

## Public Transport as an Alternative Mode of Transport During Health Emergencies and the Spread of Infectious Diseases in the Greater Accra Metropolitan Area (GAMA)

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**ABSTRACT:** Emergency medical transportation services in the developing world, including Sub-Saharan Africa, face numerous challenges. These include insufficient resources, such as vehicles, limited staff and equipment, and poor communication and transportation networks. Consequently, people often rely on private and public transport, like taxis, during emergency health situations. However, it is uncertain whether these vehicles adhere to standard disinfection protocols afterward, potentially exposing subsequent passengers and drivers to infectious diseases. This study employed a mixed-methods approach to investigate the relationship between public transport and the spread of infectious diseases in the Greater Accra Metropolitan Area (GAMA). Respondents were selected from households, health facilities, and drivers across high-, middle-, and low-income areas in GAMA. The findings indicate that taxis are frequently used during emergencies, but drivers often fail to employ proper cleaning methods, putting passengers at risk. The study also reveals that while residents are aware of the risks associated with public transport and infectious diseases, both the public and authorities have come to accept it as an “acceptable risk” due to the ineffectiveness of the ambulance service in Ghana. To mitigate this risk, the study proposes both short-term and long-term recommendations to enhance the effectiveness of the Ghana Ambulance Service (GAS).

**KEYWORDS:** Public Transport, Infectious Diseases, Emergency, Greater Accra Metropolitan Area (GAMA), Ambulance

### INTRODUCTION

Emergency situations require immediate medical attention to prevent adverse outcomes. According to Aringhieri *et al.* (2017), such situations are critical and demand prompt response. The World Health Organization (2018) identifies ischemic heart disease, stroke, chronic obstructive pulmonary disease, lower respiratory infection, and Alzheimer's disease as leading causes of death globally. However, Infectious diseases remain a significant public health concern, particularly in developing countries (Mukherjee, 2017). In Ghana, for instance, cholera outbreaks have been reported, with Accra being the epicentre in 2014 (Kwalime *et al.*, 2017). Ideally, ambulances should provide emergency transportation, but these services face numerous challenges, including insufficient resources, limited staff, and poor communication networks (Mohammed & Prabhu, 2015). Consequently, public and private transport, such as taxis, have become alternative means of emergency transportation (Bhalla *et al.*, 2019), posing risks of infectious disease transmission.

In Ghana, the inadequacy of ambulance services has led to increased reliance on public and private transport during emergency situations. For instance, a 70-year-old man was transported to various hospitals in Accra in his private vehicle but unfortunately passed away due to unavailability of beds (Welsing, 2018). Motorbikes, known as ‘Okada,’ are also used for emergency transportation in rural Ghana, even for sick and pregnant women (Oteng-Ababio & Agyemang, 2012; Atuoye *et al.*, 2015). However, this raises concerns about the potential transmission of infectious diseases through these vehicles (Lowe *et al.*, 2014). Infectious passengers may exude pathogens into the vehicle, which can subsequently be absorbed by users of the vehicle. Furthermore, vehicles used to transport deceased individuals to mortuaries or burial sites may not be properly disinfected (Agyemang, 2014), posing a risk to the public. Given that research has shown that even fumigated ambulances can harbour pathogenic microbes and facilitate disease spread (Mohamed & Prabhu, 2015), public transport providing emergency services may pose an even greater risk.

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The Ministry of Health's efforts to improve ambulance services in Ghana have been hindered by challenges in the past years, including grounded ambulances (Tawiah, 2017). Despite the government's "One Constituency-One Ambulance" initiative, which provided an ambulance to each of Ghana's 275 constituencies, a significant gap remains in meeting the international standard of one ambulance per 50,000 people, given the country's population of approximately 31 million.

This study discusses the use of public transport as an alternative mode of transportation during health emergencies and its implications for the spread of infectious diseases, particularly in the Greater Accra Metropolitan Area (GAMA). GAMA's rapid urbanization and poor sanitation create an environment conducive to disease transmission, which is further exacerbated by inadequate disinfection practices among public transport operators. The findings of this study will contribute to addressing the knowledge gap and informing strategies to establish an effective Emergency Medical Transport Service in Ghana.

## MATERIALS AND METHODS

### Study Area

Greater Accra Metropolitan Area (GAMA) is not a standard administrative term in Ghana's Greater Accra region. However, researchers have used it to describe a broader area initially comprising the Accra Metropolitan Assembly, Tema Municipal Assembly, and Ga District Assembly (Abdulai, 2024; Owusu, 2015). By 2012, GAMA had evolved into 12 independent administrative divisions due to rapid population growth and Ghana's decentralization policy (Agyemang, 2015). These divisions are headed by Chief Executive Officers appointed by the President and endorsed by local assembly members.

GAMA covers approximately 1,079 km<sup>2</sup>, about 33% of the Greater Accra region's land surface, and is home to over 4 million people (Owusu, 2015). This makes GAMA the most densely populated urban area in Ghana (Agyemang, 2015), prone to associated risks like infectious disease outbreaks (Ohene-Adjei *et al.*, 2017). For instance, in 2014, GAMA recorded the highest cholera cases in the region (Kwalime *et al.*, 2017).

