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Factors influencing compliance with inspection recommendations in food service establishments: A case study of Mansa Municipality, Zambia

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Inspection reports reflect daily operations of Food Service Establishments (FSE) with indications on levels of compliance with food safety standards and regulations, thus, making them central to the enforcement processes in food safety control systems. While compliance with food safety standards and regulations in FSEs is often viewed by the number of non-compliances or inspection violations cited during inspections, non-compliance with inspection recommendations may be an indication of continued non-compliance to the food safety standards. Using a cross-sectional study design, we assess the factors that influence compliance of FSE with inspection recommendations in Mansa Municipality, Zambia. This involved extraction of inspection process details from inspection reports for FSEs inspected was analyzed, followed by the administration of a questionnaire to FSE managers or owners on management and socio-economic factors. The data collected was subjected to both descriptive and inferential analysis. Importantly, the study results revealed that administrative enforcement, follow-up inspections, and reasonable time limits to make corrections are necessary factors to be considered in inspection processes for food establishments to comply with inspection recommendations. FSE owners compared to assigned managers exert more influence on the establishment's compliance to inspection recommendations when actively involved in the daily operations. Well-operated inspecting institutions and FSE owners play key roles in facilitating FSEs' compliance with inspection recommendations as this ultimately facilitates compliance with food safety standards.

Key words: Compliance, Inspection recommendations, Inspection violation, Food Service Establishment, Foodborne illness.

INTRODUCTION

Regular monitoring of set standards through inspections is central to the enforcement processes in food safety control systems (Mwamakamba et al., 2012). Inspections form the main means of confirming whether a Food Service Establishment (FSE) complies with food safety standards and regulations in its daily operation. Kotsanopoulos and Arvanitoyannis (2017) observe that inspections and quality audit in the food industry evaluate

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management systems assess the condition of premises and products, and confirm legal compliance. According to Powell et al. (2013), the purpose of health inspections in food systems is to continuously assess the practices and processes used by food producers at each step in the production or preparation of food. Inspections can also identify deficiencies for improved food safety in restaurants and training needs for specific restaurants following the violations identified during the inspections (Kwon et al., 2012, 2014). At the same time, evaluation of the inspection reports can give details to the deficiencies in Health Inspectors (Kwon et al., 2014), especially when they fail to identify the critical violations during the inspections. Jones et al. (2004), also note that an effective inspection system should be uniform, consistent, and focused on identifying characteristics known to affect food safety. The British Columbia Ministry of Health (2006), suggests that inspection should also concentrate on the complex food processes, which involve multiple ingredients being assembled or mixed, cooking of potentially hazardous food, holding prepared foods for several hours before service, foods which must be cooled and reheated, as these are the risk practices that are known to cause foodborne illnesses.

Research has shown that critical violations identified in food establishments have the likelihood of causing food-borne illnesses. According to Petran et al. (2012) in a study that tried to relate data collected during routine inspections in Minnesota, USA revealed that overall restaurant evaluation after routine inspections may not be predictive of the likelihood of foodborne illnesses but some of the violations observed during the routine inspection may indicate the likelihood of foodborne illnesses occurring. It has been further observed by Kirandeep (2016) that inspection violations are indications of improper food safety practices, cleanliness, and pest infestations. The type of critical violations cited after each inspection gives particular information on the potential risks of causing food-borne illnesses. The categorization of inspection violations is either critical or non-critical. Critical violations are those food handling practices that are the most common causes of foodborne illness, while non-critical violations include sanitation and maintenance risks where a loss of control would not pose a significant health risk (Nieboer et al., 2015). The inclusion of an inspection violation in the inspection report is, however, dependent on whether the Health Inspector viewed the violation as important to be included in the inspection report and that the violation had the potential of causing foodborne illness (Johnson et al., 2014). It is important to mention that all violations, whether critical or non-critical, cited in an inspection report should be included based on the food safety standards.

The violations identified in foodservice establishments during an inspection indicate poor food handling practices. According to Cseke et al. (2014), items or actions that do not cause an immediate health hazard are classified as lower risk, and these include conditions of surfaces that do not contact food such as floors, walls, ceilings, lighting, and ventilation. While critical items like employee hygiene or storage of potentially hazardous foods are more valid assessments of the risk of an establishment. Therefore, in inspections, more concentration is given to the identification of critical violations which if not controlled may result in food-borne illnesses. Appling et al. (2018), found that some of the critical violations (such as food contact surfaces not being clean to sight and touch or sanitized before use and hand-wash facilities not being stocked with hand cleanser, sanitary towels, or hand drying devices) were more likely to be cited in sporadic *Salmonella* cases. However, Yapp and Fairman (2006), noted that most inspection reports cite non-critical violations.

Risk-based inspections are used in determining food safety risks in a particular Food Service Establishment (FSE). This involves the identification of critical violations that can cause food-borne illnesses (Hoag et al., 2007; Kwon et al., 2014). This is because they act as a means for surveillance of sources of food-borne illnesses as they help categorize food service establishments into high-risk, medium, and low-risk establishments (Hoag et al., 2007). High-risk food establishments are defined as those that perform extensive handling of raw ingredients; use preparation processes that include the cooking, cooling, and reheating of potentially hazardous foods; or use a variety of processes that require the hot and cold holding of potentially hazardous food; or whose food processes include preparation for next day service (British_Columbia-MoH, 2006). When food establishments are categorized according to the food safety risk, it becomes a basis for the frequency with which the food service establishments can be inspected. Thus, food establishments categorized as high risk are expected to be frequently inspected.

