

Food Safety Knowledge and Practices among Restaurant Food Handlers in Kicukiro District, Rwanda

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Abstract

The aim of this study was to assess the food safety knowledge and practices among food handlers in restaurants located in Kicukiro District, Rwanda. The study was conducted in restaurants and a total of 349 food handlers working in selected restaurants was identified and recruited to participate in the study. A cross-sectional study was conducted to evaluate the application of five keys of food handlers and to achieve the study objectives a quantitative approach was adopted. Sample size was drawn from the target population by using Cochran formula for sample size calculation in unknown total population. Structured questionnaire was used for data collection including questions about: socio-demographic characteristics, food handling practices, personal hygiene and food borne illnesses. Data analysis was performed using the Statistics Package of Social Sciences (SPSS). Logistic regression analysis was used to examine the factors associated with food safety practices with a significant level of p-value less than 0.05. A total of 349 food-handlers participated in the study, of them the majority 181 (51.9%) of respondents were male, 132 (37.8%) were aged 35 and above and 169 (48.4%) were single. The findings on overall knowledge show that 33.8% had moderate/higher food safety knowledge and only 9.7% had good food safety practices. The study found that food-handlers aged 12 - 17 were four times more likely to have poor food safety practices compared to those aged 35 years and above [AoR = 4.031, 95% CI: 1.275 - 12.743, P = 0.018]. Food handlers still need on-job training on food safety and improved awareness on WHO recommended food handling procedure.

Keywords: Food Handlers; Food Safety; Knowledge; Food Safety Practices; Rwanda

Introduction

World Health Organization (WHO) estimated that each year 1.8 million people die as a result of diarrheal diseases and most of these cases can be attributed to contaminated food or water. Proper food preparation can prevent most food borne diseases. Unsafe food has been a human health problem since history was first recorded, and many food safety problems encountered today are not new. Although governments all over the world are doing their best to improve the safety of the food supply, the occurrence of food borne disease remains a significant health issue in both developed and developing countries [1].

In many developing and developed countries, restaurants are an important component of the food supply chain. Restaurants satisfy a vital need of the population by being reasonably priced and conveniently available, and some segments of the population depend entirely on it. Food safety is a major concern with restaurant as these foods are generally prepared and sold under unhygienic conditions, with limited access to safe water, sanitary services, or garbage disposal facilities [2].

Research suggests that food borne illness is associated with eating outside the home. Case-control studies have found that people with food borne illnesses were more likely to have eaten outside the home than their non-ill controls, and surveillance data indicate that a sig-

nificant percentage of reported food borne outbreaks are associated with restaurants. Additionally, epidemiological research has identified several food borne illness risk factors related to food preparation practices in foodservice establishments [3].

Recently, WHO has developed five main keys to safer food, which include keeping clean, separating raw and cooked food, cooking thoroughly, keeping food at safe temperatures, and using safe water and raw materials. These keys aim to open the way to safer food in restaurants. Food handlers' in different restaurants in developing country have shown poor knowledge on how to safer food, this led to poor preparation of food in these restaurants, however WHO believes that these five keys could help to improve the food preparation practices [1].

Food safety is a public health concerns both developing and developed countries, more than 200 diseases are transmitted through food. Food contamination can occur at any stage of the food production chain, a high proportion of food borne disease is caused by foods improperly prepared or handled at restaurants. Unfortunately, most food borne diseases can be prevented by using proper food handling behaviors [4].

In Developing countries including Rwanda, few studies have been conducted with the aim of assessing the knowledge, attitude and practices of five keys factors to safer food in restaurants. For example, in Rwanda only one survey was conducted in Huye District, this survey found that only 28.2% of food handlers have knowledge on the 5 keys factors to safer food. Regarding the components of five keys to safer food in restaurants, only 34.8% food handlers in restaurants were found to know at least one key factor to safer food. The practices of fifth key factor which is related to the use of safe water and law materials 38.8% of the food handler's put it in practice. Surprisingly 20.7% had no knowledge of any of the components of the key. It was observed that nearly all the food handlers did not always practice the five keys factors to safer food [5].

