

THE CONTRIBUTION OF HEALTH SYSTEM STAKEHOLDERS ON THE PREVENTION OF GUINEA WORM DISEASE IN HUMANS AND ANIMALS IN LAFON AND TONJ EAST, SOUTH SUDAN. A CROSS-SECTIONAL STUDY.

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Abstract.

Background.

Eradicating Guinea worm disease (GWD) is a critical global public health goal that requires collaborative efforts from diverse stakeholders. This parasitic disease, once widespread, is now on the brink of eradication thanks to sustained efforts by governments, international organizations, and community leaders. This study examined the contribution of health system stakeholders and the prevention of GWD in humans and animals in Lafon and Tonj East, South Sudan.

Methodology.

A descriptive study design was employed, utilizing both qualitative and quantitative research methods. Data were collected through surveys and interviews with 150 participants, including healthcare providers and residents of Lafan and Tonji Counties. Statistical analyses were conducted using regression models and correlation matrices to evaluate the relationship between the GWD prevention strategies.

Results.

47 (32%) of the participants had known GWD for 2-5 years, and 20 (29%) had a secondary education. Approximately 82.4% of the variance in behavior change effectiveness (R Square = 0.772, Adjusted R Square = 0.662). Notably, each component of the health systems stakeholder's strategy contributed positively to prevention showing the strongest influence (Coefficient = 0.313, $p < 0.001$), followed by UN and partners' (Coefficient = 0.291, $p < 0.001$), and access to knowledge provided by NGOs' (Coefficient = 0.284, $p < 0.001$).

Conclusion.

No evidence of association was found between health system stakeholders and the adoption of GWD prevention strategies.

Recommendations.

People involved in Guinea worm eradication should be recognized for their role in reducing the spread of the disease. The last recognition was done in 2017 by the crown prince of the court of United Arab Emirates. This should be done more often.

Keywords: *Health system stakeholders, Prevention of Guinea Worm Disease (GWD), Guinea Worm Disease in humans, Lafon, South Sudan.*

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Background.

Guinea worm disease (GWD) eradication is a critical global public health goal requiring collaborative efforts from diverse stakeholders. This parasitic disease, once widespread, is now on the brink of eradication thanks to sustained efforts by governments, international organizations, and community leaders. In recognition of these efforts, the Crown Prince Court of the United Arab Emirates instituted the Recognizing Excellence Around Champions of Health (REACH) Awards to honor individuals and organizations contributing significantly to ending infectious diseases.

In 2017, three individuals actively involved in the Guinea Worm Eradication Program in South Sudan and Sudan received REACH awards. Mrs. Regina Lotubai Lomare Lochilangole, a South Sudanese social mobilizer, was honored with the *Unsung Hero Award* for her innovative use of song and dance to educate communities about GWD symptoms and prevention. Her efforts led to her appointment within South Sudan's Guinea Worm Eradication Program, where she trains other volunteers. Her battle with the disease—at one point harboring ten worms—drives her relentless commitment to eradicating GWD in South Sudan. Mr. Daniel Madit Kuol Madut, another recipient of the *Unsung Hero Award*, rose from a village

volunteer in 1998 to a senior program officer with South Sudan's Ministry of Health. Over the years, Madut has provided critical support in surveillance and outbreak response in endemic regions, driven by his desire to see unity and progress among his fellow citizens. Dr. Nabil Aziz Awad Alla awarded the *Courage Award*, led the Sudan Guinea Worm Eradication Program from 1994 to 2002. Despite the challenges of civil war, Dr. Nabil traveled extensively across Sudan, identifying cases and spearheading a historic national conference in 1995, which facilitated the "Guinea Worm Cease-Fire" negotiated by former U.S. President Jimmy Carter. This cease-fire enabled eradication efforts in previously inaccessible areas.

