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Original Research Article

The occurrence of self-reported illnesses and their analyses into influenza-like and gastrointestinal syndromes in a rural community in Western Kenya, 2019

Reagan N. Chweya[1]*, Susan N. Mambo[1], John M. Gachohi[1,2]

[1]School of Public Health, Jomo Kenyatta University of Agriculture and Technology, Kenya
[2]Washington State University, Global Health Program, Kenya

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***Correspondence:**
Reagan N. Chweya,
E-mail: reaganngoge@gmail.com

ABSTRACT

Background: Data-driven population studies focusing on clinical symptoms and syndromes with the potential to improve diagnostic strategies are rare in Africa. The objective of the study was to determine the prevalence of influenza-like illness (ILI) and gastrointestinal (GI) syndromes in a rural community in western Kenya.
Methods: Using a cross-sectional study design, we collected data on self-reported symptoms experienced during the week preceding the study and clustered them into syndromes using case definitions in western Kenya. The study randomly enrolled 92 households and recruited 390 subjects aged between 5 and 83 years. On one hand, reporting at least any four prespecified respiratory-related symptoms attained influenza-like illness (ILI) syndrome while on the other, gastrointestinal (GI) syndrome constituted the reporting of at least any three of prespecified GI system symptoms. Data on individual and household-level independent variables were collected using interviewer-administered questionnaires. Using multivariable logistic regression models, we assessed relationships between the occurrence of these syndromes and the independent variables at a significance level of $p \leq 0.05$.
Results: Respectively, 27% and 9% of subjects attained ILI and GI syndromes. Twenty-four subjects attained both syndromes. Visiting outside the local sub-county of residence was associated with attaining ILI (OR=2.3, 95% CI 1.4, 3.7) and GI syndromes (OR=3.4, 95% CI 1.6, 6.9). Besides, the absence of active medical insurance was independently associated with attaining GI syndrome (OR=0.12, 95% CI 0.02, 0.94).
Conclusions: Study findings suggested the existence of a higher burden of ILI relative to GI syndrome making the study area critical for investigating disease exposures related to visiting outside the study area and the link between medical insurance and ill health occurrence.

Keywords: Illness, Syndrome, Influenza-like, Gastrointestinal, Western Kenya

INTRODUCTION

On-going Global Burden of Disease studies using disability-adjusted life years (DALYs) provides the global health burden estimates.[1] In Kenya, 78.3% of DALYs constitute years of lives lost caused by HIV/AIDS, lower respiratory tract infections, diarrhoeal diseases, tuberculosis, and malaria.[2] While many studies quantify disease burden at the national level, studies estimating the sub-national burden of disease have started to emerge in developing countries, implying progress, e.g., in Kenya.[3]

Data-driven population studies focusing on clinical symptoms and syndromes are rare in public health research in Africa. This situation limits the provision of appropriate epidemiological and clinical prescriptions on who, where, and when to address population health constraints. An option to overcome these challenges has been, to a limited extent, studies of disease syndromes in communities. Disease syndrome studies inexpensively employ case definitions based on a cluster of clinical symptoms that consistently define a medical condition in the absence of clinical or laboratory diagnosis.[4] The rationale for studying disease syndrome studies in developing countries, including the generalized insufficient diagnostic capacity to detect and respond to disease pathogens and a short supply of health care responders, are well known.[5] Previously recognized disease syndromes include hemorrhagic fever, severe acute respiratory illness, influenza-like illness, respiratory syndrome, gastrointestinal illnesses, and neurological syndrome.[6]

The work presented here analyzes baseline data collected during the recruitment of subjects targeted to participate in a 3-month longitudinal survey. The survey assembled weekly occurrence of prespecified self-reported symptoms subsequently classified into two disease syndromes using standard case definitions, including influenza-like (ILI) and gastrointestinal (GI) syndromes. The study area is a micro-geographic locale named Wasweta II ward in Migori County in western Kenya. The current paper had two key objectives. First, we determined the frequency distributions of the reported symptoms and their manner of co-occurrence at the individual level. Secondly, we determined the prevalence of subjects who attained thresholds for ILI and GI syndromes in the week preceding the recruitment exercise and examined associated independent variables.

METHODS

Study area and selection of households

Located in the Suna-West sub-county in Migori County in western Kenya, the study area has an estimated population density of 450 persons per sq Km. Out of the four administrative wards in the sub-county, one ward, namely Wasweta II ward, was randomly selected (Figure 1). Using QGIS version 3.6.1, we randomly selected 92 geographical points within the selected ward and identified their Global Positioning System *(*GPS*)* coordinates. During the first field visit, the study identified the closest household to each GPS coordinate for recruitment. We then consulted the head of the household to allow members of his/her household to participate in the study. Willing members were then requested to provide informed consent to participate in the study.