The area's emergency transport system faces challenges, including inadequate ambulance services (Zakariah *et al.*, 2017). Transportation in GAMA is primarily provided by informal services like "Trotro" mini-buses and vans, taxis, and motor-taxis ("Okada") as indicated by Agyemang (2015). This situation often forces people to rely on taxi services during emergency health situations, which influenced the choice of GAMA as the study area.

GAMA's boundaries include the Central Region to the west, Eastern Region to the north, Shai Osudoko and Ningo Prampram districts to the east, and the Gulf of Guinea to the south. For this study, GAMA's operational definition encompasses the catchment area shown in Figure 1.

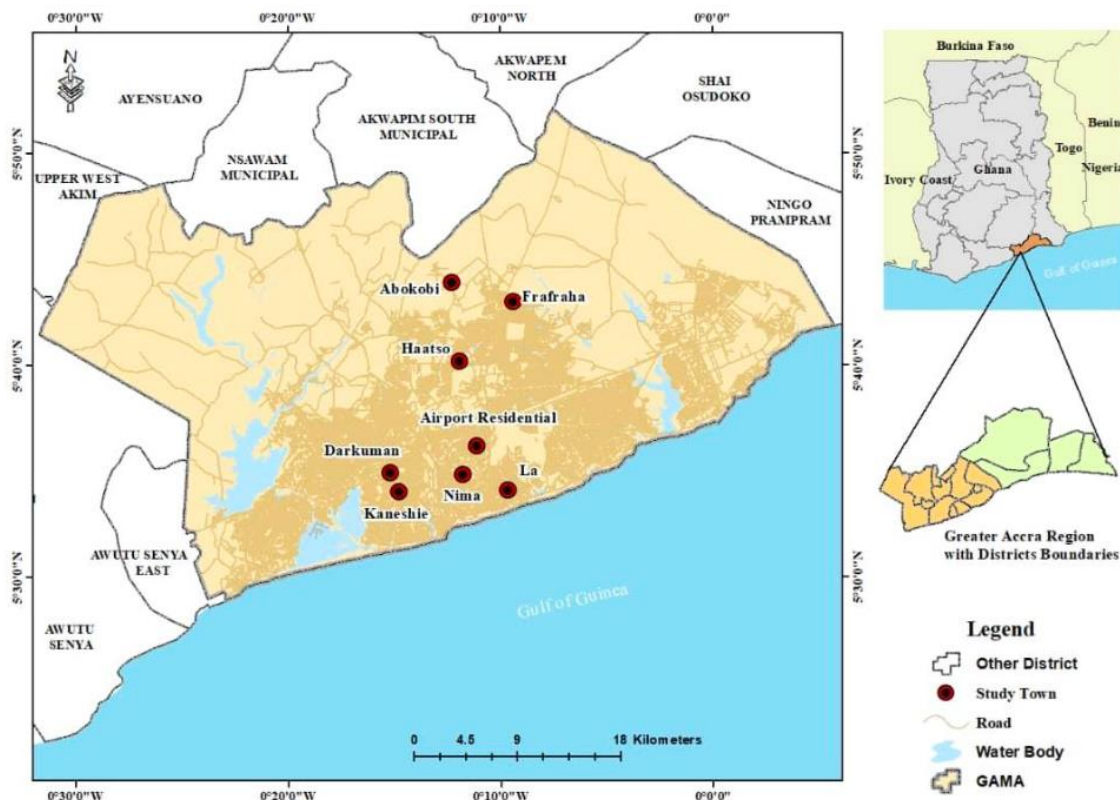


Figure 1: Study Area Map

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## Design and Sampling

The study employed a mixed method design. Through a combined sampling (i.e. systematic random sampling and convenient sampling) approach, a total of three hundred and twenty (320) self-administered questionnaires were used to assess: the main transport modes used during health emergencies, the protocols employed to prevent vehicle infection, and the risk exposure and perception among key actors in the chain of emergency transport delivery. To appreciate the spatial variation of risk knowledge awareness based on class and income status, the study relied on the classification of residential areas in GAMA by Songsore *et al.* (2009) in selecting the residential locations for the study (Figure 2).

Out of the 320 total questionnaires, one hundred and eighty (180) were administered to household members of every fifth house in each residential area, starting from a randomly selected household. One community under each residential stratum was randomly selected for this survey. The allocation was based on the 2010 population census, with adjustments made for areas with minimal representation (Abokobi, Hatso, Airport Residential Area, and Frafraha village). The adjustments involved reducing the numbers of La, Nima, Darkuman, and Kaneshie by 15% and adding them to the aforementioned areas. Eighty (80) questionnaires were also distributed to drivers who are dispersed across GAMA, while sixty (60) questionnaires were allocated to in-patients using convenient sampling, with 20 each from low-income (La Polyclinic Hospital), middle-income (Cocoa Clinic), and high-income (Nyaho Medical Centre) areas. Men and women from households were conveniently selected from various classified income areas in GAMA, with two respondents each from low-income (Nima), middle-income (Kaneshie), and high-income (Airport Residential Area) areas. Tables 1, 2, and 3 show the questionnaire allocation, while Table 4 shows the number of respondents and groups.