Kigali as capital of Rwanda and location of many restaurants, there is no research conducted on these key factors to safer food in restaurants. There is no doubt that food handlers in restaurants around the city did not know which foods were at high risk from food poisoning, even the knowledge about how a food could be made safe to eat may limited. The present study was ben conducted in Kicukiro district as one of the district make up Kigali city, to assess the food safety knowledge and practices among food handlers in restaurants from Kicukiro District.

Methods

Study design

Across-sectional study was conducted to evaluate food safety knowledge and practice of food handlers and structured questionnaire with both open ended and close ended questions used to collect data in restaurants located in Kicukiro Districts and food handlers working in different restaurants was identified.

Study population

The food handlers from several restaurants located in Kicukiro District was the target population in the present study. Total numbers of restaurants employees are not known as reported by Kicukiro district authorities.

Sample size and sampling procedure

The study was conducted in restaurants and a total of 349 food handlers working in selected restaurants was identified and recruited to participate in the study. Stratified random sampling technique was used to sort at least one restaurant in each sector of Kicukiro District to be sure that food handlers from all district are presented Stratified Sampling is referred to a judgmental or selective sampling where the researcher consciously selects subjects, elements, events or incidents to include them in the study.

Data management

Data were entered using KoBo Collect Toolbox after data collection and exported to Microsoft Office Excel for data cleaning and to SPSS for analysis and retained by investigator in locked folder. The data was entered and verified twice to guarantee the reliability and data analysis was performed twice to reject any differences.

Data analysis and ethical consideration

Descriptive analysis was done on food safety knowledge and practices among restaurant food handlers basing on the mean value of questions asked and bivariate and multivariate regression for analysis of relation between dependent and independent variables. P-Value < 0.05 was taken as significant. Factors influencing food handlers’ knowledge and practices about food safety were analysed through multivariate regression.

In this study, the proposal was approved by Mount Kenya University Rwanda and before the data collection process, ethical clearance was obtained from the Mount Kenya University and hospitals was guaranteed the data collection permit and therefore, the panel of Kicukiro district hospitals requested permission to collect data in different restaurants. Respondents voluntarily received detailed information and description of the study then they signed the consent form before their participation.

Results

Socio-demographic characteristics of the respondents

Respondents were requested to report their social demographic conditions these include gender, age group, marital status, religion, education level and work experience.

Variables	Frequency	Percentage
Gender		
Male	181	51.9
Female	168	48.1
Age group		
15 - 19	105	30.1
20 - 24	112	32.1
25 and above	132	37.8
Marital status		
Single	169	48.4
Married	122	35.0
Widowed/divorced	58	16.6
Religion		
Muslim	63	18.1
Christian	286	81.9
Education level		
Less than secondary school	145	41.5
Secondary school	163	46.7
Professional training/Above high school	41	11.6
Work experience		
Less than one year	135	38.7
One year and above	214	61.3
Source of information about food safety		
Radio or TV	136	39.0
Printed news papers	62	17.8
Social media	119	34.1
Formal/short course training	32	9.2

Table 1: Socio-demographic characteristics of respondents.

The majority 181 (51.9%) of respondents were male, aged 25 and above 132 (37.8%). Single respondents dominate the study 169 (48.4%), very few 58 (16.0%) were widowed/divorced/separated. A big number of food handlers 286 (81.9%) was Christian, only 63 (18.1%) belongs to Muslims religion.

Concerning the education level nearly a half of respondents 163 (46.7%) had completed secondary school, 145 (41.5%) had less than secondary school while 41 (11.6%) had professional training or university level. A total of 214 (61.3%) of food handlers in Kicukiro district have work experience of more than one year, 136 (39.0%) use radio or TV as their source of information about food safety, 34.1% got such information from social media.

Variable	Frequency	Percentage
Food poisoning is caused by pathogenic microbes		
Yes	182	52.1
No	167	47.9
Eating raw or half-cooked meat is highly risk for food poisoning		
Yes	158	45.3
No	191	54.7
Eating raw unwashed vegetables is highly risky for food poisoning		
Yes	149	42.7
No	200	57.3
Food handlers with unhygienic practice could be the source for food contamination		
Yes	187	53.6
No	162	46.4
Eating covered leftover cooked food, kept at room temperature for more than 6 hours increase the risk of food poisoning		
Yes	158	45.3
No	191	54.7
Keeping food at refrigerator temperature helps to prevent food poisoning		
Yes	185	53.0
No	164	47.0
Contacting ready to eat food with bare hands causes food contamination with food poisoning pathogens		
Yes	156	44.7
No	193	55.3
The correct method for thawing frozen meat or broiler is to keep them overnight at room temperature		
Yes	183	52.4
No	166	47.6
Food poisoning could cause severe diseases that end in hospitalization and sometimes death		
Yes	178	51.0
No	171	49.0
Apparently healthy food handlers might carry food borne pathogens		
Yes	176	50.4
No	173	49.6