In some countries, such as Zambia, it is expected that after an inspection, the Food Service Establishment is served with an informal letter (inspection report) or a statutory notice so that it can refer to the specific violations which need corrective measures to ensure that it fully complies with food safety standards. Non-compliance to inspection report recommendations may indicate a continued non-compliance to general food safety standards. The food safety control system, therefore, depends on the process of inspection violation abatement by food establishments in line with food safety standards (Public Health Act, Cap 295).

In the event where corrective measures are not timely acted upon by the Food Service Establishment (FSE) in the specified time frame indicated in the informal letter, more formal enforcement approaches are taken such as issuance of statutory notices, prosecutions, and closure of premise (Public Health Act, Cap 295, Yapp and Fairman, 2006; Läikkö-Roto et al., 2016). In Zambia, the regulatory framework that outlines food safety standards

includes the Food Safety Act of 2019 of the Laws of Zambia. Other regulations used to regulate food safety management include the Public Health Act, Chapter 295, and the Local Government Act, Chapter 281 of the Laws of Zambia.

On the other hand, several studies on food service establishment inspections have concentrated on factors that measure the Food Service Establishment's compliance to food safety standards and the possible risks of causing foodborne illnesses, particularly gauging the performance of a food service establishment on food safety standards by the number of violations cited during an inspection using scorecards (Irwin et al., 1989; Jones et al., 2004; Phillips et al., 2006; Newbold et al., 2008; Lee, 2013; Leinwand et al., 2017). In addition, some studies conducted have concentrated on the factors that hinder food service establishments from complying with food safety standards and regulations, with particular concentration on the enforcement implications (Yapp and Fairman, 2006; Läikkö-Roto et al., 2015; Kettunen et al., 2018). However, most of these studies have been conducted in countries that implement compliance law enforcement strategies where conformity to food safety regulations is through insuring compliance or by action to prevent potential violations without the necessity to detect, process, and penalize violators. Meanwhile, countries with deterrence law enforcement strategies have to deal with Food Service Establishment's non-compliance to recommendations after inspections or rather detecting violations to enforce food safety in Food Service Establishments (Yapp and Fairman, 2006), to which there is little information on what factors influence the Food Service Establishment's compliance to inspection recommendations.

Inspection of trading premises in Zambia is conducted by Health Inspectors employed by the Ministry of Health and Local Government and Housing. In the period between 2017 and 2018, altogether, a total number of 4,094 inspections conducted on various types of trading premises in Mansa district, with 14 premises reported to have been closed for unsanitary conditions (Mansa DHO, 2018). Despite all the health inspection activities conducted, there has been low compliance to inspection recommendations by food service establishments. It is expected that food service establishments adhere to the inspection recommendations for them to comply with food safety standards. The Health Management Information System (HMIS) reports obtained from Mansa District Health Office (2018), however, indicate that out of the 434 statutory nuisance notices issued in 2018, only 209 (48.15%) were complied with. During the same period, the provincial picture showed that only 28% (1157/4120) were complied with (Luapula Provincial Health Office, 2018). Trends of continued low compliance to statutory notices by trading premises, especially as that of non-compliance of Food Service Establishments to inspection recommendations often increase foodborne diseases. On the other hand, the credibility and purpose of conduction health inspections in Food Service Establishments are reduced (Menachemi et al., 2012).

This research study was designed to assess the factors that influence Food Service Establishments' compliance to inspection recommendations, with a particular focus on socio-economic factors, food service establishment management characteristics, and inspection processes or mechanisms used by enforcement agencies. The specific factors considered in the research study included gender, age, level of education, knowledge of food safety of the FSE manager or owner; location of the FSE, the type or size of business, income, and the type of FSE (restaurant, butchery, or bakery), or premise ownership; administrative enforcement measures instituted by the inspecting institution, follow-up inspections, inspection frequency and time limit given to the Food Service Establishment to take corrective measures.

METHODOLOGY

Data collection

Data collected from inspection reports of 148 Food Service Establishments located in the municipal area for Mansa Municipal Council in Luapula Province of Zambia and the interviewed food service managers or owners were analyzed to establish what factors influenced the compliance of Food Service Establishments with inspection recommendations in Mansa Municipality. The review of inspection reports involved reviewing inspection process details and actions taken within the inspection cycle while taking note of the varying number and type of critical and non-critical violations cited in the subsequent inspection reports in the inspection cycle from the initial inspection. The inspection details and action taken included any administrative enforcement measures instituted by the inspecting institution (notices on closure of premises, withdrawal of licenses, or any other enforcement action taken by the inspecting institution), Follow-up inspections, Number of Inspections, Inspection frequency, and time limit given. This data was collected using a checklist. The food service managers or owners of the Food Service Establishments that had their inspection reports reviewed were then interviewed on the social-economic factors using a structured questionnaire. This included the gender, age, level of education knowledge of food safety of the FSE manager or owner. Other factors included the location, type or size of business, premise ownership, income, and the type of FSE (Restaurant, Butchery, or Bakery).

Data analysis

The data analysis methods used in this study included descriptive and inferential statistical analysis. For categorical variables, firstly, the number and percentages were reported by percentage and the actual number obtained, stratified by whether the Food Service Establishment complied or not with inspection recommendations. To test for any differences in the proportions, either the Chi-squared test or Fisher's exact test was used depending on whether the assumptions of a Chi-squared test are satisfied or not. For continuous variables, the data were tested for normal distribution in a histogram. Then, if the variable follows a normal distribution, the mean and standard deviation were reported stratified by the dependent variable, otherwise, the median and interquartile range

were reported, stratified by whether the Food Service Establishment complied or not with inspection recommendations. To check any differences in the continuous variables, either a t-test or Wilcoxon rank-sum test was used depending on whether the assumptions of a t-test were satisfied or not.

