

Exploring the Role of Social Networks in Lymphatic Filariasis Mass Drug Administration Participation in Ghanaian Communities

Dominic Dormenyo Gadeka

dgadeka@ug.edu.gh

University of Ghana

Jeffrey Gabriel Sumbah

Noguchi Memorial Institute for Medical Research, University of Ghana

Kojo Mensah Sedzro

Noguchi Memorial Institute for Medical Research, University of Ghana

Collins S. Ahorlu

Noguchi Memorial Institute for Medical Research, University of Ghana

Dziedzom K. de Souza

Noguchi Memorial Institute for Medical Research, University of Ghana

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Abstract

Background

Community social networks have been shown to significantly influence health outcomes. However, the potential impact of social networks on Lymphatic Filariasis (LF) Mass Drug Administration (MDA) programmes in endemic communities has not been extensively explored. This study examines the roles that social networks play in MDA participation within four LF-endemic communities in Ghana, with a particular focus on the nature and patterns of relationships.

Methods

This was a cross-sectional study using social network analysis methodology. Data were collected from community members aged 18 and above using a pre-tested closed-ended social network questionnaire. To assess the influence of social networks on MDA participation, data were collected on friendship networks and knowledge of LF and MDA compliance. The data were analysed using Gephi software version 0.9.2.

Results

Of 288 survey respondents, only 53.5% received medication during the most recent MDA treatment round, whereas 25% reported never having ingested the MDA drug in the last three rounds. The analysis revealed that the Mempeasem and Asemda communities exhibited relatively denser friendship networks, while the Azani and Abasi communities were comparatively isolated. The findings showed that the most prominent respondents in the Azani and Abasi communities did not receive any MDA drugs during the last three rounds. Interaction patterns revealed that respondents who did not receive any drugs primarily interacted with each other. Additionally, the results indicated that women and individuals with lower or no education levels who did not receive the MDA drug tended to interact more among themselves.

Conclusion

The analysis highlights friendship networks with limited involvement of prominent community members in MDA programmes and the interactions of non-MDA drug recipients among themselves, which negatively impact the MDA treatment compliance. The analysis highlights ways to enhance the effectiveness of the MDA programme through social networks.

Introduction

Lymphatic filariasis (LF), a debilitating mosquito-borne parasitic disease, continues to plague tropical and subtropical regions, including Ghana [1–3]. Despite significant progress towards elimination, pockets of persistent transmission remain a cause for concern [4]. Ghana, like many endemic countries, has implemented Mass Drug Administration (MDA) programmes as the cornerstone of its LF elimination strategy in consonance with the Global Programme to Eliminate Lymphatic Filariasis (GPELF). However, the success of MDA in eliminating transmission hinges on achieving high treatment coverage [5–7]. Unfortunately, high coverage does not necessarily lead to high compliance [8]. The consequence of these shortfalls is evident in the persistent microfilariae prevalence among non-compliant populations [9].

Recent studies in Ghana show microfilariae presence revealing continued LF prevalence despite years of MDA campaigns [7, 10, 11]. A study by Manyeh and others (2020) found coverage of 82.9% and 89.3% in the Bole and Central Gonja districts, respectively, yet persistent transmission remained due to factors including refusal to ingest the MDA drug, adverse reactions and community misconceptions about the drug [12]. The persistent transmission suggests the presence of individuals who seldom or never takes part in MDA. These individuals are categorized into two groups: those who missed treatment because they were unavailable during the treatment campaign, and those who refused treatment [13, 14]. Thus, understanding the factors contributing to non-treatment is crucial for achieving LF elimination and ensuring healthier communities.

Social networks, the intricate web of relationships that bind individuals together, play a pivotal role in shaping health behaviors. People are more likely to adopt behaviors practiced by their close social circles, creating a ripple effect that can influence entire communities [15–17]. Katarwa et al. [18] alluded to this by using the kinship system, where treatment coverage for onchocerciasis was significantly associated with bloodline compared to the classical Community Directed Treatment system (CDT) [18]. Additionally, the closeness of family kinship systems to others was found to influence better healthcare-seeking behavior, particularly in typical rural areas [19].

The continuous interaction of individuals within a community ensures the unending passage of information and subsequently influences behaviors. The performance level of the starting point of the pieces of information is said to achieve the greatest reach. For instance, Community Medicine Distributors (CMD) in 17 villages in Uganda recorded an accelerated treatment coverage due to the close-knit friendships they had with their community members [20]. Further, greater compliance was linked to the direct trust in CMDs for health guidance [21]. In the context of LF elimination, the reliance on MDA for elimination would demand strong social networks that actively support and promote MDA participation and significantly improve program effectiveness. Conversely, social networks riddled with individuals refusing treatment can create a barrier to achieving high coverage [22].

In this study, we aimed to assess the influence of social networks on MDA participation in four endemic communities in the Western Region of Ghana: Abase, Azani, Asemda and Mempeasem. The Asemda and Mempeasem communities are located in the Ellembelle district, while Azani and Abase are in the

Ahanta West district. The Ahanta West district received 19 rounds of MDA, while the Ellembelle district received 18 rounds. MDA has been administered in Ghana since 2001 to individuals 5 years and above [7]. Previous assessments of the antigen prevalence of Lymphatic Filariasis (LF) in these communities revealed 20.27% in Azani, 6.52% in Abase, 33.33% in Asemدا, and 4.44% in Mempeasem [23]. Understanding the influence of social networks on MDA participation in these communities will help to improve the compliance of MDA and progress towards LF elimination.