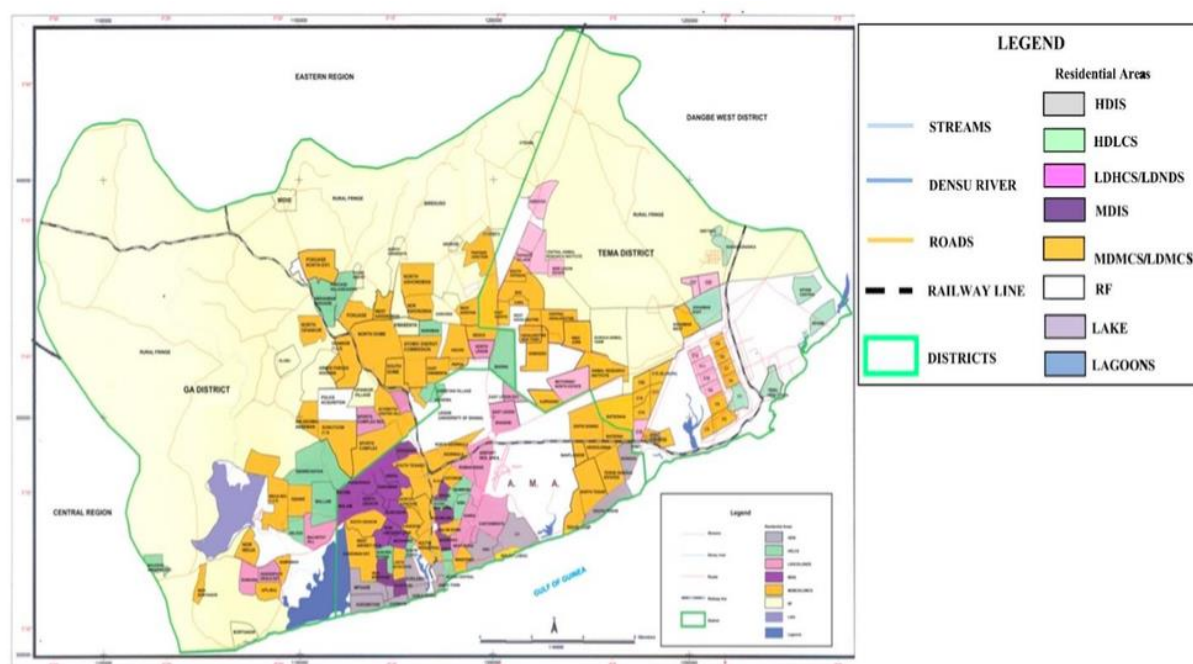


Figure 2: Classification of Residential Areas in Greater Accra Metropolitan Area (GAMA)

Source: Songsore *et al.* (2009)

Table 1: Sampling Design for Households

| Stratum (Songsore <i>et al.</i> , 2009) | Population (2010 census) | Sample Share ( $\frac{\text{Population of area}}{289,119} \times 100$ ) | Sample Size (no. of questionnaire) | Adjustment |
|-----------------------------------------|--------------------------|-------------------------------------------------------------------------|------------------------------------|------------|
| <b>Low-income Areas</b>                 |                          |                                                                         |                                    |            |
| La                                      | 98,683                   | (0.34) 34%                                                              | 61                                 | 52         |
| Nima                                    | 80,843                   | (0.28) 28%                                                              | 50                                 | 43         |
| Darkuman                                | 61,562                   | (0.21) 21%                                                              | 38                                 | 32         |
| Abokobi                                 | 1,654                    | (0.01) 1%                                                               | 2                                  | 7          |
| <b>Middle-income Areas</b>              |                          |                                                                         |                                    |            |
| Kaneshie                                | 31,141                   | (0.11) 11%                                                              | 19                                 | 16         |
| Haatso                                  | 8,062                    | (0.03) 3%                                                               | 5                                  | 10         |

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| High-income Areas |             |                |             |            |            |
|-------------------|-------------|----------------|-------------|------------|------------|
| Airport Area      | Residential | 5,696          | (0.02) 2%   | 3          | 11         |
| Frafraha          |             | 1,478          | (0.01) 1%   | 2          | 9          |
| <b>Total</b>      |             | <b>289,119</b> | <b>100%</b> | <b>180</b> | <b>180</b> |

**Table 2: Sampling Design for Emergency Patients**

| Name of Health facility            | Number of Questionnaires |
|------------------------------------|--------------------------|
| La Polyclinic (low-income area)    | 20                       |
| Cocoa Clinic (middle-income)       | 20                       |
| Nyaho Medical Centre (high-income) | 20                       |
| <b>Total</b>                       | <b>60</b>                |

**Table 3: Sampling Design for Drivers**

| Category of Drivers | Number of Questionnaires |
|---------------------|--------------------------|
| Taxi                | 20                       |
| Van (trotro)        | 20                       |
| Private Car         | 20                       |
| Motor taxi (Okada)  | 20                       |
| <b>Total</b>        | <b>80</b>                |