For inferential statistical analysis, bivariate logistic analysis was used to determine the strength of association between each independent variable and the food establishment's compliance to inspection recommendations; and multiple variable logistic regression analysis was used to determine the strength of association between each independent variable and the Food Service Establishment's compliance to inspection recommendations taking into account all other explanatory variables. Furthermore, the machine-led stepwise logistic regression was applied to check the best fitting model that explains the Food Service Establishment's compliance to inspection recommendations cited in the inspection reports.

All statistical tests were set at a 95% confidence level, and at the same time, all analyses were performed using STATA software, version 14.2 SE (Stata Corporation, College Station, TX, USA). Additionally, all research ethics protocols were adhered to, including obtaining the necessary permission from the University of Zambia Biomedical and Research Ethics Committee (UNZABREC), the National Health Research Authority (NHRA), Mansa Municipal Council (MCM), and the individual FSEs that participated in the study.

RESULTS

Demographics of food service establishments

The study subjects included 148 food service establishments; restaurants 132/148 (89.19%), butchery 11/148 (7.43%), and bakery 5/148 (3.38%). Of the Food Service Establishments in the study, 43/148 (29.1%) complied with inspection recommendations, while 105/148 (70.9%) of the FSEs did not comply with inspection recommendations. At the same time, of the FSE's that participated in the study, 24.32% were run by a male manager or owner, and 75.68% of FSE's were run by a female manager or owner.

Descriptive analysis of common inspection violations cited in the inspection reports

The analysis of the inspection reports indicated
that there were more non-critical inspection violations cited in the inspection reports than critical inspection violations. The average number of inspection violations observed per Food Establishment that was inspected was 2.89 inspection violations per inspection conducted. The average number of critical inspection violations cited in the inspection reports was 1.30 inspection violations per inspection; ranging from 0 to 4 inspection violations per inspection. On the other hand, the average number of non-critical inspection violations cited in the inspection reports analyzed was 1.59 inspection violations per inspection conducted and ranged from 0 to 5 inspection violations (Table 1).

Characteristics of Food Service Establishment's compliance with inspection recommendations

The baseline factors influencing FSE's compliance with inspection recommendations are presented as grouped into three including management factors, socio-economic factors, an lastly, inspection processes shown in Tables 2 to 4, respectively.

Management factors influencing compliance to inspection recommendations in Mansa district

Only 21.52% (n=17) of the FSE's whose daily management of the establishment was by the owner of the food establishment complied with inspection recommendations compared to 37.68% (n=26) whose day to day management of the establishment was by a manager; and this difference was statistically significant (17 vs 26; p-value = 0.031). Similarly, there was a significant difference in compliance of FSE's with inspection recommendations among FSE's whose managers or owners have undergone management training and those that have not undergone any management training. Of the Food Service Establishments whose manager or owner had undergone management training to run the food establishment, 57.14% (n=8) complied with the inspection recommendations compared to 26.12% (n=35) that did not undergo any management training (8 vs 35; p-value=0.015).

However, there was no significant difference in the median age of manager or owner of the Food Service Establishments that took part in the study; the median age being 35 (interquartile range 31 - 42) in FSE's that complied with inspection recommendations compared to 37 years (interquartile range 31 - 44) among those FSE's that did not comply with inspection recommendations (35 years vs 37 years; p-value = 0.390). Additionally, there was no significant difference, statistically, between FSE's whose managers or owners were male or female. Of the FSE's that complied with inspection recommendations, 19.44% (n=7) of the FSE's were managed by male FSE managers or owners compared to 32.14% (n=36) that were being managed by female FSE managers or owners (7 male vs 36 female; p-value 0.144). The level of education of the FSE's manager or owner was indicated not to be statistically significant. Of the FSE whose managers or owners who have reached tertiary education, 18.60% (n=8) complied with inspection recommendations compared to 11.63% FSE managers or owners that had gone up to primary education or 69.77% of FSE managers or owners that had gone up to secondary education level.

There was no significant difference in percentage between FSE's that complied with inspection recommendations compared to those that did not comply

Table 1. Common critical and non-critical inspection violations cited in the inspection reports analyzed in the research study.

S/N	Description of inspection violation	No. of FSE violating	% of FSE violating
A	**Analysis of top 5 Critical violations cited in the inspection reports**		
1	Food handlers are medically examined every six months and also restricted from handling food when sick	70	47.30
2	Adequate number of toilets and hand-wash facilities, properly located and designed	29	19.59
3	Safe water source: Availability of sufficient safe water. All water supplied to the food establishment, either from public systems or private wells, must meet WHO drinking water standards	23	15.54
4	Sewage disposal: Food establishments must meet adequate sewage and wastewater disposal requirements	20	13.51
5	Hand-wash facilities are provided with soap and hand towels or disposable tissue	13	8.78
B	**Analysis of top 5 Non-Critical violations cited in the inspection reports**		
1	Floors, walls, and ceilings: floors must be kept clean and free of any build-up of food spills, dirt, and refuse. Walls and ceilings must be kept clean and free from any build-up of food spills, splash, or dirt	62	41.89
2	Premises maintained: the premises in and around a food establishment must be kept in an orderly fashion to prevent attracting and harboring rodents and insects	47	31.76
3	Clean clothes, hair restraints: Food handlers must maintain good clean clothes to prevent contamination of their hands after touching the cloths.	45	30.61
4	FSE has a valid trading and health permit from the Local Authority	21	14.19
5	Garbage and refuse: there must be proper disposal of garbage and refuse in order not to attract, harbor, or act as a breeding place for flies and rodents	18	11.89

concerning food handler food safety training. For instance, of the food handlers that had been trained in food safety handling, 35.0% (n=14) worked for FSE's that complied with inspection recommendations compared to 65.0% (n=26) that worked for the FSE's that did not comply with inspection recommendations. However, the percentage difference was not statistically different (14 vs 26; p-value =0.333). Coupling training and knowledge of food handlers on food safety, the study results indicate that both factors had no effect in influencing overall compliance of the FSE with inspection recommendations.