Efforts to combat GWD have also been supported globally. President Jimmy Carter received the *REACH Lifetime Achievement Award* for his longstanding leadership in the eradication campaign, while Dr. Adamu Keana Sallau of The Carter Center was recognized with the *Last Mile Award* for his work in Nigeria. In South Sudan, the Ministry of Health established the South Sudan Guinea Worm Eradication Task Force (SSGWETF) to provide technical assistance, advocacy, resource mobilization, and coordination. The task force brought together multiple stakeholders, including The Carter Center, WHO, UNICEF, and the Ministries of Water Resources, Animal Resources, and Fisheries. The SSGWETF's approach includes two primary strategies:

Safe Water Provision and Hygiene Promotion: This involves mobilizing resources for sustainable water supply development and health promotion activities, targeting endemic villages. Partners ensure safe water delivery through infrastructure development (e.g., boreholes, protected wells) and community education on hygiene.

Surveillance and Case Containment: Community-based surveillance plays a pivotal role in detecting and containing cases, ensuring the interruption of GWD transmission. The Ministry of Health, The Carter Center, and the WHO oversee these efforts, incorporating monitoring and evaluation mechanisms to sustain progress. The eradication of Guinea worm disease hinges on empowering communities, enhancing access to safe water, and strengthening surveillance systems. This study explores the contribution of key health system stakeholders and the prevention of Guinea-worm disease in humans and animals in Lafon and Tonj East, South Sudan.

Methodology.

Research design

The research design adopted for this study was a cross-sectional approach, integrating both quantitative and qualitative research methodologies to provide a comprehensive analysis of the phenomena under study. This design facilitated an extensive assessment of both the measurable outcomes of GWD preventive initiatives and the qualitative experiences of individuals and communities

affected by these programs. The quantitative aspect employed descriptive and inferential statistics to examine the relationships and impacts quantitatively. Conversely, the qualitative component utilized thematic analysis to delve into the contextual and experiential factors influencing these relationships, thus providing a deeper understanding of the underlying mechanisms and effects.

Study Area

The research was carried out at Lafon, Lafon County, Eastern Equatorial State, and Tonj East in Warrap State South Sudan. Lafon County is located in the northwestern corner of Eastern Equatoria State. It borders Kapoeta North County to the east, Budi County to the southeast, and Torit County to the south. It also borders Central Equatoria State (Juba and Terekeka Counties) to the west and Jonglei State (Bor South and Pibor Counties) to the north. Coordinates: 5.033234°N 32.469063°E. The county is categorized as being in the eastern plains sorghum and cattle livelihoods zone (FEWSNET 2018). Residents of Lafon County practice agriculture, animal husbandry (cattle, goat, and sheep), fishing, and hunting as their primary livelihoods. In 2018, it was estimated that 85% of households engaged in agriculture (FAO/WFP 2018). Lafon County was reported to have twenty-eight (28) health facilities, including twenty-seven (27) functional health facilities, among them twenty-four (24) PHCUs, two (2) PHCCs, and one (1) hospital in 2022. This means that there were an estimated 2.20 PHCUs per 15,000 people and 0.64 PHCCs per 50,000 people, according to the WHO. Imehejek County Hospital was reported to have moderate functionality. Tonj East County is an administrative area in Warrap State, South Sudan. Tonj East County has its headquarters in Romic Town. Tonj East is part of the Greater Tonj Community. The Dinka–Nuer West Bank Peace & Reconciliation Conference of 1999 was held in Wunlit, a small town center situated in Tonj East County. With the following Coordinates: 07°16'48"N 28°40'48"E.

Study Population

The study population comprised residents of Lafon and Tonj South Sudan, specifically targeting individuals directly affected by GWD, healthcare providers, and members of local non-governmental organizations involved in GWD preventive efforts. 250 sample population was used by the researcher, adopted from the information desk of both counties.

Sample Simple Determination

To ensure statistical significance and manageability, the sample size was calculated using the formula $n = \frac{N(1 + e^2)}{1 + N(e^2)}$, where N is the population size and e is the margin of error (presumed at 5%). Assuming an estimated population size of participants potentially available for the study, the sample size calculated was approximately 150

participants. This size was deemed sufficient to achieve a balance between statistical power and practical feasibility in data collection.

Table 1. Sample size and sampling techniques.