Insects such as cockroaches and flies might transmit food borne pathogens		
Yes	164	47.0
No	185	53.0
Foodborne pathogens can be seen by eye		
Yes	183	52.4
No	166	47.6
Vegetables should be placed on higher shelf in refrigerator than meat and poultry		
Yes	167	47.9
No	182	52.1
Cooked food leftover should be-reheated thoroughly		
Yes	173	49.6
No	176	50.4
Temperature that a refrigerator should be kept		
Correct	87	24.9
Incorrect	262	75.1
Storage of raw meat in refrigerator		
Correct	112	32.1
Incorrect	237	67.9
Temperature at which un-eaten foods are reheated		
Above 60 C	102	29.2
Below 60 C	168	48.1
Not Applicable	79	22.6
Food handlers should be medically examined every six months		
Yes	114	32.7
No	235	67.3

Table 2: Food safety knowledge of respondents.

The findings show that 52.1% of food handlers knew that food poisoning is caused by pathogenic microbes, 45.3% knew that eating raw or half cooked meat increase the risk of food poisoning, 42.7% knew that eating raw unwashed food vegetables increase the risk of food poisoning and 53.6% knew that handling food in unhygienic conditions could be the source of food contamination. A total of 158 (45.3%) knew that eating covered leftover cooked food increase the risk of food poisoning, 185 (53.0%) knew that keeping food at refrigerator temperature helps to prevent food poisoning while 156 (44.7%) knew that contacting ready to eat food with bare hands increase the risk of food contamination.

A total of 183 (52.4%) knew that the correct method for thawing meat or broiler is to keep them overnight at room temperature, half of food handlers 178 (51.0%) knew that food poisoning could cause severe disease.

A total of 176 (50.4%) food handlers knew that apparently healthy person might carry borne pathogens, nearly a half 166 (52.4%) knew that food borne pathogens cannot be seen by eyes, 167 (47.9%) knew that vegetables should be placed on higher shelf in refrigerator, 173 (49.6%) knew that food leftover should be reheated thoroughly.

The findings further showed that only 87 (24.9%) of food handlers knew the appropriate temperature to keep refrigerator depending on food stored, 32.1% knew how to store raw meat in refrigerator, 29.2% knew that un-eaten food are reheated above 60 degrees Celsius and 32.7% are aware that food handlers should be medically examined at least once in six months.

The overall food safety knowledge among food handlers were estimated using scoring where the right answer was scored “1” while the wrong one was scored “0”. The mean score was 7.7 and the maximum score was 16, the respondents who scored 7 and above were classified as having moderate/higher food safety while those with total score of less than 7 were classified as having lower knowledge.

Variables	Often N (%)	Always N (%)	Sometimes N (%)	Rarely N (%)	Never N (%)
Wash fresh vegetables and fruits in tap water before served to clients	72 (20.6)	58 (16.6)	87 (24.9)	132 (37.8)	-
Wash hands with water and soap before preparing food	54 (15.5)	62 (17.8)	142 (40.7)	91 (26.1)	-
Clean food contact surfaces before and after preparing food	55 (15.8)	34 (9.7)	61 (17.5)	199 (57.0)	-
Wash hands with water and soap after handling raw meat	110 (31.5)	187 (53.6)	33 (9.5)	19 (5.4)	-
Wearing apron	-	66 (18.9)	46 (13.2)		237 (67.9)
Wearing hair cover	-	26 (7.4)	50 (14.3)		173 (78.2)
Wearing gloves	-	49 (14.0)	80 (22.9)		220 (63.0)
Raw and cooked food storage separation	-	32 (9.2)	95 (27.2)		222 (62.6)
Raw and cooked food handling with separate sets of knives and chopping boards	-	63 (18.1)	76 (21.8)		210 (60.2)

Table 3: Food safety practices of food handlers working in restaurant.

