



Food Safety and Road Safety Implications of Delivery Rider Practices in Accra, Ghana

Solomon Buenor Adi¹, Doreen Dedo Adi^{2*}, John Acquah-Mensah², Chris Yaw Asare³,
Yaa Mawufemor Akubia², Ellen Olu Fagbemi²

¹Department of Civil Engineering, Cape Coast Technical University, Cape Coast, Ghana

²Department of Hospitality and Tourism Education, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Kumasi, Ghana

³Department of Biochemistry and Biotechnology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Email: *ddadi@aamusted.edu.gh

How to cite this paper: Adi, S.B., Adi, D.D., Acquah-Mensah, J., Asare, C.Y., Akubia, Y.M. and Fagbemi, E.O. (2024) Food Safety and Road Safety Implications of Delivery Rider Practices in Accra, Ghana. *Open Access Library Journal*, **11**: e12170.
<https://doi.org/10.4236/oalib.1112170>

Received: August 26, 2024

Accepted: September 20, 2024

Published: September 23, 2024

Copyright © 2024 by author(s) and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

The rise of online food ordering has led to a proliferation of delivery riders, serving as the final link in the online-to-offline transport chain. Delivery riders are crucial in ensuring customer satisfaction and food integrity, akin to traditional restaurant waiters. However, they face challenges in maintaining food safety standards during transportation and adhering to road safety regulations. The study investigates the food and road safety practices of delivery riders in Accra, Ghana, amid the growth of online food ordering. Structured questionnaires and observation checklists were administered to 355 conveniently sampled delivery riders and a velocity speed gun aided the collection of speed data riders. The study found that while most riders have received training in food hygiene and delivery services, few have food handlers' certificates, highlighting a gap in regulatory enforcement. Although many use insulated carriers to keep food hot, hygiene practices like hand washing are inconsistent. On the road, riders exhibited selective compliance with road traffic regulations, resulting in a high percentage of riders experiencing crashes, often leading to injuries. The study calls for stricter regulations, mandatory food handlers' certification, improved hygiene training, and efficient and effective enforcement of traffic laws to enhance safety and public health.

Subject Areas

Food Science & Technology, Transportation Engineering

Keywords

Food Safety, Road Safety, Delivery Riders, Accra

1. Introduction

There is a fast-growing trend of customers ordering food online in Ghana, especially in the capital city of Accra. This has resulted in increased delivery riders in the capital, which is the last step of the online-to-offline transport services [1]. These riders provide convenient and fast food delivery services to customers [2]. Food delivery riding jobs are increasing as it is providing jobs to most youth with minimal training. In Ghana, the most common online delivery brands are Glovo, Bolt Foods, Jumia Foods, KFC, and Uber Foods with some small-scale local operators also in the industry [3]. The industry is estimated to be worth over 140 billion USD in 2023 [4]. The riders play the role of the waiter as they are the only persons that the customers interact with physically in the whole online-offline transaction.

In the food service industry, the waiter and the delivery riders have similar roles that will influence the meal experience of their customers [5] [6]. Both the waiter and the food delivery rider provide customer service by interacting with the customer, playing a vital role in ensuring customer satisfaction [7]. Secondly, they both handle food. While the waiter serves the food in the restaurant, the food delivery rider transports the food from the restaurant to the location of the customer [8]. These services are done in a high time-pressure environment, which requires certain technical skills and alertness to minimise risks associated with the job.

The food delivery rider is faced with both food safety and road safety challenges. Food safety and road safety are significant to public health [9]-[11]. According to Lawal and Adzitey [3], most consumers patronise online food platforms because they are convenient and ready to eat. The characteristics of the food patronised by consumers require stringent food safety protocols during the transportation of the food. Food safety is a vital aspect of food delivery as it plays a pivotal role in preventing food-borne illnesses and ensuring customer satisfaction [12]. Proper adherence to food safety protocols by food delivery riders will prevent contamination, spoilage, damage, or allergen exposure to the food [3].

The food safety practices that the delivery riders are to adhere to include the practice of good personal hygiene; cleaning and sanitising of thermal bags regularly using food-grade chemicals, especially after experiencing a spill; protecting food from time-temperature abuses (thus keeping hot foods above 63°C and cold foods below 8°C); delivering the food within the shortest possible time, preventing cross contamination and allergen exposure by keeping different types of food and orders in different packages and inspecting the packaged food before after delivery to ensure there is no damages, leakages or tempering [9] [13]. These practices are essential to protect the integrity of the meals as collected from the service provider (restaurant). The delivery rider must have a good understanding of these food safety requirements of their jobs to protect the interest of their customers, as these will enhance their reputation and professionalism [14]. Food delivery riders may or may not be considered food handlers depending on the extent to which they have direct contact with the food [3]. However, to be on the safer side it would be

ideal if the rider offering courier services is certified as a food handler [14]. Such requirements are yet to be streamlined by the relevant authorities in Ghana.

The increase in the food delivery service has been associated with road safety issues [6]. Compliance with road safety regulations by riders will avoid crashes and prevent food spillages, cross-contamination, and exposure to food allergens. Studies have shown that food delivery riders are likely to practice risky riding behaviour due to the pressures of their work demands [15]. Risky behaviour reported includes disregarding traffic rules, dangerous travel speed, and non-usage of appropriate clothing [16].

In Ghana, studies to ascertain the practices of food delivery riders and how they influence food safety and road safety are yet to be established. This research is an exploratory study aimed at evaluating the food safety and road safety practices of the food delivery riders in Accra.

2. Methodology

Delivery riders (355) were conveniently sampled for the study. The essence of the study was duly explained to the riders, and only riders who were willing to take part were used in the study. Structured questionnaires were administered to the respondents, and data on their demographics, work patterns, hygiene practices, and road safety practices was collected. A seven-point Likert scale (1, extremely disagree to 7, extremely agree) was used to measure the extent to which reported food hygiene and road safety practices were adhered to by the respondents. An observation checklist was used to collect data on their adherence to traffic rules and use of personal protective equipment. A Bushnell Velocity Speed Gun (029757101921) was positioned at a single, straight stretch of road so that enumerators could easily gather the speed data of approaching riders, and the traffic speed was measured.