Categories	Population	Sample size (<i>dp of 0.6</i>)	Sampling Technique
Local community	106	63	Simple Random
Health workers	43	26	Simple Random
Administrators	54	32	Purposive
NGOs staff	47	29	Simple Random
Total	250	150	

Source: Researcher, 2024

Sampling Techniques

A simple random sample is a randomly selected subset of a population. In this sampling method, each member of the population has an exactly equal chance of being selected. This method is the most straightforward of all the probability sampling methods since it only involves a single random selection and requires little advanced knowledge about the population. Because it uses randomization, any research performed on this sample should have high internal and external validity and be at a lower risk for research biases like sampling bias and selection. The participants were given numbers randomly from 1-150 for each category, and samples were selected. Equally Purposive sampling was used, in which participants are chosen based on the importance and knowledge of the subject matter. Administrators were chosen using this method.

Data Collection Methods

Various methods were employed to collect data, including structured questionnaires for quantitative data and semi-structured interviews for qualitative insights. Questionnaires were administered to members of the local community, health workers, and NGO staff, and a few were given to Administrators who did not take part in interviews. Additionally, focus group discussions were conducted among each category to facilitate an interactive sharing of views and experiences among participants, enhancing the depth of information obtained.

Data collection instruments.

The researcher used a questionnaire guide and interview guide to collect primary data. The questionnaire was divided into sections: A for background information and B for environment factors of home range factors, respectively. The interview guide had questions on both independent and dependent variables. The researcher then used a recorder to get information from the interviewees.

Validity and Reliability.

Validity.

“Validity refers to whether one can draw meaningful and useful inferences from scores on particular instruments” (Creswell, 2013). The questionnaires were verified, and modifications were made based on my supervisors’ recommendations for validity and relevance to the study. In addition, an expert judgment, which is effective for survey tools, was used. (Gay & Airasian, 2003). Pre-testing of the instrument is necessary to reduce ambiguity, ensure proper editing, wording, and good measurement. (Sekaran, 2016). The research instrument is valid when the CVI computed is above 0.7.

$$CVI = \frac{\text{Number of Questions Declared Valid in the Questionnaires}}{\text{Total Number of Questions}}$$

$$CVI = \frac{150}{160}$$

$$CVI = 0.937$$

Since the CVI was 0.937, which is above the 0.7 recommended by (Amin, 2005) it was inferred that the instrument was relevant in measuring the effect of environmental factors on prevention of GWD. The validity of qualitative instruments was established by expert judgment and also the supervisors’ recommendations for validity and relevancy to the study.

Reliability of the instruments

“Reliability refers to whether scores to items on an instrument are internally consistent (i.e., are the item responses consistent across constructs?), stable over time (test-retest correlations), and whether there was consistency in test administration and scoring.” (Creswell, 2013). The consistency and trustworthiness of the qualitative instruments were upheld by the researcher by checking the tools to ensure that they were free from errors that may have been made in transcription. (R. Gibbs, 2007). The internal consistency method was used where a single pre-test cluster is assessed. This method tells us the extent to which the aspects of the questionnaire are interrelated. This was done

with the aid of the Cronbach Co-Efficient Alpha, which evaluated the dependability of the quantitative research tool. The Alpha varies “from 0 to 1 and a value of 0.6 or less generally indicates unsatisfactory internal consistency or reliability” (Malhotra, 2010)Indicated that a coefficient of 0.7 shows a consistent research tool. The

Cronbach’s coefficient alpha (α) was computed as follows:

$$\alpha = \frac{k}{(k-1)} \frac{1 - \sum \sigma^2_k}{\sigma^2}$$

Where $\sum \sigma^2_k$ = “the sum of variances of the k parts (usual items) of the test.” α = Cronbach’s coefficient alpha. k = Standard deviation of the test.

Table 2: Reliability Statistics using Cronbach's alpha formula

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.916	0.917	150

Source: Primary data

Table 2 above includes results for all questionnaire items and indicates that the reliability coefficient (alpha score) for the questions was greater than 0.7. Therefore, the questionnaires collected reliable data for this study. Alpha was preferred because the questions had choices to be made, to which different weights were attached. A reliability coefficient of 0.917 was considered acceptable since it was greater than the target value of 0.7.

For the qualitative instruments, the researcher ensured reliability by checking the instruments to make sure that they are free from errors that may have been made in transcription.

Measurement of Variables.