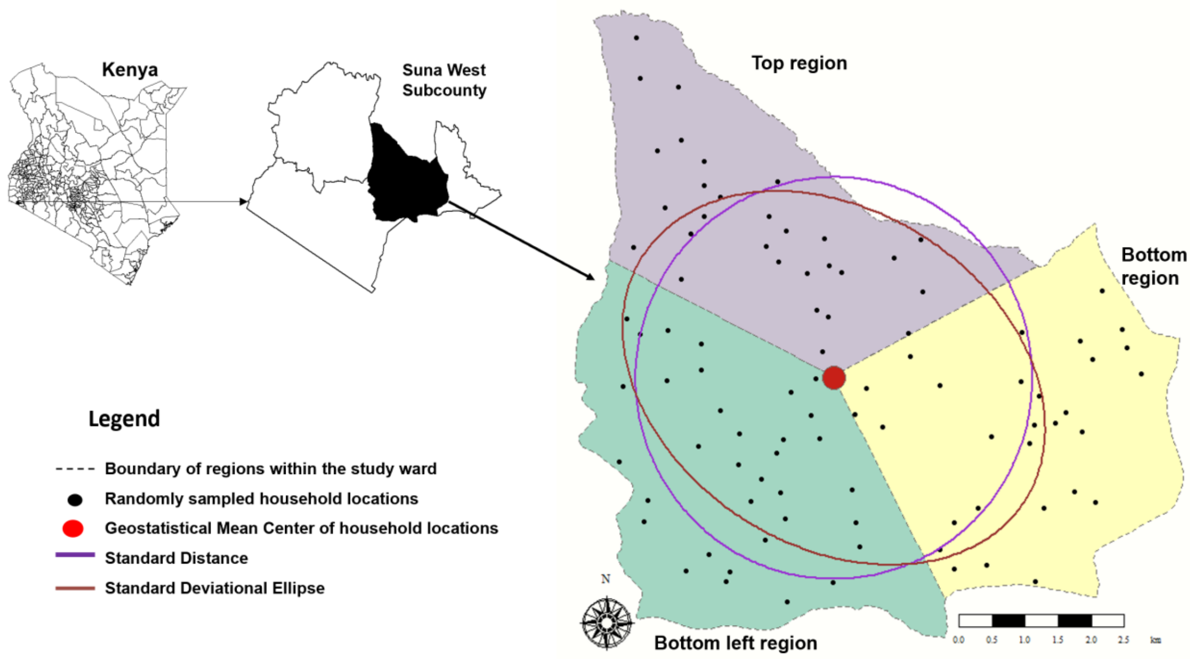

Figure 1: Map of the study area. Left: A map of Kenya sub-counties showing the location (arrow) of Suna West subcounty. Middle: a map of Suna West sub-county showing the location of our specific study area, Wasweta II ward (black polygon). Right: a map of Wasweta II ward showing the location of randomly sampled households (black points). The red circle in the middle of the study site is the geospatially computed mean centre of household locations. The purple and brown large circles are centrographic standard distance and standard deviational ellipse of household locations, respectively. The study area was arbitrarily divided into three regions (top, bottom left and bottom right). The scale applies to Wasweta II ward only.

During recruitment, we documented the exact household point coordinates using the ODK Collect® application in a smartphone to help create a map of the study area (Figure 1). To determine whether the distribution of the identified households was random, we computed the Average Nearest-Neighbour index (ANNI).[7]

Study design and data collection

This study adopted a cross-sectional study design. Using a standard questionnaire, we collected data on a host of independent variables via researcher-administered interviews and data on the occurrence of symptom presentation during the week preceding this study. To ensure consistency, the first author conducted all interviews in the local Dholuo language. The questionnaire consisted of questions presented in closed format, designed to maximize the reliability and validity of measurement of key variables and to get, as much as possible, standardized responses.

Case definition of the syndromes

From each subject recruited, we collected prespecified symptoms experienced during the week preceding this study and classified them into ILI or GI syndromes based on case definitions. Specifically, attaining a threshold for ILI syndrome was based on reporting greater than or equal to four of the following eight symptoms.[8] 1. Cough of rapid onset defined as forced respiratory expulsive manoeuvres, with a characteristic "cough" sound for lesser than or equal to three days.[9] 2. Fever defined as an elevated rise in body temperature or perceived hotness of the body.[10] 3. Sore throat defined as a burning sensation in the throat and pain on swallowing.[11] 4. Joint and muscle pain characterized by pain in a body muscle or joints. 5. Malaise defined as a general feeling of discomfort, illness, or lack of well-being. 6. Breathing difficulty defined as perceptions of difficulty or distress related to breathing.[12] 7. Persistent running nose defined as persistent watery mucus discharge running for <3 days.[13] 8. Transient nasal mucoid discharge for ≤3 days defined as non-persistent or watery nasal discharge.[13]

