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Perspectives of men and women working in vector control in Africa regarding barriers and opportunities for achieving gender inclusivity

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Abstract

Background Gender-inclusive strategies are crucial for tackling vector-borne diseases in Africa, but most programs still overlook the lived experiences of local practitioners regarding cultural norms, power imbalances, gender stereotypes, and workplace dynamics. This study investigated the gender-related perspectives of men and women working in vector control in Africa and their recommendations for effective gender inclusivity.

Methods An exploratory mixed-methods study was conducted, starting in Tanzania with 22 in-depth interviews with team leaders, seven focus group discussions with scientists and vector control practitioners and two group discussions with vector control students. This was followed by an online survey of 150 researchers, academics, technicians, students, and vector-control staff from 16 African countries. Data on gender distribution, inclusivity, divergent male–female perspectives, and related experiences, including sexual harassment, were analysed thematically for qualitative responses and descriptively for survey responses.

Results The study revealed significant gender disparities in staffing and leadership of vector control programmes in Africa, with 70.3% of men and only 40.7% of women having held leadership roles. Men occupied most vector-control roles, except in acadaemia where parity is maintained until master's degree level but biased towards men at PhD levels. Marriage weighed more heavily on women, with 44.1% of female staff remaining unmarried, compared to only 18.7% of men. Most respondents said mixed-gender teams strengthen community engagement, but they differed on effects for creativity, cost and morale, with some insisting that merit alone matters, while others seeing diversity as essential for better results. Women were more likely than men to dismiss the claims that inclusivity is ineffective or disruptive. Challenges to gender inclusivity included cultural norms limiting women's participation in overnight fieldwork, work-family pressures, and scant workplace accommodations. Men recognized the benefits of working with women but noted challenges related to societal expectations and workplace accommodations. Majority of participants (84.1%) reported had never experienced gender-based violence, but women were more likely than men to report sexual harassment. Over half of respondents believed their manager's gender significantly

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impacted their work environment; and some women preferred female leaders for relatability and support, while others were indifferent.

Conclusion The study reveals wide gender gaps in African vector-control staffing and leadership and provides key insights for stakeholders to develop fairer workplace practices. Although the value of inclusivity is broadly recognized, cultural norms, family demands, and social expectations still weigh more heavily on women. These challenges can be addressed by incorporating a gender lens considering the perspectives of both men and women in vector control.

Keywords Gender inclusivity, Vector control

Background

Vector control has been historically dominated by men despite the notable progress in the last decade to include more women [1, 2]. However, it is widely recognized that inclusive and diverse vector control programmes that consider different contexts, cultures, and environments are more likely to be accepted, effective, and sustainable. Indeed, studies have shown that incorporating a gender lens in vector borne diseases programmes can enhance productivity, effectiveness, and sustainability of the programmes [1, 2]. Increasing participation of women and promoting the qualified ones into leadership roles can particularly enhance the uptake of interventions [3, 4]. In one example, in Bioko Island, Equatorial Guinea, where an indoor residual spraying (IRS) programme was implemented using gender-guided policies, there was a significant increase in female employment and leadership roles, underscoring the importance of such initiatives [5].

Societal constructs of gender and the resultant gender roles, norms, expectations, and behaviours have important implications for the health workforce [4]. These constructs may impact recruitment, training opportunities, promotion prospects, compensation, and policies to prevent workplace harassment. Even when opportunities for training or professional development are available for both men and women, gendered responsibilities, norms, and access can limit/influence how men and women utilize these opportunities [6–8]. For instance, field evidence suggests that cultural norms and societal expectations often restrict women's participation in field activities that require overnight stays, thereby limiting their career advancement opportunities in vector control [4, 9].

Some studies also suggest the gender of individual health workers can affect their ability to reach the people at risk of vector borne diseases. In societies with strict gender roles and patriarchal norms, women may be restricted from discussing health issues with men or entering certain spaces, making a gender perspective crucial in addressing these challenges [10, 11]. This gender-based restriction can hinder the effectiveness of health interventions and highlights the need for inclusive strategies that accommodate these societal norms [9]. Moreover, because practices vary based on local cultures and societal norms, it is crucial to understand these differences across communities to address the challenges more effectively.

Several studies in sub-Saharan Africa have explored the impact of gender on community response and the effectiveness of health service delivery related to NTD prophylaxis drug distribution. One study revealed that during the distribution of ivermectin, community members often perceived female drug distributors as more dedicated, convincing, and patient compared to male distributors [12]. In another study in Uganda, increasing the number of female drug distributors was shown to enhance the success of Mass Drug Administration (MDA) programmes [13]. In Tanzania, female drug distributors were noted for their communicative skills and thoroughness in discussing trachoma prevention [10] in comparison to their male counterparts. On the contrary, there are also studies that have reported lower coverage by female distributors, potentially due to their additional gendered roles and responsibilities, highlighting the complexities of gender dynamics in health service delivery [14]. Fortunately, these challenges can be readily addressed by using gendered approaches to interventions. For example, data from the IRS programme in Equatorial Guinea also revealed that after implementing a series of gender guided policies which included ensuring privacy and safety at the workplace, guaranteeing job security during pregnancy and encouraging qualified female candidates to apply for leadership positions, there was increased women employment from 23% in 2012 to 29% in 2015 and even greater increase in women in leadership from 17 to 46%. Although the study also reported the number of houses sprayed by women to be fewer than those sprayed by men. The difference was not statistically significant to alter the overall outcomes of the activity [15].

Although the gender gap has been widely studied in many areas of science, there is scarcity of data on a balanced opinion on the matter as most studies have synonymously merged gender concerns with women's concerns. Most of the reports showcase how women are underrepresented and the challenges they face in professional or career advancement[6, 16, 17] but little is known about

experiences, perspectives and perceptions of men that come along with the change in gender power structures, sharing of leadership roles, gender stereotypes, response to institutional environment by both genders, gendered supervisor-subordinate relationships, and team formation. Fortunately, there is a growing recognition that inclusive and diverse vector control programmes, which consider different contexts, cultures, and environments, are more likely to be effective, and sustainable [3, 17–19].

More importantly, incorporating an appropriate gender lens in vector-borne disease strategies is also crucial due to disproportionate societal impacts and can facilitate translating research into policy and practice. Unfortunately, ongoing advancements often reflect "Western" gender roles and fail to capture the experiences and perceptions of African vector control practitioners. The views of local practitioners on gender power structures, leadership, stereotypes, workplace relationships, and team dynamics are underexplored, hindering gender inclusivity in African vector control programmes.

This study, gender was a term used similarly as biological sex categories therefore the gender dynamics, experiences and perspectives were focused on understanding how these affect men and women in vector control. For the context of this study therefore, the term gender was used to refer to men and women although the understanding of gender may not be confined to a binary of male or female however other gender identities they were not explicitly considered in this study.

This study, therefore, aimed to investigate the gender experiences, perceptions, and recommendations for gender inclusivity among men and women working in vector control programmes and research institutions in Africa. This study sought to bring a balanced opinion to understanding gender differences in vector control by investigating gender experiences, perceptions and recommendations towards gender inclusivity, so as to inform formulation of appropriate gender inclusivity strategies in vector control.

Methods

Study design and sites

This study targeted staff in public and private institutions involved in vector control research and implementation across 16 African countries, with a central focus on Tanzania (Fig. 1). An exploratory mixed-methods design was used, starting in Tanzania with 22 in-depth interviews with team leaders, followed by seven focus group discussions with scientists and practitioners and two small group discussions with students pursuing vector-related courses, followed by an online survey with 150 participants from all the 16 countries. This study was done from March −2023 to December 2023, and institutions involved included research and academic institutions, non-governmental organizations, government vector control bodies and programmes.

Focus group discussions

A total of seven FGDs were conducted in institutions involved in vector control in Tanzania. These included Ifakara Health Institute, Pan-African Malaria Vector Research Consortium (Product testing unit) at Kilimanjaro Christian Medical University college, National Institute of Medical Research- Mwanza, Muheza and Tanga branches. An additional FGD was conducted for government district leaders in the Kilombero Valley, southeastern Tanzania, where several malaria vector research projects were ongoing.