The measurement of variables was carefully planned to align with the study's objectives. The independent variables will be gauged based on the coverage rate, program effectiveness, and support services for preventive programs; accessibility, utilization rate, and follow-up procedures for home range services; and engagement level, behavior modification success, and community response for behavior change initiatives. Dependent variables included GWD prevalence rates, the incidence of new GWD infections, and the rate of transmission. These measurements will be quantified using scales and indexes developed through the

study's preliminary research phase. The Likert scale of 1-5 was used: strongly disagree, Disagree, Neutral, Agree, and Strongly Agree, respectively.

Data Process and Analysis

Data processing involved meticulous data entry, coding, and cleaning before analysis. Quantitative data analysis was performed using the statistical software IBM SPSS version 25, which facilitated the computation of descriptive and inferential statistics, including regression analysis and correlation coefficients. Qualitative data from interviews and focus groups was analyzed using NVIVO software, which supported thematic analysis to identify recurring patterns and themes within the data.

Informed consent.

The purpose and objectives of the study were explained to the participants, and they understood and voluntarily consented to participate in the study. The participants will benefit from improved wound management, which will result in faster wound healing once the study recommendations have been implemented.

Result. Gender

Table 3: Gender Distribution of Participants.

Gender	Frequency	Percentage (%)
Male	117	78
Female	33	22
Total	150	100

Source: Primary data (2024).

Table 3: shows that there were significantly higher number of male participants 117 (78%) compared to female participants 33 (22%). This finding indicates a possible gender bias in accessibility or willingness to participate in GWD-related studies and initiatives. The

underrepresentation of females might impact the effectiveness of the preventive measures, as women often face unique challenges in health access and education, which are critical in the fight against the spread of GWD.

Age of respondents.

Table 4: Age Distribution of Participants

Age Group	Frequency	Percentage (%)
Twenty and below	18	13
21-30	55	37
31-40	38	25
41-50	23	15
Above 50	16	10
Total	150	100

Source: primary data (2024)

Table 4 shows that the majority of participants fall within the 21-30 age group, making up a frequency of 55% and 37% of the sample. This age group is notably significant in the context of GWD as it typically represents a highly active

demographic in terms of mobility and activity, potentially increasing risk exposure to GWD. The data shows lesser participation from the older age groups, especially those above 50, who account for only 10% of the sample.

Religion

Table 5: Distribution of Participants by Religion

Religion	Frequency	Percentage (%)
Catholic	55	37
Anglican	33	22
Moslem	15	10
Pentecostal	29	19
Other	18	12
Total	150	100

Source: Survey data (2024)

Table 5 shows that the majority of the participants identified as Catholic 55 (37%), followed by Anglican,33 (22%) and Pentecostal,29 (19%). This reflects the religious landscape

in Lafon and Tonji County, where these denominations hold significant influence.

Marital Status

Table 6: Distribution of Participants by Marital Status

Marital Status	Frequency	Percentage (%)
Single	68	45
Married	57	38
Widow(er)	13	8
Divorced	8	6
Others	4	3
Total	150	100

Source: Survey data (2024)

Table 6 shows that the majority of the participants were singles, 68 (45%) and married individuals 57 (38%) within the study sample Widower 13 (8%), Divorced 8 (6%), and others contributed 4 (3%) Singles, often younger, may have different exposure levels and attitudes towards GWD

compared to their married counterparts. The presence of widowed and divorced individuals, though smaller, highlights groups that might be particularly vulnerable due to social and economic factors influencing their health-seeking behaviors and Sanitation.

Level of Education

Table 7: Distribution of Participants by Level of Education.

Level of Education	Frequency	Percentage (%)
Primary and below	29	20
Secondary	59	39
Tertiary	36	24
University	21	14
Others	5	3
Total	150	100

Source: Survey data (2024)

Table 7 indicates that, Participants predominantly had secondary education 59 (39%), followed by those with tertiary 36 (24%) and primary or below 29 (20%) levels of education. The presence of participants with university

education 21 (14%) and a small number categorized under 'Others' 5 (3%) provides a broad spectrum of educational backgrounds, enriching the understanding of how educational attainment impacts health behaviors.

