



Exploring the Knowledge of Meningitis and Treatment Preference of Residents of Kete-Krachi in the Oti Region of Ghana

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Abstract

Despite the availability of antibiotics, meningitis continues to cause significant morbidity and mortality worldwide, especially in the meningitis belt of Africa. In Ghana, the mortality rate ranges from 36% to 50%. This study sought to find out the knowledge level of the people of Kete-Krachi, on the causes, mode of transmission, signs, and symptoms of meningitis. Again, it looked at the prevailing environmental conditions in the community, the treatment preference of the people in the event of an outbreak, and finally, explored if sensitization on meningitis is visible in the community. Focus group discussions and individual interviews were used to solicit information from the participants. Generally, the individuals interviewed showed a low level of awareness on the causes, mode of transmission, signs, and symptoms of the disease. Participants had a penchant for alternative treatment because it is perceived to be efficacious as against orthodox treatment. Public health awareness on meningitis was almost absent. We recommend as an implication for policy, a rigorous sensitization on meningitis by health workers and a periodic vaccination exercise in the community and other areas within the meningitis belt.

Subject Areas

Public health

Keywords

Meningitis, Kete-Krachi, Disease, Knowledge, Prevention, Ghana

1. Introduction

Meningitis undoubtedly is one of the most dreaded infectious diseases in countries found within the meningitis belt, owing to the seasonal nature and the debility effects on survivors even after treatment. Letsa *et al.* and Akanwake *et al.* described the disease as swelling of the meninges (membranes covering the brain and the spinal cord) and this swelling often leads to obstruction in the flow of blood and oxygen to the brain tissue resulting in brain injury, convulsion, visual impairment, hearing loss, the inertness of limbs, etc. [1] [2]. The causative agents responsible for the inflammation of the meninges according to Dartey *et al.* [3], are bacteria, viruses, and in rare cases some drugs. Oordt-Speets *et al.* [4] enumerated some common pathogens associated with meningitis as: *Nesseiria meningitides*, *Streptococcus pneumoniae*, *Pneumococcal meningitides*, and *Haemophilus influenza b*. Meningitis is contagious and the spread from person to person is by close contact with the respiratory secretions of the infected individual [5]. Persons with meningitis usually present with symptoms such as fever, vomiting, headache, convulsion, and neck stiffness among others [6]. As an acute life-threatening condition, the public health drain of it cannot be discounted taking into consideration its mortality and morbidity rates. For instance, it is estimated that 1.2 million cases with about 170,000 deaths are recorded annually. The fatality rate is as high as 70% with about 10% - 20% of survivors developing permanent disability [7] [8].

Studies have shown a correlation between prevailing environmental and weather conditions and spikes in cases. Geographically, the prevalence of the disease is high in areas along the meningitis belt. This belt which extends from Senegal to Ethiopia is characterized by arid seasons [9]. It has been propounded that high concentrations of dust, strong winds, elevated temperatures, and low humidity could cause damage to the nasopharyngeal mucosa, thus heightening an individual's chances of being infected with meningitis [10] [11]. In addition, Trumah [12] indicated that these climatic conditions coupled with congested human spaces, cluster movements inevitably lead to an outbreak.

Ghana is not immune to the menace of meningitis because the five regions of the North (Northern, North East, Savanna, Upper East, and Upper West), some parts of the Oti and Bono East regions are found within the African meningitis belt [13]. According to Issahaku *et al.* [14], close to over 3000 cases of meningitis and 400 deaths were reported in Ghana between the period of 2010 and 2015. Again, from December 2015 to February 2016, Ghana recorded over 1000 cases of meningitis infection, which resulted in 125 deaths. Outbreaks of meningitis in Ghana were previously recorded almost entirely in the five regions of the North, however, recent reports show rising incidence in the other meningitis belt like the Bono-East region. A case in point is the 2015/2016 epidemic season, where the Bono East region was hit by the *Streptococcus Pneumococcal meningitis* outbreak and six (6) districts recorded cases above the epidemic threshold of 10/100,000 per week and a case fatality rate of 24% [15].