The number of participants per FGD ranged from six people to twelve people. The participants' verbal consent for audio recording was sought before the discussions began and detailed notes were taken throughout the discussion. Discussions ranged from 60 to 120 min. In each institution, two FGD sessions were held, separating the participants by gender to enhance participation. The discussions were guided to explore participants': i) knowledge and perceptions on institutional gender distribution, ii) opinions on the importance of gender inclusivity in vector control, iii) opportunities and challenges of achieving gender inclusivity in different aspects of vector control, iv) gender-related experiences including gender-based violence(GBV) in working in vector control. The discussions were predominantly done in English, except for the more community representative groups, which were done in Swahili.

Small group discussions

Two small group discussions were conducted with male and female Masters and PhD students pursuing vector related courses from Sokoine University of Agriculture (SUA) with four people in each group. The discussions followed the same structure as focus group discussions and the areas explored were the same with focus on the academic setting.

In-depth interviews

A total of 22 IDIs were conducted with participants from the Tanzanian institutions listed above plus participants from Muhimbili university of Health and Allied Sciences (MUHAS) and University of Dar es salaam (UDSM). The participants, purposively selected to ensure gender balance, included institutional or departmental leaders (18), as well as individuals that were unable to participate in the FGDs (four). The discussions revolved around the participants': i) general understanding and perspectives about gender representation and inclusivity within their

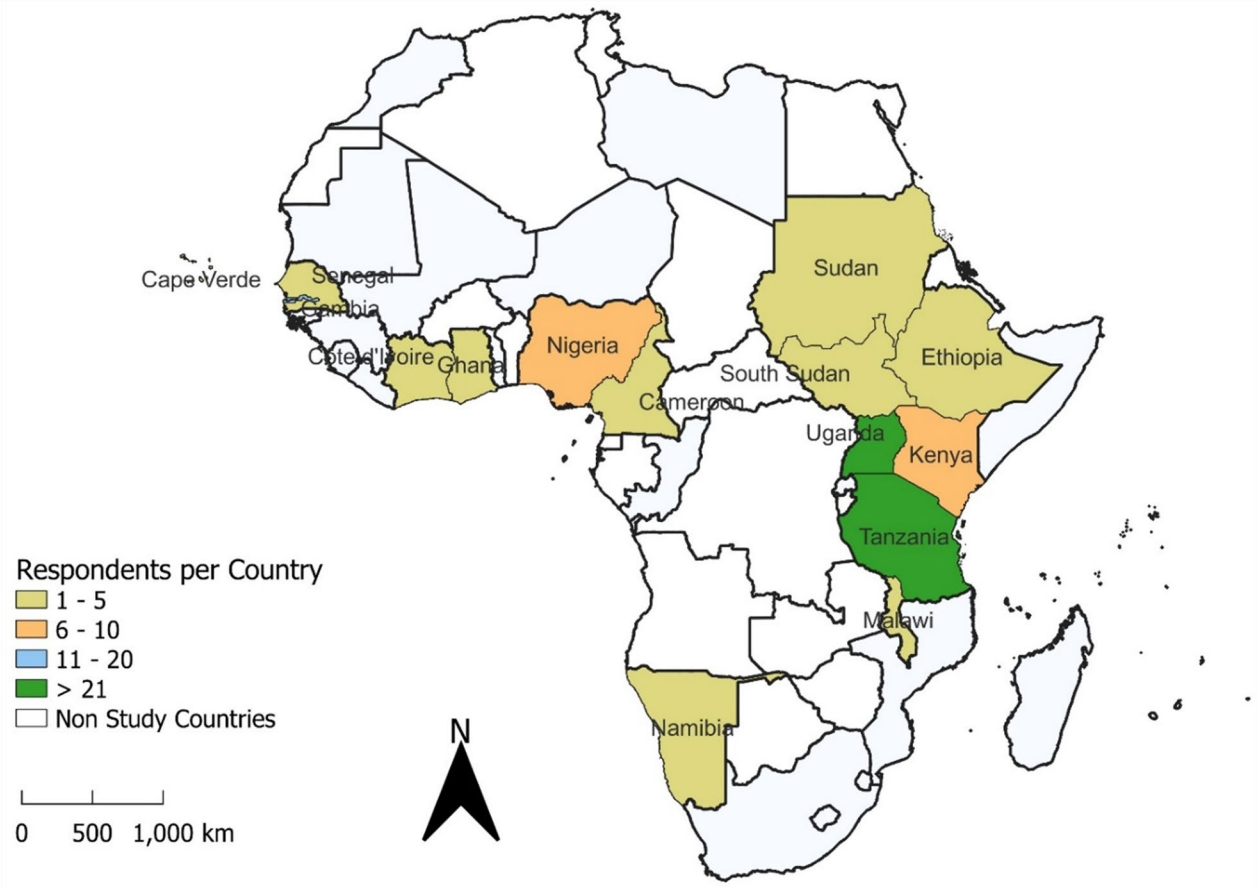

Fig. 1 Map showing countries where the study respondents to the online survey lived or worked

institutions or departments, ii) gender related experiences in terms of opportunities for advancement and career progression, leadership positions and gender-based challenges iii) perceptions regarding the role of gender specifically to vector control activities, iv) gender-related challenges faced at the institutions and during implementation of vector control activities, and v) recommendations towards gender inclusivity strategies, policies and institutional culture. The interviews lasted between 30 and 60 min. The interviews were done at participants' place of work where applicable, or virtually via Zoom for those that were not present for face-to-face interviews.

While exploring experiences with GBV in the work place, participants were asked what their definition/understanding of GBV was and the options given included the UN and the UNCHR definitions followed by questions regarding what forms of GBV they knew and if they had ever experienced any. For the participants in FGDs and IDIs we asked for their understanding of the term GBV and later defined for them the working GBV definitions for the study using the UN and UNCHR definitions and even gave them some examples and scenarios that may be applicable in the workplace and then explored further to find out if any of them had ever experienced what we had described to them.

Although quite a number of participants were interviewed (22 IDIs, 7 FGDs and 2 small group discussions), a point of saturation was not realized since the main interest of the study was to get representatives from most stakeholder groups involved in vector control. These included researchers both from academic and research institutions, students and vector control practitioners in local government. Although there were similarities between responses during data collection, a point where there was no new information being gathered was not reached. The differences could have been due to the different contexts that the interviewees were being selected from making the experiences quite different from one another and due to limited time and resources, more people could not be interviewed.

Questionnaire survey

A structured questionnaire was developed to assess respondents' views, perceptions, experiences and recommendations towards gender inclusivity, practices and policies in African institutions dealing with vector control research and implementation. The survey had five parts: i) participants' socio-demographic information like age, gender, country of origin and country of work; ii) characteristic information of participants in regards to their work in vector control, e.g. years of experience, area of expertise, whether they hold leadership position and the vector borne diseases they work on; iii) views and perceptions regarding gender inclusivity and institutional policies; iv) gender related experiences; and v) recommendations on how to improve gender inclusivity, equity and diversity in vector control. It was administered online using KoboToolbox™ software[20, 21], targeting all institutions working in vector control across Africa. The survey link was shared by email with known individuals working in vector control in different countries, who were in turn asked to share it across their local networks. The link was also shared through social media platforms such as Linkedin, X.com (formerly known as Twitter), Facebook and Whatsapp Messenger. Additionally, Pan African Malaria Control Association(PAMCA) country chapters and PAMCA Women in Vector control (WiVC) groups were asked to help circulate the survey link to respective members of each country chapter. A total of 150 men and women involved in vector control research or practice consented and responded to the survey (Table 1).

Data processing and analysis

Recordings from the in-depth interviews and focus group discussions were transcribed, and the discussions that were done in Swahili language were translated to English. All the transcriptions were done by the lead author, AP and reviewed by MFF. The transcripts were then imported to NVIVO 14 software version 14.23.0 [22] where they were coded. Deductive and inductive codes were generated following a codebook which was developed by lead author AP, reviewed by coauthor WPM and it was revised and approved by MFF; the IDI and FGD guides were used to develop the deductive codes, and inductive codes were generated through a thorough review of the transcripts. Repetitive themes were extracted and major themes supported by direct quotations from participants.