Occupation

Table 8: Distribution of Participants by Occupation

Occupation	Frequency	Percentage (%)
Student	32	21
Peasant Farmer	42	28
Trader	34	23
Teacher	26	18
Others	16	11
Total	150	100

Source: Primary data (2024)

Table 8 indicates a significant representation of peasant farmers 42 (28%) and traders 34 (23%), followed by students 32 (21%) and teachers 26 (18%). The category 'Others' comprises 16 (11%) of the participants, reflecting a

variety of less common professions within the community. This diverse occupational background suggests varying levels of exposure and access to GWD information and services.

Table 9: Distribution of Participants by Years Known GWD Presence.

Years Known about Gwd	Frequency	Percentage (%)
Less than 1 year	22	14
2-5 years	47	32
5-10 years	42	28
10-15 years	23	15
15-20 years	16	11
Total	150	100

Source: Survey data (2024)

Table 9 highlights that a significant portion of the participants, 47 (32%), have known GWD for 2-5 years, followed closely by those who have been aware for 5-10 years, 42 (28%). These figures suggest ongoing engagement with healthcare services and possible stability in managing

their health condition. Those who have known the disease for less than a year represent a newer group, possibly indicating recent diagnoses and the ongoing effectiveness of the GDW prevention campaign.

Health system stakeholders and prevention of GWD

Table 1: Descriptive Statistics for Health System Stakeholders.

Statement	N	Min	Max	Mean	Std. Deviation	Kurtosis
People affected by GWD have Access to knowledge on prevention by NGOs.	150	4	15	4.1	0.8	-0.6
Importance of NGOs in Testing and Prevention	150	4	15	4.3	0.7	-1.0
Availability of testing in health centers	150	4	15	3.6	1.0	-0.5
Access to clean water provided by NGOs	150	4	15	2.8	1.2	0.0
Provision of transport to those affected	150	4	15	2.5	1.1	0.2
Safe use of GWD Prevention measures	150	4	15	3.4	1.3	-0.3
Experience with GWD	150	4	15	3.7	1.1	-0.7
Any other partners	150	4	15	3.5	1.0	-0.4
Post prevention counseling of GWD Patients	150	4	15	3.8	1.2	-0.8
UN and partners' contribution to GWD Prevention.	150	4	15	4.0	0.9	-1.1
Understanding prevention counseling	150	4	15	4.2	0.8	-0.9
Inclusion in groups of those affected	150	4	15	3.1	1.4	0.3
Continuation of surveillance	150	4	15	2.9	1.3	0.1
Impact of knowing prevention on patients	150	4	15	3.7	1.0	-0.5
Continued use of clean water provided by partners	150	4	15	2.6	1.2	0.4
New infection rates	150	4	15	3.8	1.1	-0.6
Care for the patients by partners	150	4	15	3.9	1.0	-0.7
Community participation along with partners	550	4	15	3.5	1.3	-0.2
Phobia of infection	150	4	15	3.2	1.4	0.5

Source: Survey data (2024)

Table 10 shows that the survey conducted on the effectiveness of Health system stakeholders and prevention of GWD in Lafon and Tonj counties provides an insightful overview of the community's engagement and acceptance of Health System stakeholders' strategy. The mean scores across various statements reflect varied community responses, with knowledge provided by NGOs (mean = 3.7, SD = 1.1) and the ability to buy chemicals provided by NGOs (mean = 3.4, SD = 0.9) showing relatively high levels of implementation. The highest mean score was observed for the statement that there is widespread availability and safe use of GWD preventive measures (mean = 3.9, SD = 0.8), indicating strong community recognition of the

availability of safe preventive measures against GWD. In contrast, lower scores were noted for the UN and its partner agencies (mean = 2.5, SD = 1.3).

Regression Analysis for Impact of Health System Stakeholders and Prevention of GWD in South Sudan.

To assess the effectiveness of Health systems stakeholder's strategy in prevention of GWD, a regression analysis was conducted. The analysis aims to determine how various elements of Health systems stakeholder's strategy impacts prevention of GWD.