Methods

Study Design

This was a cross-sectional study using Social Network Analysis (SNA) methodology [24, 25] to investigate the influence of social networks on MDA participation in four endemic communities in the Western Region of Ghana. We applied the SNA to discover the treatment behavioural details among community members who identify themselves as closest friends. Ethical approval for the study was obtained from the Noguchi Memorial Institute for Medical Research (NMIMR) Institutional Review Board (CPN 021/19–20). Approval was also sought and granted from the chief, elders, and opinion leaders of the study communities, as well as from the District Health Management Team (DHMT). Informed written consent was obtained from all study participants.

Study settings and population

The Asemدا, Mempeasem, Azani, and Abase are rural communities in the Western Region of Ghana with a high burden of LF (Fig. 1). These communities fall within the moist evergreen ecological zone and experience year-round rainfall. Farming and fishing are the primary occupations [26, 27]. The communities were chosen due to their manageable size, with populations of approximately 741 (Asemدا), 784 (Mempeasem), 1119 (Azani), and 1008 (Abase). The study population was community members aged 18 years and above.

Data collection

Data were collected from 22nd November to 1st December 2022. First, we conducted community engagement with chiefs, elders, and opinion leaders of the study communities, as well as the District Health Management Teams (DHMTs). We also engaged the communities through public announcement activities. These engagements helped to foster trust and understanding of the study objectives. Subsequently, data were collected from household members aged 18 years and above using a standardized pre-tested closed-ended social network questionnaire in each of the four communities. To maximize participation, data collection spanned 3–4 days in each location, with sampling periods from 6 am to 12 noon and 3 pm to 6 pm. Respondents' basic demographic information, such as age, sex, education level, occupation, and family head status (male or female), was collected to understand the potential influence of these factors on LF treatment behaviour. Knowledge of LF was assessed to understand the respondents' perceptions of risk and participation in MDA.

The respondents were asked to indicate whether they had ever heard of LF or not, whether they knew the causes of LF (Yes or No), the signs or symptoms, and whether they perceived themselves to be at risk of being infected (Yes or No). Additionally, the respondents were asked if they knew of any LF MDA campaign (Yes or No) and whether they had received any drugs during the last treatment round, as well as the number of times they swallowed MDA drugs in the last three MDAs (i.e. zero (none), once, twice or three times). Furthermore, the respondents were asked if they knew anyone who refused or stopped taking the MDA drugs (Yes or No). The questionnaire also included individuals' acceptability of the MDA drugs (ivermectin and albendazole), awareness of the drug's purpose in LF elimination and potential side effects. Respondents were also asked about their reasons for taking or refusing the medication and if they would encourage their family members to take the medication during MDA.

Respondents social network mapping

The first household was randomly selected in each of the four communities. This was followed by an exponential non-discriminative snowball sampling method where recruited respondents were asked to name up to ten (10) other respondents who he or she identified as closest friends in the particular community. The exponential non-discriminative snowball sampling method helped to produce the participants' accounts of their lives as closest friends [28]. The 10 named closest friends of the first respondents were followed and recruited into the study. Each respondent was also asked to name up to ten (10) other respondents they identified with as closest friends. This continued until the respondents who were available and agreed to participate in the study in each community were exhausted. Closest friends were defined as those individuals who comfortably helped each other on any given issue [29]. For this study friendship relationship was reported to exist as far as one of the respondents stated it. That is, the existence of friendship was not dependent on confirmation by the nominated respondents.

Data Analysis

Data were entered into Microsoft Excel® 2019, managed, and then imported to Gephi software version 0.9.2 for network visualization and analysis [30]. Graphs (sociograms) of the closest friends for each community and district were generated. The respondents' knowledge on Lymphatic Filariasis (LF), including its causes, signs, symptoms, and perceived risk of infection, were then mapped on the closest friendship networks for each of the communities and the districts. The networks were further detailed by respondents' knowledge of the LF MDA campaign, whether they had received any medications during the last treatment round, the number of times they took MDA drugs in the last three rounds, whether they knew anyone who refused or stopped taking the drugs, as well as background characteristics such as sex, marital status, and educational level.

We hypothesize that household heads who are closest friends within a particular community share similar treatment response behaviours regarding MDA. To determine the treatment response behaviours among the networks in the particular community, the degree centrality measure was determined. The degree centrality, connotes the connectedness of the closest friends, representing their prominence or

importance in the community, and the betweenness centrality, which connotes closest friends who serve as bridges of the flow of information regarding LF in the communities [24], were also determined. In addition, network density, which represents the proportion of the relations that exist in the network within the community to all possible ties, was determined. Furthermore, we assessed the network diameters, and the shortest distance between the two most distant friends in the network was determined. The network diameter indicates how long it takes for information to flow from one friend to another in the network [31].

Results

Characteristics of study respondents

Table 1 presents the characteristics of the respondents. The total network size consisted of 288 nodes (community members). These included 68 (23.5%) respondents from Asemda, 57 (20.0%) from Mempeasem, 84 (29.1%) from Azani, and 79 (27.3%) from Abase, while the majority, 163 (56.6%), were from the Ahanta West district. Overall, 180 (62.5%) of the respondents were females, the majority, 102 (35.4%) had no formal education, while 12 (4.2%) had up to a tertiary level of education. Concerning the knowledge of LF, almost all 275 (95.5%) of the respondents had ever heard of LF, but only 76 (26.4%) knew of the causes of LF. Additionally, 233 (77.6%) of the respondents reported knowing the signs or symptoms of LF, while 165 (57.3%) perceived themselves to be at risk of LF infection. Furthermore, while the majority, 239 (83.0%), reported they knew of the LF MDA campaign, just a little above fifty percent, 154 (53.5%), received any drugs during the last treatment round. In all, one-fourth of the respondents, 71 (25%), reported they never swallowed MDA drug in the last three MDAs.