The quantitative survey data was analysed using R software version 4.2.3 [23] and Microsoft excel. Participants' perceptions were analysed using a 5-point Likert scale [24]. Descriptive analyses were used to compare between men and women responses using percentages and proportions. To test for statistical significance, the chi-square test of independence (fisher's exact) was applied to compare observations between males and females and

Table 1 Socio-demographic characteristics of survey respondents

Variable		Overall	Gender		p-value
			Female; N (%)	Male; N (%)	
Age (Years)	18–25	9 (6.0)	6 (10.2)	3 (3.3)	0.200
	26–35	65(43.3)	26 (44.1)	39 (42.9)	
	36–45	47 (31.3)	13 (22.0)	34 (37.4)	
	46–55	26 (17.3)	13 (22.0)	13 (14.3)	
	56–65	3 (2.0)	1 (1.7)	2 (2.2)	
Marital Status	Currently married	95 (63.3)	27 (45.8)	68 (74.7)	< 0.001
	Never married	43 (28.7)	26 (44.1)	17 (18.7)	
	Prefer not to say	12 (8.0)	6 (10.2)	6 (6.6)	
Highest Level of Education level	Diploma (1–2 years post-secondary)	25 (16.7)	9 (15.3)	16 (17.6)	0.600
	Bachelors	49 (32.7)	16 (27.1)	33 (36.3)	
	Masters	45 (29.3)	19 (32.2)	25 (27.5)	
	PhD	32 (21.3)	15 (25.4)	17 (18.7)	
Institution type	Academic Institution	19 (12.7)	10 (16.9)	9 (9.9)	0.075
	Government Agency	54 (36.0)	15 (25.4)	39 (42.9)	
	Non-Governmental Organization	8 (5.3)	4 (6.8)	4 (4.4)	
	Research Institution	69 (46.0)	30 (50.8)	39 (42.9)	
Ever held any leadership position	Yes	88 (58.7)	24 (40.7)	64 (70.3)	< 0.001
	No	62 (41.3)	35 (59.3)	27 (29.7)	

Significant p-value ≤ 0.05

values with a p value < = 0.05 were considered statistically significant. Continuous variables were expressed as means and categorical variables expressed as percentages. The data was triangulated by using different data collection tools to assess the same research questions i.e. FGDs, IDIs, survey. The quantitative and qualitative data were integrated in the results section through a weaving approach [25].

Results

Characteristics of study participants

A total of 150 people from 16 countries responded to the online survey (Table 1). Of these, (60.7%, n= 91) were male, (39.3%, n= 59) were female. Overall, majority of the respondents were aged 26 to 35 years (43.3%, n= 65), and nearly half were employed in research institutions (46.0%, n= 69). Nearly two thirds (63.3%, n= 95) of the respondents were married at the time of the survey, and a third (32.7%, n= 49) had attained at least a bachelor's degree.

A higher proportion of males (74.7%, n= 68) were married, compared to females (45.8%, n= 27), and a greater percentage of females (44.1%, n= 26) stated that they had never been married, compared to their male counterparts (18.7%, n= 17). Additionally, a higher percentage of females (10.2%, n= 6) did not disclose their marital status, compared to males (6.6%, n= 6) (Table 1). Gender differences were also observed in leadership roles; a higher proportion of males (70.3%, n= 64) had held leadership positions compared to female respondents (40.7%, n= 24). No gender differences were observed in age and education between male and female respondents.

Regarding participants in the qualitative discussions, altogether 31 discussions were conducted, consisting of 22 IDIs (10 women and 12 men), seven FGDs (four with men and three with women), and two small group discussions with students, one for each gender (Table 2).

Knowledge and perceptions regarding gender distribution in the institutions

When asked about gender distribution in their departments, nearly half of the survey respondents (44.7%, n= 67) reported that there were more men than women in their departments, while; (33.3%, n= 50) reported an approximately equal number of men and women. In leadership roles, over half (58.0%, n= 87) reported that more men had leadership roles in their institutions than women. These findings were similar to those of the IDIs and focus FGDs, where participants used terms like "more or less" and "ratios" such as "60/40" and "70/30" to describe the gender imbalance, with men outnumbering women. Notably, in academic institutions, gender distribution was reported to be 50/50 at the master's level but skewed towards men at the PhD level.

When asked about their insights on what may have caused the differences in the numbers of men and women, the participants listed several potential factors including low number of female students who pursue vector control related courses and the impact that society has on what careers girls usually opt for. Participants reported that many girls are usually encouraged to shy away from science subjects as they are perceived as difficult and time demanding which interferes with the time girls are supposed to dedicate to other societal responsibilities like childbirth and care giving. It was also believed by the participants that the number of female employees also reduces as they start family and childbearing. The reasons cited were that usually childbearing years coincide with career progression leading women to retain lower positions, do the bare minimum to keep their job or switch to careers that better balance family and work.

However, there were also participants who explained that it is not wise to just look at crude numbers of men and women overall, as there are tasks that are more suitable for one gender and not the other, which may be the cause for the imbalance. Particularly, 31.3% (n =47) of the survey respondents agreed that certain activities in vector control may require a specific gender due to their nature or physical demands. Some of these activities, as described in the in-depth discussion, included human landing catches, insecticide spraying in rivers for onchocerciasis control, sleeping in experimental huts to attract mosquitoes, and activities requiring overnight stays. These participants explained:

> *"Gender balance might look different in various tasks and roles in vector control but institutions should aim to achieve acceptable levels of gender representation in overall staff." (Male researcher)*.

Another leader elaborated on why the number of men and women might vary in different vector control tasks while also highlighting the importance of having a well-balanced gendered team as both bring different and unique skill sets to the team.

> *"Men are very helpful with activities that involve a lot of physical energy whereas women come in handy with activities that need extra vigilance because in*

Table 2 Participants of the qualitative component

Discussion	# of sessions	# of males	# of females
FGDs	7	4	3
IDIs	22	12	10
Small group discussions	2	1	1

most times they have an eye for details and are more thorough compared to men, so I find that having a team of both men and women is the best compared to either having a single gendered team." (Female project leader).

Moreover, 28.7% (n = 43) of the respondents agreed that health risks associated with vector-borne disease control could impact genders differently. Altogether, these factors were believed to justify the underrepresentation of women in the vector control workforce as these participants said.

"I believe that although there are limitations for involving women in vector control, if supported they can perform as well as the men for example I remember I appointed an acting coordinator after the previous coordinator was relived of her duties due to performance issues but she was 3 months pregnant at the time so I had to deal with a lot of backlash from other colleagues in the department since she required to go to the field sometimes on a motorbike but I convinced them that she is capable according to her performance and on days that she had to go to the field I assigned someone to assist her and she has never disappointed on any assignment." District leader.

"There are activities that we don't include women not necessarily because they cannot perform that task but for security reasons and ethical concerns as a way of protecting them for example you cannot allow a woman of reproductive age to be a bait in human landing catches because they are directly exposed to mosquito bites and could be pregnant which might be fatal for the mother and child in case of malaria infection. Also including women in mosquito trapping at night in remote areas can be risky as they can be assaulted or raped." Male departmental head.

Opinions varied on the perceived gender distribution differences. Some participants saw them as inevitable due to the subjects and courses required in secondary school and university respectively, noting that girls often avoid science subjects, which ultimately steers them away from science careers, as one participant elaborated.

"I remember when I was in my advanced level and I opted for science subjects, my aunt asked me why I opted to do sciences and I told her I just loved them as I admired seeing medical doctors putting on clinical coats and she said she cannot allow her daughters to take sciences. So some of the limitations start at the family level when girls are taught to shy away from sciences and lack support." Female district leader.

Similarly, the vector control practitioners, particularly the vector surveillance officers and malaria focal persons elaborated that in their courses on environmental health, there were often very few or no women at all, which has resulted in the professions being populated by men, as this officer explained:

"I remember during our time when in the class of environmental health science, there were very few women and yet this is the course where most people who end up as health officers or surveillance officers have to pursue. So the problem starts from lower levels and gets reflected at the workforce hired to do these kinds of jobs". Vector surveillance officer.

