role in bridging the gap between communities and formal healthcare systems, particularly in areas with limited access to healthcare, few health professionals, and significant health disparities including high malaria burden [1]. Further, CHWs play a critical role in bridging the gap between the communities they serve and external organizations, including for programme support or research [2]. When engaged effectively, motivated CHWs can inspire healthier behaviours, demonstrate the positive impact of their work, and encourage the adoption of new interventions aimed at improving community health [3].

Globally these frontline health workers are known by various terms including community-based volunteers, village health workers, community health agents, and other context-specific designations, reflecting the diversity of community health programmes across different countries. Community health in Zambia is mainly composed of two cadres: Community Health Assistants (CHAs), who undergo a formal 1-year training and are employed by the government of Zambia; and Community-based Volunteers (CBVs), an informal cadre of volunteers often managed and supported by NGOs, who commonly receive incentives for specific job functions [4–6]. In this paper, when referring to CHWs, it will specifically mean community-based volunteers (CBVs).

CHWs undergo specific training to perform designated health tasks, allowing them to deliver essential services at the community level [7]. These services can range from health promotion activities and basic curative care to facilitating referrals for those needing higher levels of medical attention. The roles of CHWs encompass four main technical areas: health service delivery, health education and promotion, community mobilization, and monitoring and surveillance [1, 8–11]. By acting as a link between communities and health facilities, CHWs contribute to improved geographical access to primary healthcare services, increase intervention acceptability, and are key to achievement of universal health coverage goals [7, 11, 12]. This grassroots approach directly supports the Zambia Ministry of Health's mission to provide equitable access to cost-effective, quality health services as close to the family as possible [13].

Despite the value CHWs add at the community level, they face several operational challenges in their day-to-day work which can impact their ability to deliver quality services. These include individual challenges, such as competing priorities with personal responsibilities, activities in the community, heavy workloads, and lack of motivation [3, 10, 14–16]. Additionally, community challenges, such as low community interest, low participation, and skepticism regarding CHWs' capabilities can further hinder effective engagement [10, 11].

In the context of malaria, CHWs are a valuable resource for advancing malaria interventions. Success in reducing malaria incidence has been attributed to CHW work [17]. The gains achieved in malaria control efforts since the early 2000s are currently at risk due to challenges such as insecticide resistance and outdoor biting Anopheline populations, among other factors, necessitating innovative approaches for vector control [18]. Among these innovations is the Attractive Targeted Sugar Bait (ATSB), a novel vector control tool designed to attract and kill mosquitoes using a sugar-based bait. A phase III cluster randomized control trial (cRCT) was conducted in Western province, Zambia from November 2021 to June 2023 to assess the impact of ATSBs on malaria transmission [19].

Within the ATSB trial in Zambia, a cadre of CHWs was recruited, trained, supervised, and paid to implement community engagement—a term used in the ATSB trial to mean actions intended to strengthen awareness of and build trust in the ATSB intervention and/or research components of the trial [20]. Specifically, CHWs were tasked with fostering understanding and trust through conducting proactive and reactive interpersonal and mass communication to share information about trial activities and the ATSB intervention. They also routinely accompanied research team members to households within their communities to introduce and explain study components (e.g., cohort study, household survey). CHWs accompanied ATSB installation teams to provide information and answer questions about the ATSB intervention. Finally, CHWs encouraged members of their

community to share concerns and questions and relayed these to the trial team. To perform these tasks, the CHWs were provided with annual training sessions, orientation to the work of other trial workstreams and individuals performing other trial tasks within their community, and routine supportive supervision. They were paid a daily rate to work between 5–15 days per month. The responsibilities for ATSB trial CHWs broadly aligned with common tasks for CBVs engaged by NGOs in Zambia [4, 5].

Community health initiatives led by CHWs are typically focused on improving population health through encouraging certain health behaviors. In the context of the ATSB trial, CHWs were focused on acceptance and adherence to the ATSB intervention under study. However, they were also leveraged to foster acceptance and participation in trial research components. The involvement of CHWs by a trial team to perform both health and research promotion functions could potentially mean that these CHWs faced management practices and challenges different to those commonly observed with CHWs engaged by NGOs for health promotion. The analysis reported here was undertaken to examine the management practices and challenges faced by ATSB trial CHWs in relation to national guidelines in Zambia and existing literature. This analysis is important to understand the alignment of management practices for trial-involved CHWs with national guidelines and best practices, and to understand the extent to which challenges for this cadre are similar to those commonly observed for CHWs involved in health promotion. This analysis could inform guidelines and practices for managing CHW involvement in field research.