**Table 4: Sampling Design for Focus Group Discussion**

| Group                                          | Number of Questionnaires |
|------------------------------------------------|--------------------------|
| Health workers involved in direct patient care | 6                        |
| Men from households                            | 6                        |
| Women form households                          | 6                        |
| <b>Total</b>                                   | <b>18</b>                |

### Data Collection Methods

The study employed a mixed-methods approach, combining qualitative and quantitative data collection methods. Specifically, the study conducted In-Depth Key Informant Interviews with key stakeholders, including a Principal Biomedical Scientist at Ghana National Public Health Reference Laboratory (Ministry of Health), Public Relations Officer at National Disaster Management Organization (NADMO), Environmental Health Analyst at Metropolitan Public Health Department- AMA, Greater Accra, Industrial Relations Officer at Ghana Private Road Transport Union of Trade Union congress (GPRTU of TUC), and a Research Officer at Gillman and Abbey Funeral Services-Accra. Focus Group Discussions were also organized with Health Personnel involved in direct patient care and household representatives (Men and women) from various households. This approach allowed for a comprehensive understanding of the research topic, incorporating diverse perspectives and expertise.

### Data Analysis and Presentation

Completed questionnaires were coded and analysed using the Statistical Package for the Social Sciences (SPSS version 23). The analysis involved calculating descriptive statistics, such as percentages and frequencies, which were presented in tables and charts. Additionally, qualitative data was analysed thematically, with key findings reported under each main theme and supported by verbatim quotes from participants. This comprehensive approach enabled a rich understanding of the research topic by integrating both quantitative and qualitative insights.

## RESULTS

### Normality Test

Before the Before analysing the results, a normality test was conducted to assess the data's adequacy for statistical inferences. According to the central limit theorem, a sample size of 30 or more tends to produce a normal sampling distribution, regardless of the population distribution (Kwak & Kim, 2017). With a total sample size of 320 respondents, this study met the normality requirement.

The data's normality was further evaluated using skewness and kurtosis values. According to Hatem *et al.* (2022), absolute

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values greater than 3 for skewness and 8 for kurtosis indicate extreme values. The results showed: Maximum skewness value = 1.53 (within acceptable range), Maximum kurtosis value = 1.02 (within acceptable range).

Since the skewness and kurtosis values were within the acceptable ranges, the data appeared to be normal, allowing for reliable statistical inferences. The skewness and kurtosis values for respondents' demographics are presented in Table 5.

**Table 5: Normality Test**

| Demographic Characteristics | Frequency (%) | Skewness     | Kurtosis     |
|-----------------------------|---------------|--------------|--------------|
| <b>Gender</b>               |               | <b>0.37</b>  | <b>-1.88</b> |
| Male                        | 189 (59.1%)   |              |              |
| Female                      | 131 (40.9%)   |              |              |
| <b>Age</b>                  |               | <b>0.53</b>  | <b>-0.60</b> |
| 0-14 years                  | 0 (0%)        |              |              |
| 15-64 years                 | 306 (95.6%)   |              |              |
| 65 years and above          | 14 (4.4%)     | <b>-0.13</b> | <b>-1.29</b> |
| <b>Level of Education</b>   |               |              |              |
| Basic                       | 112 (34.9%)   |              |              |
| Secondary                   | 97 (30.3%)    |              |              |
| Tertiary                    | 89 (27.9%)    |              |              |
| None                        | 22 (6.9%)     |              |              |

### Socio-Demographic Characteristics of Participants

Out of the 320 participants, 189(59.1%) were males while 131(40.9%) were females (Table 5). Those aged 0-14 years (Youth) were not interviewed since the research was targeted at responsible adults which explains why they constitute 0% (see Table 5). Respondents between the ages of 15-64 years (Economically Active) constituted 95.6% while those above 65 (Old Age) years represented 4.4% (Table 5). With respect to level of education, 6.9% had no formal education. 34.9% of the respondents acquired basic education (Table 5). 30.3% acquired O levels or SHS education, while 27.9% represented respondents who are enrolled in tertiary institution as well as those who have completed tertiary education (Table 5).

### Main Mode of Transport During Medical Emergencies in GAMA

Two hundred and forty (240) respondents made up of 60 emergency patients and 180 responsible adults from respective health facilities and households were consulted on the mode of transport they used and will use during medical emergency respectively as shown in Table 6. Out of the 60 questionnaires that were administered to emergency patients on admission at the selected health facilities, none resorted to ambulance. However, 85% resorted to taxis, 11.7% used a private vehicle, and 3.3% resorted to Uber as a means of transport to the hospital (Table 6).