In academic institutions it was believed that the progressive increase in the number of female students to an almost 50/50 ratio of male and female students is accounted to the efforts of the government to promote education especially for the girl child and putting emphasis on encouraging female students through raising awareness, scholarships and other financial aid like student loans. It was also noted that universities encourage more girls to pursue higher education mainly science courses and ensuring gender balance in the selection process.

Participants in the in-depth discussions also noted that in some institutions, it is easier for female students than males to have a change of course after admission especially if they are changing to science courses like medicine. Universities have over the years put in place systems that prevent gender-based violence. This has been emphasized through establishing gender desks, formulation of gender policies and gender departments. This was confirmed by the presence of at least one of the three mentioned in all three academic institutions that were involved in this study.

Insights on gender inclusivity in vector control

When asked what they understood as gender inclusivity, a majority of survey respondents (78.4%, n = 105) said it was related to providing an inclusive environment for men and women to thrive, (56.0%, n = 75) said it was related to having equal opportunities for men and women, (35.1%, n = 47) reported that it was related to addressing gender barriers and stereotypes whereas (26.1%, n = 35) reported that it was related to providing more opportunities for women. Similar findings were reported during the FGDs, where several factors were associated with gender inclusivity, including equal opportunities for men and women, supporting family life balance and having gender balance in staff and leadership.

"I know that gender has been given several meanings in other parts of the world but as far as I am concerned and as far as Tanzania is concerned, gender is male and female and the different roles they do in society. In my own understanding gender inclusivity is ensuring to achieve acceptable levels of gender balance in different tasks and responsibilities and this might look different in vector control tasks as some might have more males than females while others have more females than males depending on the nature of the task." Male scientist.

Table 3 summarizes survey respondents'insights on gender inclusivity. While 41.3% (n = 62) strongly agreed that gender-specific roles enhance community engagement in vector-borne disease prevention, 8.7% (n = 13) disagreed. In-depth discussions revealed that in communities with strict gender norms, leveraging existing gender roles can improve engagement in vector control programmes. For example, involving women in home-based vector control is effective because they better understand household needs, while including husbands is crucial since they often make household decisions.

When participants were asked whether their institutions had a gender policy in place (Table 4), a little over half of the participants (53.4%, n = 80) responded yes, (9.3%, n = 14) responded no and an astonishing (37.3%, n = 56) did not know of whether their institutions had a gender policy. The knowledge gaps on institutional gender policies were however more pronounced in the in-depth discussions, most of the participants interviewed reported that their institutions did not have gender policies even in institutions who actually had a gender policy in place. Additionally, none of the participants was able to state clearly what their gender policy entails in regards to promoting gender diversity, equity and inclusion. In this regard, one of the participants had this to say;

"We don't have gender policies, and if there is, they are only written documents" Male Scientist.

On whether they viewed gender inclusivity policy as beneficial in their institutions, (43.3%, n = 65) of the respondents strongly disagreed that institutions or teams with gender inclusivity policies are less creative and innovative. The opinion that gender inclusivity had no additional benefits to the institutions or teams was however supported by some of the participants of the in-depth discussions, who believed that gender had no impact on vector control activities and that employment should be based solely on qualifications and not gender, as this scientist said:

"I do not think it is important to just employ people based on their sex whether male or female but it should be based on qualifications. Results should be taken into account. If you need a person with a certain grade or qualification, and they score highest in the job interview, it makes sense to select that person, regardless of their gender. The issue of gender inclusion may result in under performance at the Institute, meaning that you might employ people with no capabilities, but simply because you want to achieve gender balance you employ based on gender and at the end of the day they cannot deliver. In conclusion, I do not think gender inclusion is important in science as it is what you can deliver that gets you hired and not your gender" (Male scientist)

However, there were participants that expressed support for ensuring gender inclusivity, who argued that, if left to the performance alone, it might lead to further under representation of women in vector control as the pool of women to hire from is already small, if no conscious steps are taken to ensure that the hiring process is gender sensitive by recognizing that,men and women face different barriers to how they utilize opportunities like biological limitations that women face different from men that necessitate proactive gender inclusivity strategies and gender transformative environments that ensure retention of the already existing personnel working in vector control.

"I think we need to recognize that men and women are different and although the opportunities for both exist, the probability at which men and women utilize these opportunities vary given that for a woman, one has to consider a lot of things before taking on a responsibility for example consent from the husband if married, child care in case they have children, safety, pregnancy related concerns, proximity from their family which might not be the case for men. This makes men more flexible and appear more attractive for hire. Without proactive strategies to ensure gender inclusivity in hiring, retention and promotion, gender inequality might continue to systematically exist". Female project leader

When discussing challenges associated with gender inclusivity in vector control, (35.3%, n = 53) of the respondents strongly disagreed that gender inclusivity significantly increases operational costs, whereas (49.3% n = 74) strongly disagreed that gender inclusivity efforts lead to a decline in employee morale and job satisfaction. When comparing opinions by gender, significant differences emerged. More females (50.8%, n = 30) than males (29.7%, n = 27) strongly disagreed that gender inclusivity offers no tangible benefits (p = 0.024). Similarly,

Table 3 Participants insights about gender inclusivity in vector control

Variable	Overall		Gender		p-value
			Female N (%)	Male N (%)	
Gender Inclusivity	Inclusive environment	105(78.4)	42(79.2)	63 (77.8)	0.900
	Equal opportunities	75(56.0)	30(56.6)	45 (55.6)	0.700
	Addressing barriers and gender stereotypes	47(35.1)	22(41.5)	25 (30.9)	0.200
	More opportunities for women	35(26.1)	15(28.3)	20 (24.7)	0.600
	Don't know	1(0.7)	0(0.0)	1 (1.2)	0.900
Rating of statements about gender inclusivity in vector control					
Gender-specific roles can enhance community engagement for vector borne disease control	Agree	50(33.3)	18 (30.5)	32 (35.2)	0.600
	Disagree	9 (6.0)	3 (5.1)	6 (6.6)	
	Neutral	16 (10.7)	9 (15.3)	7 (7.7)	
	Strongly Agree	62 (41.3)	23 (39.0)	39 (42.9)	
	Strongly Disagree	13 (8.7)	6 (10.2)	7 (7.7)	
Teams with gender-inclusive policies are less creative and innovative compared to non-inclusive teams	Agree	15 (10.0)	6 (10.2)	9 (9.9)	0.130
	Disagree	38 (25.3)	11 (18.6)	27 (29.7	
	Neutral	21 (14.0)	7 (11.9)	14 (15.4)	
	Strongly Agree	11 (7.3)	3 (5.1)	8 (8.8)	
	Strongly Disagree	65 (43.3)	32 (54.2)	33 (36.3)	
Certain tasks in vector-borne disease control, which may require specific physical abilities, are more suited to specific genders	Agree	47 (31.3)	14 (23.7)	33 (36.3)	0.300
	Disagree	29 (19.3)	11 (18.6)	18 (19.8)	
	Neutral	23 (15.3)	10 (16.9)	13 (14.3)	
	Strongly Agree	23 (15.3)	9 (15.3)	14 (15.4)	
	Strongly Disagree	28 (18.7)	15 (25.4)	13 (14.3)	
Gender inclusivity in the workplace significantly increases the cost of operations	Agree	17 (11.3)	5 (8.5)	12 (13.2)	0.200
	Disagree	46 (30.7)	14 (23.7)	32 (35.2)	
	Neutral	22 (14.7)	11 (18.6)	11 (12.1)	
	Strongly Agree	12 (8.0)	5 (8.5)	7 (7.7)	
	Strongly Disagree	53 (35.3)	24 (40.7)	29 (31.9)	
Gender inclusivity efforts lead to a decline in overall employee morale and job satisfaction	Agree	8 (5.3)	4 (6.8)	4 (4.4)	0.400
	Disagree	43 (28.7)	15 (25.4)	28 (30.8)	
	Neutral	12 (8.0)	2 (3.4)	10 (11.0)	
	Strongly Agree	13 (8.7)	6 (10.2)	7 (7.7)	
	Strongly Disagree	74 (49.3)	32 (54.2)	42 (46.2)	
Different health risks associated with vector-borne disease control work could impact genders differently	Agree	43 (28.7)	21 (35.6)	22 (24.2)	0.400
	Disagree	27 (18.0)	8 (13.6)	19 (20.9)	
	Neutral	27 (18.0)	7 (11.9)	20 (22.0)	
	Strongly Agree	29 (19.3)	12 (20.3)	17 (18.7)	
	Strongly Disagree	24 (16.0)	11 (18.6)	13 (14.3)	
Implementing gender inclusivity in organizations results in lower quality of work	Agree	10 (6.7)	3 (5.1)	7 (7.7)	0.053
	Disagree	39 (26.0)	10 (16.9)	29 (31.9)	
	Neutral	12 (7.9)	3 (5.1)	9 (9.9)	
	Strongly Agree	8 (5.3)	2 (3.4)	6 (6.6)	
	Strongly Disagree	81 (54.0)	41 (69.5)	40 (44.0)	
Gender inclusivity in the workplace offers no tangible benefits compared to non-inclusive workplaces	Agree	19 (12.7)	7 (11.9)	12 (13.2)	0.024
	Disagree	34 (22.7)	7 (11.9)	27 (29.7)	
	Neutral	19 (12.7)	5 (8.5)	14 (15.4)	
	Strongly Agree	21 (14.0)	10 (16.9)	11 (12.1)	
	Strongly Disagree	57 (38.0)	30 (50.8)	27 (29.7)	