3. Results and Discussions

The demographic characteristics of the respondents are presented in **Table 1**. All the respondents were males (100%), with the majority (72.1%) being in the youthful age bracket between 21 - 30 years. A few riders (0.2 %) were above the stipulated retirement age (60 years) in Ghana. The majority of the respondents (91.5%) had secondary education, whereas 3.1 % of the respondents had tertiary education. About (89.9%) of the respondents were working full-time, while 10.1% worked on a part-time basis. It was observed that the majority of the respondents (58.9%) owned the bike they were working with and few (4.2%) did rental. About 25.6% of the bikes were company-owned. This implies that delivery work is a major source of employment for the youth in Ghana and can reduce the rising rate of unemployment in Ghana [17].

Respondents were asked about the number of deliveries they carry out per day, it was revealed that 49.6% of the respondents made between 5 - 10 deliveries within a day, 40.6% made between 11 - 15 deliveries per day, and very few (4.5%)

Table 1. Demographic characteristics of respondents.

Demographic variable	Number of respondents	Percentage (%)
Gender		
Male	355	100
Female	0	0
Total	355	100
Age (years)		
18 - 20	7	2
21 - 30	256	72.1
31 - 40	85	23.9
41 - 50	1	0.3
>60	2	0.6
No response	4	1.1
Total	355	100
Educational level		
Basic	18	5.1
No formal education	1	0.3
Secondary	325	91.5
Tertiary	11	3.1
Total	355	100
Employment Status		
Fulltime	319	89.9
Part-time	36	10.1
Total	355	100

Researcher's Construct (2024).

made greater than 20 deliveries per day. They also preferred working both day and night (67.3%), and it takes them less than 20 minutes (40.3%) to get an order and deliver, but sometimes it can take between 20 - 40 minutes (59.4%) to get an order and deliver. The results also showed that the majority of the respondents (62.5%) made between 1001 - 2000 cedis per month, with few (1.7%) making less than 500 cedis per month and very few (0.6%) making between 3001 - 4000 cedis per month. About 63.1% of the respondents delivered ready-to-eat food only, while 36.9% delivered other items such as pharmaceutical products, cosmetics, and groceries apart from ready-to-eat foods. The long working hours will result in fatigue and reduced rider alertness and reaction time, increasing the risk of accidents. The riders may also engage in risky behaviour such as jumping red lights, weaving through traffic, and speeding to meet tight delivery demands. Also, fatigued riders may be less diligent on issues such as hand washing and cleaning of delivery bags,

hence compromising food safety. Delays in the delivery could also result in the proliferation of microbes which may exceed safe limits [18] [19].

The majority of the respondents claim they have received food hygiene training (74.6%) and food delivery service training (88.7%) (See **Table 2**). Training for food handlers has been recognised as an important food safety tool, hence a

Table 2. Bike ownership and delivery activities of riders.

Variable	Frequency	Percentage
Bike Ownership		
Company owned	91	25.6
Owned	209	58.9
Rented/Sales	15	4.2
Work and pay	40	11.3
Total	355	100
Number of deliveries/day		
5 - 10	176	49.6
11 - 15	144	40.6
16 - 20	19	5.4
>20	16	4.5
Total	355	100
Which periods do you work?		
Day	103	29.0
Night	13	3.7
Both	239	67.3
Total	355	100
Duration to get an order and deliver (min)		
<20	103	40.3
20 - 40	208	59.4
40 - 60	44	0.3
Total	355	100
Income		
<500	6	1.7
500 - 1000	86	24.2
1001 - 2000	222	62.5
2001 - 3000	39	11.0
3001 - 4000	2	0.6
Total	355	100

Continued

Duration in food delivery business (year/s)		
<1	77	21.7
1	92	25.9
2	106	29.9
3	70	19.7
4	9	2.5
5	1	0.3
Total	355	100
Do you deliver ready-to-eat food only?		
No	131	36.9
Yes	224	63.1
Total	355	100

deliberate effort in training all delivery riders is essential to minimise cross-contamination [20]. Almost all the respondents do not have a food handlers certificate (96.9%), with very few (3.1%) possessing a food handlers certificate. The majority of the respondents (86.2%) are not aware that they are required to have the food handlers' certificate before they operate. The standard international practice requires all food handlers to be certified before being allowed to operate [21]. The riders are food handlers since they are involved in its transportation. According to Tuglo *et al.* [22], a food handler is referred to as any individual who participates in the production, preparation, storage, and service. Thus, they work on the food contact surfaces which includes activities that are involved in the transportation of food. This is an area worth addressing by the regulatory bodies in the interest of public health. Enforcing laws that require delivery riders to possess food handler's certificates can guarantee compliance. This strategy has been successful in several areas where food safety is a top concern [23]. More motorcyclists may get certified if training courses are provided for free or at a reduced cost. Online classes have been demonstrated to boost participation rates since they are convenient and can be finished at the rider's leisure [24] [25]. All riders can be certified by working with food delivery firms to incorporate certification standards into their hiring and training procedures [26]. Setting up a method for routinely observing and assessing riders' food safety procedures can aid in upholding high standards. To ensure compliance, this may involve conducting audits and sporadic checks [27].

The majority of the respondents had their carrier made up of insulated fabric (74.9%) followed by plastic (23.7%), with very few being made up of metal (0.8%) (See **Table 3**). Food should be served at the appropriate temperature, hence respondents should be encouraged to use insulated fabric [28]. The insulation fabric in the carrier can keep food warm or cold for a longer period before it is delivered

to the consumer [29]. Therefore, in Ghana, delivery carrier bags permitted to be utilised should be made of insulation fabric to ensure foods are held at appropriate temperature until served and consumed.

Table 3. Training information on hygiene of riders.