The findings on food safety practices presented in table 4.3 show that 20.6% of food handlers wash fresh vegetables before served to clients while 37.8% rarely do it, 15% and 17.8% often and always wash hand with water and soap before preparing food respectively, 26.1% rarely practice this. The majority of food handlers 57.0% rarely clean food contact surfaces before and after preparing food, 53.6% always wash hand with water and soap after handling raw meat. In term of food safety wearing equipment, the results show that the majority of food handlers do not wear those equipment for example 67.9% never wear apron, 78.2% never wear hair cover, 63.0% never wear gloves.

The findings show that only 9.2% of food handlers always separate raw and cooked food, 18.1% separate sets of knives and chopping boards while handling raw and cooked food.

Frequency	Variables	Percentage
	Use of electrocutes to control flying insects	
185	Yes	53.0
164	No	47.0
	Restaurant has hygiene policy	
99 (28.4)	Yes	
250 (71.6)	No	
	Storing food in containers	
181	Yes	51.9
168	No	48.1
	Use of expired food	
155	Yes	44.4
194	No	55.6

Table 4: Other food safety practices of food handlers working in restaurant.

The researcher found that 185 (53.0%) of food handlers use electrocutes to control flying insects in the restaurant, the majority of food handlers 250 (71.6%) reported that their restaurant does not have hygiene policy. More than a half of food handlers 181 (51.9%) reported that they store food in containers, 55.6% said that in their restaurant they do not serve expired food to clients.

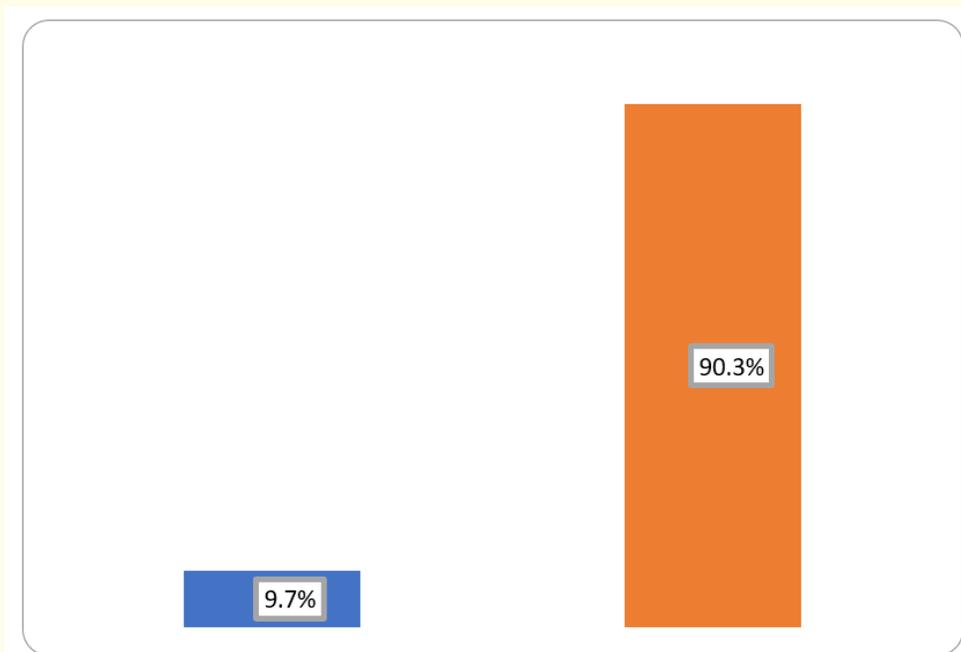


Figure 1: Overall food safety practices.

The overall food safety practice was estimated by estimation of total scores. Often, always and correct answer for all food safety practices were scored “1” while sometimes rarely, never and wrong answers for all food safety practices questions were scored “0”. The maximum score what 8 and the mean scores was 3.3. The result revealed the very low food safety practices where only 34 (9.7%) of food handlers in Kicukiro district had good practices in terms of food safety.

Factors associated with food safety practices

The third objective of this study was to assess factors associated with food safety practices. To achieve this objective both bivariate and multivariate analysis was used. The variables with p-value less than 0.05 were taken in multivariate analysis to identify the factors associated with poor food handling practices.