Table 3 (continued)

Variable	Overall		Gender		p-value
			Female N (%)	Male N (%)	
Gender inclusivity can enable unique insights in research and strategy	Agree	49 (32.7)	17 (28.8	32 (35.2	0.500
	Disagree	8 (5.3)	3 (5.1)	5 (5.5)	
	Neutral	8 (5.3)	2 (3.4)	6 (6.6)	
	Strongly Agree	73 (48.7)	34 (57.6)	39 (42.9)	
	Strongly Disagree	12 (8.0)	3 (5.1)	9 (9.9)	
Gender inclusivity policies create a more hostile and divided workplace environment	Agree	15 (10.0)	7 (11.9)	8 (8.8)	0.015
	Disagree	40 (26.7)	7 (11.9)	33 (36.3)	
	Neutral	17 (11.3)	7 (11.9)	10 (11.0)	
	Strongly Agree	16 (10.7)	6 (10.2)	10 (11.0)	
	Strongly Disagree	62 (41.3)	32 (54.2)	30 (33.0)	
Targeting employment opportunities towards under-represented genders in regions with gender inequality is a strategy for socio-economic empowerment	Agree	42 (28.0)	17 (28.8)	25 (27.5)	0.081
	Disagree	15 (10.0)	3 (5.1)	12 (13.2)	
	Neutral	28 (18.7)	7 (11.9)	21 (23.1)	
	Strongly Agree	54 (36.0)	28 (47.5)	26 (28.6)	
	Strongly Disagree	11 (7.3)	4 (6.8)	7 (7.7)	
Gender inclusivity enables understanding how vector-borne diseases affect different genders	Agree	43 (28.7)	11 (18.6)	32 (35.2)	0.006
	Disagree	14 (9.3)	1 (1.7)	13 (14.3)	
	Neutral	17 (11.3)	9 (15.3)	8 (8.8)	
	Strongly Agree	58 (38.7)	29 (49.2)	29 (31.9)	
	Strongly Disagree	18 (12.0)	9 (15.3)	9 (9.9)	

Table 4 Institutional gender policy and accessibility

Variable		Overall	Gender		p-value
			Female; N (%)	Male; N (%)	
Gender policy available	Yes	80 (53.4)	28 (47.5)	52 (57.1)	0.500
	No	14 (9.3)	6 (10.2)	8 (8.8)	
	I don't know	56 (37.3)	25 (42.4)	31 (34.1)	
Key areas the policy covers	Equal opportunity	66 (82.5)	21 (75.0)	45 (86.5)	0.200
	Institutional commitment	47 (58.8)	15 (53.6)	32 (61.5)	0.500
	Work life balance	28 (35.0)	8 (28.6)	20 (38.5)	0.600
	Do not know	2 (2.5)	2 (7.1)	0 (0.0)	0.140
Policy accessible	Yes	58 (72.5)	20 (71.4)	38 (73.0)	0.600
	No	10 (12.5)	3 (10.7)	7 (13.7)	
	Do not know	12 (15.0)	5 (17.9)	7 (13.5)	

more females (54.2%, n = 32) than males (33.0%, n = 30) strongly disagreed that gender inclusivity policies create a more hostile and divided workplace environment (p = 0.015) (Table 3). Moreover, more females (69.5%, n = 41) than males (44.0%, n = 40) strongly disagreed that gender inclusivity results in lower work quality (p = 0.053). Additionally, more females (49.2%, n = 29) than males (31.9%, n = 29) strongly agreed that gender inclusivity enables understanding how vector-borne diseases affect different genders (Table 3).

Participants of the in-depth discussions also highlighted the role that cultural norms and beliefs play especially in the inclusion of women in field activities that might require spending a large amount of time from their home or require overnight stays. Both male and female participants agreed that such activities are mostly male

dominated, as they do not offer the flexibility for women to return to their homes at the end of the day to fulfill their domestic responsibilities, such as childcare and preparing meals for the family. Moreover, the participants discussed that overnight stay is not culturally acceptable for women especially if they are working with men who are not their husbands, as this participant elaborated:

> *"In most of the African cultures, males are superior to females, so sometimes even if you want to include a married woman to participate in field activities, her husband may not allow her to work overnight collecting mosquitoes while he is left in the house alone." Male field team leader*

Gender-related experiences of men and women in vector control

Table 5 summarizes the key gender-related experiences of men and women in vector control, highlighting both positive aspects and challenges faced by each gender. Clear differences in experiences were observed between male and female participants of both the survey and the in-depth discussions. While most men mostly expressed positive experiences working with women, the same was not observed among women working with men.

In detailing their experiences, a majority of the men highlighted the unique insights women bring to vector-borne disease control. They noted that women, being predominantly home keepers in many African cultures, might have a better understanding of what works in the implementation of home-based vector control strategies. These are some quotations from male participants praising women saying:

> *"Working with women is great especially on issues to do with community engagement, women are more equipped than us men in handling such situations of explaining concepts of the intended activity to the community and since they know most of what happens in the home, people believe in them. In addition, women are very diligent and honest people, when given a task they usually give their best and deliver results. In fact, most of the best performing people on my team are women." Male district medical officer.*
>
> *Another leader added "women are more truthful and dedicated to the job compared to men, for example when we send people to the field like for habitat sampling or mosquito collection, it is rare that you find women fabricating data of samples from one site to another site but men might not even go to the allocated site but get a nearer village and collect mosquitoes there and locate them to a different village or they may work less days than the actual days which women do not do." Male NMCP-TZ representative.*

Table 5 Gender-related experiences of men and women in vector control, highlighting both positive aspects and challenges faced by each gender

Gender-Related Experiences	Males	Females
Gender-Based Violence (GBV) Incidence	44.4% reported experiencing sexual harassment	57.1% reported experiencing sexual harassment
Positive Work Experiences	Appreciated women's insights on certain vector control strategies, especially those deployed within homes	Recognized for their unique insights and reported to have an eye for detail and are more vigilant than men
Challenges with Gender Inclusivity	Believed it can be a barrier in strenuous activities Believed it might not be applicable in some activities due to health risks to women than men	Often faced cultural norms limiting fieldwork; especially "away-from-home" field work Often excluded from filed activities due to unfavourable working environment, security concerns and increased health risks or the belief they are weaker than men
Reporting Sexual Harassment	Reluctant to report due to societal views on masculinity	More likely to face and report harassment
Work-Life Balance Struggles	Less mentioned	Struggle to balance family and work commitments
Societal and Cultural Barriers	Rarely mentioned	Often cited as barriers to career advancement
Impact of Short-Term Contracts	Less mentioned	Pressure to avoid pregnancy and family responsibilities
Line Manager Gender	22% had opposite-gender managers	67.8% had opposite-gender managers
Work Environment Quality	Believed the gender of manager had a neutral effect	Felt positive impact from having female managers
Team Member Preferences	Some prefer men to avoid cultural issues with husbands	Some prefer balanced teams or female leaders for support
Perception on female leaders	Mixed views on female leadership	Value female leaders for relatability and support