Variable	Frequency	Percentage
Received food hygiene training		
Yes	265	74.6
No	90	25.4
Total	355	100
Received training on delivery service		
Yes	315	88.7
No	40	11.3
Total	355	100
Do you have food handlers certificate?		
Yes	11	3.1
No	344	96.9
Total	355	100
Are you required to have food handlers certificate before you operate?		
Yes	11	3.1
No	38	10.7
I Don't Know	306	86.2
Total	355	100
What is your carrier made up of?		
Insulated fabric	266	74.9
Metal	3	0.8
Plastic	84	23.7
Others	2	0.6
Total	355	100

3.1. Respondents Rating of Their Hygiene Practices

The results on respondents' hygiene ratings are presented in **Table 4**. The mean rating indicating the respondent's agreement with hygienic practices revealed that they were undecided about the washing of hands (4.35), delivery bags (3.56), and bikes (3.55) before every shift and working when having a cold (3.75). Proper hygienic practices such as hand washing, keeping fingernails short, wearing food gloves when serving or handling food, and wearing inappropriate attire whilst cooking and serving foods in hygienic conditions should be adhered to at all times

[30]. Delivery riders must understand that cleanliness and tidiness eradicate the chances of food contamination.

Table 4. Independent Sample t-test of respondents' rating on hygiene

Question	Mean rating ± SD	T	p-value
I clean my bike always	3.55 ± 1.40	-6.181	0.000
I wash my delivery bag before every shift	3.43 ± 1.01	-10.561	0.000
I wash my delivery bag after every shift	3.56 ± 0.84	-9.924	0.000
I always sanitize my delivery bag after washing (comment on sanitizer used)	2.88 ± 1.54	-13.698	0.000
I wash my hands before every shift	4.35 ± 1.33	4.993	0.000
I wash my hands before packing any order for delivery	3.68 ± 0.98	-6.198	0.000
I wash my hands before handing over deliveries to customers	3.26 ± 1.04	-13.459	0.000
Anytime I wash my hands, I wash with soap and running water for at least 20 sec	5.81 ± 1.9	28.638	0.000
Orders do spill in my bag	2.40 ± 2.12	-14.175	0.000
I have left undelivered food in my bag over night	1.20 ± 0.78	-67.880	0.000
Clients have ever complained on the appearance of my delivery	1.81 ± 1.14	-36.029	0.000
Clients have ever complained on the taste of my delivery	1.86 ± 1.21	-33.444	0.000
I keep cold food (ice cream and salads) and hot food (rice, chips, pizza, etc.) items in the same box	5.58 ± 1.72	17.285	0.000
Improper transportation of food makes it unsafe for consumption	5.44 ± 1.74	15.575	0.000
I do work when I have a cold	3.75 ± 1.37	-3.479	0.001
I work when I have stomach upset	3.43 ± 1.49	-7.253	0.000
I am responsible for the safety of the food	5.83 ± 1.46	23.470	0.000
Deliveries are always well labelled with Client Name order and contact	5.64 ± 1.55	19.899	0.000
I verify every order before dispatch	5.64 ± 1.51	20.422	0.000

1-extremely disagree; 2-strongly disagree; 3-disagree; 4-undecided; 5-agree; 6-strongly agree; 7-extremely agree.

Again, the respondents disagreed with working while having stomach upset, washing delivery bags before every shift, sanitising delivery bags, and washing hands before handing over deliveries to customers, with a mean rating of 3.43, 3.34, 2.88, and 3.26, respectively. To prevent the spread of foodborne diseases, food handlers need to pay heed to proper food handling and hygienic protocols

[31]. Ghana has also had cholera epidemics in recent years in a number of its largest towns and cities, including Accra, Kumasi, and Koforidua. Over the past ten years, several studies spanning many aspects of food hygiene conducted in Ghana have discovered that the majority of food handlers have poor attitudes and understanding of food hygiene, which has an impact on their hygiene [32]. Certain food-borne diseases like Hepatitis A can be transferred from person to person through food [33], therefore, authorities must enforce proper food handling and hygienic protocols.

Respondents strongly disagreed with having complaints from their clients on the taste of the delivery, the appearance of the delivery, and spillage of orders in their bag, with a mean rating of 1.86, 1.81, and 2.40, respectively. Services rendered to clients must meet or exceed their expectations, leading to clients' satisfaction [34]. There are several ways in which inadequate handling during food preparation can result in the presence of dangerous materials. These include contaminated food from sick people or inadequate hygiene, prepared food left at high temperatures for prolonged periods, and the release of foreign compounds from acidic-pH storage containers. The respondents not receiving negative feedback from clients about the taste, appearance, and storage of food is an indication of good food safety practices, hence they must be encouraged to keep it up [35]. For food service businesses to thrive, clients must be delighted with the services of the business for them to make repeat purchases.

The respondents strongly agreed to washing their hands with soap and running water, keeping cold food and hot food in the same box, and being responsible for the safety of the food delivered with a mean rating of 5.81, 5.58, and 5.83, respectively. According to Ricci *et al.* [36], inadequate temperature control during heat treatment and food storage is the main cause of foodborne illnesses like those that were documented in the UK (2005) and Australia (2010). Temperatures between 5 and 57 degrees Celsius are suitable for the growth of food-associated microorganisms, including diseases. Cross-contamination is one of the most prevalent foodborne infections in people and has been demonstrated to have detrimental effects on both human health and the profitability of foods like chicken, fish, dairy, and cattle [37]. When contaminated food is combined with uncontaminated food, cross-contamination happens. This facilitates the spread of harmful, resistant-to-drug microbes. Undercooked, uncooked, or poorly cleaned food can harbour a high concentration of drug-resistant bacteria, such as *Clostridium perfringens*, *Salmonella*, *Campylobacter*, *E. coli*, *Staphylococcus aureus*, and *Listeria monocytogenes*. Any of these bacteria that we eat could be hazardous to our health [37]. Foods that are most likely to contain germs are leafy greens, bean sprouts, leftover rice, unpasteurised milk, soft cheeses, deli meats, raw eggs, chicken, pork, and seafood. For example, unwashed, infected lettuce may contaminate other things in a fresh salad, which could spread the virus [38] [39]. According to Ayeh-Kumi [40], disregarding hygienic measures by food handlers has been linked to enablers for the spread of pathogenic microorganisms. Therefore food delivery riders

should step up to their responsibility of ensuring the safety of the food they are to deliver to consumers. The respondents agreed that “Improper transportation of food makes it unsafe for consumption”.