The findings from bivariate analysis revealed that of 34 food handlers with good food safety practices 22 (64.7%) are female, therefore female are most likely to have good food safety practices than male. Gender was significantly associated with food safety practices in bivariate analysis ($p = 0.042$). The majority of respondents with good food safety practices 19 (55.9%) were aged 25 and above this shows that older food handlers are more likely to have good practices compared to young one. Age group was statistically associated with food safety practices ($p = 0.024$). Marital status was significantly associated with food safety practices ($p = 0.024$) where single food handlers 23 (67.4%) are more likely to have good practices compared to others.

Variables	Food Safety Practices		P-Value
	Poor Practices N (%)	Good Practices N (%)	
Gender			0.042
Male	169 (53.7)	12 (35.3)	
Female	146 (46.3)	22 (64.7)	
Age group			0.024
15 - 19	101 (32.1)	4 (11.8)	
20 - 24	101 (32.1)	11 (32.4)	
25 and above	113 (35.9)	19 (55.9)	
Marital status			0.024
Single	146 (46.3)	23 (67.6)	
Married	112 (35.6)	109 (29.4)	
Widowed/divorced/separated	57 (18.1)	1 (2.9)	
Religion			0.179
Muslim	54 (17.1)	9 (26.5)	
Christian	261 (82.9)	25 (73.5)	
Education level			0.017
Less than secondary school	125 (39.7)	20 (58.8)	
Secondary school	155 (49.2)	8 (23.5)	
Professional training/Above high school	35 (11.1)	6 (17.6)	
Work experience			0.030
Less than one year	116 (36.8)	19 (55.9)	
One year and above	199 (63.2)	15 (44.1)	
The main source of information about food safety			0.100
Radio or TV	116 (36.8)	20 (58.8)	
Printed news papers	58 (18.4)	4 (11.8)	
Social media	111 (35.2)	8 (23.5)	
Formal/short course training	30 (9.5)	2 (5.9)	
Trained about food safety			0.022
Yes	118 (37.5)	6 (17.6)	
No	197 (62.5)	28 (82.4)	
Food safety knowledge			0.037
Poor Knowledge	203 (64.4)	28 (82.4)	
Moderate/higher Knowledge	112 (35.6)	6 (17.6)	

Table 5: Bivariate analysis on factors associated with food safety practices.

Education level was statistically associated with food safety practices in bivariate analysis ($p = 0.017$), surprisingly the majority of respondents with good safety practices 58.8% had less than secondary school. Of the respondents with good food safety practices 19 (55.9%) had work experience of less than one year; there was a significant relationship between work experience and food safety practices ($p = 0.030$). The majority of study participants 28 (82.4%) with good food safety practices did not have any training about food safety,

the statistical significant was observed between training on food safety and food safety practices ($p = 0.022$). 34 respondents with good safety practices 28 (82.4%) had poor food safety knowledge, there was an association between food safety knowledge and food safety practices ($p = 0.037$).

Variables	AOR	95%CI	p-value
Gender			
Male	2.085	0.949-4.581	0.067
Female	Ref.		
Age group			
15 - 19	4.031	1.275-12.743	0.018
20 - 24	1.979	0.847-4.625	0.115
25 and above	Ref.		
Marital status			
Single	0.082	0.010-0.655	0.018
Married	0.150	0.018-1.267	0.081
Widowed/divorced	Ref.		
Education level			
Less than secondary school	0.943	0.314-2.835	0.917
Secondary school	2.637	0.784-8.871	0.117
Professional training/Above high school	Ref.		
Work experience			
Less than one year	0.641	0.290-1.417	0.272
One year and above	Ref.		
Trained about food safety			
Yes	0.545	0.197-1.507	0.242
No	Ref.		
Food safety knowledge			
Poor Knowledge	0.617	0.221-1.723	0.617
Moderate/higher Knowledge	Ref.		

Table 6: Factors associated with poor food safety practices.

In multivariate analysis, the researcher found that study participants aged 12 - 17 were four time more likely to have poor food safety practices compared to those aged 35 years and above [AoR = 4.031, 95% CI: 1.275 - 12.743, P = 0.018]. Being single was found to be associated with good food safety practices where single respondents were less likely to have poor food safety practices compare to widowed [AoR = 0.082, 95% CI: 0.010 - 0.655, P = 0.018]. No significant association observed in multivariate analysis for other factors which showed significant association in bivariate analysis. Despite, statistical significant male food handlers had higher risk of having poor food safety practices [AoR = 2.085, 95% CI: 0.949 - 4.581, P = 0.067] compared to female food handlers.