Kwarteng *et al.* [16] also reported that for the 2015/2016 season, there were suspected meningitis cases in Ashanti, Eastern, and other regions. These regions of the south typically are not within the meningitis belt however, they had pockets of cases being recorded. This, they attributed to changes in the general climatic conditions (mean temperature), close contact with infected persons via activities like coughing, sneezing, kissing, and sharing of personal items, along with overcrowded living settings.

As far as the geographical distribution of meningitis is concerned, the spread of the disease is no more exclusively embedded in the five Regions of the North (Northern, North East, Savanna, Upper East, and Upper West) which is predicated on the aforementioned. There is a trickling down of infection in other meningitis belt and even areas outside the belt. That being said, there is a need to turn attention to communities other than the five Regions of the North, to explore the meningitis dynamics. One such community is the Kete-Krachi, a community in the Krachi West district of the Oti region. Data from the health information unit of the district assembly indicates that 30 suspected cases of meningitis were recorded in 2016, out of which four were confirmed with one death. In 2017, four suspected cases of meningitis were recorded [17]. This report shows that people in Krachi West are susceptible to the infection because the climatic, spatial, and general conditions pertain in parts of the Oti region parallel closely to that of the five Regions of the North since these areas fall within the meningitis belt. The study, therefore, had the following as its objectives: to explore the knowledge level of the people on the disease; find out their treatment preference; their response to the disease; public health surveillance in terms of sensitization; and the prevailing environmental conditions.

This research was considered important because it deviated from numerous accounts in the literature on the epidemiology of the disease, clinical trials of vaccines, seasonality and rate of infection, etc. As the spread of infection drifts to other non-epidemic regions, there is the need to comprehend how people perceive the disease. Instead of focusing on quantifying patterns of the disease as seen in many studies, our emphasis was to provide descriptions of the phenomenon by describing the perceptions and actions of the participants in their context. Aside from adding to scholarship, this study would provide a piece of community-based information on meningitis to the Integrated Disease Surveillance Systems/Protocols of the Ministry of Health to either redirect or intensify current measures to prevent or effectively manage an outbreak at the community, district and the national levels at large.

2. Theoretical Support

The study was underpinned by the Health Belief Model (HBM). Theories and models are purposeful in predicting and explaining human behaviour, therefore HBM was considered relevant to the study because of the constructs that are employed in explaining health behaviour. As a health behaviour model, Conner

& Norman [18] conceptualized it as being centered on the assumption that people generally are afraid of diseases and the resultant effects thus the health-seeking behaviour of individuals is often propelled by the degree of perceived threats. Carpenter [19], also explained that the willingness of people to partake in health-promoting behaviour is occasioned by their beliefs about the health problem, the seeming benefits of action and barriers to action, and self-efficacy. A stimulus, or cue to action, must also be present to trigger a person's health-promoting behaviour. From the foregoing, this model constitutes a useful framework for understanding how people respond to health risks. It sets the tone to appreciate how the people of Kete Krachi perceive meningitis as a health threat; their assessment of their susceptibility to the illness (if they feel they are personally prone to the illness); the benefit of action (if they believe the benefits associated with protective behaviour outweigh the cost *i.e.*, money spent on treatment and in severe cases death); barriers to action among others.