Socio-economic factors influencing compliance to inspection recommendations by FSE in Mansa district

Only 11.63% (n=5) of the FSE's had a monthly income below K1,500 complied with inspection recommendations compared to 9.30% (n=4) of FSE's that had a monthly income between K1,500 and K4,000, and also compared to 37.21% (n=16) of FSE's that had an income of between ≥ K4, 000 and ≤ K7, 500 and 41.86% (n=18) of FSE's that had a monthly income of K7,500 and above. This difference in the relationship between the FSE's monthly income and the compliance with inspection recommendations was statistically significant (5 vs 4 vs 16 vs 18; p-value = 0.022). At the same time, among the FSE's that had a monthly income of K7,500 and above, 41.86% (n=18) complied with inspection recommendations compared to 32.38% (n=34) that did not comply with inspection recommendations.

However, there was no significant difference in the FSE's that complied with inspection recommendations concerning the type of FSE, location of FSE, premise ownership, or the size of the FSE. Of those FSE's that complied with

Table 2. Baseline characteristics of management factors influencing Food Service Establishment's compliance with inspection recommendations.

Management factors	FSE compliance to inspection recommendation		P-value < 0.05
	Complied (n=43)	Not complied (n=105)	
Manager or owner' sex			
Male	7 (19.44)	29 (80.56)	0.144*
Female	36 (32.14)	76 (67.86)	
manager or owner's age			
Median (Interquartile range)	35 (31 – 42)	37 (31 – 44)	0.390**
Person in-charge			
FSE Owner	17 (21.52)	62 (78.48)	0.031*
FSE manager	26 (37.68)	43 (62.32)	
Level of education			
Primary education	5 (11.63)	17 (16.19)	
Secondary education	30 (69.77)	73 (69.52)	0.643*
Tertiary education	8 (18.60)	15 (14.29)	
Food safety training - manager or owner			
Trained in food safety	14 (31.11)	31 (68.89)	0.700*
Not trained in food safety	29 (28.16)	74 (71.84)	
Knowledge on food safety - manager or owner			
Average	0 (0)	2 (1.35)	
Good	5 (11.63)	11 (10.48)	0.651*
Very good	38 (88.37)	92 (87.62)	
Knowledge on food safety - Food handler			
Average	0 (0)	1 (0.95)	
Good	6 (13.95)	23 (21.90)	0.548***
Very Good	37 (86.05)	81 (77.14)	
Management training			
Trained in managerial skills	8 (57.14)	6 (42.86)	0.015*
Not trained in managerial skills	35 (26.12)	99 (73.88)	
View on Inspectors performance			
Below average	0 (0)	3 (2.86)	
Average	34 (79.07)	82 (78.10)	0.714***
Above average	9 (20.93)	20 (19.05)	
Months of experience			
Median (Interquartile range)	32 (13 – 58)	36 (18 – 64)	0.278**
Food Handler food safety training			
Food handlers trained in food safety	14 (35.00)	26 (65.00)	0.332*
Food handlers not trained in food safety	26 (26.85)	79 (73.15)	

*Chi-squared test; **ManneWhitney test; ***Fisher exact test.

inspection recommendations, 83.72% (n=36) of the FSE's were restaurants compared to 11.63% (n=5) butcheries and 4.65% (n=2) bakeries (36 vs 5 vs 2; p-value = 0.391). Of the FSE's that were occupied by the owner of the premise (this is where the owner of the premise was running a Food Service Establishment), 30.77% (n=8) complied with the inspection recommendations compared to 28.69% (n=35) that were

Table 3. Baseline characteristics of socio-economic factors influencing Food Service Establishment's compliance with inspection recommendations.

Socio-economic factors	FSE compliance to inspection recommendation		P-value < 0.05
	Complied n=43	Not complied n=105	
Type of FSE			
Restaurant	36 (83.72)	96 (91.43)	
Butchery	5 (11.63)	6 (5.71)	0.391***
Bakery	2 (4.65)	3 (2.86)	
Location of FSE			
Town Centre	19 (44.19)	37 (35.24)	
Market (low density residential area)	1 (2.33)	2 (1.90)	0.244***
Market (medium density residential area)	20 (46.51)	46 (43.81)	
Market (high density residential area)	3 (6.98)	20 (19.05)	
Premise Ownership			
Owner occupying premise	8 (30.77)	18 (69.23)	0.832*
Tenant occupying the premise	35 (28.69)	87 (71.31)	
Size of business			
Micro enterprises	39 (90.70)	99 (94.29)	
Small enterprises	3 (6.98)	6 (5.71)	0.295***
Medium enterprises	1 (2.33)	0 (0)	
FSE's Monthly Income			
Below K1,500	5 (11.63)	6 (5.71)	
K1,500 to K3,999	4 (9.30)	33 (31.43)	0.022***
K4,000 to K7,499	16 (37.21)	32 (30.48)	
K7,500 and above	18 (41.86)	34 (32.38)	

*Chi-squared test; **ManneWhitney test; ***Fisher exact test.

occupied by a tenant (8 vs 35; p-value = 0.816).