However, the men also cited experiences where gender inclusivity could be a barrier to executing their work. For instance, they noted that field entomology involves several strenuous activities, long hours away from home, and hard labour, which they felt placed them at a disadvantage as they often had to slow down to accommodate the women on the team. Additionally, they had to deal with "jealous" husbands who did not want their wives working outside the home, and sometimes, this inclusivity became an added expense to the project because of the several modifications needed to make the women on the team comfortable, as this participant explained:

> *"Most field activities are in remote areas and require one to know how to ride a motorcycle to access the sites but most women do not know how to ride and some are not interested so usually when we have such activities where we have women on the team, sometimes you are forced to get a car to take the team but that comes with an added cost. Also in instances where work is in areas with no amenities like clean water and safe housing, if its men alone, they can even sleep in a tent and continue work the next day but when there is a woman on the team, you have to look for where there is safe lodging and some clean water for personal hygiene and then go back to the field the next day." Male field team leader.*

A majority of women, on the other hand, reported that generally they believed there were equal opportunities for employment and advancement for both men and women, however the differences were brought by the different roles that women and men have in their societies, and the work conditions which sometimes favour men than women, as this participant explained:

> *"It is not that we do not want to get involved in field entomology work or that we are not capable but sometimes the field conditions are unfavorable for a woman to work comfortably in the field. Some sites are too remote there is no clean water for bathing, no facilities that offer privacy for changing and sleeping arrangements. Sometimes I would swallow birth control pills to delay my menstruation so that I do not get my period on field days." (Female researcher)*

The women further explained that societal gender roles can be a barrier to how men and women exploit opportunities presented to them, with more women choosing options that will enable them a balance between their families and work or having to choose between one or the either, as this participant said:

> *"It is hard as a woman especially when you have a family to take up some activities for example I have had to give up some opportunities of professional trainings and further studies that out of the country because my children are still very little and they are still depending on me. Even field activities, you can be excluded because the supervisor knows as a woman you have a lot of other things that depend on you at home while for men its easier even if he is called in to the office at any time he will just pack a small bag and leave which is not the same for us women as we have to put a lot of things in order before we can leave which sometimes includes seeking approval from your husband". Female scientist.*

Women also reported the struggle of choosing between family and work or finding a balance. Women who had families were often forced to choose family, and those who were single were left in fear to start a family for fear of career breaks. Women reported having less time to concentrate on writing grant proposals, work related travel, and further studies, as this participant explained:

> *"We cannot ignore that men and women have some differences, even though we try, and we work equally with them. A simple example; if we leave work right now, you and I go home to continue with chores, but a man goes home and relaxes. When a woman gets home, she doesn't relax. She checks the child's homework, irons the children's clothes, prepares clothes for the husband, prepares food for the family, ensures everyone has eaten, and many other things. So, sometimes we might think that women lag behind men, but sometimes it is due to the environment." Female scientist.*

Differences were noted between the experiences of participants employed under short-term project contracts and those with permanent government contracts. Short-term contract employees often reported low job security, with contract durations ranging from three months to one year. Women on short-term contracts faced overwhelming pressure to always perform at their best, fearing that pregnancy would make them be perceived as liabilities and extra expenses due to the need for 90 days of maternity leave or the necessity of returning to work early, compromising their recovery and the baby's wellbeing. This a quotation from one female scientist who had to make the difficult choice between maintaining their job and wellbeing, as well as that of their baby:

> *"I had to leave my baby behind and go to the field but by the time I came back after 2 weeks the child no longer wanted to breastfeed. And by that time, the child had not even reached six months." (Female researcher)*

Cultural barriers and norms also hindered women from taking up opportunities, as some jobs are seen as culturally inappropriate for women, especially those involving night work, carrying heavy equipment, and staying away from home. Women reported higher instances of sexual harassment and discrimination and noted unequal representation in positions of power and influence.

Reported experiences with gender-based violence in the workplace

While most respondents (78.7%, n= 118) reported having never experienced gender-based violence (GBV), a total of 23 (15.3%) survey respondents reported experiencing it (Table 6). Of these, (34.8%, n= 8) experienced gender discrimination, (52.2%, n= 12) experienced sexual harassment, (39.1%, n= 9) gender-based bullying, and (43.5%, n= 10) experienced denial of opportunities due to their gender. Of those that had experienced GBV, (73.9%, n= 17) did not report the incidents to their superiors. Major reasons given for not reporting included lack of knowledge of where to report to, fear of losing their job, the shame they felt that it happened, mistrust of the justice system, some gave in whereas others did not have sufficient evidence of the claim. Of the 12 respondents that experienced sexual harassment, (57.1%, n= 8) were women and (44.4%, n= 4) were men. Significant gender differences (p =0.043) were observed between men and women who selected did not know where to report to as a reason for not reporting GBV cases, with all these being women (54.5%, n= 6).

Many female-participants of in-depth discussions also reported experiencing sexual harassment from their male colleagues and supervisors. The majority of these were verbal, gestures, suggestive sexual messages and physical sexual abuse. Female participants expressed the need for institutions to define clearly sexual harassment as it is such an ambiguous term that even when it happens it is hard to tell when it crossed from being friendly to harassment. They also expressed how lack of reporting procedures and support for sexual harassment victims prevent people from reporting such cases as they noted that even when one reports the case, they are instead questioned what they were wearing, how they behaved around the perpetrator which makes the victims feel judged instead of helped. These participants had this to say:

> *"Personally I have faced sexual harassment, there is a work colleague whom we became friends and he could even visit my home, but then I did not understand how it graduated from being friends to one time almost forcing himself on me but I could not even report or tell anyone because first I blamed myself thinking of what I may have done to make him think that's what I wanted. Another reason is*

Table 6 Respondents' reported experiences with gender based violence in the workplace

Variable		Overall	Gender		p-value
			Female; N (%)	Male; N (%)	
Reported Ever experienced GBV	Yes	23 (15.3)	14 (23.7)	9 (9.9)	0.071
	No	118 (78.7)	41 (69.5)	77 (84.6)	
	I don't know	9 (6.0)	4 (6.8)	5 (5.5)	
Reported Forms of GBV experienced (N = 23)	Gender based discrimination	8 (34.8)	5 (35.7)	3 (33.3)	> 0.900
	Sexual harassment	12 (52.2)	8 (57.1)	4 (44.4)	0.700
	Gender based bullying	9 (39.1)	5 (35.7)	4 (44.4)	> 0.900
	Denial of opportunities	10 (43.5)	6 (42.9)	4 (44.4)	> 0.900
Ever reported incidence	Yes	4 (17.4)	2 (14.3)	2 (22.2)	0.800
	No	17 (73.9)	11 (78.6)	6 (66.7)	
	Prefer not to say	2 (8.7)	1 (7.1)	1 (11.1)	
Why the incident was not reported (N = 17)	Self-blame	2 (11.8)	1 (9.1)	1 (16.7)	> 0.900
	Did not know where to report	6 (35.3)	6 (54.5)	0 (0.0)	0.043
	I gave in	1 (5.9)	0 (0.0)	1 (16.7)	0.400
	Feared to lose my job	4 (23.5)	3 (27.3)	1 (16.7)	> 0.900
	Presumed unfair justice	6 (35.3)	5 (45.5)	1 (16.7)	0.300
	Had insufficient evidence	1 (5.9)	1 (9.1)	0 (0.0)	> 0.900
	Stigma and shame	1 (5.9)	1 (9.1)	0 (0.0)	> 0.900
	Just left the job	1 (5.9)	1 (9.1)	0 (0.0)	> 0.900
	Did not take it seriously	3 (17.6)	1 (9.1)	2 (33.3)	0.500

that we were very close friends so even if I told someone, they could easily say I am the one who tempted him." Female scientist.

"I think the biggest problem is that there is no clear definition of sexual harassment, where do we draw the line, there is no pathway to report in case one is harassed, there is no training on what to do in case you been harassed and then also our cultures at times often tend to blame harassed women so I think most people are forced to keep quiet about it." Female scientist.