On the other hand, 72.8% of responsible adults from the various household in GAMA indicated that they will resort to taxis during emergency medical situations, while 13.9% of them said they will resort to a private vehicle (Table 6). Meanwhile, those who intend resorting to ambulance constituted 7.8%, while 3.3% intend to request for Uber in case of emergency health situation (Table 6). None of the respondents resorted or intend to resort to either Van (Trotro) or Motor Taxi (Okada) (Table 6). This therefore indicate that taxis are the most preferred mode of transport during emergency health situations (Table 6). This result is consistent with Agyemang (2014) who found that taxis serves as ambulances in Ghana.

**Table 6: Main Mode of Transport During Medical Emergencies**

| Means of Transport | Patients N (60) | Household N (180) | Total N (%) |
|--------------------|-----------------|-------------------|-------------|
| Ambulance          | 0 (0%)          | 14 (5.8%)         | 14 (5.8)    |
| Taxi               | 52 (85)         | 131 (72.8%)       | 182 (72.8%) |
| Private car        | 7 (11.7%)       | 25 (13.9%)        | 32 (13.3%)  |
| Uber               | 2 (3.3%)        | 10 (5.5%)         | 12 (5%)     |
| Van (Trotro)       | 0 (0%)          | 0 (0%)            | 0 (0%)      |
| Motor Taxi (Okada) | 0 (0%)          | 0 (0%)            | 0 (0%)      |

### Spatial variation of Transport Mode During Emergencies

The study's data indicates that the preference for taxis during emergency health conditions is consistent across different areas in GAMA, with high preference observed in low, middle, and high-income areas (Figure 2). The minority who prefer private vehicles

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or ambulances may do so due to factors such as: ownership of a private vehicle, access to ambulance services through social influence or financial means, and ability to afford private ambulance services. This suggests that socioeconomic factors may play a role in determining transportation preferences during emergency health situations.

### Protocols/Disinfection Practices Employed to Prevent Vehicle Infection

A survey of 80 drivers (private and public transport) revealed that 40% have transported patients during medical emergencies (Table 7). 5% of those 40% reported deaths during transport (Table 7). 8% have transported dead bodies to or from the morgue. None fumigated their vehicles. 24% sent vehicles to the washing bay, while 16% personally cleaned vehicles with detergents (Table 7). Hence, most drivers clean their vehicles at the washing bay after transporting dead bodies or sick passengers (Table 7).

**Table 7: Vehicle Disinfection Practices**

| Variable                                                                             | Yes             | No                |
|--------------------------------------------------------------------------------------|-----------------|-------------------|
| <b>Have you ever transported patients especially during medical emergencies?</b>     |                 |                   |
| Private Car                                                                          | 2               | 18                |
| Taxi                                                                                 | 20              | 0                 |
| Van (Trotro)                                                                         | 8               | 12                |
| Motor taxi (Okada)                                                                   | 2               | 18                |
| <b>Total</b>                                                                         | <b>32 (40%)</b> | <b>48 (60%)</b>   |
| <b>Have you ever recorded any deaths in your vehicle during medical emergencies?</b> |                 |                   |
| Private Car                                                                          | 0               | 20                |
| Taxi                                                                                 | 4               | 16                |
| Van (Trotro)                                                                         | 0               | 20                |
| Motor taxi (Okada)                                                                   | 0               | 20                |
| <b>Total</b>                                                                         | <b>4 (5%)</b>   | <b>76 (95%)</b>   |
| <b>Have you ever transported a dead body to or from the morgue?</b>                  |                 |                   |
| Private Car                                                                          | 2               | 18                |
| Taxi                                                                                 | 4               | 16                |
| Van (Trotro)                                                                         | 2               | 18                |
| Motor taxi (Okada)                                                                   | 0               | 20                |
| <b>Total</b>                                                                         | <b>8 (10%)</b>  | <b>72 (90%)</b>   |
| <b>Which cleaning method did you employ after delivering the service?</b>            |                 |                   |
| Fumigation                                                                           | 0               | 0                 |
| Washing bay                                                                          | 24              | 60                |
| Normal detergent                                                                     | 16              | 40                |
| Airing/drying                                                                        | 0               | 0                 |
| Ritual cleansing                                                                     | 0               | 0                 |
| <b>Total</b>                                                                         | <b>40 (40%)</b> | <b>100 (100%)</b> |

Key informant interviews with officials from stakeholder institutions including: National Disaster Management Organization (NADMO), Ghana Private Road Transport Union (GPRTU), and Environmental Health Department of AMA suggests that there is currently no policy regulating the transportation of infectious patients and dead bodies, which is not accurate.

An official from the Environmental Health Department of AMA noted:

*"A policy is only a course of action to, let's say, achieve a particular objective, so for us I don't think that there is any policy that regulates the transportation of infectious patients and dead bodies within the metropolis. I have not come across any carved policy. But that is not to say that in the absence this policy we don't really handle infectious cases as city authorities. We do handle them. We do transport them. When there is any case as in a dead body found somewhere as a result of neglect of family or flooding, we tend to handle them by sometimes giving them what we call sanitary burial. So basically, if it is an infectious case then of course as city authorities we ensure that the burial becomes free. So, we actually assume custody of the case and when the family is involved then we tend to break that link or that chain between the isolated case and the family in the case of infectious diseases like TB or cholera. So, I will say that there is no clear-cut policy that regulates the transportation of infectious patients or dead bodies. However, when it comes to an outbreak in the metropolis, definitely there is a mode of transporting these patients and dead bodies."* (Participant 1- Key Informant Interview, April 16, 2018.)