Inspection process factors influencing compliance to inspection recommendations by FSE in Mansa district

It was noted that of the Food Service Establishments that complied with inspection recommendations, 69.44% (n=25) of FSEs had received follow-up inspections to verify if the FSE had made corrective actions on the inspection violations compared to 16.07% (n=18) of the FSE that did not receive follow-up inspections of their premises; and this difference is statistically significant (25 vs 18; p-value <0.000). At the same time, there was a significant difference between those FSE's that complied with inspection recommendations and those that did not comply with the various variables relating to whether the inspecting institution subjected administrative enforcementmeasures against those FSE's that did not make correct the inspection violations cited in the initial inspection. For instance, 39.53% (n=17) of FSE's whose inspecting institution did not institute administrative enforcement measures against complied with inspection recommendations compared to 94.29% (n=99) of the FSE's that did not comply with the inspection recommendations (17 vs 99; p-value <0.000). Of the FSE's that were issued with closure notices as an administrative enforcement measure taken by the inspecting institution, 18.60% (n=8) complied with inspection recommendation compared to 3.81% (n=4) that did not comply with the inspection recommendations; and this difference amongst the group was statistically significant (8 vs 4; p-value <0.000). Lastly, of the FSE's that were given a time frame of 24 h to make corrective actions on the inspection violations sited during the initial inspection, 20.93% (n=9) FSE complied with inspection recommendations compared to 47.62% (n=50) of FSE's that did not comply with inspection recommendations; and this difference is statistically significant (9 vs 47; p-value <0.000).

Factors influencing the compliance of food service establishment with inspection recommendations cited in the inspection report

Some factors remained statistically significant both as

Table 4. Baseline characteristics of factors relating to inspection processes influencing FSE's compliance with inspection recommendations.

S/N	Factors relating to inspection processes	FSE compliance to inspection recommendation		P-value < 0.05
		Complied (n=43)	Not complied (n=105)	
1	**Follow-up Inspections**			
	Follow-up inspections done	25 (69.44)	11 (30.56)	0.000*
	No follow-up inspections done	18 (16.07)	94 (83.93)	
2	**Number of follow-up inspections**			
	Median (Interquartile range)	1 (0 - 1)	0 (0 - 0)	0.000**
3	**Time limit given**			
	Immediately (within 24hrs)	9 (20.93)	50 (47.62)	0.000*
	2 - 7 days	7 (16.28)	32 (30.48)	
	8 - 14 days	0 (0)	0 (0)	
	15 - 28 days	0 (0)	0 (0)	
	No time specified	11 (25.58)	22 (20.95)	
	Not required	16 (37.21)	1 (0.95)	
4	**Frequency of inspections/per year**			
	Once/year	12 (27.91)	34 (32.38)	0.190*
	Twice/year	13 (30.23)	42 (40.00)	
	Three times/year	12 (27.91)	24 (22.86)	
	Four times and above/year	6 (13.95)	5 (4.76)	
5	**Inspection report generation**			
	Report submitted after each inspection	37 (35.24)	68 (64.76)	0.010*
	Report not submitted after each inspection	6 (13.95)	37 (86.05)	
6	**Administrative enforcement measures**			
	Not necessary for administrative enforcement action	17 (39.53)	1 (0.95)	0.000*
	No administrative enforcement action taken	16 (37.21)	99 (94.29)	
	Penalty charged	2 (4.65)	1 (0.95)	
	Premise closed	8 (18.60)	4 (3.81)	
	Premise closed and penalty charged	0 (0)	0 (0)	

*Chi-squared test; **ManneWhitney test; ***Fisher exact test.

crude and adjusted levels; while others gained their statistical significance while taking into account the other factors (Table 5). Among the management factors assessed to whether they influenced the Food Service Establishment's compliance with inspection recommendations, only factors including the manager or owner's gender, the person in charge of the daily operation of the FSE, and management training indicated influencing FSE's compliance with inspection recommendations after adjusting the odds ratios. Whilst the majority of socio-economic factors indicated not influencing FSE's compliance with inspection recommendations after adjusting the odds ratios except for the FSE's monthly income. Food Service Establishments that earned a monthly income between K1,500 and K4,000, concerning those FSE's that earned a monthly income below K1,500, indicated to influence the FSE's compliance with inspection recommendations. Inspection processes that remained influential to the FSE's compliance with inspection recommendations even after adjusting the odds ratio include that of follow–up inspections and administrative enforcement measures taken by the inspecting institution. While factors whose variables had indicated to influence the FSE's compliance with inspection recommendations under crude odds ratios such as the number of follow-up inspections conducted by the inspecting institution, time limit given to the FSE to take corrective measures against the inspection recommendations, and inspection report generation indicated not to influence the FSE's compliance with inspection recommendations after adjusting the odds ratios.

Table 5. Crude and adjusted odds ratio of factors influencing FSE's compliance with inspection recommendations.

S/N	Factor	Crude				Adjusted			
		Odds ratio	95% CI		P-value < 0.05	Odds ratio	95% CI		P-value < 0.05
A	**Food service establishment management factors**								
1	**Manager or owner' sex**								
	Male	Ref.	n/a	n/a	n/a	Ref.	n/a	n/a	n/a
	Female	0.510	0.203	1.273	0.149	0.105	0.017	0.643	0.015
2	**Manager or owner's age**								
	Age	1.020	0.981	1.060	0.318				
3	**Person in-charge**								
	FSE Owner	Ref.	n/a	n/a	n/a	Ref.	n/a	n/a	n/a
	FSE manager	0.453	0.220	0.936	0.032	0.248	0.058	1.042	0.057
4	**Level of education**								
	Primary	Ref.	n/a	n/a	n/a				
	Secondary	0.716	0.242	2.116	0.545				
	Tertiary	0.551	0.148	2.055	0.375				
5	**Food safety training: Manager or owner**								
	Trained in food safety	Ref.	n/a	n/a	n/a				
	Not trained in food safety	1.152	0.537	2.472	0.716				
6	**Knowledge on food safety – Manager or owner**								
	Average	1*	-	-	-				
	Good	0.909	0.296	2.792	0.867				
	Very good	1**	-	-	-				
7	**Management training**								
	Trained in managerial skills	Ref.	n/a	n/a	n/a	Ref.	n/a	n/a	n/a
	Not trained in managerial skills	3.771	1.223	11.634	0.021	5.444	1.176	25.201	0.030
8	**View on inspectors performance**								
	Below average	1*	-	-	-				
	Average	1.085	0.449	2.623	0.856				
	Above average	1**	-	-	-				
9	**Months of experience**								
	Experience	1.001	0.991	1.011	0.842				

Table 5. Contd.