3.2. Road Safety Practices

The road safety practices revealed that the respondents agreed to have a license, drive at the required speed, wear a helmet, and rest when tired, with a mean rating of 4.80, 4.54, 4.70, and 5.38, respectively (Table 5). Driving tired and overlooking road user regulations can lead to road carnage [41] [42]. Every year, traffic accidents claim the lives of about 1.35 million people and injure up to 50 million more [43]. So, riders must abide by road user regulations to avoid endangering their lives and the lives of other road users.

Table 5. Independent t-test of respondents’ rating on road safety

Question	Mean rating± SD	T	p-value
I have a valid driver’s license	4.80 ± 2.551	5.910	0.000
I drive at the required speed limit	4.54 ± 2.039	4.971	0.000
I always respect the road traffic rules	4.21 ± 1.768	2.251	0.025
I always wear a helmet	4.70 ± 1.564	8.448	0.000
I wear a protective vest	3.74 ± 1.983	−2.462	0.014
I ride against traffic	1.81 ± 1.195	−34.458	0.000
I use mobile phones while riding	3.03 ± 2.260	−8.056	0.000
I wear sport glass during riding	4.33 ± 1.779	3.490	0.001
I reduce my speed when it is raining	5.71 ± 1.577	20.459	0.000
I rest whenever I am tired	5.38 ± 1.486	17.535	0.000

1-extremely disagree; 2-strongly disagree; 3-disagree; 4-undecided; 5-agree; 6-strongly agree; 7-extremely agree. Researcher’s Construct (2024).

The respondent strongly agreed that they reduce their speed when it is raining with a mean rating of 5.71. The respondents were undecided when asked about their respect for traffic rules, and wearing of protective vests and sports glasses with mean ratings of 4.21, 3.74, and 4.33, respectively. For young people and adults aged 5 - 29, traffic accidents are the leading cause of death worldwide [44]. Traffic and road safety practices have been implemented to save lives by halting the increase in road traffic fatalities [9]. This indicates the importance of delivery riders diligently following traffic and road safety regulations in Ghana.

The respondents disagreed that they used mobile phones while riding and strongly disagreed with riding against traffic rules. Using a mobile phone while riding could lead to road accidents [45]. Divided attention whilst riding a motor-bike in the bustling city of Accra could be very dangerous, thus, staying focused when riding is key to staying safe on the roads.

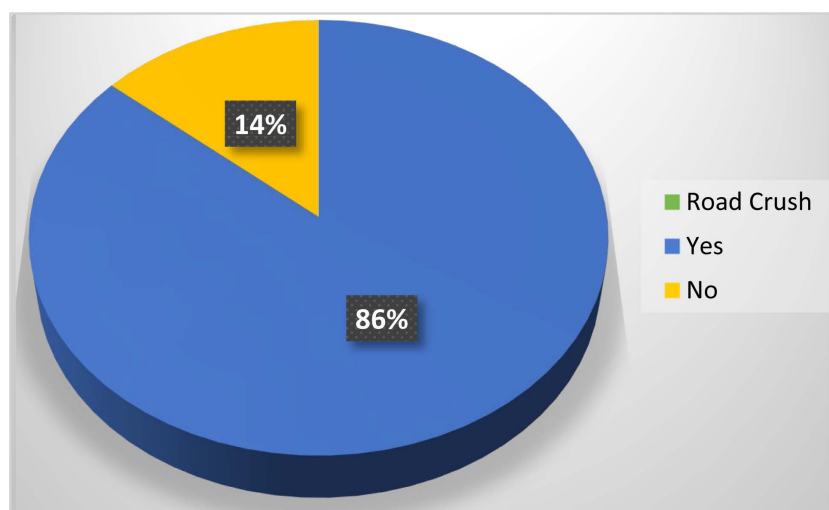


Figure 1. Road crash response of respondents.

The majority (86%) of the respondents have been involved in a road crash, whereas only 14% of the respondents have not been involved in a road crash (See **Figure 1**). Out of the 86% of the road crash, 74% resulted in bruises and 26% resulted in fractures and dislocation (**Figure 2**). About 53% of respondents who have had road crashes have been involved in it about seven times, and 16% have been involved twice in road crashes (**Figure 3**). Even high-income nations have seen an upsurge in traffic fatalities in recent years [44]. Similar studies across different countries highlighted the predicament of the recklessness of drivers on the road [42] [45]. Delivery riders may suffer severe injuries when involved in an accident as also noted in many countries, however, targeted training interventions could significantly aid rider safety [46]. Many a time, death could be the result of road accidents riders suffer [47] [48], and this is proportional to the effectiveness of road safety interventions across different economic contexts [49]. The high multiple (7x) crash rates (53%) seem to suggest inadequate and or inefficient safety interventions in the Ghanaian context.

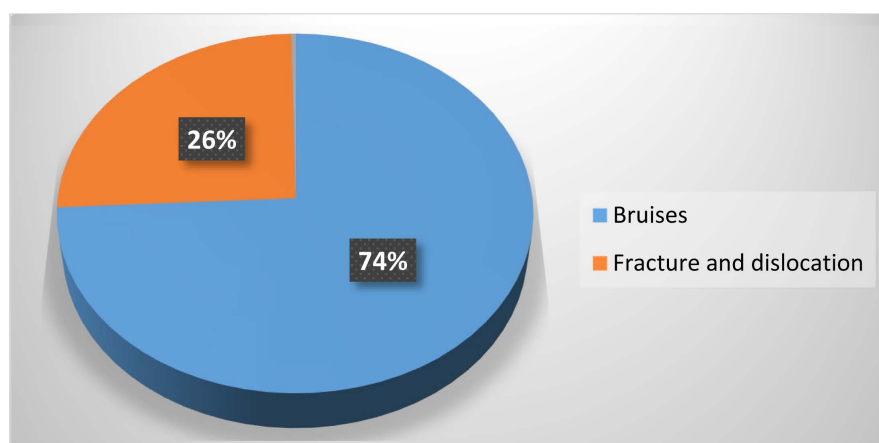


Figure 2. Distribution of the types injuries suffered by respondents.