While an official from Accra Metro NADMO also noted:

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*"We don't have a law that regulates transporting infectious patients or dead bodies. I haven't seen or come across any law like that".* (Participant 2- Key Informant Interview, April 24, 2018.)

Meanwhile, an official from the Greater Accra GPRTU noted:

*"I don't know of any law. I have to be frank with you. But what I know is we as GPRTU, we operate trotros, taxis, long journey buses, tipper cars. That is what we operate. And basically, we don't transport dead bodies. Because I think transporting a dead body or a corpse, may be the person dies in the house and you have to convey the body to the mortuary. That should be done by the ambulance that is why there is ambulance service available. So, we don't transport dead bodies. But I also know that sometimes a taxi can be asked to may be take a sick person to the hospital then unfortunately on the way the person will give up the ghost. For that it has been happening but it will be very difficult to tell that driver that when the person dies in the car because the person is dead because of that since it is a taxi I will stop on the way and call an ambulance. First of all, you are not a doctor to determine whether the person is dead or not"* (Participant 3- Key Informant Interview, May 14, 2018.)

On the contrary, the Ghana National Public Health Reference Laboratory (Ministry of Health) reported the existence of a policy framework regulating the transportation of infectious patients and dead bodies, along with standard protocols for disinfection (SOPs 2016). This discrepancy may be due to inadequate coordination among stakeholder institutions.

### Standard Protocols of Transporting Infectious Patients and Vehicle Disinfection

The Second Edition of the Standard Operating Procedures for the Prevention and Control of Cholera in Ghana (SOPs), 2016 outlines how infectious patients and dead bodies should be transported and disinfections be carried out. It further explained that the SOPs is cholera specific because cholera remains a major public health challenge in Ghana, however it is useful with respect to other infectious diseases such as Ebola, Lassa Fever, amongst others.

The Standard Operating Procedures for the Prevention and Control of Cholera in Ghana (SOPs), 2016 state emphatically that patients should be transported by national ambulance services other than taxis or other public vehicles. According to the SOPs 2016, should it become necessary to use public transport, seats must be covered with impermeable materials such as rubber that can easily be disinfected or destroyed. The SOPs further states that the receiving health facility should perform or supervise appropriate decontamination, cleaning and disinfection of the vehicle with 2% chlorine solution. According to a Principal Biomedical Scientist, Disease Control Officers at various health facilities are to ensure the effectiveness of the SOPs at their facility. However, data gathered revealed that taxis and private vehicles do not adhere to these precautions and protocols for vehicle disinfection before, during, and after delivering emergency medical services (see Table 7). 60% of the drivers who indicated that they have ever transported infectious patients and dead bodies indicated that they sent their vehicles to the washing bay afterwards, while 40% also indicated that they personally cleaned their vehicles with detergents afterwards. It is surprising to also know that some private hearse drivers also clean their ambulance personally while others subscribe to the washing bay. However, observations and interviews at three different washing bays in Airport residential area, Kaneshie, and Darkuman revealed that no disinfectants are used apart from washing detergents in cleaning these vehicles. This can lead to a rapid spread of infectious diseases as Lowe *et al.* (2014) established that the rapid spread of Porcine Epidemic Diarrhea Virus Infection among pigs was as a result of how pigs were transported in vehicles that were not cleaned and disinfected.

It is gratifying to know that some funeral homes adhere to the standard protocols of disinfection and transportation of dead bodies according to information gathered from this study. A Research Officer at the Gillman and Abbey Funeral Services in Darkuman-Accra explained how their hearse transport dead bodies from health facilities to and from the morgue as well as the periodic fumigation of their premises, which is in line with the SOPs 2016. He revealed:

*"Normally they (dead bodies) are put in a water proof rubber bags at the origin (hospital) like as we have here then we seal it. Then the drivers who do the conveyance put on gloves then they put them on the stretcher and bring them. When they bring them, the stretcher is pulled out from the hearse then we use a lift (elevator) to send them to the morgue. Periodically, we do disinfection of the entire premises. Every three months, people come from the AMA to do it. You know that, excuse me to say, we deal with dead bodies. So, we do that to safeguard us. But because the bodies are put in the waterproof bags, no liquid or anything comes out. However, we use chemicals to clean the hearse after conveyance".* (Official 4- Key Informant Interview, May 14, 2018.)

### Public Trust in Emergency Transport Delivery System

As previously established, taxis are the most preferred mode of transportation during emergencies (Table 8). To understand this preference, 60 patients recovering from emergency trauma in various hospital wards were surveyed. With respect to reasons why they resorted to their mode of transport other than ambulance, 23 out of the 60 respondents revealed that their mode of transport was the only available means (Table 8). Also, 12 others indicated that it was the only convenient means, meanwhile 4 out of the 60 attributed their reasons to affordability, while 21 also noted all the above reasons (Table 8). The findings suggest that the public

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has more confidence and trust in taxis during emergency situations than in ambulances, likely due to deficiencies in the Ghana Ambulance Service. This supports previous research (Page *et al.*, 2013; Adamtey *et al.*, 2015) highlighting the challenges of inadequate ambulances, trained staff, and modern equipment in developing countries. Notably, all 60 respondents expressed satisfaction with the taxi services they used (Table 8).