Discussion

Food safety is a public health concern, specifically in developing countries. The overall objective of this study was to assess food safety knowledge and practices of food handlers in Kicukiro Districts. It is well known that when food is cooked on a large scale for many people

in the places such as restaurants, it may be handled by many individuals and this increase the risk of contamination of the final served food. The findings show that more than a half 52.1% of food handlers knew that food poisoning is caused by pathogenic microbes, and 53.6% knew that handling food in unhygienic conditions could be the source of food contamination. In contrast to the present findings, a study conducted in India found that 92% of the participants knew that it is safe to store raw meat poultry and fish directly above ready-to-eat food [6,11] found that the overall food safety knowledge score was 49% which is different from what observed in this study where 33.8% had some good knowledge about food safety.

In terms of practices a study conducted in India found that, most of the male participants followed hand hygiene practices such as wearing gloves when preparing sandwiches (86.8%), washing hands with soap and water before preparing food (94.1%), washing hands with soap and water after using the bathroom (85.3%), washing hands with water and soap before eating (89.7%) and washing hands with water and soap after handling raw meat (88.2%) as compared to the female participants [6]. These proportions on food safety practices aspects were much higher than what reported in the presented study where 32.8% of the study participants wash hand with water and soap before preparing food, 53.6% always wash hand with water and soap after handling raw meat, 67.9% never wear apron, 78.2% never wear hair cover, and 63.0% never wear gloves while handling food. A study conducted in Italy suggested that food handlers who had good food safety knowledge are more likely to have proper food handling practices [7]. A study in Saudi Arabia found that generally respondents had good knowledge with the highest pass rate of 77.9% for knowledge of cross contamination followed by 52.8% for knowledge of food poisoning and 49.7% of knowledge of food storage.

The overall good practices on food safety were 9.7%, which much lower to other previous study. In contrast, a study conducted in Saudi Arabia found that 92.6% of the respondents had good food safety practices [8]. The low practices and low knowledge observed among food handlers in Kicukiro district can be attributed to the lack of in-job training and lower level of education as reported in this study.

The researcher found that female is more likely to have good knowledge on food safety than male. Similarly, it was previous found that pass rate for food safety knowledge of female respondents (46.3%) was higher than that of male [8], however this study did not found an association between gender and food safety knowledge as the researcher observed it in the present study. A study conducted in Malaysia did not found significant association between gender and food safety knowledge [9]. But the finding from the present study argued with other study which found a significant association between gender and food safety knowledge [8].

A significant association between gender, age, marital status, education level and work experience and foods safety practices was observed. In contrast, no significant association between gender, age and work experience and food safety practices observed in the study conducted in Saudi Arabia, however this study found that young respondent had greatest passing food safety practices than older respondents and female had better practices than males [10]. A study conducted in Calabria, Italy to evaluate food hygiene among food handlers also found that the younger the food-services staff, the more aware they were of good practices [2]. In line with this findings, a study conducted in Ghana reported an association between level of education and food safety practices.

Some previous studies suggest that the lack of knowledge in food safety can lead to poor hygienic practices by food-handlers [10]. However, Clayton, *et al.* (2002) reported that about 63% of food-handlers demonstrating knowledge in food safety did not demonstrate a corresponding positive behavior towards food safety/hygienic practices. This shows that food-handlers might not necessarily be practicing strict food safety procedures during food handling, even when they provide answers to show that they are knowledgeable on some aspect of food safety knowledge. Therefore, other factors such as employee motivation and continuous education and training on the job should be provided to inspire food-handlers, which will affect subsequently food-safety practices.

Conclusion

In general, restaurants food-handlers in Kicukiro District of Rwanda had moderate knowledge in the areas of food safety, general and personal hygiene, cleaning and sanitation procedures. However, this did not translate into strict food hygiene practices where the majority

was found with poor food safety practices. Therefore, continuous food safety education, on-job training and motivation for food-handlers of various demographic backgrounds with special attention paid to those with lower levels of education would complement other interventions that pursue the enhancement of food safety systems in Kicukiro District as well as in Rwanda.

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