3. Methodology

3.1. Study Site

The Krachi West district is positioned in the transitional area between the savannah zone to the north and the forest zone to the south. It is evident to see savannah grassland, especially in the northern parts of the district. The district shares boundaries with Krachi Nchumuru district to the North, and Krachi East district to the East (**Figure 1**). According to the 2010 Population and Housing Census, the estimated population was 49,417. It comprised 49.0 percent females and 51.0 percent males. The population of the district is youthful with the population under age 15 constituting 43.3 percent. The district has a mean maximum temperature of 30°C and this is often recorded in March. The mean minimum temperature of 25°C is recorded in August which is usually the peak of the rains. The mean annual rainfall is 1300 mm. The dry season spans from November to March with generally harsh dry weather. The relative humidity is high in the rainy season (averaging 85%) and very low in the dry season (25% on average) [20]. Kete-Krachi was selected for the study because it is the administrative town of the district and is within the meningitis belt. Being the administrative town of the Krachi West district, we found the setting of Kete Krachi to be a collectivistic community, with an easy flow of social interaction. It is a peri-urban community with both urban and rural outlooks. The area is the seat of the district administrative block, district hospital, and commercial centers. Some principal streets within the town have some touch of coal tar, whereas most of the roads leading to communities within the town are untarred and dusty. It was observed that quite a number of the buildings and houses in the urban part of the town are in concrete form with a minimum of two windows depending on the structure. Buildings in the rural part are either built from mud with straw roofing materials or a mixture of mud and mortar with aluminum sheets as roofing. Windows in these rural structures are mostly single, small, and enclosed with polythene

DISTRICT MAP OF KRACHI WEST



Figure 1. District Map of Krachie West (Source: District Analytical Report, 2010).

material. On average, the number of occupants per room ranged from four to seven people.

3.2. Research Approach

The overarching research approach of the study was qualitative design. This research style gives the avenue for researchers to garner an insider perspective of a phenomenon. According to Creswell & Poth [21], researchers adopt this design to observe and describe human behaviour and interpret individuals' ascriptions and experiences. Again, the use of qualitative research in health studies allows

researchers to highlight specific knowledge, attitudes, and practices which are deeply rooted in the lived processes of a group of people in a social context [22]. We deemed this design appropriate because of its subjective and context-specific nature in uncovering and analyzing important expressions/perspectives of participants in their real-life milieu.

The duration of the study was 8 weeks, however, before the start of the research, the lead and third authors visited the community for a feasibility study and also to establish contacts with some gatekeepers of the community. We explained to some community leaders the purpose of the study and our methodology. Permission was granted and the date for commencement was communicated to the research team.

With assistance from community leaders and elders, men, and women aged 18 years and above were recruited to partake in the study. For the recruitment process, the authors together with the field assistants and our gatekeepers (*i.e.* the community leaders) visited households to invite members to participate in the study. After the objectives of the study were explained to them, the names of interested residents were taken as potential participants. Out of the 140 residents who had given their names as potential participants, 98 were recorded to have participated in the study. A chunk of the participants were crop farmers (*i.e.* farming is their main source of livelihood) with few from other economic engagements.

Six focus group discussions (FGDs) were conducted. They comprised 3-female groups and 3-male groups with 10 members in each set. The individual interviews had 38 participants. The individual interviews and FGDs were moderated by the lead and second authors with the help of two assistants who were fluent in the Kaakyi, the native and predominant dialect. All sessions began after establishing a mutual understanding of the study objectives. In addition to the interviews, field notes were taken to capture the environmental conditions and the visible adaptive measures in the locale.

3.3. Data Analysis

Analysis was done in sync with the objectives framed for the study and was premised on an inductive approach. Transcripts from audio recordings were coded using Nvivo software to organize insights into major themes/categories encompassing the knowledge level of the people on the disease; preventive strategies, environmental conditions, and adaptation strategies/response to the disease. The themes/categories were identified through patterns in the data and buttressed with insights from the theory, and observational notes. The content was also closely analyzed to evaluate “who said what”. Relevant verbatim extracts were used to enrich the descriptions of the data.

To avoid biases of the researchers, the validity of the data was ensured through member-checking (tracing the data to the source and verifying if the transcribed data reflected their narration), auditing of data by the interview moderators, di-

versity in participants, triangulating results from the various methods *i.e.* FGDs, individual interviews and observational notes used.

For ethical considerations, a letter was sent to the District Directorate of Health Services for ethical clearance for the study. Clearance was given for the conduct of the study. Before the start of each engagement with participants, we spelt out to them the ethical measures such as voluntary participation, confidentiality, and the use of pseudonyms to protect their identities.