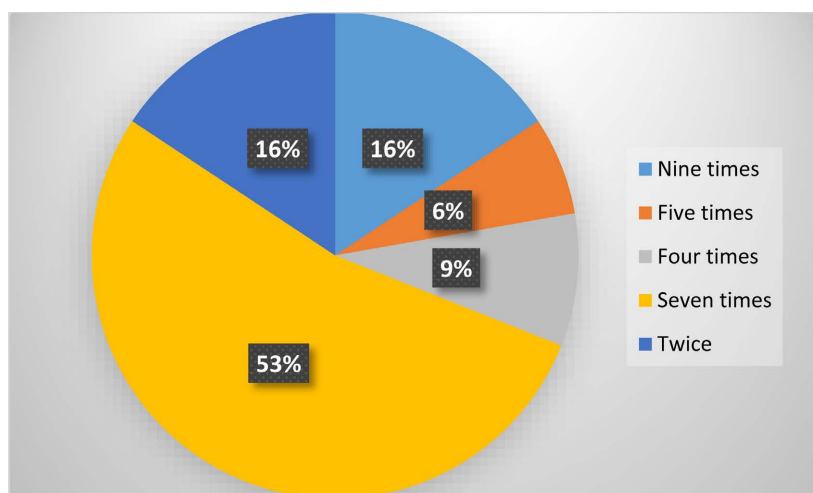


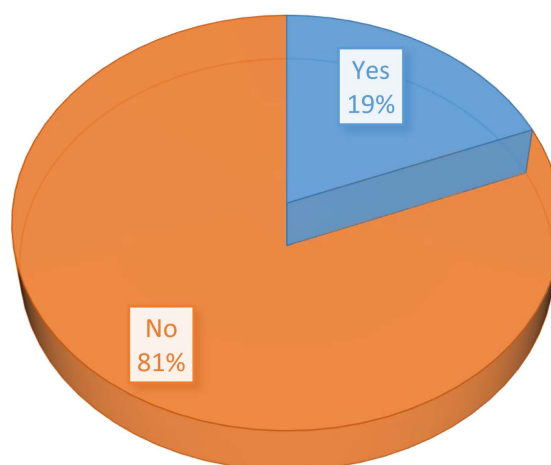
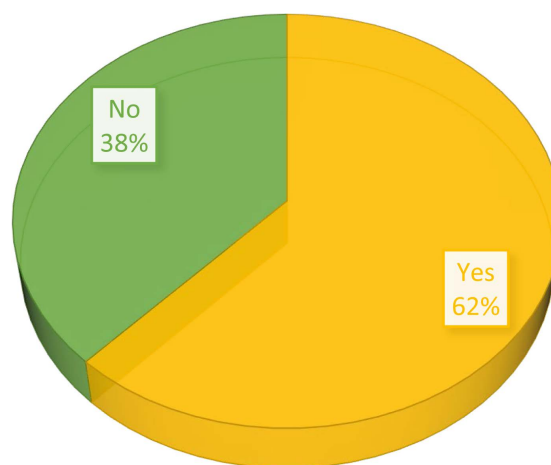
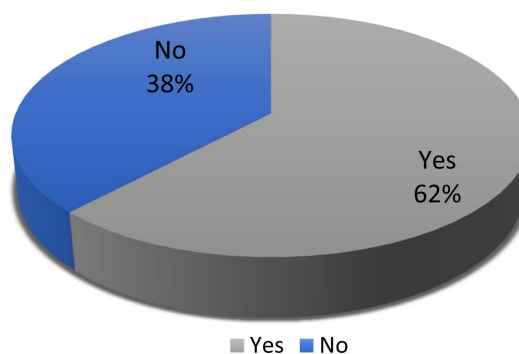
Figure 3. Frequency of road crash.

The compliance with traffic regulations by the dispatch riders was observed. The results showed that the average speed of riders was 54.80 ± 10.21 km/h. The highest speed observed was 78km/h and the lowest speed recorded was 28 km/h. In Ghana, the required speed limit for motorcycles in urban areas is 50 km/h [50]. Section 65 of the Ghana Road Traffic Regulations [51] (LI 2180) sets out various traffic rules and speed limits for different categories of vehicles, including motorcycles. According to these regulations, the general speed limit for motorcycles within urban areas is typically 50 km/h (31 mph), unless otherwise indicated by road signs. The majority (68.66%) of the riders rode above the required speed limit (See **Table 6**). It is no surprise that most of the delivery riders (86%) in this study have experienced multiple crashes. This could be a result of high congestion levels experienced in Accra and the high tendency of crashes [52]. Residents in Accra, therefore, are reviewing various strategies for movement [53], one of which is to avoid personal movement and resorting to delivery riders for their meal purchases. Less than one-third of the rider population sampled (31.34%) adhered to the speed limit regulation in Ghanaian urban areas. Notably, the lowest rider speed measured even exceeds the maximum permitted speed limit of 20km/h speed limit in major cities around the globe [54]. When riding above the regulated speed limits, pedestrians and riders alike are not likely to survive or may sustain serious injuries in the unlikely event of an accident [49].

Respondents' compliance with wearing protective clothing revealed that only 19% complied (**Figure 4**), but the majority (62%) of them complied with wearing of helmet (**Figure 5**), suggesting selective compliance. Sections 128 and 129 of the Ghana Road Traffic Regulations [51] (LI 2180) mandate that all motorcycle riders and their passengers wear protective helmets and protective clothing to enhance their visibility while on the road. It specifies that the helmet must be securely fastened and meet the standards set by the Ghana Standards Authority. The regulation aims to reduce head injuries in the event of accidents. Respondent's responses of adherence to traffic regulations (65%) (**Figure 6**) suggest they

Table 6. Speed compliance of riders.