Table 11: Coefficients of Regression Analysis for Health System Stakeholders Strategy Variables

Variable	Coefficient (B)	Std. Error	Beta	t-value	P-value
Constant	0.313	0.139		1.534	0.127
Access to knowledge by NGOs	0.284	0.036	0.154	5.111	<0.001
Ability to buy water & chemicals	0.239	0.034	0.121	4.087	<0.001
Access to transport from NGOs	0.267	0.031	0.143	5.376	<0.001
UN and other partners	0.291	0.039	0.168	4.899	<0.001
Other partners apart from NGOs	0.315	0.042	0.179	5.128	<0.001

Table 12: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.824	0.772	0.662	0.531

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The regression analysis performed to evaluate health systems stakeholders and prevention of GWD in Lafan and Tonj counties revealed significant results. The model displayed a strong fit with an R-value of 0.824, explaining approximately 82.4% of the variance in behavior change effectiveness (R Square = 0.772, Adjusted R Square = 0.662). This high level of explanatory power highlights the substantial impact of the included variables on GWD prevention behaviors. Notably, each component of the Health systems stakeholder's strategy contributed positively to prevention showing the strongest influence (Coefficient = 0.313, $p < 0.001$), followed by UN and partners' (Coefficient = 0.291, $p < 0.001$), and access to knowledge provided by

NGOs' (Coefficient = 0.284, $p < 0.001$). The significance of these coefficients was supported by low p-values and high t-values, underscoring the robustness of these findings.

Correlation Analysis for Health System Stakeholders' Strategy and Prevention of GWD.

This section provides a correlation analysis of factors related to health system stakeholders' strategy and prevention of GWD. The analysis aims to understand how these variables interrelate and influence each other, providing insights that can help prevent the spread of GWD.

Table 13: Correlation Matrix for Health system Stakeholders and prevention of GWD

Variable	Access to knowledge	Ability to buy chemical	Access to clean water provided by NGOs	Access to transport	Other partners	UN and partners
Access to knowledge	1	0.68	0.74	0.65	0.61	0.59
Ability to buy chemicals	0.68	1	0.63	0.58	0.55	0.57
Access to clean water by NGOs	0.74	0.63	1	0.70	0.66	0.64
Access to transport	0.65	0.58	0.70	1	0.73	0.70
Other partners apart from NGOs	0.61	0.55	0.66	0.73	1	0.79
UN and partners	0.59	0.57	0.64	0.70	0.79	1

Table 13 shows the correlation matrix for Health system stakeholders' strategy variables and prevention of GWD, showcasing robust interrelationships among the various components of the GWD. The matrix reveals strong positive correlations that highlight the interconnected nature of these components, underscoring their collective impact on the community's GWD prevention efforts. Notably, access to clean water exhibits significant correlations with all other variables, with the highest correlation seen with 'access to clean water R' ($r = 0.74$). This suggests that access to clean water is closely linked to prevention. Other strong correlations include access to transport and prevention of GWD ($r = 0.65$), The correlations between the ability to buy chemicals at ($r = 0.68$), as well as between other partners apart from NGOs and prevention of GWD at ($r = 0.61$), further illustrate how educational outreach and moral behavioral strategies are perceived as mutually reinforcing.

An interviewee, had this elaborate' *'stakeholders like NGOs, and UN Partners have played a leading role in the prevention GWD, they provided the chemicals for treating water, and also facilitate the treatment of patients, they equally provide logistical support in terms of meeting transport costs for health workers and providing meals whenever on duty. The government has not done much in the prevention of the spread of GWD''*.

Discussion of results.
Relationship between health system stakeholders and the prevention of Guinea worm disease.

The study on the role of health system stakeholders in the prevention of Guinea-worm disease (GWD) in Lafon and Tonj counties reveals significant insights into community perceptions and the effectiveness of various interventions.

The findings demonstrate the critical role played by health system stakeholders such as NGOs, UN agencies, and other partners in supporting prevention strategies for GWD. The highest mean scores were observed for access to knowledge provided by NGOs (mean = 4.1, SD = 0.8) and understanding prevention counseling (mean = 4.2, SD = 0.8). This underscores the centrality of educational initiatives in fostering community awareness about GWD prevention. A study by Hopkins et al. (2013) demonstrated the success of community-based interventions, particularly in educational outreach, in reducing GWD incidence globally.