4. Results

4.1. Socio-Demographic Data of Participants

The study had 52 males and 46 females. For age distribution, 37 were aged less than 30 years while the rest were above 30 years. With regards to education, the findings showed that the majority (69) had attained a primary level of education, 20 had secondary school education, and 2 were NVTI trainees with 7 reporting that they had not received any formal education. The study had participants engaged in diverse occupations thus out of the 98 participants, 43 were crop farmers, 17 petty traders, 3 primary school teachers, 8 carpenters, 4 fishermen, 7 seamstresses, 9 masons, 5 canoe boat riders, and 2 students. The majority of the participants, (51) were found to be Christians while 32 were reported to be in the African Traditional Religion, and 15 were Muslims. For ethnicity, 46 were found to be Kaakye 27 were Ewe, 8 were Akans, 12 were Dagombas, and 5 were Gonjas. The socio-demographic characteristics of our participants generally reflected the population dynamics of the Krachi West district.

4.2. Meningitis, a Known Disease?

Under this theme, we sought to find out participants' knowledge of the causes, mode of transmission, signs, and symptoms.

4.2.1. Knowledge of Causes of the Infection

The main tenet of the study was to explore how conversant the people were with the causes of meningitis. Being in a meningitis belt, participants were asked about what they think the causes of meningitis are. Many of the participants had no idea about the infection. A few however, indicated that meningitis is an air-borne infection.

"It is an air-bone disease." (Yvonne, 25 years, individual interview)

"It is an air infection like pneumonia." (Victoria, 40 years, FGD)

"I have no idea. Is it like malaria?" (Kojo, 60 years, individual interview)

"I have no knowledge about the causes of the disease." (Sampson, 23 years, FGD)

We sought to find out if participants could link weather patterns to meningitis. They expressed that high temperature generally causes illness and discomfort, so there is a likelihood that meningitis may be caused by extreme tempera-

ture. They indicated that the duration of the hot dry season is now much longer than it used to be. It now spans from November to March instead of from November to late January in the past years. Participants stated that the heat experienced in recent times is much more severe than in the past. They articulated that the variation in the climate comes along with its health complications like severe dehydration, skin rash, etc, and not just meningitis. Below are the expressions of Righteous and Garvi:

“The weather is very unpredictable now. The season does not start as it was some years back. For example, the dry season was November to about ending of January. Now it has extended to March. When the weather is dry and hot it makes us uncomfortable and it can make you sick.” (Righteous, 58 years, individual interview)

“Oh, the way the temperature is hot these days, it can cause any illness. Even aside meningitis you can get severe heat rash, dry throat, headache and more. So yes, I believe that climate change can cause this sickness.” (Garvi, 40 years, FGD)

4.2.2. Mode of Transmission

We enquired about the mode of transmission of the disease. They expressed that, it is common knowledge that most diseases are spread through human contact. However, they could not tell the exact means through which an infected person can transmit meningitis to others. Their responses were diffused. For example:

“I think it spreads from one person to the other. I don’t really know how. Maybe through handshake or coughing.” (Candy, 23 years, Individual interview)

“I believe when you sleep with an infected person then you can also be infected.” (Jehu, 45 years, individual interview)

“I think it can be several ways. Since my brother said it is airborne then the infected person can spread it through sneezing, coughing, sharing spoons. But if it is not air-borne then it can be through sex.” (Ladie, 27 years, FGD)

4.2.3. Signs and Symptoms

For symptoms, many did not know any symptoms of meningitis. Nonetheless, few mentioned fever, rashes, and neck stiffness among others. The voices are presented below:

“In 2016 when it happened, I heard that when the disease attacks you, you feel like you have fever. I heard you then begin to talk as if you have seen ancestors (describing hallucination) and you shiver. That is what I know.” (Buju, 40 years, individual interview)

“Mmm, I think when you have stiff neck and it is painful, then you may have the disease. Oh yes, there are times you may just have neck pains, that is normal, but when you can’t even turn and it pains you really bad then I

think you have to look for solution.” (Yao, 30 years, individual interview)

“The last time I heard it is like having high-fever, some had rashes, some couldn't talk.” (Beatrice, 28 years, FGD)