Methods

Literature review

A literature review was conducted to identify best practices and challenges associated with engaging CHWs in research, with a focus on CHW involvement in health programmes and malaria control efforts in sub-Saharan Africa. Additional search parameters are detailed in Additional file 1.

Search parameters

The literature search was performed in PubMed between December 5–15, 2023, using predetermined keywords related to CHW involvement in health programmes, health research, and malaria control. The initial search identified 138 articles.

Eligibility criteria and selection process

Articles were screened by title and abstract using the following inclusion criteria: (1) conducted in sub-Saharan Africa, (2) focused on CHWs involved in health programmes (particularly malaria control or research), and (3) discussed CHW roles, best practices for engagement, or challenges faced by CHWs in malaria control or community health programmes. This review narrowed the selection to 37 articles.

Additional sources

Five additional articles were included through reference list screening of the selected articles. Furthermore, consultations with field experts identified two relevant articles: the ATSB trial protocol and the ATSB acceptance paper. All seven additional articles met the inclusion criteria. In total, 44 articles were included in the literature review.

Data extraction and synthesis

Data from the selected articles was extracted, coded using Microsoft Excel, and thematically organized into categories related to best practices and challenges for involving CHWs in health research.

Additional grey literature

In addition to the included articles, three significant pieces of grey literature were pulled for grounding the analysis: Zambia Ministry of Health Community Based Volunteers Contract Guidelines [21], Zambia Ministry of Health Community Based Volunteers Incentive Guidelines [22], and WHO guideline on health policy and system support to optimize community health worker programmes [23].

ATSB trial document review

Community engagement field operations documents from the ATSB trial (November 2021 to June 2023) were gathered and analysed to understand trial practices. The inclusion criteria for the document review covered materials detailing CHW recruitment guidelines, onboarding training materials, CHW agreement forms, weekly activity reports from Community Engagement Officers, community concern response reports, CHW supervision/huddle reports, motivational materials, community feedback documentation, and correspondence with local stakeholders (Additional file 2).

Data extraction and synthesis

Data from the documents were extracted, coded using Microsoft Excel, and thematically organized to: (1) describe the working expectations and motivational resources provided to CHWs; (2) detail the activities undertaken by CHWs to promote awareness and acceptance of the ATSB intervention and research activities; and (3) identify challenges faced by CHWs during the trial. A total of 61 documents were included in the

analysis, covering various aspects of CHW involvement throughout the trial.

Comparative analysis

A comparison was conducted between themes from the literature review, MoH guidelines, WHO guidelines, and the practices extracted from the ATSB trial documents. Data was compared based on a hybrid approach of deductive and inductive thematic analysis. Deductive coding was used to identify content related to CHW involvement practices, followed by inductive analysis to capture new themes. Comparative matrices were created and utilized based on themes to identify alignments, discrepancies, and gaps.

The MoH guidelines were released post-trial and were not in effect during the ATSB trial period. Comparisons to these guidelines are included to provide context on evolving standards for CHW management in Zambia, rather than as an assessment of the ATSB trial's compliance.

Results

Literature review

The literature review identified ten themes for involving CHWs: five best practices and five common challenges, as shown in Table 1.