Table 1
Characteristics of study respondents

Characteristics		N0 (%)
Sex of respondents	Male	108 (37.5)
	Female	180 (62.5)
Age of respondent (years)	Mean $\pm$ SD	38.1 $\pm$ 15.4
	18–24	57 (20.0)
	25–29	43 (15.1)
	30–39	71 (24.9)
	40–49	47 (16.5)
	≥ 50	67 (23.5)
Educational level	No formal education	102 (35.4)
	Primary	45 (15.6)
	Junior High School	92 (31.9)
	Senior High School	0 (0.0)
	Technical/vocational	37 (12.9)
	Tertiary	12 (4.2)
District	Ahanta West	163 (56.6)
	Ellembelle	125 (43.4)
Community/locality	Abasi	79 (27.4)
	Azani	84 (29.2)
	Mempeasem	57 (19.8)
	Asem-da	68 (23.6)
Ever heard of LF	Heard of LF	275 (95.5)
	Never heard of LF	13 (4.5)

Characteristics		N0 (%)
Knowledge of causes of LF	Knew causes of LF	76 (26.4)
	Did not know causes of LF	212 (73.6)
Knowledge of signs or symptoms of LF	Knew signs or symptoms of LF	223 (77.4)
	Did not know signs or symptoms of LF	65 (22.6)
Perception of being at risk of LF	Perceived to be at risk of LF	165 (57.3)
	Perceived not to be at risk	123 (42.7)
Knowledge of LF MDA campaign	Had knowledge of LF MDA campaign	239 (83.0)
	Had no knowledge of LF MDA campaign	49 (17.0)
Whether respondent received any drugs during last treatment round	Received drug	154 (53.5)
	Did not receive drug	134 (46.5)
Number of times respondent swallowed MDA drug in the last 3 MDAs	Zero	71 (24.7)
	Once	44 (15.3)
	Twice	66 (22.9)
	Three times	107 (37.2)
Knowledge of anyone who refused or stopped taking MDA drugs	Knew someone	69(24.0)
	Did not know anyone	219 (76.0)

Network structure and nature of relations of participants across communities

Figure 2 illustrates the network structure and the nature of relationships among participants who were close friends within each community. Notably, the Mempeasem community displayed a relatively higher connection (network density = 0.023) (Table 2) among respondents compared to all the other communities.

Table 2
Network matrices of friendship networks in studied communities

Community	Network Density	Average degree	Network Diameter
Mempeasem	0.023	1.30	6
Asem-Ada	0.018	1.22	8
Abasi	0.014	1.13	6
Azani	0.009	0.73	4

Knowledge of LF among participants and patterns of interactions

Most of the identified participants who were close friends reported having knowledge of LF. However, the results indicate that there are more prominent close friends, referred to as the most central close friends, in the Mempeasem and Asemnda communities who are aware of LF, compared to those in the Azani and Abasi communities. Additionally, the patterns of interaction revealed a more isolated network of close friends in the Azani and Abasi communities when contrasted with those in Mempeasem and Asemnda.

The study found that there were more female participants who had close friends knowledgeable about LF compared to their male counterparts in each community. However, in the Asemnda and Mempeasem communities, there were more prominent male participants who were close friends than in the Azani and Abasi communities. Interaction patterns revealed that males with knowledge about LF tended to engage more with other males, while females also preferred to interact among themselves rather than with males. As a result, interactions between male and female participants were limited.

In each community, participants who were married interacted more frequently with one another, while those who were single primarily engaged with other singles but also interacted with married individuals. This suggests a greater ease of information flow between these two groups. Regarding education, the results indicate a fairly even distribution of interactions across different educational levels. Therefore, the observed patterns of interaction were largely independent of the participants' educational status.

In each community, participants who were close friends reported having some knowledge about LF, yet only a few could identify its causes and symptoms. It was observed that even those who were highly connected within their networks lacked understanding of the causes and symptoms of LF. The patterns of interaction indicated that both groups—those who knew the causes and symptoms and those who did not—interacted with one another, although those with knowledge seemed to engage more frequently. The findings suggest limited knowledge sharing among network members, despite their close friendships within the communities. However, most participants in each community were aware of the LF MDA campaign.

The perceptions of individuals regarding their risk of LF and their awareness of the MDA campaign among community members who are knowledgeable about LF are illustrated in Fig. 3. It was found that

most participants who were aware of LF also believed they were at risk of contracting the disease. Additionally, the patterns of interaction indicated that individuals who perceived themselves to be at risk tended to engage more with each other, while those who did not perceive themselves to be at risk generally interacted more within their own group.

Compliance with MDA drug treatments and patterns of relations in each community

Figure 4 illustrates the relationships among participants with knowledge of LF in four communities, specifically focusing on whether they received any MDA drugs during the last treatment round and the number of times they ingested MDA drugs over the last three MDAs. The results indicate that the most prominent participants in the Azani and Abasi communities did not receive any MDA drugs at all during the last three rounds, while the majority of participants in the Mempeasem and Asemnda communities did receive treatment. It was observed that participants in the Azani and Abasi communities who did not receive any drugs interacted primarily with one another. In contrast, interactions within the Mempeasem and Asemnda communities occurred among both those who received the MDA drug and those who did not.