A majority of the participants in in-depth discussions were unaware of any sexual harassment policies or reporting guidelines in their institutions, where as the ones who were aware did not trust that they were fair. For example, many of them assumed that one would report to human resource or line manager in case they are in such a situation, however this line of reporting was queried by participants themselves that what happens if the very person you are supposed to report to is the one who is sexually harassing you. In such circumstances, participants expressed that one might be forced to either leave the job or put up with the harassment.

The men, on the other hand, reported feeling that there were double standards in handling sexual harassment claims, which they believed tended to favour women over men. They shared instances of false accusations from women who did not want to work. The societal status quo, which portrays masculinity as strong, prohibits men from reporting sexual harassment claims, as it is frowned upon as a sign of weakness and not 'manly'. Therefore, even the few men who had experienced sexual harassment said they would never report it, as this participant reported:

"In most of our African cultures and societies, males are raised to be strong and fierce while women are portrayed as the weaker sex and in need of protection from men therefore even when as a man you face some challenge like sexual harassment, most of us will just keep quiet and put up with it and if the worst comes to the worst you just leave the job. It is very hard for a man to talk about such a thing or better yet report it because even when you tell your fellow men that a woman harassed me they would just laugh at you". Male scientist

Gender and leadership

More women (67.8%, n = 40) than men (22%, n = 20) reported having opposite-gender line managers, and about a half of the survey participants believed that the gender of their line manager positively affected the work environment (50.7%, n = 76) while (44%, n = 66) believed the gender of their line manager had a neutral effect on their work environment. When asked about their gender-preferences for supervisors, 5.1% (n = 3) of women preferred same gender, 13.6% (n = 8) preferred opposite gender, and 76.3% (n = 45) had no preferences. On the other hand, 6.6% (n = 6) of the men preferred supervisors of the same gender, 3.3% (n = 3) preferred opposite gender and 90.1% (n = 82) had no preferences. In discussing this further, many of the FGD participants expressed no preference for supervisors, although some women felt that having a female line manager was relatable and encouraging. These women also noted that female leaders could better address issues specific to women and provide valuable support.

"It is important for women to be in leadership positions in vector control because sometimes a man can't relate to struggles or things that maybe younger women are experiencing, so I think having a female leader is more advantageous to a lady than it is when it's a man. In the sense that there are certain struggles you feel more comfortable sharing or be open with a female leader, for example if I cannot come to work today because I have period pain, it's a genuine reason but you are going to lie and create something else, when it's something that you can be open about. So, I feel like having a woman in leadership is much more comfortable environment than it is when it's a man, I think the pros out way the cons." (Female scientist).

However, there were female participants who felt that having women as supervisors could also be restricting for younger women to advance. These participants explained that sometimes, since leadership opportunities are so scarce for women, women that are already in these positions develop fear that other women may be up to grab their positions, and as a result, may act hostile towards them. In this regard, these women expressed that they preferred having male supervisors as this participant explained:

"When we had just joined the institute, I remember women were very few and I and my other fellow woman whom we joined together were younger than the women we found at the institution but the women whom we had thought would be the ones to support us since they have been in our shoes before and know how it feels, they were instead the same people who alienated us, accused us of wanting to steal their husbands and told us to put up with several injustices because that's just how life is in the name of you have to develop tough skin. So I think in

our field being that women are already few, we can sometimes get a little too competitive and sometimes insecure that the new people might replace us which might bring about a strained relationship. This is why I would prefer a male supervisor to a female one." Female research scientist.

There were conflicting views, however, when respondents were asked about which gender they preferred as team members. Some participants reported they had no preference as long as the person is qualified, others said they preferred a gender-balanced team while some preferred either men or women alone. Some of these gender preferences stemmed from the belief of what men and women can or cannot do.

"One of the problems I have faced working with women is their husbands needing to get communications to make sure that when they say they are somewhere they are actually there, those are cultural issues but they matter when it comes to working with women for example a husband to one of the women we had hired called me one day that I want you to fire my wife because the only thing keeping her far from me is because you have given her a job and she can earn her own money, as a scientist you have many things to do and you still have to deal with peoples husbands and deal with their problems, when it comes to that, you think it is better to have men in my team and the problem will be over". Male field team leader

Participants' suggested recommendations for achieving gender inclusivity

Some of the major recommendations provided for achieving gender inclusivity included provision of gender-sensitive facilities and structures, mentorship programmes and overall changes in societal gender-related norms. Regarding the gender norms, the participants recommended a comprehensive approach, starting with systemic changes at the family level and extending to the formulation and implementation of policies and gender strategies that promote equitable environments, as this participant said:

"I think all systems start from the family level, we should start with ourselves and what we teach our children, boys and girls should be taught that they both can do the same things, house work does not have to be for only girls while the boys are seated, that way when they grow, it will not come as a shock when both have to work and take care of home responsibilities in their homes." (Female post-graduate student).

They also recommended institutions to provide gender-responsive facilities and structures that cater to the needs of both men and women. For women, there were recommendations for establishment of family rooms where mothers can comfortably breastfeed their babies while balancing work responsibilities. Additionally, there was a call for more flexible working hours to accommodate the needs of women with small children, enabling them to manage both work and caregiving effectively. As for men, participants recommended extending paternity leave from 7 days to at least 14 days to encourage greater involvement of fathers in early childcare responsibilities. Flexible working hours were also recommended for fathers of small children, allowing them to actively participate in domestic responsibilities and caregiving duties at home, as this participant explained:

"It would be helpful if paternity leave would be extended from 7 days to at least 14 days and also allowed flexible working schedules in the first three months of our child's life so that we can be able to also bond with the child and also help out our women who have given birth." (Male team leader).

Additionally, mentorship programmes were recommended for staff to foster continuous professional development. These programmes would pair experienced professionals with mentees, providing guidance, support, and opportunities for skill development and career advancement. Regarding gender-based violence reports, participants recommended independent bodies from the institutions to handle sexual harassment and any other gender based violence claims, as this participant said:

"I think it would be good to have an independent body that is not affiliated to the institution that can receive and investigate sexual harassment claims. That counters the fear to be discovered if the person harassing me is my boss and he is the same one I have to report to." (Female researcher).

Discussion

To the best of our knowledge this is the first cross country study in Africa to investigate how gender intersects with other factors on a personal and institutional level to shape experiences, and perceptions of inclusivity among men and women working in vector control in African Institutions. Participants in this study included individuals from academic and research institutions, local government vector control personnel, and implementing partners. This diverse group provided a comprehensive view of the challenges and opportunities related to gender inclusivity in vector control. Their vast experiences and knowledge, as well as their opinions on gender

dynamics and valuable recommendations, offer critical insights for integrating gender considerations into vector control strategies. While previous research has highlighted the importance of addressing cultural norms and structural barriers to enhance gender equity in this field, this current study was designed explicitly to understand differences in perspectives of male and female practitioners working in Africa, and to use the evidence for informing future strategies towards achieving gender equity.

It was recognized that significant improvements have been made in the last few years from the in-depth discussions with study participants, with 2017 being commonly cited as a significant year when the gender outlook started changing. This shift was attributed to combined efforts, which might include but not limited to institutional and national policies and initiatives. Funders have also increasingly required gender-sensitive grant proposals. Despite progress, gender disparity remains pronounced in leadership roles, with men predominantly holding top positions. These findings align with studies from other countries, such as the United States, where entomology remains male-dominated, despite increased gender balance among students and early-career scientists [26].

Overall, the study revealed significant gender disparities in leadership within vector control and highlighted the impact of cultural and societal norms on gender dynamics in vector control, for example, over two thirds of men and only 40.7% of women had previously held any leadership roles at any levels. These dynamics are not unique to vector control, and certainly not in Africa. [27–29].

The findings also revealed that marriage was a greater hindrance to women than men in career advancements, as married women were less represented compared to men. This is likely due to traditional gender roles that compel a woman to stay at home to take care of the family once she is married, limiting chances of career advancements. As a result, women are more likely to delay marriage or starting families until they have advanced their career. These patterns are also observed across the world, as the proportion of women in workforce continues to raise, and age at first marriage also continues to increase[30–32].