Best practices for involving CHWs

1. Participatory and gender-equitable recruitment and selection of CHWs: Adopting a participatory approach in CHW recruitment, involving both community and health systems, is critical for successful engagement. This method enhances trust, acceptance, and motivation [16, 24]. Balancing community input with professional criteria ensures CHWs possess necessary skills and represent diverse groups, including the representation of women [24, 25]. Selection criteria should consider gender balance, marital status, experience, education, support for household roles, and sanitation practices, particularly in malaria CHW programmes [3].
2. Comprehensive training offered to CHWs: Comprehensive, concise training is a key component for enhancing CHW knowledge, motivation, and performance [2]. Trainings should last of minimum of 2–3 days, focusing on fundamental concepts to avoid information overload, and include opportunities to confirm learning objectives [3]. Competency-based methods, including practice exercises, role-playing, and practical applications, effectively enhance knowledge acquisition [26]. Additionally, training CHWs in communication skills is crucial for fostering behavior change at the community level [27].
3. Incentivize CHWs for enhanced motivation and performance: While community service remains a primary motivator for CHWs in performing their role [27, 28], incentives are shown to significantly boost motivation and performance [29]. Both financial and non-financial incentives have shown to be important motivators. Providing resources such as bicycles, T-shirts, and training certificates help facilitate effective service delivery and demonstrate to the CHW that there work is valuable [26]. Similarly, providing supplies such as uniforms or ID badges help to promote CHWs' role in the community [25].
4. High-quality supportive supervision: Regular, high-quality supportive supervision can play an important role in CHW success [14, 30]. When conducted by trained supervisors, these visits offer guidance, monitor performance, and foster skill development. Capacity building for CHWs is an ongoing process that can be enhanced through the incorporation of field visits and peer learning [31]. The quality of supervision has been shown to have greater benefit than the frequency of supervision in optimizing CHW effectiveness, specifically in malaria prevention and control programmes [3].
5. Foster community support: Prioritizing community support for CHWs helps to improve performance and programme effectiveness [3, 11, 24]. This involves community ownership, engagement, and collaboration throughout the programme life cycle. Strategies like establishing village health committees and involving community leaders can promote participation in community health programs, positively influencing CHW performance [16, 24].

Table 1 Best practices and common challenges for involving CHWs in health programmes

Best practices	Common challenges
• Participatory and gender equitable recruitment and selection of CHWs • Comprehensive training offered to CHWs • Incentivize CHWs for enhanced motivation and performance • Strengthen CHW capacity through high quality supportive supervision visits • Foster community support for CHWs	• Inadequate and poor-quality supervision of CHWs • Low compensation and motivation • Logistical constraints (i.e., limited supplies, resources and transportation challenges) • Workload/multiplicity of roles • Community challenges

Common challenges for involving CHWs

Despite the role CHWs play in community health programs, CHWs often encounter challenges that hinder their performance, effectiveness, and impact health outcomes.

1. Inadequate and poor-quality supervision: Lack of adequate supervision is a common challenge for CHWs and is often correlated with decreased motivation and retention [9, 16]. Logistical challenges, including travel costs and a lack of dedicated supervisors for CHWs, contribute to this gap in quality supervision. Additionally, supervisors often lack specific training on how to provide effective supervision and give constructive feedback [10, 17].
2. Low compensation and motivation: CHWs frequently face low compensation and inadequate community recognition for their contributions and volume of work, leading to demotivation [32]. Short-term contracts, low wages, and the absence of clear career paths are common concerns [9]. These factors not only affect CHWs'morale but also their retention in programmes, posing significant challenges to programme sustainability [9]. Addressing compensation and recognition issues is crucial for maintaining a motivated and effective CHW workforce.
3. Logistical constraints: CHWs often face significant logistical challenges in implementing their scope of work, including inadequate supplies and transportation difficulties. Limited supplies and the assumption that CHWs will provide their own supplies can hinder service delivery [33, 34]. Similarly, transportation challenges, especially in remote areas and during rainy seasons, impede CHWs' ability to conduct timely work and perform programme-specific tasks [3, 10]. These constraints underscore systemic challenges in resource allocation within CHW programmes.
4. Workload and multiplicity of roles: CHWs often experience overburdening due to diverse responsibilities and competing priorities, as demonstrated when juggling health facility assignments, work with various NGOs, community events, and personal responsibilities [16, 17]. Other factors that contribute to CHW overload and burn-out include the responsibility to cover a large population size or geographic distance, and the emotional burden of patient care. Managing CHWs'workload and commitments is crucial to prevent burnout and maintain effectiveness during the period of engagement.
5. Community challenges: Low community interest and participation, coupled with a lack of understanding about CHW roles, often hinder effective community engagement [35]. Community challenges can include skepticism from the community regarding CHWs' knowledge and technical capabilities, barriers to community interaction, and low interest in the health topic [10, 11]. These challenges underscore the need for strategies to enhance community trust, appreciation, and active participation in CHW-led initiatives.