4.3. Susceptibility to the Disease

Environmental elements like congestion of structures, and climatic variations often result in meningitis outbreaks. As a contagious disease, we sought to find out if the people felt susceptible to the disease. They responded in the negative. They conceded that although their warm environment, overcrowded living areas, and poor socioeconomic conditions are recipes for meningitis outbreaks, nonetheless they were confident that, with their lifestyle, diet, and general well-being they were less prone to meningitis. They explained that they eat more of their local foods as against processed foods. Also, they engage in physical activities and rely on traditional herbs which make them strong and not easily susceptible to illnesses. When asked about the 2016 epidemic year, they pointed out that their lifestyle and habits saved them, thus recording a low number of casualties unlike in other regions where the number of casualties were quite high. For instance:

“Oh, as for me I would never be infected with this disease or any other disease because I live a healthy life. Every morning I boil my herbs and drink. It washes my system of any illness. Right after taking the drink, I begin to sweat which is a sign that the bad things which will cause sickness is coming out through the sweat. I eat our local foods especially the green leaves. I don't joke with it because they are healthy. With my work too, as you can see it is an active one.” (Josiah, 48 years, individual interview)

“As they say prevention is better than cure. You see when your system (referring to the immune system) is strong you cannot be sick like that. Diseases are for those with weak system. How do you get strong system? It is by what you eat, drink and protecting yourself.” For the protection, I am not just talking about spiritual protection but physical one too. For example, you know the weather is hot and dusty. What do you do? You wear long dresses and you cover your nose so that the air does not get into you. If you do these you will not get sick. (Cosmos, 51 years, individual interview)

“When you eat healthy and you exercise you would not be prone to any disease.” (Sunshine, 19 years, individual interview)

4.4. Treatment Preference

We sought to explore the treatment preferences of the people in the advent of an outbreak. They appreciated the fact that modern medicine is beneficial in diagnosing disease however they believe that modern medicine manages illness but does not treat it completely. They added that indigenous treatment is efficacious and sometimes goes beyond the physical. From their expressions indigenous treatment practices were preferred over modern medicine. For example:

“Foreign medicine is good but I think our traditional way of treating sickness is better. The treatment herbalists give us are natural which does not cause harm to us.” (Paul, 56 years, FGD)

“Going to the hospital is not bad. At least you will know the kind of illness you are suffering from. But you see these medications are not able to cure illnesses completely. With the traditional medicine it works really well. Sometimes the herbalist is able to give the root cause of the illness and so treatment starts from there. Not all sicknesses are caused physically. There is more to which we cannot see, and the hospital treatment cannot go beyond physical treatment.” (Jude, 29 years, FGD)

4.5. Public Health Intervention

Under this theme, we sought to find out from the people what the preventive measures are by way of intervention from the health authorities. From their responses, it was gathered that less surveillance had been done. The majority indicated that they had not yet encountered health workers promoting discussions on the causes, signs and symptoms, and prevention of meningitis as well as the need for early reporting. Also, it was recorded that vaccination exercise against the infection was almost absent. Below are some extracts from the FGDs:

“I haven’t seen any community education on the disease. I think the health workers do not give us attention because we don’t die from it like the other people in other regions. It is normal, those in other regions suffer more than us. So, for me it is just like when you don’t make noise you don’t attract attention.” (Karim, 35 years, FGD)

“As for education on meningitis we haven’t had one.” (Erica, 30 years, FDG)

“Well in 2016 I think some of our people had it and that was when I even heard about the disease and saw some community nurses. After, that time I haven’t seen or heard anything. I would say they do not have routine checks. They only come when something bad happens.” As for the injection those who were sick were given. Those of us who were not sick we did not get the injection”. (Saviour, 28 years, FDG)

5. Discussion

The environmental evaluation of the study area (as discussed in the methodology) showed a dry and windy environment, poor ventilation, and overcrowded room spaces occupied by members of households. These conditions posed a recipe for the rapid spread of the disease. Congestion and climatic conditions have been articulated in literature as the principal environmental causative factors of the disease. As demonstrated by Molesworth *et al.* [23] and Al-Ghamdi & Kabbash [24], severe climatic conditions, and congestions of living spaces have the potential to spread the disease. Again, the people of Kete-Krachi live in a closely-knitted setting. In a community where the expressive ties between the

people are strong, social groupings and togetherness are evident. Meningitis is contagious and the spread from person to person is by close contact with the respiratory secretions of the infected individual. Thus, taking cognizance of their social setting, an inference can be made that a single case of infection would easily lead to a serious outbreak in the community.