On the other hand, attaining a threshold for GI syndrome was based on reporting greater than or equal to three of the following five symptoms: 1. Flatulence defined as a condition in which the abdomen felt full and tight.[14] 2. Diarrhoea defined as the passage of loose or watery stools ≥3 times in 24 hours.[15] 3. fever. 4. Nausea/vomiting characterized as an urge or forcing the contents of the stomach out of the mouth. 5. Stomach pain characterized as an unpleasant abdominal distress sensation.[12]

Independent variables

We classified independent variables into individual-level, household-level, and physical environmental variables. Individual-level variables included gender dichotomized as male or females. Age was categorized into 5-17 years, 18-54 years, and >54 years denoted from now on as young age, middle-aged and older age, respectively. We stratified the subjects into school going and non-school going. Education level combined those without formal education and primary education as one category while combining all those with post-primary education as a separate category.

Household-level variables included monthly household income for the household head and active medical insurance covering all household members. Keeping domestic animals in the households was categorized by animal species. We also asked whether there was an animal illness and or death reported in the week prior to this study. Data on household physical infrastructure concerned the house floor, roof, and wall types. Other household-level variables included household size, source and mode of treatment of drinking water, human waste disposal, and trash disposal. Environmental variables included the occurrence of rain during the week preceding the study exhibited by the presence of rainwater pools around the homesteads. The physical environmental variable included the arbitrary partitioning of the study area into three regions, namely top, bottom left, and bottom right, according to their geographical positions. We constructed a relational database designed using Microsoft excel® to store the data.

Estimating the prevalence and clustering of syndromes

For each syndrome, the prevalence was estimated under the binomial model as $p = \frac{y}{n}$, where y represented the proportion of the sample size that attained ILI or GI syndrome. We determined the variance as follows: $Var(p) = \frac{p(1-p)}{n}$ and used it to estimate the 95% confidence limits for the prevalence as $p \pm 1.96\,[Var(p)]^{0.5}$.

For each syndrome, we also estimated the prevalence in the presence of extra-binomial variation. We computed a variance-inflation factor (VIF) to account for the variation in attaining a threshold of the syndrome as $1+\rho(\check{n}+1)$ where ρ denoted intra-cluster correlation coefficient (ICC) with cluster symbolizing a household and $\check{n}$ represented the average household size. The ICC provided a measure of similarity in each syndrome among study subjects within a household. Given the sample size n in the i^{th} household, we estimated ρ as equal to $\frac{MSB-MSW}{MSB+MSW(\check{n}-1)}$ where MSB and MSW denoted mean square error between households and mean square error within households, respectively[16]. A one-factor Analysis of Variance (ANOVA) generated the MSB and MSW. The product of VIF and the variance determined under simple random sampling estimated the inflated variance.

Estimation of association between syndromes and independent variables and clustering of syndromes at the household level

We constructed logistic regression models to estimate the association between ILI and GI syndromes and the independent variables. To generate dichotomized response variables, study subjects who attained a threshold for ILI or GI syndrome were coded 1 and 0 for those who did not. We carried out a univariable analysis to screen all significant variables associated with ILI or GI syndrome using a less-restrictive level of significance of p≤0.1. The significant variables were then fitted into a standard multivariable logistic regression model using a backward selection technique based on Wald`s test statistics at a significance level of p<0.05.[17] To estimate the magnitude and statistical significance of the clustering of syndromes at the household level, we fitted generalized linear mixed models. We employed STATA version 14 and R software version 3.5.3 for all data analysis.

Ethical review statement

AMREF health Africa provided ethical clearance for the study under approval number ESRC P635/2019.

RESULTS

Distribution of individual and household characteristics

Table 1 shows the description of the 390 subjects. While female subjects constituted 55% of the sample, 48% of all subjects were <18 years old, ranging between 5 and 83 years. 53% of the subjects (n=207) were schooling. Of the 47% non-schooling subjects, 46% and 1% engaged in informal and formal occupations, respectively. Of those >18 years of age (n=203), 73% and 27% had attained primary and post-primary education respectively. The mean, standard deviation, and median of the sample in households were 5.1, 2.1, and 5.0, with the minimum and maximum sample sizes in households being 2 and 12. Table 2 describes the household-level variables for the 92 households. Approximately 83% of household heads were earning Kenya shillings (KSH) ≤10,000 monthly equivalent of ≤USD 100 with a maximum of KSH 30,000 equivalent of ≤USD 300. Only 15% of the households reported having active medical insurance.

Table 1: Description of individual-level variables of study subjects (n=390).