ATSB trial document review

The document review showcased how CHWs in the ATSB trial utilized a comprehensive approach to promote intervention awareness and acceptance, which included routine community engagement activities, response community engagement activities, and iterative adaption of key messaging. In control clusters—areas without ATSBs, CHWs supported trial implementation by assisting 2–3 study teams (cohort, household, and entomology where applicable) and addressing community concerns. In intervention clusters, CHWs supported trial implementation by assisting 3–4 study teams (cohort, household, ATSB monitors, and entomology where applicable) and addressing community concerns. This multi-faceted strategy and localized support to study teams aimed to enhance community understanding of the ATSB product, quickly address concerns, and foster positive perceptions of the ATSB trial. CHWs also integrated broader malaria prevention education into their activities. Table 2 provides a detailed summary of CHW activities in promoting ATSB trial and product awareness and acceptance. Additional information on the ATSB Community Engagement Strategy is available in Orange et al. [20].

The review of ATSB trial recruitment records showed that over the 2-year trial period, a total of 152 CHWs were recruited. In Year 1, the gender distribution was 37% (53/142) female and 63% (89/142) male. Year 2 saw a slight shift to 32% (49/152) female and 68% (103/152) male. The retention rate from Year 1 to Year 2 was 85.9% (122/142), with 30 new CHWs recruited in Year 2 to replace departures and expand coverage (Table 3).

Comparative analysis results of best practices for involving CHWs

1. Participatory and gender-equitable recruitment and selection of CHWs: All reviewed sources emphasized community membership as a key criterion for recruitment, along with literacy requirements. Age criteria were mentioned in ATSB trial and Zambia MoH guidelines (18+ and 18–45, respectively), while the WHO guidelines advise against age as a selection criterion. The ATSB trial and literature review considered the reputation of CHWs in their communi-

Table 2 Activities Conducted by CHWs to promote the ATSB trial and product

Category	Activities [Typical frequency and scope*]
Community Sensitization	• Door-to-door visits [Conducted during 5-day monthly sensitization; reached ~ 20–30 households per CHW per month] • Organizing and conducting community meetings [2 meetings per trial round per cluster (one at beginning and one at end of trial round; reached ~ 10,000 community members across 70 clusters each round] • One-on-one introductions with household heads [50–120 household introduction pending cluster activities in the cluster, including cohort households, household survey households, entomology households]
Education and Information Dissemination	• Explaining the ATSB trial objectives and procedures to community members and participants [2 meetings per trial round per cluster (one at ATSB installation and one at ATSB hang-down); reached ~ 5000 community members across 35 clusters each round] • Providing information about ATSBs and their role in mosquito control • Offering general health education on malaria prevention [All integrated into 5-day monthly community sensitization visits; messaging reinforced during trial team visits and household follow-ups as needed]
Support for Trial Implementation	• Assisting ATSB monitors with ATSB installation and removal [10 days for ATSB deployment & 10 days for ATSB removal] • Helping cRCT teams navigate clusters and locate households for cohort study, household survey, and entomological collections [2–3 days per month depending on study team schedule and cluster activity] • Supporting study team schedules (e.g., making appointments for household visits, following up on participants) [2–3 days per month depending on study team schedule and cluster activity]
Community Liaison	• Working with local leaders (indunas, headmen, church leaders) [CHWs engaged these leaders regularly during scheduled meetings and consulted them as needed for unresolved issues] • Addressing community concerns and questions [sporadic throughout the month; exact frequency not systematically tracked, but CHWs commonly reported addressing questions outside scheduled days] • Dispelling myths and rumors about the study [sporadic; reactive to rumors or concerns raised in the community]
Follow-up and Adherence Support	• Ensuring cohort participants complete their full course of treatment [1–2 days per month] • Encouraging environmental cleanliness (e.g., no ATSBs discarded in community) [Embedded in monthly messaging during 5-day sensitization period] • Promoting acceptance of other interventions (e.g., Indoor Residual Spraying & Insecticide Treated Nets) [included in 5-day monthly sensitization; plus 3 additional days during ITN distribution and IRS campaigns for targeted reinforcement]
Coordination with ATSB Study Team	• Communicating concerns to ATSB study team [Ad hoc; initiated in response to CHW-identified challenges or community concerns] • Introducing and supporting cohort, household survey, and entomology study teams [2–3 days per month depending on cluster activity]