10	**Food handlers food safety training**								
	Food handlers trained in food safety	Ref.	n/a	n/a	n/a				
	Food handlers not trained in food safety	1.467	0.675	3.189	0.334				
B	**Socio-economic factors**								
1	**Type of FSE**								
	Restaurant	Ref.	n/a	n/a	n/a				
	Butchery	0.45	0.129	1.566	0.209				
	Bakery	0.563	0.090	3.506	0.538				
2	**Location of FSE**								
	Town Centre (CBD)	Ref.	n/a	n/a	n/a				
	Market (low density residential area)	1.027	0.874	12.062	0.983				
	Market (medium density residential area)	1.181	0.551	2.532	0.669				
	Market (high density residential area)	3.423	0.902	12.991	0.071				
3	**Premise ownership**								
	Owner occupying premise	Ref.	n/a	n/a	n/a				
	Tenant occupying premise	1.105	0.440	2.774	0.832				
4	**Size of business**								
	Micro enterprise	Ref.	n/a	n/a	n/a				
	Small enterprise	0.788	0.188	3.307	0.745				
	Medium enterprise	1*	-	-	-				
5	**FSE's monthly income**								
	Below K1,500	Ref.	n/a	n/a	n/a				
	K1,500 to K3,999	6.875	1.421	33.261	0.017				
	K4,000 to K7,499	1.667	0.441	6.301	0.452				
	K7,500 and above	1.574	0.423	5.876	0.500				
C	**Factors relating to inspection processes**								
1	**Follow-up inspections**								
	Follow-up inspections done	Ref.	n/a	n/a	n/a	Ref.	n/a	n/a	n/a
	No follow-up inspections done	11.869	4.972	28.334	0.000	112.135	18.744	670.83	0.000
2	**Number of follow-up inspections**								
	# of inspections	0.229	0.116	0.452	0.000				

Table 5. Contd.

3	**Time limit given**								
	Immediately (within 24 hrs)	Ref.	n/a	n/a	n/a	Ref.	n/a	n/a	n/a
	2 - 7 days	0.823	0.279	2.430	0.724	0.967	0.163	5.745	0.970
	No time specified	0.360	0.131	0.992	0.048	0.472	0.059	3.754	0.478
	Not required	0.011	0.001	0.096	0.000	0.020	0.0007	0.707	0.031
4	**Frequency of inspections/per year**								
	Once/year	Ref.	n/a	n/a	n/a				
	Twice/year	1.140	0.461	2.820	0.776				
	Three times/year	0.706	0.271	1.836	0.475				
	Four times and above	0.294	0.076	1.143	0.077				
5	**Inspection report generation**								
	Report submitted after each inspection	Ref.	n/a	n/a	n/a				
	Report not submitted after each inspection	3.356	1.130	8.685	0.013				
6	**Administrative enforcement measures**								
	Not necessary for administrative enforcement	Ref.	n/a	n/a	n/a	Ref.	n/a	n/a	n/a
	No administrative enforcement action taken	100.0	12.477	801.49	0.000	40.486	2.034	806	0.015
	Penalty charged	17.0	0.552	523.79	0.105	44.552	0.552	3595.5	0.090
	Premise closed	6.375	0.570	71.274	0.133	22.353	0.673	742.48	0.082

In the final model, the lack of conducting follow-up inspections to verify if the FSE had complied with the inspection recommendation and whether the inspecting institution took administrative enforcement measures against the FSE or not was seen to be associated with non-compliance with inspection recommendations cited in the inspection report by the FSE. Meanwhile, factors such as gender of FSE manager or owner, the person responsible for the daily management of FSE, and the time limit set for the FSE to make corrective actions were associated with enhancing the FSE's chance of complying with inspection recommendations cited in the inspection report.

The odds of non-compliance of FSE's with inspection recommendations cited in the inspection report was 112.135 (95% CI = 18.744 - 670.828; p-value > 0.000) times more in FSE that did not receive follow-up inspections to verify if the FSE had made corrective actions on the inspection recommendations cited in initial inspection than in FSE's that received follow-up inspection. Similarly, the odds of FSE's non-compliance with inspection recommendations in FSE's managed or owned by female managers or owners were 0.105 times less than in FSE's that were managed by male FSE managers or owners (95% CI = 0.017 - 0.643; p-value = 0.015). The odds of FSE's non-compliance with inspection recommendations in FSE's that had no necessity to be given time limits (as no inspection violations were cited during the initial inspection) was 0.020 (95% CI = 0.0007 – 0.707; p-value = 0.031) times less than in FSE's that were given a time limit of 24 h (at most) to make corrective actions. The odds of FSE's non-compliance with inspection recommendations cited in the inspections report in FSEs who did not receive any administrative enforcement measures by the inspecting institution was 40.846 (95% CI = 2.034 - 805.996; p-value = 0.015) times more than in FSE's that had no necessity to receive administrative enforcement measures by the inspecting institution, taking into account the other factors. Additionally, the odds of FSE's non-compliance with inspection recommendations in FSE's whose daily management was by the manager for FSE was 0.248 (95% CI = 0.058 - 1.042; p-value =

0.057) times less than in FSE's whose daily management was by the owner of the establishment.