The analysis of the number of times participants in each community received the MDA drug during the last three rounds reveals some interesting patterns. In the Mempeasem community, most prominent participants received the MDA drug either two or three times. In contrast, the majority of prominent participants in the Asemnda community received the drug three times. For the Azani community, there was not much variation observed among prominent participants, as they received the drug once, twice, or three times in relatively equal numbers. However, in the Abasi community, most participants did not receive the MDA drug at all, in comparison to participants from the other communities. In the Asemnda community, where participants who received the MDA drug three times tended to interact with one another, no specific patterns of interaction were noted in the other communities (See Fig. 5). Most participants who did not receive the MDA drugs were female. The results indicate that these female participants tend to connect with each other more (Fig. 6).

It was observed that participants who did not receive the drug interacted with each other in their networks, regardless of their educational levels. The results indicated that most participants without formal education did not receive the MDA drug. Among those who missed the MDA drug were individuals identified as prominent close friends. No specific patterns of interaction were found between those who received the drug and those who did not. Furthermore, most participants who did not receive the MDA drug were close friends who were unaware of the causes of LF. They were also seen interacting among themselves.

In terms of non-compliance patterns related to knowledge of risk factors and awareness of the MDA campaign, the findings showed that prominent close friends lacking knowledge about LF risk factors did not receive the MDA drugs. This group of prominent close friends was also observed to engage more frequently with one another.

Discussion

The World Health Organization's ambitious goal of attaining certain NTD elimination targets, including LF, by 2030 has diversified research efforts in various areas [32, 33]. Significant research has been conducted on vector dynamics, MDA uptake and coverage, as well as water and sanitation [34–36]. To fully understand transmission and achieve our goals, we need to explore additional approaches. We recognize the significant influence of social networks within communities, so we investigated how individual social connections affect knowledge and participation in MDA programs. The impact of these social networks was evaluated in four LF endemic communities: Abase, Azani (located in the Ahanta West district), Asemnda, and Mempeasem (in the Ellembelle district) of the western region of Ghana. Our findings revealed the potential dynamics of LF knowledge and participation in MDA programs within these communities.

The Mempeasem community exhibited the highest network density and average degree, demonstrating the most interconnected social structure among the studied communities. This level of social connectivity facilitates the rapid and widespread dissemination of intervention-related activities [37]. Information and influence could be communicated throughout the entire community more quickly, which would benefit health education campaigns and promote the uptake of MDA. Utilizing existing social networks for information sharing and peer influence would be especially effective in increasing MDA uptake and enhancing knowledge about LF [38]. Community health workers and local leaders would play essential roles as key influencers in such well-connected communities [39].

Asemnda and Abasi displayed moderate levels of social connectivity, which suggests a slower rate of information spread compared to Mempeasem. Notably, Asemnda has the largest network diameter, indicating that certain individuals or groups may be more isolated. This situation may necessitate targeted efforts to ensure that intervention programs reach everyone comprehensively [40]. Azani is characterized by the lowest network density, indicating a more fragmented social structure. This fragmentation may hinder the spread of intervention-related activities. Additionally, the smaller network diameter in Azani, along with its low connectivity, points to the existence of small, isolated clusters within the community. To effectively reach all community members during MDA campaigns and health education initiatives, tailored strategies will be necessary [41, 42].

The different social structures of communities can unintentionally affect the success of MDA treatment approaches. In communities with strong connections among residents, peer-to-peer education and support systems are likely to be more effective in promoting participation in MDA programs. Conversely, communities like Azani may need more intensive efforts to recruit and train community health workers who can effectively reach all segments of the population, given the community's fragmented structure.

MDA uptake in communities indicated that women and individuals with lower education levels were less likely to receive MDA. Female non-recipients tended to interact with one another more frequently, potentially reinforcing negative attitudes toward MDA [43]. The limited interaction between those who receive medication and those who do not indicates a division within the community regarding MDA

participation. This separation hinders the sharing of positive experiences and valuable information about the program. To enhance the effectiveness of MDA, it is essential to implement targeted outreach efforts aimed at women and individuals with lower levels of education. Engaging community leaders as advocates for MDA, creating opportunities for interaction between recipients and non-recipients, addressing specific concerns and misconceptions about MDA, and ensuring equitable access to MDA drugs for all segments of the community are vital steps to take [44, 45].

Participants from Mempeasem and Asemnda, which have higher network densities, reported a greater knowledge of LF compared to those in Azani and Abasi. This suggests that higher network density promotes better dissemination of LF-related information, enabling individuals to share knowledge more effectively within their social circles. Additionally, the average number of connections in Mempeasem and Asemnda indicates that individuals in these communities have more close friends, which likely enhances the flow of information about LF. The observation of a higher number of close friends with LF knowledge in these communities supports the idea that more connections per individual lead to improved information sharing [46].

Interestingly, although Asemnda has a larger network diameter, it still demonstrates a higher concentration of knowledgeable individuals. This indicates that, despite the potential for greater distance between members, the community's overall density and average degree may help to overcome challenges in information dissemination. In contrast, Azani and Abasi are characterized by more isolated networks. The lower network density and average degree in these communities likely contribute to a decrease in knowledge about LF. The isolation observed in these networks suggests that information about LF may not effectively reach all individuals, which could hinder awareness and participation in control efforts.