One outcome of the study showed that the individuals exhibited a low level of awareness of the causes, mode of transmission, signs, and symptoms of the disease. This could be ascribed to the argument that people in highly prevalent areas are more likely to demonstrate better knowledge of the disease because there is quite an abundance and free flow of information than those in relatively lower prevalent areas like Kete Krachi. As depicted in Hayden *et al.* work, participants in a meningitis-prone area that is, Nankana in the Upper East Region of Ghana demonstrated an in-depth awareness of meningitis [25].

To comprehend how people respond to the spread of a disease, it is imperative to observe and appreciate their perception of their vulnerability to the disease. Perception in public health discourse is important because it is the social lens through which people make meaning of illnesses. It further generates strategies for mitigating health crises. For susceptibility to the disease, participants perceived meningitis as any other disease, and the surest way of keeping diseases at bay is to adopt a healthy lifestyle. Participants, therefore, alluded that, despite their warm environment, overcrowded living areas, poor socioeconomic situation, etc, their lifestyle and their general attitude to health and wellness made them less prone to meningitis. This tailors in the health belief model which presumes that people generally want to avoid diseases and the consequential effects so the pursuit of health is often influenced by the extent of perceived threats. In the case of our participants, the seeming benefit of their action (healthy lifestyle) has reduced the perceived threat of the disease. It is therefore not surprising that their evaluation of their susceptibility to the disease is low because they trust that their protective behaviour makes them less vulnerable to the disease.

According to Karikari & Boateng [26], treatment choices of people are either based on the individual's perceived interpretation of a disease, the potency of the said treatment, or even a blend of the two. Participants in this study had a penchant for alternative treatment over orthodox/medical treatment. This preference was hinged on their perceived potency of alternative treatment. As a medical pluralistic society, this result is not surprising because there are numerous treatment options for one to choose from. Acknowledging this will bring forth appropriate health interventions/strategies to suit the needs of the people to mitigate diseases.

Health is essential to the continued existence and growth of the human race as such resources are spent on preserving and enhancing health. From the individual interviews and focus group discussions, responses on the public health intervention by health authorities showed that less surveillance had been done. Health promotion and vaccination exercise had not been experienced. A proba-

ble explanation is that because Kete-Krachi is not an endemic enclave, much attention has not been drawn to the community. This further explains why the awareness of the disease is near to the ground. This is unfortunate because current reported cases point to the fact that the infection is being spread to other areas aside from the endemic communities. Ghana has a highly mobile population and the damage would be colossal if we have to wait for the disease to strike before people are given intensive knowledge about the disease and vaccinated against it.

6. Conclusions and Recommendations

This study has provided some empirical information on the knowledge level of people on the causes, mode of transmission, signs, symptoms, and prevention of meningitis in Kete-Krachi. The findings showed that the majority of the participants were oblivious to meningitis which can be attributed to poor awareness about the disease. In addition, in the event of an outbreak, the treatment pattern participants are likely to subscribe to is the indigenous medicine because of the perceived effectiveness.

Based on the findings of the study, the following are some recommendations:

- 1) There is a need for stronger collaboration between public health officers and media houses to grant airtime for health programs. By this, quality information would be broadcasted to the general public.
- 2) Again, we suggest that vaccination exercises should be done periodically as a preventive measure.
- 3) Public health practitioners should incorporate treatment preference because knowing the treatment inclination of a social group yields a suitable health intervention plan for the community.
- 4) District, Municipal, and Metropolitan Assemblies in collaboration with key stakeholders should enforce laws and bylaws regulating the construction of houses to ensure that settlements are well-planned and building plans meet standards of ventilation before building permits are granted.