* CHWs performed trial tasks from November to June each year for 2 years/round of trial implementation

Table 3 Community Health Worker characteristics and retention across 2 years of the ATSB trial

Characteristic	Year 1 (Round 1)	Year 2 (Round 2)
Total CHWs	142	152
Female CHWs	37% (53/142)	32% (49/152)
Male CHWs	63% (89/142)	68% (103/152)
Retained from previous round	N/A	85.9% (122/142)
New recruits	142 (initial)	30 (20 replacements + 10 additional)

ties, whereas this was not explicitly mentioned in the WHO or Zambia MoH guidelines. ATSB trial did not consider gender balance or community-driven selection processes in CHW recruitment, in contrast to recommendations in the literature and WHO guidelines. Instead, the ATSB trial selected CHWs based of recommendations from health facility staff. The Zambia MoH guidelines, released after the ATSB trial period, advise using Neighborhood Health Committees (NHCs) to facilitate the selection process and to engage with health facilities through the District Health Office.

2. Comprehensive training offered to CHWs: All reviewed sources emphasized structured training for CHWs, though with varying approaches to duration and content. The ATSB trial conducted initial trainings of 1–3 days with supplementary sessions as needed, aligning with literature recommendations of 2–3 days to manage information load. WHO guidelines focused on competency-based adaptation and pre-existing knowledge rather than prescribing specific durations. Regarding content, the ATSB

trial employed a focused curriculum (malaria, ATSB product, trial protocols, and ethics), whereas other sources advocated for broader health topics. While the trial's training methods incorporated recommended approaches like role plays, frequently asked questions sessions, and practical exercises, the ATSB trial did not report use of e-learning or mobile health technologies for training, which are increasingly recommended in WHO guidelines and literature.

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3. Incentivize CHWs for enhanced motivation and performance: All reviewed sources recommended a combination of monetary and non-monetary incentives. The ATSB trial provided a monetary incentive to CHWs in the form of transportation allowances and Daily Subsistence Allowances (DSA) while attending trainings, allowances for rain gear and bicycle maintenance, and a daily lunch allowance of ZMW100 (approximately $5 USD/day) per day worked within their community. Allowances were disbursed in-person at trainings and monthly based on the number of days worked within the cluster, resulting in a monthly range of ZMW500 to ZMW1500 ($25 to $75 USD). In contrast, Zambia MoH guidelines, introduced after the trial, recommend a fixed monthly volunteer allowance of at least ZMW750 ($37.50 USD) for CHWs engaged for a month or more, with additional support such as lunch allowances for working beyond 2 h past lunch, transport refunds, and DSA for overnight or out-of-district assignments. WHO guidelines advised against sole reliance on performance-based incentives.

The ATSB trial's CHW workdays varied from 5 to 15 days per month, with each day lasting from 20 min to 6 h. This setup differed from the MoH's later guidance of a maximum of 5 h per day, 4 days per week, but aligned more closely with WHO's emphasis on adapting to local needs.

Non-monetary incentives provided to CHWs in the ATSB trial included airtime, ID badges, branded T-shirts, backpacks, certificates of appreciation, and bicycles, which were donated to CHWs at the trial's conclusion. The trial did not report specific career progression opportunities, which are emphasized in WHO guidelines and some literature.

4. High-quality supportive supervision: The ATSB trial implemented a multi-faceted supervision approach, combining weekly remote support (e.g., phone calls and SMS) with targeted in-person visits, aligning well with recommendations for regular, supportive supervision. The WHO and literature review emphasized the use of standardized tools for supervision, which aligned with the ATSB trial's practice of direct observation and protocol adherence checks. While the Zambia MoH guidelines specified the supervisory roles of CHWs and NHCs, they did not provide specific supervisory tools for CHW oversight. In addition to supervisory visits, the ATSB trial incorporated group meetings (called "huddle meetings") where CHWs gathered with their supervisors to discuss their work, share experiences, learn from each other, and provide feedback about community responses.
5. Foster community support: The trial engaged various community structures to support CHWs, including chiefs, local leaders, community group leaders, religious leaders, ward councilors, teachers, and Neighbourhood Health Committees. Local health facility staff, namely nurses, environmental health technicians and/or community health assistants were involved in community meetings, CHW recruitment, and addressing community concerns. This approach aligned with literature recommendations for fostering community support. However, the trial did not report establishing formal community-based structures for regular monitoring and support of CHWs, as recommended by WHO guidelines and some literature sources.