**Table 8: Vehicle Disinfection Practices**

| Variable                                                         | Frequency (%) |
|------------------------------------------------------------------|---------------|
| <b>What influenced your mode of transport?</b>                   |               |
| That was the only available mode of transport                    | 23 (38.3)     |
| It was affordable                                                | 14 (6.7%)     |
| That was the only convenient means                               | 12 (20%)      |
| All the above                                                    | 21 (35%)      |
| <b>Did the mode of transport meet your needs satisfactorily?</b> |               |
| Yes                                                              | 60 (100%)     |
| No                                                               | 0 (0%)        |

### Risk Perception and Exposure of Key Actors in the Emergency Service Delivery Chain

Perception of risk about transport and infectious diseases was sought from all the 320 respondents. 91.9% are aware of infectious diseases, while 86.6% believe vehicles can transmit infectious diseases (Table 9). However, 16.2% believe infectious diseases can spread via body to body contact with infectious passenger on board (Table 9). Table 9 further shows that 5.6% claimed infectious diseases can spread via body contact with infected part of vehicle, while 56.3% indicated one can contract infectious/communicable diseases from vehicles by breathing in contaminated air on board. Also, 21.9% believe that vehicles can spread diseases through all the above factors (Table 9).

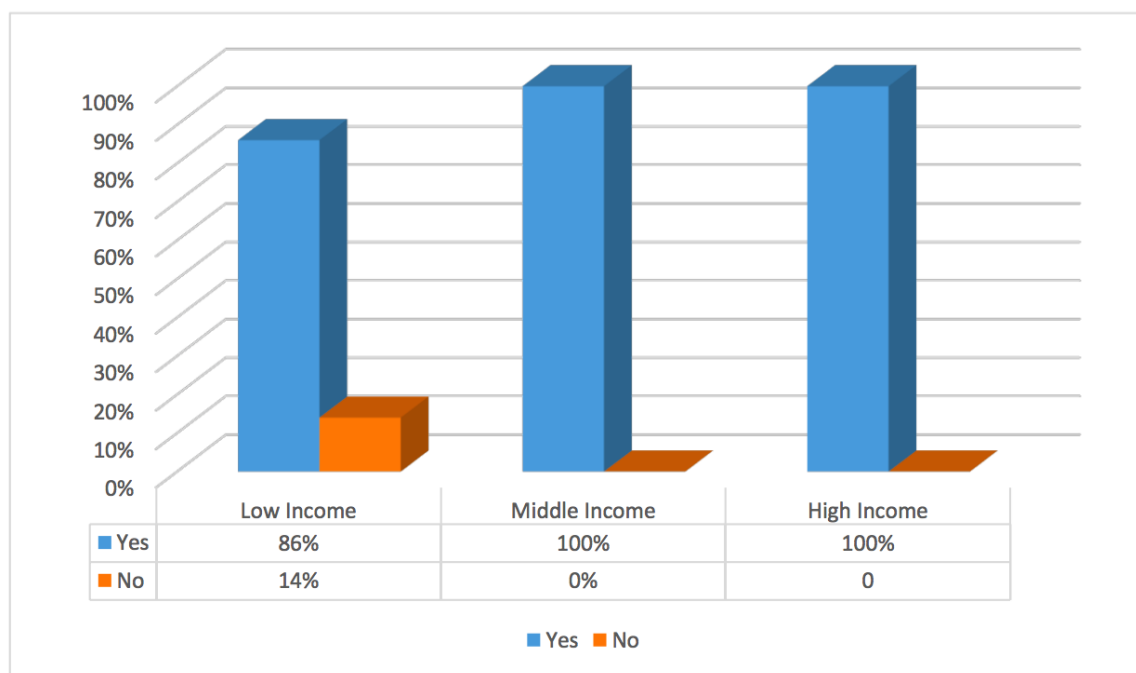
**Table 9: Risk Perception of Respondents**

| Variable                                                                    | Frequency (%) |
|-----------------------------------------------------------------------------|---------------|
| <b>Do you know about infectious/communicable diseases?</b>                  |               |
| Yes                                                                         | 294 (91.9)    |
| No                                                                          | 26 (8.1%)     |
| <b>Do you think vehicles can spread infectious diseases?</b>                |               |
| Yes                                                                         | 227 (86.6%)   |
| No                                                                          | 43 (13.4%)    |
| <b>In what way(s) do you think vehicles can spread infectious diseases?</b> |               |
| Body to body contact with infectious patient on board                       | 52 (16.2)     |
| Body contact with infected surface or object                                | 18 (5.6%)     |
| Breathing or inhaling contaminated air                                      | 180 (56.3%)   |
| All the above                                                               | 70 (21.9%)    |