The knowledge patterns regarding LF have important implications for LF control strategies. It is crucial for communities such as Mempeasem and Asemnda to engage key individuals who have expertise in LF. These central figures can effectively disseminate information and encourage participation in MDA programs [39]. In Azani and Abasi, focused efforts are essential. Identifying key individuals within these isolated clusters and educating them about LF could significantly enhance awareness and boost participation in health initiatives.

There is a correlation between knowledge of LF and the perception of being at risk. In communities with higher network densities, such as Mempeasem and Asemnda, it can be inferred that a greater understanding of LF likely leads to an increased perception of risk. The denser social networks in these communities facilitate the spread of accurate information about LF and MDA among individuals who believe they are at risk [47]. In more isolated networks like Azani and Abasi, clustering can make it more challenging to reach individuals who do not see themselves as being at risk. This may result in areas with low participation in MDA. The interaction patterns observed indicate that MDA campaigns may need to adopt different strategies for different groups. For those who recognize their risk and have knowledge about LF, utilizing existing social connections could effectively encourage MDA participation. On the

other hand, for individuals who do not perceive themselves as at risk, targeted interventions may be required to overcome social barriers and provide accurate information about LF and the significance of MDA [48].

In terms of compliance with the MDA, the communities of Azani and Abasi, which have lower network densities and more isolated social structures, exhibit a concerning pattern. Notably, the most prominent members of these communities have not fully participated in the last three rounds of MDA. This lack of involvement from influential individuals could significantly hinder overall community engagement with the MDA program. Additionally, the observation that those who did not receive any drugs tend to interact mainly among themselves suggests the emergence of clusters resistant to MDA participation. This resistance could lead to persistently low treatment coverage in these communities. On the other hand, Mempeasem and Asemnda show a more positive trend. In these communities, the majority of prominent individuals have received MDA treatment. Moreover, interactions occur between those who received the drug and those who did not, which may encourage higher participation rates [49].

These patterns align with our understanding of how social network structures can influence health behaviors and the dissemination of information. In the more isolated networks of Azani and Abasi, the clustering of non-participants may reinforce negative perceptions or misinformation about the MDA, making it difficult to improve participation rates. The absence of participation from prominent community members is particularly concerning, as these individuals often serve as role models and opinion leaders. In contrast, the more interconnected networks of Mempeasem and Asemnda seem to support better uptake of the MDA program. The involvement of prominent individuals can lend credibility to the MDA initiative, while the interaction between treated and untreated individuals creates opportunities for positive experiences and information to spread throughout the community [50].

In Mempeasem and Asemnda, many prominent participants took part in the MDA program two or three times over the last three rounds. This high level of participation indicates that these communities are actively engaged with the MDA initiatives. In Asemnda, individuals who received the drug three times tended to interact with one another, forming a supportive group that encouraged others to take part. In contrast, Azani displayed a mixed pattern, with no clear trend in how many times prominent participants received the drug. This inconsistency may reflect challenges in maintaining participation in a community with weaker social ties [51]. Abasi stands out as one of the most concerning cases, as the majority of participants did not receive the MDA drug at all. This low participation rate could significantly undermine the effectiveness of the program in the community. Additionally, the lack of specific interaction patterns related to MDA participation in most communities suggests that taking the drug may not have a substantial impact on social relationships. This situation presents both challenges and opportunities for improving engagement with the program by addressing concerns or misconceptions surrounding it [52, 53].

This study encountered several limitations. Firstly, the absence of some close friends during the data collection period created gaps in our understanding of the social network dynamics related to LF and

MDA. These missing participants could have offered valuable insights into the flow of information and attitudes within the community networks. Additionally, the study faced challenges with individuals who declined to participate. This group of non-participants may represent a significant segment of the population, potentially including those who do not engage with the intervention activities. Their absence from the study could lead to an underestimation of the barriers to MDA uptake and may not fully capture the reasons for non-compliance within the communities. Another issue was the low sample sizes. We reached as many people in the communities as possible during the 3 to 4-day surveys, except for those who were unavailable or refused to participate. In this context, conducting a census of the communities might have provided a more comprehensive understanding of the social networks and their impact on MDA.

In conclusion, this study offers important insights into the complex relationship between social network structures, knowledge of LF, and participation in MDA within the communities examined. The findings revealed significant differences in social connectivity and MDA participation across various communities, underscoring the necessity for tailored approaches in efforts to control LF.

Abbreviations

CDT	Community Directed Treatment system
CMD	Community Medicine Distributors
DHMT	District Health Management Team
GPELF	Global Programme to Eliminate Lymphatic Filariasis
LF	Lymphatic Filariasis
MDA	Mass Drug Administration
NMIMR	Noguchi Memorial Institute for Medical Research
SNA	Social Network Analysis

Declarations

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Ethical Issues

Ethical approval for the study was obtained from the NMIMR Institutional Review Board (CPN 021/19-20) and was conducted according to ethical guidelines and principles of the International Declaration of Helsinki. Approval was also sought and granted from the chief, elders, and opinion leaders of the study communities, as well as from the District Health Management Team (DHMT). Informed written consent was obtained from all study participants.

Informed Consent Statement

Informed consent was obtained from all study participants involved in the study

Consent for Publication

Not Applicable

Conflicts of interest

The authors declare that they have no conflicts of interest

Data Availability Statement

All data are fully available without restriction

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Author Contributions

D.K.d.S. and C.S.A. were responsible for the conceptualization and design of the study, funding acquisition and project administration. In addition, D.K.d.S. was responsible for the investigation, methodology, resources, supervision, validation, visualization and writing, and revising of the manuscript. D.D.G. contributed to the data curation, data analysis, methodology, validation, visualization, and writing and revising the manuscript. J.G.S. and K.M.S. contributed to data curation, investigation, methodology, and validation of the manuscript. In addition, J.G.S. contributed to the project administration, visualization and writing and revising of the manuscript. All authors have read and approved the final version of the manuscript.