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Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Letsa, T., Noora, C.L., Kuma, G.K., Asiedu, E., Kye-Duodu, G., Afari, E., *et al.* (2018) Pneumococcal Meningitis Outbreak and Associated Factors in Six Districts of Brong Ahafo Region, Ghana, 2016. *BMC Public Health*, **18**, Article No. 781. <https://doi.org/10.1186/s12889-018-5529-z>

- [2] Akanwake, J.B., Atinga, R.A. and Boafo, Y.A. (2022) Effect of Climate Change on Cerebrospinal Meningitis Morbidities and Mortalities: A Longitudinal and Community-Based Study in Ghana. *PLOS Climate*, **1**, e0000067. <https://doi.org/10.1371/journal.pclm.0000067>
- [3] Dartey, B., Afreh, O., Teviu, E., Khumalo, G., Letsa, T., Issah, K., Opoku, S., Iddrisah, F. and Nortey, P. (2020) Analysis of Meningitis Outbreak Data, Jaman North District, Brong Ahafo Region, Ghana. *Ghana Medical Journal*, **54**, 53-58. <https://doi.org/10.4314/gmj.v54i2s.9>
- [4] Oordt-Speets, A.M., Bolijn, R., van Hoorn, R.C., Bhavsar, A. and Kyaw, M.H. (2018) Global Etiology of Bacterial Meningitis: A Systematic Review and Meta-Analysis. *PLOS ONE*, **13**, e0198772. <https://doi.org/10.1371/journal.pone.0198772>
- [5] Domo N.R., Nuolabong C., Nyarko K.M., Kenu E., Balagumyetime P., Konnyeba G., Noora C.L., Ameme K.D., Wurapa F. and Afari E. (2017) Uncommon Mixed Outbreak of Pneumococcal and Meningococcal Meningitis in Jirapa District, Upper West Region, Ghana, 2016. *Ghana Medical Journal*, **51**, 149-155. <https://doi.org/10.4314/gmj.v51i4.2>
- [6] Amidu, N., Antuamwine, B.B., Addai-Mensah, O., Abdul-Karim, A., Stebleson, A., Abubakari, B.B., *et al.* (2019) Diagnosis of Bacterial Meningitis in Ghana: Polymerase Chain Reaction versus Latex Agglutination Methods. *PLOS ONE*, **14**, e0210812. <https://doi.org/10.1371/journal.pone.0210812>
- [7] World Health Organization (2017) Epidemic Meningitis Control in Countries of the African Meningitis Belt. *World Health Organization's Weekly Epidemiological Record*, **13**, 145-164.
- [8] Colombini, A., Bationo, F., Zongo, S., Ouattara, F., Badolo, O., Jaillard, P., Seini, E., Gessner, B.D. and Da Silva, A. (2009) Costs for Households and Community Perception of Meningitis Epidemics in Burkina Faso. *Clinical Infectious Diseases*, **49**, 1520-1525. <https://doi.org/10.1086/644623>
- [9] Trotter, C.L. and Greenwood, B.M. (2007) Meningococcal Carriage in the African Meningitis Belt. *The Lancet Infectious Diseases*, **7**, 797-803. [https://doi.org/10.1016/S1473-3099\(07\)70288-8](https://doi.org/10.1016/S1473-3099(07)70288-8)
- [10] Sultan, B., Labadi, K., Guégan, J.F. and Janicot, S. (2005) Climate Drives the Meningitis Epidemics Onset in West Africa. *PLOS Medicine*, **2**, e6. <https://doi.org/10.1371/journal.pmed.0020006>
- [11] Smith, M.S. and Tietaah, G.K.M. (2017) Online Media Surveillance: Coverage of Meningitis Outbreaks in Ghana. *Athens Journal of Health*, **4**, 303-320. <https://doi.org/10.30958/ajh.4-4-2>
- [12] Trumah, R.B. (2013) Relationship between Selected Climatic Variables and Cerebrospinal Meningitis (CSM). Unpublished Master's Thesis, Kwame Nkrumah University of Science and Technology, Kumasi.
- [13] Holliman, R.E., Liddy, H., Johnson, J.D. and Adjei, O. (2007) Epidemiology of Invasive Pneumococcal Disease in Kumasi, Ghana. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **101**, 405-413. <https://doi.org/10.1016/j.trstmh.2006.08.014>
- [14] Issahaku, G.R., Amoatika, D.A., Ameme, D.K., Bando, D.A., Sackey, S.O. and Kenu, E. (2022) Imminent Meningitis Outbreak Prevented by Early Warning and Response Action: Nadowli-Kaleo District, Upper West Region, Ghana-2017. *Journal of Interventional Epidemiology and Public Health*, **5**, Article 12. <https://doi.org/10.37432/jieph.2022.5.2.60>
- [15] Wulifan, J.K., Dapilah, F. and Angko, W. (2022) A Retrospective Evaluation of Ce-