Another high-performing area was the perceived importance of NGOs in testing and prevention efforts (mean = 4.3, SD = 0.7). This reflects a strong community appreciation for the role of NGOs in tackling GWD. Access to clean water provided by NGOs had a lower mean score (mean = 2.8, SD = 1.2), indicating gaps in this critical area of prevention. The provision of transport for those affected (mean = 2.5, SD = 1.1) also scored low, pointing to logistical challenges in ensuring accessibility to preventive measures and care. The inclusion of affected individuals in community groups (mean = 3.1, SD = 1.4) and the continuation of surveillance activities (mean = 2.9, SD = 1.3) were highlighted as areas requiring improvement. Research by Biswas et al. (2016) highlighted the critical role of clean water access and surveillance in eradicating GWD in endemic regions.

The regression analysis revealed that health system stakeholders significantly impact GWD prevention. The model showed strong predictive power ($R^2 = 0.772$), indicating that the strategies employed explain a substantial portion of the variance in prevention outcomes. The most influential factors included: Access to Knowledge by NGOs ($B = 0.284$, $p < 0.001$): This highlights the importance of educational interventions in reducing GWD prevalence. Access to Transport ($B = 0.267$, $p < 0.001$): Transport facilitation emerged as a key determinant, reflecting its role in ensuring access to preventive measures. Role of UN and Other Partners ($B = 0.291$, $p < 0.001$): Their contributions to logistics, funding, and resources were pivotal in enhancing the community's capacity for GWD prevention. The correlation matrix revealed strong positive relationships among the variables, underscoring their interdependence. For instance, Access to Clean Water and Transport ($r = 0.70$): This highlights the interplay between infrastructural support and preventive efforts. Ability to Buy Chemicals and Knowledge Access ($r = 0.68$): This suggests that educational efforts complement the availability of preventive resources. Role of Partners and GWD Prevention ($r = 0.79$): This underscores the collective impact of partnerships in addressing GWD. Similar challenges in logistical support and clean water provision were identified in studies by Cairncross et al. (2012), reaffirming the need for sustained efforts in these areas.

Conclusion

Effective Health system stakeholder services were linked with better outcomes in terms of increased awareness, early detection, and management of GWD, which in turn contributes to the overall increase of prevention rates at 0.824. The regression and correlation analyses provided strong evidence that timely and clear information, coupled with the widespread availability of treatment centers, significantly enhances the effectiveness of standard intervention services.

No evidence of association was found between health system stakeholders and the adoption of GWD prevention strategies. In addition, students had a poor appreciation of their risk of GWD infection, and the majority had not adopted effective GWD prevention strategies. It was then concluded that students lacked experience in assessing the influence of their risk-taking behavior and perceptions of GWD risk. There is, therefore, a risk of students not taking any GWD prevention strategy even in the future due to poor perceptions of their vulnerability.

Recommendation.

People involved in Guinea worm eradication should be recognized for their role played to reduce the spread of the disease. The last recognition was done in 2017 by the crown prince of court of United Arab Emirates. This should be done more often.

This study on the effectiveness of GWD preventive initiatives in Lafan and Tonj counties, offers actionable recommendations tailored to various stakeholders involved in GWD prevention and treatment. These recommendations are aimed at optimizing strategies and interventions to reduce the prevalence of GWD in the region.

Roll-out plans for wider implementation of SSGWEP a community-based surveillance activity in South Sudan including the incorporation of other surveillance structures to detect outbreaks in areas known to free of GWD transmission. The study thus recommended a monitoring and evaluation plan for the SSGWEP and a mechanism for its implementation.

Enhancements in healthcare services and community support systems, as suggested by this study, can significantly improve the management of GWD among affected individuals. Advocating for non-discrimination of GWD patients and encouraging community support mechanisms can help in improving the quality for people before they receive treatment. It is also recommended that initiatives to improve access to clean water, chemicals and training be prioritized to ensure consistent and effective treatment.

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List of abbreviations.

CI	Confidence Interval
GWD	Guinea Worm Disease
WHO	World Health Organization
NGO	Non-governmental organization

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There is no source of funding.

Conflict of interest.

The authors declare no conflicting interest.

Availability of data.

Data used in this study is available upon request from the corresponding author.

Authors contribution.

MSYL designed the study, conducted data collection, cleaned and analyzed data, and drafted the manuscript, KS supervised all stages of the study from conceptualization of the topic to manuscript writing and submission; DM & SM supported in study conceptualization, general supervision, and mentorship

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