### Spatial variation of Risk Perception

This study investigated the perception of risk among household individuals across three (high, middle, and low) income areas (see Figure 3). Respondents were asked if they believed vehicles can transmit infectious diseases. Figure 3 shows a notable variation in risk knowledge among residents across income areas. Specifically, in high-income and middle-income areas, all respondents recognize that vehicles can spread infectious diseases. In low-income areas, respondents exhibit relatively lower risk knowledge compared to the other two groups. Further, in low-income areas, 86% of respondents believe vehicles can spread infectious diseases, while 14% disagree. The 14% 'No' response may stem from limited knowledge or cultural/religious beliefs, given the influence of education, social status, and faith on risk perception. Overall, the findings indicate that most respondents recognize vehicles as potential disease transmission vectors.

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**Figure 3: Spatial Variation of Risk Perception**

## DISCUSSION

### Demographics

Education is one of the essential determinants of risk knowledge and awareness of infectious diseases which reflect in the outcome of the study. 85% of emergency patients used taxis to get to the hospital due to availability and speed. 80% of taxi drivers have transported dead bodies, despite regulations in the Public Health Act 2012, while 72.8% of household respondents prefer taxis during emergencies due to efficiency, reliability, and affordability. A smaller percentage prefer ambulances (5.8%) or private vehicles (13.3%), mainly high- and middle-income area residents. This shows that although taxis are the main transport mode during emergency health situations in GAMA, a handful of the population also resort to ambulance and private vehicles.

### Institutional Inconsistencies

The Ministry of Health's 2016 SOPs outline guidelines for transporting infectious patients and disinfecting vehicles. However, data collected indicate that drivers fail to adhere to these protocols, exposing themselves and passengers to infectious diseases. This supports the Centres for Disease Control and Prevention's claim that travellers can be exposed to infectious diseases due to the presence of infectious agents (CDC, 2019). However, the study reveals inconsistencies among stakeholder institutions regarding policies regulating the transportation of infectious patients and dead bodies, likely due to poor coordination.

### Trust in Taxi Services

Respondents trust taxi services over ambulance services during emergency health situations due to the ambulance service's inadequacies. This is consistent with Adamtey *et al.*'s (2015) findings on ineffective emergency and ambulance services in Ghana. This also affirms Hotor (2016) who found timeliness as one of the primary reasons people's transport mode choice.

### Vehicle Fumigation and Risk

Taxis and private vehicles providing emergency health transport are not properly fumigated after service delivery. Drivers resort to personal cleaning with detergents or washing bay services, leaving drivers, passengers, attendants, and the public at risk of infectious disease transmission.

### Potential for Epidemic Outbreak

Although this study did not find evidence of disease transmission, other studies (Mohammed & Prabhu, 2015; Lowe *et al.*, 2014) suggest that improper vehicle cleaning and disinfection can lead to the spread of infectious diseases. The use of public transport as ambulances in GAMA, despite known risks, further exacerbates this issue.

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## Awareness and Acceptable Risk

All stakeholders, including household individuals, drivers, passengers, health workers, and patients, are aware of the risks associated with transporting patients using public transport. However, due to the deficiency of the emergency medical transport system, this practice has become an acceptable risk, putting drivers and passengers at risk of infectious diseases.

## CONCLUSION

Everyone desires quality pre-hospital care and timely intervention during emergencies. However, the lack of alternatives forces individuals to rely on unsuitable vehicles, such as taxis, which has become an “acceptable risk” for both authorities and individuals. If a highly infectious disease like Ebola were to emerge, the current transportation mode and inadequate vehicle cleaning methods could lead to rapid spread and devastating consequences.

It is essential for the government and stakeholders to implement measures to prevent the spread of infectious diseases through transportation while ensuring effective emergency medical services nationwide. Prioritizing prevention is crucial in mitigating these risks.

The study recommends that:

- The government should prioritize emergency service delivery by equipping the Ghana Ambulance Service with sufficient ambulances and staff. This would reduce reliance on public and private transport during emergencies and mitigate the spread of infectious diseases.
- The Ministry of Health's 2016 SOPs on transporting infectious patients and dead bodies should be disseminated to all stakeholders. Strict enforcement, including penalties for non-compliance, is necessary to ensure adherence.
- The government and NGOs should support the Ministry of Health and Ghana Health Service in providing health facilities with necessary logistics (disinfectants, gloves, etc.). This would enable vehicles transporting infectious patients to be properly fumigated at the destination facility, addressing logistical constraints.

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## AUTHOR'S CONTRIBUTIONS

**Eric Sepenu Afli:** Reviewed literature, collected the data and drafted the research.

**Ernest Agyemang:** Supervised the research and helped with the conceptualization of the methodology and analysis of data.

## ETHICS

This study is extracted from a student thesis. At the time, permission was granted by University of Ghana ethical review committee to conduct the study. The principles of ethical research such as informed consent, participation without coercion, confidentiality, anonymity, and respect for research participants were adhered to.

## CONFLICT OF INTEREST

The authors declare therefore no conflict of interest.

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