Comparative analysis results of common challenges for involving CHWs

1. Inadequate and poor-quality supervision: Due to the implementation of a multi-faceted supervision approach, inadequate supervision was not a challenge identified in the ATSB document review. ATSB Community Engagement Officers who provided supervision to CHWs, also received direct support from ATSB Trial management on their supervision approach.
2. Low compensation and motivation: During the first year of the ATSB trial, trial documents indicate that CHWs in intervention clusters expressed dissatisfaction with their monthly lunch allowance payments, specifically when CHWs compared their allowances with study team field workers. Study field workers employed by the ATSB trial team (malaria cohort study data collectors, household survey data collectors, entomology collectors, and ATSB monitors) had a more technical scope of work and differing working

schedule from CHWs and therefore received different allowances. Compensation issues were resolved in the second year of the trial through clearer communication about disbursement schedules and an adjustment to the minimum guaranteed 10 working days per month, while maintaining the same scope of work, effectively increasing their monthly earnings.

3. Logistical constraints: The ATSB trial documents did not report significant logistical constraints related to supplies and resources. However, a unique challenge noted was CHWs'difficulty in coordinating between multiple, overlapping trial activities (entomology collections, ATSB visits, and epidemiology data collection) and their communities, as they served as the primary point of contact for all trial-related activities. This occasionally required CHWs to prepare multiple appointments and provide navigation support to multiple study teams within the same day (e.g., cohort visits and entomological collections occurring on the same day in a cluster).
4. Workload and multiplicity of roles: Workload management emerged as a significant challenge during the first year of the ATSB trial for CHWs in geographically expansive clusters. Ten clusters reported that their assigned areas were too expansive for two workers to complete the required responsibilities. In the second year, the ATSB trial team augmented the workforce by adding one additional CHW in each of these clusters.
5. Community challenges: CHWs faced considerable community-related challenges as part of introducing a new malaria intervention tool, particularly in addressing safety concerns about the ATSB product and countering misconceptions that associated it with satanism. These concerns required CHWs to engage in extensive community education and trust-building activities to maintain acceptance for the ATSB product and trial.

Discussion

Results from this analysis of CHW contributions to the first field trial of the ATSB in Zambia suggest that many established best practices for CHWs working in community-based health promotion are relevant to CHWs contributing to field research. Furthermore, challenges commonly faced by CHWs working in health promotion may not necessarily be present within the context of a cRCT. The comparative analysis revealed that the research trial successfully implemented several recommended best practices from the literature and WHO guidelines. These include selecting CHWs from their communities, providing training, offering both monetary and non-financial incentives, and establishing a structure for supportive supervision. Additionally, the ATSB trial effectively engaged various community structures such as local leaders, NHCs, and local health facility staff to foster community support.

Following established CHW best practices was in many respects straightforward for the trial team because they align with best practices for conducting rigorous, ethical research. For example, ensuring adequate training for research field teams and establishing supervisory structures for field teams are critical components of conducting field research. Furthermore, this study was a randomized controlled trial characterized by tightly controlled and highly supervised implementation [36]. As such, technical and financial resources were dedicated to ensuring high-quality training and routine supportive supervision. Contacting local leaders and health facility staff and seeking approval to conduct field implementation is typically essential to gaining permission to enter rural communities and conduct research. Training, supervision, and involving community structures were practices that were extended to all cadres engaged in the ATSB trial according to the study protocol and standard operating procedures. Furthermore, the research budget included monetary and non-financial incentives for all cadres engaged in the trial. Finally, the clearly defined finite time period for the trial operating from November to June for 2 years/rounds meant that the management team could adequately and proactively budget for monetary and non-financial incentives to cover the entire study period.