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Figures

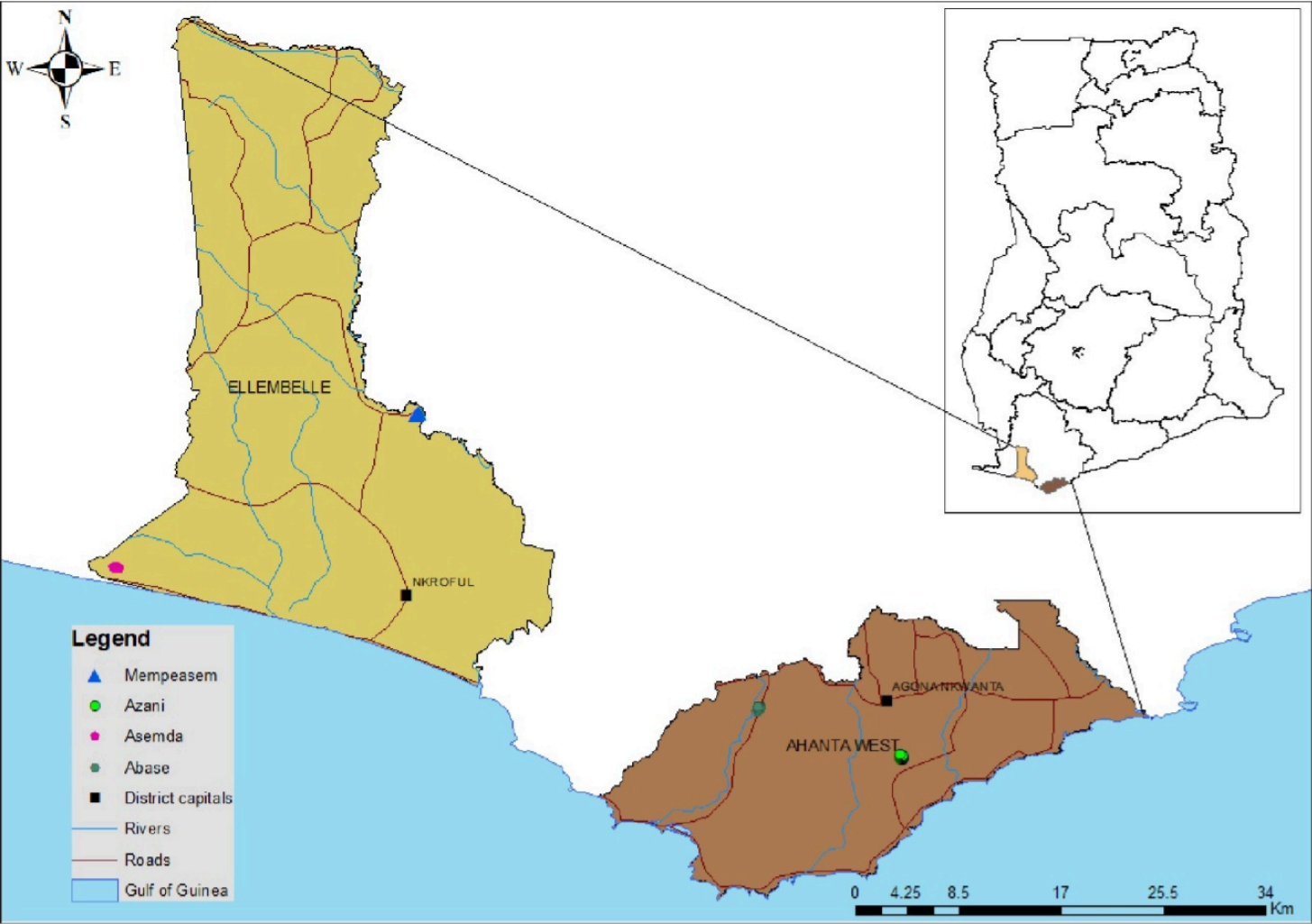


Figure 1
Map of study communities

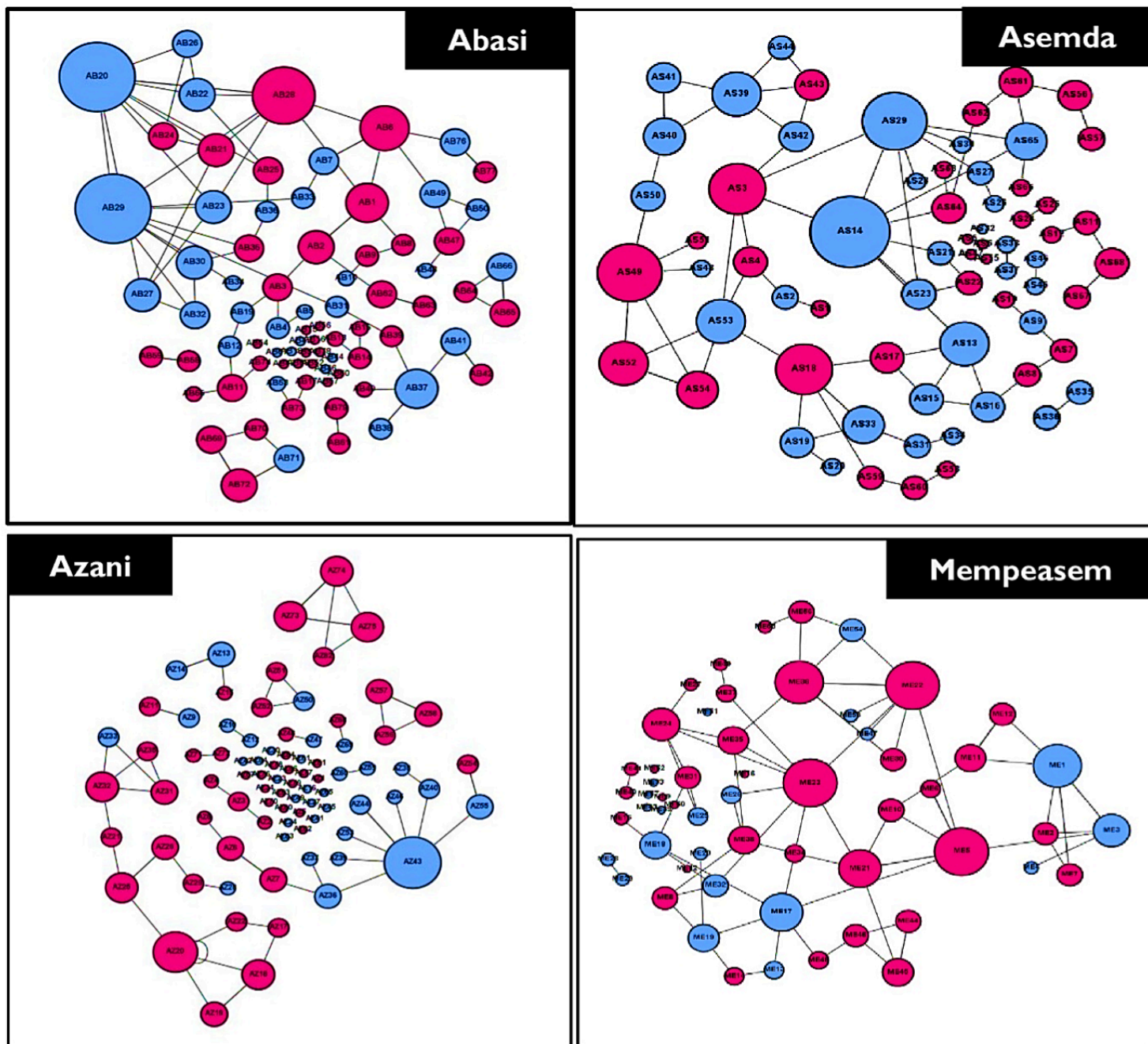


Figure 3

Knowledge of LF among participants and patterns of their interactions in each community based on perception of being at risk. Red circle denotes those who perceive to be at risk; Blue circles denote those who perceive not to be at risk