Speed limit (50 km/h)	Frequency	Percentage (%)
Below	92	30.67
Normal	2	0.67
Above	206	68.66

**Figure 4.** Respondents' compliance with wearing protective clothing.**Figure 5.** Respondents' compliance with wearing of a helmet.**Figure 6.** Respondents' compliance with obeying traffic signals.

do not fully appreciate the extent of rider compliance to road traffic regulation, as selective compliance is not true compliance [55]. Strict adherence to traffic and road safety regulations by delivery riders in Ghana is vital [9].

4. Conclusion

There are notable gaps in compliance with essential protocols, despite the fact that many food delivery riders are aware of basic food and road safety requirements. A low number of riders possess food handlers' certificates, and despite some food hygiene training, awareness and adherence to practices like hand washing and cleaning delivery bags are inconsistent. Although insulated carriers are commonly used to maintain food temperature, improper handling can still compromise food safety. Riders exhibit selective compliance with road safety regulations, often exceeding speed limits and frequently involved in road crashes, particularly in high-traffic areas like Accra. This research highlights the need for stricter enforcement of food safety and traffic regulations, targeted safety training, and better working conditions, including reasonable working hours and support for obtaining necessary certifications. Collaboration among regulatory authorities, delivery companies, and riders is essential to improve both food and road safety.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Li, E., Shi, K., Yang, Y. and Witlox, F. (2024) The Influence of Online Food Delivery Services on Eating-Out Travel—A Case Study of Chengdu, China. *Journal of Retailing and Consumer Services*, **81**, Article 104023. <https://doi.org/10.1016/j.jretconser.2024.104023>
- [2] Su, D.N., Nguyen-Phuoc, D.Q., Duong, T.H., Dinh, M.T.T., Luu, T.T. and Johnson, L. (2022) How Does Quality of Mobile Food Delivery Services Influence Customer Loyalty? Gronroos's Service Quality Perspective. *International Journal of Contemporary Hospitality Management*, **34**, 4178-4205. <https://doi.org/10.1108/ijchm-08-2021-1039>
- [3] Lawal, M. and Adzitey, F. (2022) Online Ordering and Delivery of Ready-to-Eat Foods in Ghana: A Call for Policy Towards Ensuring Food Safety in the Service. *Journal of Food Safety and Hygiene*, **8**, 144-155. <https://doi.org/10.18502/jfsh.v8i3.11015>
- [4] Farahat, M.F., El-Shafie, M.M. and Waly, M.I. (2015) Food Safety Knowledge and Practices among Saudi Women. *Food Control*, **47**, 427-435. <https://doi.org/10.1016/j.foodcont.2014.07.045>
- [5] Pine, B.J. and Gilmore, J.H. (1999) Welcome to the Experience Economy. *Harvard Business Review*, **76**, 97-105.
- [6] Li, C., Miroso, M. and Bremer, P. (2020) Review of Online Food Delivery Platforms and Their Impacts on Sustainability. *Sustainability*, **12**, Article 5528. <https://doi.org/10.3390/su12145528>
- [7] Chen McCain, S., Lolli, J., Liu, E. and Lin, L. (2021) An Analysis of a Third-Party Food Delivery App during the COVID-19 Pandemic. *British Food Journal*, **124**, 3032-3052. <https://doi.org/10.1108/bfj-03-2021-0332>
- [8] Paithane, P., Wagh, S.J. and Kakarwal, S. (2023) Optimization of Route Distance