- rebrospinal Meningitis Data in Upper West Region, Ghana, 2015-2021. *PAMJ-One Health*, **8**, Article 13. <https://doi.org/10.11604/pamj-oh.2022.8.13.35310>
- [16] Kwarteng, A., Amuasi, J., Annan, A., Ahuno, S., Opore, D., Nagel, M., Vinnemeier, C., May, J. and Owusu-Dabo, E. (2017) Current Meningitis Outbreak in Ghana: Historical Perspectives and the Importance of Diagnostics. *Acta Tropica*, **169**, 51-56. <https://doi.org/10.1016/j.actatropica.2017.01.014>
- [17] Krachi West District Health Management Team (2017) Annual Performance Review Report. Krachi West District Assembly, Kete-Krachi.
- [18] Conner, M. and Norman, P. (2005) Predicting Health Behaviour: Research and Practice with Social Cognition Models. Open University Press, Buckingham.
- [19] Carpenter, C.J. (2010) A Meta-Analysis of the Effectiveness of Health Belief Model Variables in Predicting Behavior. *Health Communication*, **25**, 661-669. <https://doi.org/10.1080/10410236.2010.521906>
- [20] Ghana Statistical Service (2014) 2010 Population and Housing Census, Krachie West District Analytical Report. Ghana Statistical Service, Accra.
- [21] Creswell, J.W. and Poth, C.N. (2016) Qualitative Inquiry and Research Design: Choosing among Five Approaches. SAGE Publications, Singapore.
- [22] Cubellis, L., Schmid, C. and von Peter, S. (2021) Ethnography in Health Services Research: Oscillation between Theory and Practice. *Qualitative Health Research*, **31**, 2029-2040. <https://doi.org/10.1177/10497323211022312>
- [23] Al-Ghamdi, A.S. and Kabbash, I.A. (2011) Awareness of Healthcare Workers Regarding Preventive Measures for Communicable Diseases among Hajj Pilgrims at the Entry Point in West Saudi. *Saudi Medical Journal*, **32**, 1161-1167.
- [24] Molesworth, A.M., Cuevas, L.E., Connor, S.J., Morse, A.P. and Thomson, M.C. (2003) Environmental Risk and Meningitis Epidemics in Africa. *Emerging Infectious Diseases*, **9**, 1287-1293. <https://doi.org/10.3201/eid0910.030182>
- [25] Hayden, M.H., Dalaba, M., Awine, T., Akweongo, P., Nyaaba, G., Anaseba, D., Pelzman, J., Hodgson, A. and Pandya, R. (2013) Knowledge, Attitudes, and Practices Related to Meningitis in Northern Ghana. *The American Journal of Tropical Medicine and Hygiene*, **89**, 265-270. <https://doi.org/10.4269/ajtmh.12-0515>
- [26] Karikari, N.A. and Boateng, W. (2019) Coping Strategies of Female Breast Cancer Patients at the Cape Coast Teaching Hospital in Ghana. *Gender and Behaviour*, **17**, 14370-14378.