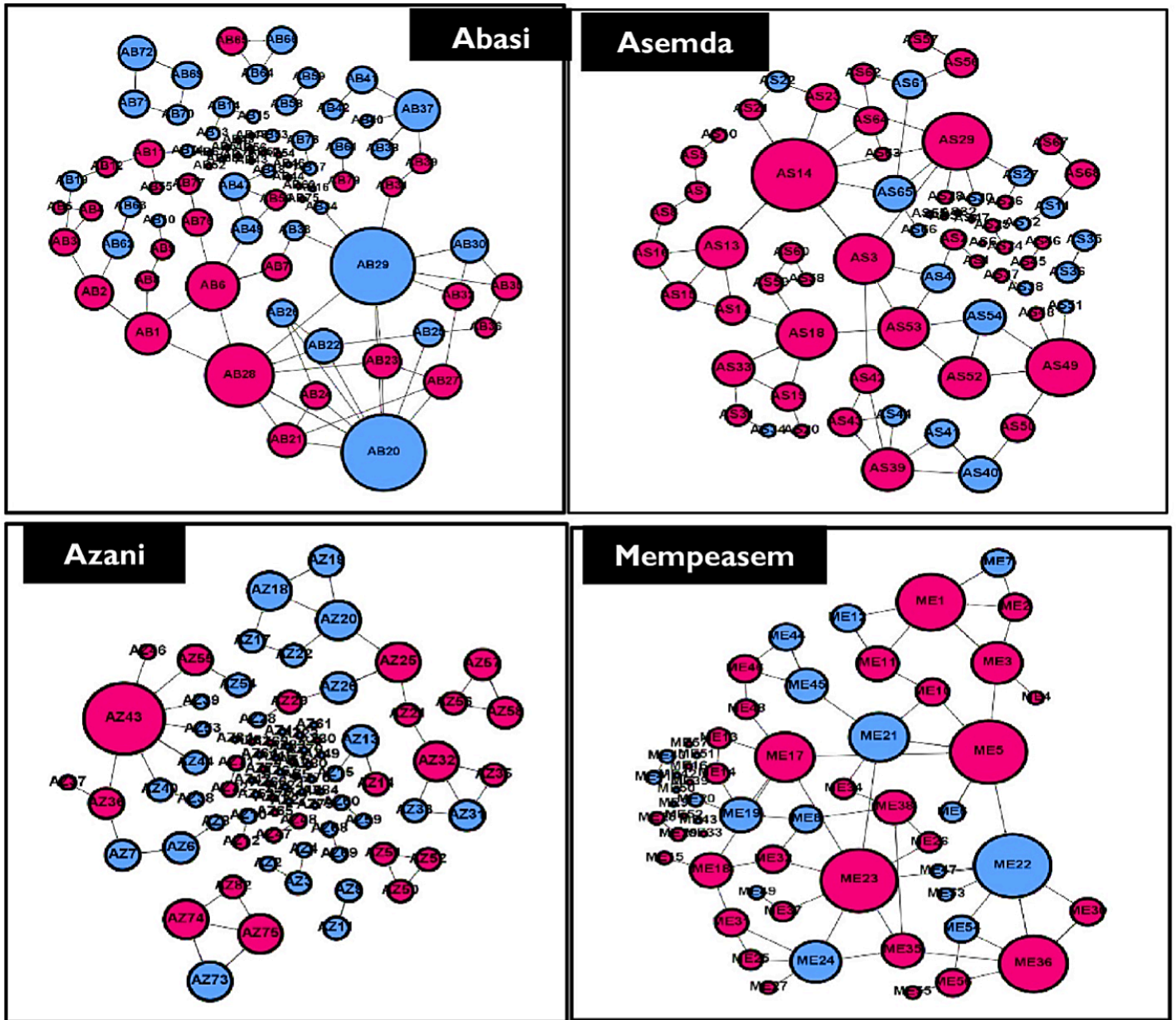


Figure 4

Compliance with MDA and patterns of relations among participants in each community. Red circle denotes those who received MDA; Blue circles denote those who did not receive MDA

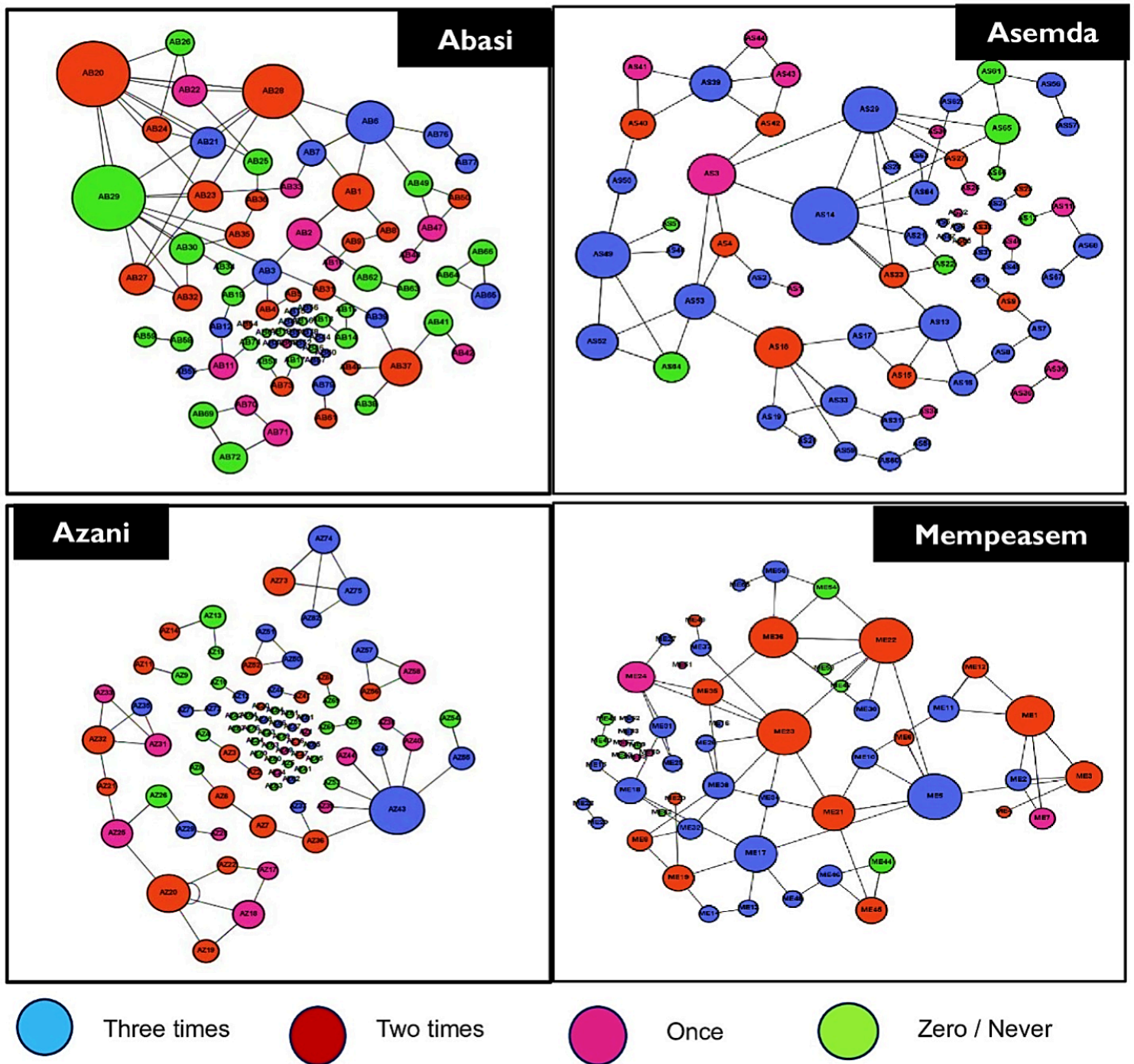


Figure 5

Number of times participants in each community received MDA drug