- Using K-NN Algorithm for on-Demand Food Delivery. *System Research and Information Technologies*, **1**, 85-101. <https://doi.org/10.20535/srit.2308-8893.2023.1.07>
- [9] World Health Organization (2015) Global Status Report on Road Safety 2015.
 - [10] World Health Organization (2023) Pedestrian Safety: A Road Safety Manual for Decision-Makers and Practitioners.
 - [11] Nagaraj, S. (2021) Role of Consumer Health Consciousness, Food Safety & Attitude on Organic Food Purchase in Emerging Market: A Serial Mediation Model. *Journal of Retailing and Consumer Services*, **59**, Article 102423. <https://doi.org/10.1016/j.jretconser.2020.102423>
 - [12] Kanu, P.J. and Turay, H. (2024) Food Hygiene and Safety Practices amongst Food Vendors in the Western Area, Sierra Leone. *Food and Nutrition Sciences*, **15**, 421-431.
 - [13] Tuglo, L.S., Agordoh, P.D., Tekpor, D., Pan, Z., Agbanyo, G. and Chu, M. (2021) Food Safety Knowledge, Attitude, and Hygiene Practices of Street-Cooked Food Handlers in North Dayi District, Ghana. *Environmental Health and Preventive Medicine*, **26**, Article No. 54. <https://doi.org/10.1186/s12199-021-00975-9>
 - [14] Saad, A.T. (2020) Factors Affecting Online Food Delivery Service in Bangladesh: An Empirical Study. *British Food Journal*, **123**, 535-550. <https://doi.org/10.1108/bfj-05-2020-0449>
 - [15] Nguyen-Phuoc, D.Q., Mai, N.X., Ho-Mai, N.T., Nguyen, M.H. and Oviedo-Trespalcios, O. (2024) What Factors Contribute to in-Role and Extra-Role Safety Behavior among Food Delivery Riders? *Transportation Research Part F: Traffic Psychology and Behaviour*, **102**, 177-198. <https://doi.org/10.1016/j.trf.2024.01.013>
 - [16] Sumit, K., Brijs, K., Ross, V., Wets, G. and Ruiter, R. A. (2022) A Focus Group Study to Explore Risky Ridership among Young Motorcyclists in Manipal, India. *Safety*, **8**, Article No. 40. <https://doi.org/10.3390/safety8020040>
 - [17] Yao Dumevi, A. (2023) The Effect of Unemployment on the Economy of Ghana. *SCI-REA Journal of Economics*, **8**, 1-20. <https://doi.org/10.54647/economics79350>
 - [18] Quy Nguyen-Phuoc, D., An Ngoc Nguyen, N., Nguyen, M.H., Ngoc Thi Nguyen, L. and Oviedo-Trespalcios, O. (2022) Factors Influencing Road Safety Compliance among Food Delivery Riders: An Extension of the Job Demands-Resources (JD-R) Model. *Transportation Research Part A: Policy and Practice*, **166**, 541-556. <https://doi.org/10.1016/j.tra.2022.11.002>
 - [19] Zulkifly, S.S. (2023) Work-Related Safety and Health Issues among Food and Parcel Delivery Riders. In: Mohiuddin, M., Ed-Dafali, S., Hosseini, E. and Al-Azad, S., Eds., *International Business—New Insights on Changing Scenarios*, IntechOpen, 1-12. <https://doi.org/10.5772/intechopen.110783>
 - [20] Odonkor, S.T. and Odonkor, C.J.A. (2020) An Assessment of Food Safety Knowledge and Practices in the Ghanaian Hospitality Industry. *Journal of Food Quality*, **2020**, Article 5618492. <https://doi.org/10.1155/2020/5618492>
 - [21] Sharif, L. and Al-Malki, T. (2010) Knowledge, Attitude and Practice of Taif University Students on Food Poisoning. *Food Control*, **21**, 55-60. <https://doi.org/10.1016/j.foodcont.2009.03.015>
 - [22] Tuglo, L.S., Mishra, S., Mohapatra, R.K., Kortei, N.K., Nsor-Atindana, J., Mulugeta, H., et al. (2023) A Systematic Review and Meta-Analysis of Food Handling Practices in Ghana vis-a-vis the Associated Factors among Food Handlers during 2009 and 2022. *Scientific Reports*, **13**, Article No. 18748. <https://doi.org/10.1038/s41598-023-46150-8>
 - [23] Teffo, L.A. and Tabit, F.T. (2020) An Assessment of the Food Safety Knowledge and Attitudes of Food Handlers in Hospitals. *BMC Public Health*, **20**, Article No. 311. <https://doi.org/10.1186/s12889-020-8430-5>
 - [24] Baral, P. and Koirala, M.P. (2022) Assessment of Safety and Health Practices in Road Construction. *Open Journal of Safety Science and Technology*, **12**, 85-95.

- <https://doi.org/10.4236/ojsst.2022.124008>
- [25] Yu, S. and Tsai, W. (2021) The Effects of Road Safety Education on the Occurrence of Motorcycle Violations and Accidents for Novice Riders: An Analysis of Population-Based Data. *Accident Analysis & Prevention*, **163**, Article 106457. <https://doi.org/10.1016/j.aap.2021.106457>
- [26] Saydam, M.B., Borzyszkowski, J. and Karatepe, O.M. (2023) An Exploration of Employees' Experiences of Online Food Delivery: Evidence from Employee Reviews. *International Journal of Contemporary Hospitality Management*, **36**, 2909-2931. <https://doi.org/10.1108/ijchm-12-2022-1540>
- [27] Oviedo-Trespalacios, O., Rubie, E. and Haworth, N. (2022) Risky Business: Comparing the Riding Behaviours of Food Delivery and Private Bicycle Riders. *Accident Analysis & Prevention*, **177**, Article 106820. <https://doi.org/10.1016/j.aap.2022.106820>
- [28] Ruby, G.E., Ungku Zainal Abidin, U.F., Lihan, S., Jambari, N.N. and Radu, S. (2019) A Cross Sectional Study on Food Safety Knowledge among Adult Consumers. *Food Control*, **99**, 98-105. <https://doi.org/10.1016/j.foodcont.2018.12.045>
- [29] James, S.J. and James, C. (2023) Chilling and Freezing. In: Andersen, V., Lelieveld, H. and Motarjemi, Y., Eds., *Food Safety Management: A Practical Guide for the Food Industry*, Academic Press, 453-474. <https://doi.org/10.1016/b978-0-12-820013-1.00005-x>
- [30] Thaivalappil, A., Waddell, L., Greig, J., Meldrum, R. and Young, I. (2018) A Systematic Review and Thematic Synthesis of Qualitative Research Studies on Factors Affecting Safe Food Handling at Retail and Food Service. *Food Control*, **89**, 97-107. <https://doi.org/10.1016/j.foodcont.2018.01.028>
- [31] Augustin, J., Kooh, P., Bayeux, T., Guillier, L., Meyer, T., Jourdan-Da Silva, N., et al. (2020) Contribution of Foods and Poor Food-Handling Practices to the Burden of Foodborne Infectious Diseases in France. *Foods*, **9**, Article 1644. <https://doi.org/10.3390/foods9111644>
- [32] Arthur, P., Serwaa Lah, E., Turkson, R. and Anane, M. (2021) Knowledge Base on Food Borne Diseases and Hygiene in Ghana: Appraisal of Food Vendors in Oguua Koforidua. *Trends Journal of Sciences Research*, **1**, 1-9. <https://doi.org/10.31586/ojfn.2022.120>
- [33] Di Cola, G., Fantilli, A.C., Pisano, M.B. and Ré, V.E. (2021) Foodborne Transmission of Hepatitis a and Hepatitis E Viruses: A Literature Review. *International Journal of Food Microbiology*, **338**, Article 108986. <https://doi.org/10.1016/j.ijfoodmicro.2020.108986>
- [34] Ali, B.J., Saleh, P.F., Akoi, S., Abdulrahman, A.A., Muhamed, A.S., Noori, H.N., et al. (2021) Impact of Service Quality on the Customer Satisfaction: Case Study at Online Meeting Platforms. *International Journal of Engineering, Business and Management*, **5**, 65-77. <https://doi.org/10.22161/ijebm.5.2.6>
- [35] Gallo, M., Ferrara, L., Calogero, A., Montesano, D. and Naviglio, D. (2020) Relationships between Food and Diseases: What to Know to Ensure Food Safety. *Food Research International*, **137**, Article 109414. <https://doi.org/10.1016/j.foodres.2020.109414>
- [36] Ricci, A., Martelli, F., Razzano, R., Cassi, D., Lazzi, C., Neviani, E., et al. (2020) Service Temperature Preservation Approach for Food Safety: Microbiological Evaluation of Ready Meals. *Food Control*, **115**, Article 107297. <https://doi.org/10.1016/j.foodcont.2020.107297>
- [37] FA, S. (2024) Ways of Food Contamination, Its Impact and Prevention. *Food Science & Nutrition Technology*, **9**, 1-8. <https://doi.org/10.23880/fsnt-16000326>
- [38] Ragab, A., Edris, A.M., Shaltout, F.A.E. and Salem, A.M. (2022) Effect of Titanium Dioxide Nanoparticles and Thyme Essential Oil on the Quality of the Chicken Fillet.