The high retention rate of Zambia ATSB trial CHWs (85.9%) over the 2-year study period suggests that the alignment with best practices was important for overcoming the common challenge of waning motivation among CHW cadres. Additionally, results from assessments of ATSB acceptance among the study communities suggest that the work of the trial CHWs to facilitate trust and acceptance of the intervention was successful [20]. In addition, the work of the CHWs likely contributed to high levels of participation, low levels of loss to follow-up in the cohort study [36] and low levels of refusal in the entomological collections [37].

Some challenges were observed in the ATSB trial's implementation of recommended best practices, including gender consideration during CHW recruitment and community involvement in CHW selection [3, 23]. The low female representation among recruited CHWs (< 37%) and slight decrease in female CHW representation between trial years (37% to 32%) indicates a potential area for improvement in future trials. Similar gender imbalances have been observed in other malaria programmes [24], underscoring the need for ongoing

attention to gender equity in malaria programmes and research.

While CHW programmes may aspire to provide adequate supervision, compensation, and supplies for CHWs, the literature review highlighted common challenges with these aspects of CHW programming. The ATSB trial did not face substantial challenges with consistent supervision, sufficient compensation, and ensuring supplies for CHWs. The time-limited and tightly controlled and monitored nature of the cRCT ensured that supervision, compensation, and supplies were continually provided to CHWs. While ATSB trial CHWs faced the broader common challenges related to heavy workload and community concerns surrounding the broader trial and/or intervention, these challenges were rapidly identified and mitigated by trial management and CHW supervisors (Community Engagement Officers) [20]. In the trial context, the management team was consistently focused on maintaining high intervention coverage and research participation and thus was very responsive to CHW challenges and needs (e.g., overburdened CHWs requiring a reduction in workload).

In early 2023, the Zambia MoH released new Community Health Work Incentives Guidelines, and these guidelines were not in effect during the trial. These guidelines do not speak to potentially important issues for CHWs engaged in field research. These include guidelines around working hours and financial incentives which may not be realistically abided by in the context of field research [36].

This analysis compared CHWs engaged in a large-scale, multi-faceted, rigorous randomized controlled trial to the literature and guidelines for CHWs engaged more broadly in health promotion. A limitation of the analysis is the context of the ATSB trial—a trial of a novel vector control product with substantial human and financial resources dedicated to proactive supervision and communication strategies as well as routine monitoring and data review to guide reactive activities to ensure trust, acceptance, high intervention coverage, and high research participation rates. Additional research is needed to understand the CHW experience and challenges participating in other types of field research.

Conclusion

CHWs tasked with building community trust and acceptance of field research implementation activities have scopes of work that are similar to the CHW cadre in Zambia known as CBVs. Where involvement of CHWs is critical to the success of a research study, the guidance from the National Ministry of Health and the WHO and the scientific literature equally apply to the research context. Additionally, field research that is adequately funded and characterized by rigorous implementation may largely avoid common challenges faced by CHWs implementing health promotion activities. Nonetheless, some CHW cadre challenges appear universal to programmatic and research contexts, including an imbalance in gender representation favoring male participation in CHW opportunities. More documentation of research experiences may be needed to understand CHW engagement and experiences in field research outside of randomized controlled trials.

Abbreviations

ATSB	Attractive Targeted Sugar Bait
CBV	Community-based volunteer
CHA	Community Health Assistant
CHW	Community Health Worker
cRCT	Cluster randomized control trial
ITN	Insecticide-treated net
MoH	Ministry of Health
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12936-025-05503-6.

Additional file 1. Literature review methodology

Additional file 2. ATSB Trial Document Review sources

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Author contributions

Conceptualized the study: FN, DM, EO. Performed the literature review, data analysis, and wrote the first draft of the manuscript: FN. Contributed to community engagement documentation and data acquisition: CM, TT, SA, FN, EO, AA. Reviewed and provided thematic feedback on the manuscript: EO. All authors reviewed, edited, and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the National Health Research Ethics Board (NHREB) at the University Teaching Hospital (ethical institution of record) in Zambia (Ref # 1197-2020), the PATH Research Ethics Committee (Ref # 1460046-5), and the Institutional Review Board at Tulane University (Ref # 2019-595). This study involved secondary data analysis and did not require approval from a human subject research committee. Formal permission to use ATSB trial data was obtained, and all data were anonymized to protect the privacy of CHWs and communities.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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