Surprisingly, the association between the closure of a food establishment as an administrative enforcement measure taken by the inspecting institution and the FSE's compliance with inspection recommendations cited in the inspection report was not statistically significant, with reference being compared with FSE's that had no necessity for the inspecting institution to take any administrative enforcement measures against the food establishment. The odds of FSE's non-compliance with inspection recommendations cited in the inspection report in FSE's whose premises were closed to enhance compliance was 22.353 (95% CI = 0.673 - 742.481; p = 0.082) times more than FSE's that had no necessity of taking administrative enforcement measures against them. Additionally, there was an insignificant association between compliance of any trading premise with inspection recommendations and closure of premise and having penalty fees charged against the FSE as an administrative measure taken by the inspecting institution.

Similarly, there was no statistical significance in the following: the associations between penalty charges as administrative enforcement measures taken by inspecting institution and the FSE's compliance with inspection recommendations; the association between the time limit of 2 to 7 days of which the FSE is to make corrective actions and the FSE's compliance with inspection recommendations; and that of the association between no time limit given or specified in the inspection report when the FSE is required to take corrective measures against the inspection violations cited in the inspection report and the FSE's compliance with the inspection recommendations.

DISCUSSION

Of the factors reviewed in this study, the factors that influenced compliance of FSE's with inspection recommendations in Mansa district in the period between 2018 and 2019 include FSE manager or owner's gender; person responsible for the day-to-day management of the FSE; whether or not FSE received follow-up inspection; time limit set for the FSE to take corrective actions against the inspection recommendations cited in the inspection report; and administrative enforcement measures taken by inspecting institution. Kotsanopoulos and Arvanitoyannis (2017), noted that the mechanism of conducting inspections is meant to verify as to whether the premise being inspected is compliant with food safety principles, national food safety policies, and law. Thus compliance of the inspected Food Service Establishment (FSE) with the inspection recommendations completes the inspection cycle while giving an assurance that the FSE has fully complied with food safety principles and regulations. Our discussion concerning the findings of the study will be focused on the following.

Compliance levels of food service establishment's with inspection recommendations

The results of the study showed that the prevalence of FSE's compliance with inspection recommendations was low. The results indicated that the prevalence of FSE's compliance with inspection recommendations was 29.1%. This finding is consistent but slightly lower than the quarterly environmental health HMIS records of 48.15% compliance of trading premises with inspection reports issued to them (Mansa DHO, 2018); while during the same period, the Provincial Health Office (2018) HMIS record on compliance of trading premises with inspection reports was 28%. In my view, the low prevalence rate for FSE compliance with inspection recommendations may have reflective implications such as having continued unhygienic conditions and standards in the FSEs that do not comply, loss of economic value of FSEs, unreliable inspection systems, and low expectations from the general public.

Inspection reports

The study results showed that the inspection violations cited in the inspection reports analyzed indicated that health inspectors had no structured inspection template that had a risk-based approach in which a wide range of food safety principles would be checked during the inspection. The approach of inspection reporting being used is where the inspector listed the findings and recommendations and this would result in the inspector not checking on compliance of the FSE on of the key food safety standards as the inspector is not properly guided on what to check for when conducting the inspection. While acknowledging the fact that there could be several factors that may influence the likelihood of writing down the inspection violations as noted in a study conducted in Indiana, United States of America (USA) by Johnson et al. (2014), it can be noted by the frequency of the inspection violations cited in the reports that inspectors tend to check for the same things over and over each time they went for inspections. A study conducted in Finland by Läikkö-Roto et al. (2015), revealed that the use of properly-outlined templates for inspections reports increased the number of inspected items and the number of inspection violations cited. The study results also confirm the findings in a study by Mulat (2006), that indicated that most inspections conducted in Zambia were not focused. The analysis of the inspection reports suggests that most health inspectors make use of visual inspections to cite the violations recorded in the inspection report, with the implication that their recommendations are not aided by any laboratory

investigations. Thus, knowing that there is a possibility that the inspectors may not have inspected some of the critical items, questions the FSE's compliance to food safety standards and regulations.

Food service establishment management factors

The study results showed that FSE's run by female FSE managers or owners were more likely to comply with inspection recommendations than male FSE managers or owners. The contrast between males and female FSE managers or owners was also noted in the number of females against females that ventured into setting up or getting employed in the Food Service Establishments (FSEs). There are more females in the foodservice business in Mansa Municipality than males (that is about 24% males against 75% females).

Dudeja and Singh (2016), suggest that both the FSE manager and owner are supposed to ensure that the food establishment is following all the food safety guidelines and principles. This may be different when we are considering the FSE's compliance with inspection recommendations after the food establishment has been inspected. The results of this study showed that Food Service Establishments whose daily operations are managed by the owner of the FSE business are more likely to comply with inspection recommendations than those managed by the manager or any other employee. This may complement the idea that the FSE owner may be always the person to make a decision and source money to make corrective actions. However, the need for both the manager and the owner to ensure that the inspection recommendations are complied with is important as it facilitates the improvement of the establishment's outlook and also increases customer confidence (Arendt et al., 2014); and at the same time reduce the chances for the inspecting institution from taking administrative actions.

The results in this study showed that Food Service Establishment's whose manager or owner had undergone management training were more likely to comply with inspection recommendations than FSE's whose managers or owners had not undergone management training to run an FSE. The results complement the results of a study conducted in Ohio, USA by Kassa et al. (2010) that showed that FSE's that had certified or trained FSE managers had low critical violations after inspections compared to those FSE's that had no trained or certified managers. This implies that FSE's whose manager or owner has undergone management training to run an FSE may not only have lower inspection violations but also strive to comply with the inspection recommendations.