Cultural norms and family responsibilities were identified as the major barriers for women in advancing in their career in vector control, especially in participating in overnight field activities or activities that require traveling. Some of the reasons provided by the participants included traditional gender roles and societal expectations for women to manage household duties, motherhood responsibilities, unsupportive environment in the field and higher safety risks for women working at night. These expectations are further exacerbated when one is married and with children. This leaves women with little time to engage in activities that might benefit their career advancement like grant proposal writing, attending conferences and exchange fellowships. These findings align with other studies that describe the struggle to balance work and life, often referred to as the "glass ball" (family) and "rubber ball" (career), where one aspect typically suffers at the expense of the other [4, 33, 34].

This study revealed knowledge gaps in institutional gender policies as a good number of study participants were not aware whether their institution had a gender policy in place. This study did not investigate any relationship between presence of a gender policy and its effect of gender distribution in the institution, although there has been previous research in Kenya that reported absence of correlation between presence of gender policy and improvement in gender equity/equality [35]. On the contrary, another study in Equatorial Guinea reported that promotion of gender policies resulted in increased hiring of women in supervisory roles in an IRS programme [15].

Societal norms and expectations significantly influence how men and women engage in workplace opportunities, as evident in this analysis of vector control programmes. Participants noted that involving women from patriarchal societies in Tanzania might be challenging because these communities expect women to stay home and care for children while men work outside. As an example, it was commonly noted by participants that overnight fieldwork is culturally inappropriate for women, making it difficult for them to participate in activities like nighttime mosquito collection or early morning trap retrieval, which conflict with their household responsibilities and community norms. Similar findings have also been reported in other studies as a barrier to women involvement in vector control [19, 36]. Moreover, the intersectionality theory explains how gender interacts with institutions and structures in society to privilege certain groups over others, and to maintain power. The intersections of gender with other dimensions of social identity (at the micro level of the household and community, as well as the individual or 'self') connected systems and structures of power in institutions at the meso-level (e.g. state laws, policies, bureaucracies, religious institutions, media) together are forms of privilege and oppression shaped by macro-level historical forces such as colonialism, imperialism, racism, homophobia, ableism and patriarchy are created [37].

Approximately 15% reported that they had experienced at least one form of GBV, with more women reporting experiences with sexual harassment. Most of these cases were also never reported. While this proportion may

seem small overall, when selecting for gender, this was 23.7% of all women that participated in the survey. This study's findings are similar to other studies where women reported experiences of GBV including sexual harassment more than men [38–40].

Some of the reasons for not reporting GBV provided included lack of knowledge of where or whom to report to, fear to lose a job and loss of trust in the justice system as sometimes the perpetrators are at the same time the very people one should report to incase they are harassed and the believe that GBV cases are not treated seriously but rather most times query the integrity and decency of the victim. These reasons given are similar to those given in other studies where sexual harassment cases were not reported either due to fear of retaliation, lack of trust in the system to respond and lack of clarity on what counts as harassment and confusion of the reporting process[39–41]. Participants who had never encountered this problem were asked whether they could report it in case it happened, majority said they would never report it. In many cases, women were afraid of their character being scrutinized once they report where as men opted to keep quiet due to cultural expectations on masculinity. This could be due to lack sexual harassment policies or poor implementation of the existing ones.

Men on the other hand reported being victims of false accusations of sexual harassment from women who didn't perform to expectation but use the weakness of most gender policies and societal perception that favour women over men when it comes to gender violence claims. It is widely perceived by society that women are the weaker gender compared to men so when it comes to gender-based violence claims, the system is mostly biased towards women protection than men. This societal belief forces men who experience violence, extortion or harassment to not report it because it is perceived as a sign of weakness and not "manly". This finding brings new insights to understanding experiences of both men and women as most previous studies have focused on experiences of women as a homogenous group [42].

A majority of the survey respondents reported to have no gender preferences whom to hire for vector control jobs whereas when asked if they believed that some jobs are more suited for either men or women, there were conflicting ideas with some agreeing that jobs that required more physical energy like carrying heavy equipment and walking long distances searching for habitats are more suited for men while women were more suited for tasks that required extra caution like laboratory work and were more equipped to handle community engagement than men due to their ability to engage and relate with communities. Leaders also reported that women were more truthful and dedicated to the job compared to men therefore they are usually placed in positions that require record keeping which could be the reason why most secretaries and project administrators are women due to the perception that women are better at organizing and record keeping than men. This however can be a stereotype in itself and not necessarily a fact because it keeps women in positions which are immobile while men are placed in positions that are mobile which aligns with the societal norms and expectations of women not being expected to travel away from their homes.

Overall, vector control as a field also presents certain tasks where women are exempted on the basis of ethics for example pregnant women are exempted from taking part in indoor residual spraying activity because of exposure to chemicals, women of reproductive age are exempted from taking part in human landing catches where the individual is exposed to mosquito bites which could be a risk for infection to malaria which is detrimental in case one falls pregnant. Other activities like sleeping under experimental huts, mosquito trapping in the night could also be more biased towards men for security reasons or cultural appropriateness for women involvement.

Limitations of the study

Whereas this study achieved all its stated objectives, there were also some important limitations. For instance, the in-depth interviews were only done in Tanzania so the researchers acknowledge that they might not be comparable to the responses of survey participants from other African countries that responded. Second, the attained sample size of the expanded online survey was only 150, so the findings might not be generalizable to the whole field of vector control but besides the limitations. It might however be stated that since vector control experts are not too many in Africa, reaching 150 of them might be a reasonable sample size [43]. Overall, this study still produced valuable insights into the experiences and perceptions of men and women working in vector control towards gender inclusivity and what can be done to have equitable environments for men and women in vector control work.

Conclusions

This study revealed significant gender disparities in staffing and leadership roles within vector control, with men predominantly occupying these positions. While the benefits of gender inclusivity were widely acknowledged, both men and women noted the impact of some gender biases, cultural norms and societal expectations that hinder women's participation in field activities and their ability to balance family responsibilities with career advancement. To enhance the effectiveness and

sustainability of vector control programmes, it is crucial to incorporate an appropriate gender lens that addresses these barriers while also considering the diverse perspectives and experiences of both male and female practitioners. This analysis provides insights into individual, social, cultural, and institutional factors, and could guide stakeholders in developing strategies that promote equitable work environments in vector control.

The study also reveals that gender might not in itself result in inequities in the work place but it intersects with other factors at a personal, institutional, societal levels to influence how men and women perceive and utilize opportunities or barriers to progression. Gender also intersects with several factors to shape experiences of men and women in the workplace. This could lead to the belief that one gender is privileged over the other. This shows us that simply looking at the difference in number of men to women in the work place is not enough but to look beyond these gender differences to the factors that perpetuate this differences and design policies, strategies and action plans to counter them at all levels.

Although this study assessed whether there were gender policies in the participating institutions, it did not go as far as reviewing any available policies/laws in the participating countries or institutions but rather focused more on experiences and perspectives on barriers and opportunities to achieving gender inclusivity in vector control. Future research that evaluates how existing policies and laws regarding gender equality, sexual violence and harassment in the workplace may help/hinder change and advocacy for change are recommended.

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Author contributions
AP was involved in the idea conceptualization, study design, data collection. Entry, cleaning, analysis, interpretation of results and writing of the manuscript. MFF FOO and DMM were involved in idea conception, study design, supervision and critical revision of the manuscript. RMB was involved in developing data collection tools, quantitative analysis and developing the study map. BJM was involved in mapping institutions involved in vector control in Tanzania. WPM was involved in revision of data collection tools and data collection. All authors have read and approved the final manuscript.

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Availability of data and materials
All the data for this study is available upon request.

Declarations

Ethics approval and consent to participate
Ethical consideration was sought prior to the field work, ethical approval was sought from the Ifakara Health Institutional Review Board (IRB) reference number (IHI/IRB/no:31-2023) National Institute for Medical Research reference number (NIMR/HQ/R.8a/Vol. IX/3560) and granted permission reference number (BA. 126/329/01/55) and PORALG for NMCP and local government participation. Permission to publish was sought from National Institute for Medical Research (NIMR) and was granted Ref No. BD.242/437/01 C/46.

Competing interests
The authors declare no competing interests.

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