- Benha Veterinary Medical Journal*, **41**, 38-40.
<https://doi.org/10.21608/bvmj.2021.107456.1488>
- [39] Hassan, M., Shaltout, F.A. and Saqur, N. (2020) Histamine in Some Fish Products. *Archives of Animal Husbandry & Dairy Science*, **2**, 1-3.
<https://doi.org/10.33552/aahds.2020.02.000527>
- [40] Ayeh-Kumi, P.F., Quarcoo, S., Kwakye-Nuako, G., Kretchy, J.P., Osafo-Kantanka, A. and Mortu, S. (2015) Prevalence of Intestinal Parasitic Infections among Food Vendors in Accra, Ghana. *Journal of Tropical Medicine and Parasitology*, **32**, 1-8.
- [41] Yu, R. and Abdel-Aty, M. (2014) An Optimal Variable Speed Limits System to Ameliorate Traffic Safety Risk. *Transportation Research Part C: Emerging Technologies*, **46**, 235-246. <https://doi.org/10.1016/j.trc.2014.05.016>
- [42] Pang, M., Zheng, S. and Cai, Z. (2015) Simulation of Three Lanes One-Way Freeway in Low Visibility Weather by Possible Traffic Accidents. *Physica A: Statistical Mechanics and Its Applications*, **433**, 161-170.
<https://doi.org/10.1016/j.physa.2015.03.066>
- [43] Katrakazas, C., Michelaraki, E., Sekadakis, M. and Yannis, G. (2020) A Descriptive Analysis of the Effect of the COVID-19 Pandemic on Driving Behavior and Road Safety. *Transportation Research Interdisciplinary Perspectives*, **7**, Article 100186.
<https://doi.org/10.1016/j.trip.2020.100186>
- [44] Job, R.F.S., Truong, J. and Sakashita, C. (2022) The Ultimate Safe System: Redefining the Safe System Approach for Road Safety. *Sustainability*, **14**, Article 2978.
<https://doi.org/10.3390/su14052978>
- [45] Wang, L., Abdel-Aty, M. and Lee, J. (2017) Implementation of Active Traffic Management Strategies for Safety on Congested Expressway Weaving Segments. *Transportation Research Record: Journal of the Transportation Research Board*, **2635**, 28-35.
<https://doi.org/10.3141/2635-04>
- [46] Huertas-Leyva, P., Baldanzini, N., Savino, G. and Pierini, M. (2021) Human Error in Motorcycle Crashes: A Methodology Based on in-Depth Data to Identify the Skills Needed and Support Training Interventions for Safe Riding. *Traffic Injury Prevention*, **22**, 294-300. <https://doi.org/10.1080/15389588.2021.1896714>
- [47] Haque, M.M. and Washington, S. (2015) The Impact of Mobile Phone Distraction on the Braking Behaviour of Young Drivers: A Hazard-Based Duration Model. *Transportation Research Part C: Emerging Technologies*, **50**, 13-27.
<https://doi.org/10.1016/j.trc.2014.07.011>
- [48] World Health Organization (2018) Global Status Report on Road Safety 2018. Geneva.
<https://www.who.int/publications/i/item/9789241565684>
- [49] Yasin, Y.J., Grivna, M. and Abu-Zidan, F.M. (2022) Motorized 2-3 Wheelers Death Rates over a Decade: A Global Study. *World Journal of Emergency Surgery*, **17**, Article No. 7. <https://doi.org/10.1186/s13017-022-00412-4>
- [50] Johns Hopkins International Injury Unit (2023) Status Summary Report 2023: Road Safety Risk Factors in Kumasi, Ghana. Baltimore.
<https://publichealth.jhu.edu/sites/default/files/2024-03/20240319bigrskumasi21pages.pdf>
- [51] Driver and Vehicle Licensing Authority (2012) The Ghana Road Traffic Regulations 2012, (LI 2180). Assembly Press.
- [52] Agyapong, F. and Ojo, T.K. (2018) Managing Traffic Congestion in the Accra Central Market, Ghana. *Journal of Urban Management*, **7**, 85-96.
<https://doi.org/10.1016/j.jum.2018.04.002>
- [53] Amanor, W.K., Adanu, E.K., Adams, C.A. and Adi, S.B. (2024) Assessing Road Users' Preferences for Various Travel Demand Management Strategies for Adoption in Accra, Ghana. *Future Transportation*, **4**, 919-937.
<https://doi.org/10.3390/futuretransp4030044>

- [54] Tian, D., Zhou, J., Wang, Y., Sheng, Z., Xia, H. and Yi, Z. (2016) Modeling Chain Collisions in Vehicular Networks with Variable Penetration Rates. *Transportation Research Part C: Emerging Technologies*, **69**, 36-59.
<https://doi.org/10.1016/j.trc.2016.05.013>
- [55] Parker, C. and Nielsen, V.L. (2009) Compliance: Regulation and Environment. Edward Elgar Publishing.