In this study, food safety training of food handlers and FSE managers or knowing food safety principles, as well as the education level of the FSE manager or owner, had no significant influence on the FSE's compliance with inspection recommendations cited in the inspection report. This may be because food safety training or knowing food safety principles may influence the number of critical and non-critical violations observed in the food establishment (Mathias et al., 1995), as the trained manager or owner will be able to follow the food safety principles. Effective food safety training increases the likelihood that safe working practices are carried out at all times (Seaman and Eves, 2006). The study results are also different from those found in a study done in Chinsali, Zambia by Makombe et al. (2017), who in his study found that education levels of secondary and tertiary were in a better position to make proper decisions on food handling of food. The reason for the results may be because compliance to inspection recommendations is an aftermath of initial inspections and thus factors such as knowledge of food safety principles nor food safety training, education level, all of which only affect the outcome of the initial inspection.

Socio-economic factors

The study results indicated that the majority of socio-economic factors assessed in the study had no significant influence on the FSE's compliance with inspection recommendations except for the FSE's monthly income. Specific references are given on socio-economic characteristics such as the type of FSE (whether restaurant, bakery, or butchery), the location of the FSE, and whether the owner of the premise was the one operating the food establishment, did not influence the FSE's compliance with inspection recommendations. This particular finding is consistent with other studies. A study by Yapp and Fairman (2006) found that small businesses are more likely to choose partial compliance or non-compliance than large businesses, with the lack of money being one of the factors observed as they tend to focus on business survival than compliance. It is, however not consistent with findings of a study conducted in Alabama, the USA by Menachemi et al. (2012), who observed that certain characteristics of restaurants were associated with particular types of inspection violations. At the same time, owing to the fact as observed earlier in the discussion that inspections conducted in Zambia were not focused and had no risk basis, is an indication that certain FSE characteristics such location of FSE or type of FSE would the affect the type of inspection violations cited and not influence the FSE's compliance with inspection recommendations.

Inspection process factors

The study results reveal that the FSE's that the inspecting institution followed up after the initial inspection to verify

whether the FSE had made corrective actions within the specific time frame stated in the inspection report was likely to comply with inspection recommendations than those FSE's that the inspecting institution did follow – up. The study also revealed that administrative enforcement measures taken by the inspecting institution influenced the FSE's compliance with inspection recommendations. Foodservice establishments that are issued with a closure notice or were issued with a penalty charge fee were more likely to comply with inspections than those FSE's that the inspecting institution did not take any administrative enforcement measure against. This result, however, was not statistically significant. A study by Läikkö-Roto et al. (2015) found that the strictness of the actions taken by the inspectors depended on the nature of the inspection violations and often was strengthened when the inspector noticed that the first enforcement actions were not effective. The authors also observed that the correction of the inspection violations was verified always. Thus without follow-up inspections being conducted, the FSE tends to take their time in correcting the inspection violations observed during the initial inspection.

The time limits for correcting the inspection violations are critical for conducting follow-up inspections and administrative enforcement actions. Läikkö-Roto et al. (2015), found that the more often the inspectors set time limits for performing the corrections, the more often they also used stronger actions since the first actions proved ineffective. This implies that time limits for the FSE to perform corrections on the inspection violations would tell the inspector when to make a follow–up inspection. If repeated inspection violations are recorded during the follow–up inspection, then the inspector may need to take administrative enforcement actions. The recently enacted Food Safety Act of 2019 of the Laws of Zambia detects that a certificate of compliance is to be given to all food establishments that comply with the recommendations cited in the inspection report. Hence, the inspecting institution is obliged to conduct the necessary follow–up inspection before they can certify the food establishment as being fully compliant with the food safety standards. The Public Health Act, CAP 295 of the Laws of Zambia also, detects that following several follow–up inspections conducted, legal or administrative enforcement are taken on the food establishment that fails to take corrective actions against the inspection violations cited in the inspection report with the specified time limit (Public Health Act, Cap 295). This also requires that an inspection report is written always and given to the food establishment as reference for having inspected the premise and having specified the time limit the food establishment was to make corrections against the inspection recommendations (Läikkö-Roto et al., 2015). In line with the above literature, the study results showed that FSE's that were given a specific time limit through which they were to make corrections against the inspection recommendations were more likely to comply with inspection recommendations. The results also indicated that FSE's that received inspection reports each time the food establishment was inspected were more likely to comply with inspection recommendations, though the finding was not statistically significant.

Conclusion

The study had sought to establish the factors that influence the compliance of FSE's with inspection recommendations in Mansa Municipality in 2018 and 2019. The level of compliance of Food Service Establishments to inspection recommendations stood at 29.1%. The study results clearly show that unlike the full initial model developed in the conceptual framework, factors including FSE manager or owner's gender; person responsible for the day-to-day management of the FSE; the monthly income for the FSE; whether or not FSE received follow-up inspection; and administrative enforcement measures are taken by inspecting institution influenced the compliance of FSE with inspection recommendations in Mansa Municipality.

It can thus be noted that throughout the inspection processes, factors such as food safety and management training of FSE managers and food handlers, frequency of inspections, and FSE's manager's level of education may influence the FSE's compliance with food safety standards. While, factors such as inspection follow-ups, administrative enforcement measures, the time limit specified for the FSE to take corrective actions against the inspection violations cited in the inspection reports influence the FSE's compliance with inspection recommendations and ultimately results in having the FSE fully comply with food safety standards.

Inspecting institutions and Food Service Establishment owners, therefore, play key roles in facilitating Food Service Establishments' compliance with inspection recommendations as this ultimately facilitates compliance with food safety standards.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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