Variables	Level	Frequency	%
Age in years	≥5-17	187	48.0
	18-54	156	40.0
	>54	47	12.0
Gender	Female	215	55.1
	Male	175	44.9
Employment status	Formal	3	0.8
	Informal	180	46.2
	School going	207	53.1
Education level	Primary	327	83.8
	Post-primary [a]	63	16.2

[a]Study subjects with the secondary, university, or vocational studies.

Table 2: Description of the household- and area-level variables (n=92).

Variables		Households		No. of study subjects nested in the households	
	Level	Frequency	%	Frequency	%
Income	0-10,000	76	82.6	323	82.8
	>10,000	16	17.4	67	17.2
Medical insurance	Yes	14	15.2	63	16.2
	No	78	84.8	327	83.8
Floor-type	Cement floor	13	14.1	57	14.6
	Earth floor	79	85.9	333	85.4
Wall type	Brick wall	13	14.1	53	13.6
	Mud wall	79	85.9	337	86.4
Roofing type	Aluminum sheets	90	97.8	380	97.4
	Thatch roofing	2	2.2	10	2.6
Drinking water source	River	25	27.2	110	28.2
	Other sources [a]	67	72.8	280	71.8
Treat drinking water	Yes	82	89.1	353	90.5
	No	10	10.9	37	9.5
Water treatment method	Filtration/decantation	34	41.5	140	39.7
	Chlorine/boiling	48	58.5	213	60.3
Human waste destination	Pit latrine	84	91.3	361	92.6
	Open defecation	8	8.7	29	7.4
Trash disposal	Garden disposal	24	26.1	96	24.6
	Garbage pit	68	73.9	294	75.4
Domestic animal owned	Yes	87	94.6	376	96.4
	No[b]	5	5.4	14	3.6
Presence of ill animal [b]	Yes	32	36.8	151	40.2
	No	55	63.2	225	59.8

Continued.

Variables		Households		No. of study subjects nested in the households	
	Level	Frequency	%	Frequency	%
Animal death reported	Yes	13	14.9	53	13.6
	No	74	85.1	323	82.8
No. of cattle	<4	44	71.0	192	69.3
	≥4[c]	18	29.0	85	30.7
No. of sheep	<2	8	53.3	32	50.0
	≥2[d]	7	46.7	32	50.0
No. of goat	<2	17	50.0	64	41.8
	≥2[e]	17	50.0	89	58.2
No. of poultry	<15	51	65.4	201	59.3
	≥15[f]	27	34.6	138	40.7
No. of dogs	1	20	40.8	97	42.0
	>1[g]	29	59.2	134	58.0
No. of cat	1	43	71.7	207	75.8
	≥1[h]	17	28.3	66	24.2
Area-level variable - region variables [i]	Top	29	31.5	133	34.1
	Bottom right	28	30.4	106	27.2
	Bottom left	35	38.0	151	38.7

[a] Other sources include spring, well water, municipal tap system, and rainwater; [b] Number of households with domestic animals=87; [c] Maximum number of cattle=18; [d] Max number of sheep=17; [e] Maximum no. of goats=14; [f] Maximum number of poultry=110; [g] Maximum number of dogs=11; [h] Max number of cats=5; [I] Arbitrary generated study site regions.

Table 2 shows characteristics of materials used in house structures: >85% of the houses had earthen floors, mud walls, and roofs made of aluminum sheets. Of 92 households, 74% had a household garbage pit for trash disposal. 73% of the households used spring water, well water, municipal tap system, and rainwater as sources of water. Of the 82 households (89%) that treated water for drinking, 59% predominantly used chlorine and or boiling, while 41% used filtration and decantation methods. 9% of the households did not have pit latrines, primarily practicing open defecation. 87 households (95%) owned at least 1 species of domestic animals, including cattle, sheep, goats, poultry, dogs, or cats (Table 2). Of these 87 households, 37% reported illness in the animals, while 15% reported at least 1 animal death (Table 2). Further, the nearest neighbor index was 0.98 for all sampled households, highlighting a random distribution of sampled households.[7]

Prevalence of syndromes

Table 3 shows the prevalence of ILI and GI syndromes, confidence intervals, and estimated variations under binomial and extra binomial variation. While the prevalence of ILI syndrome was 27% (n=104), that of GI syndrome was 9% (n=35). ANOVA analyses returned low values of intra-household correlation coefficients (ICC), an indication of little or no clustering for each syndrome between households (Table 3).

Females accounted for 57% and 60% of ILI (n=59) and GI (n=21) syndrome, respectively. When study participants attaining the thresholds of both ILI and GI (n=24) were examined, females, once more, had a higher proportion (67%) relative to males.

Table 3: ANOVA analysis showing an estimation of the prevalence of attaining ILI and GI syndrome and variance, ICC and VIF.

Syndrome	Parameters under the binomial model			Parameters under extra-binomial variation			
	Prevalence %	Variance	95% CI	ICC	VIF	Variance	95%CI
ILI	27	5.0 X 10^{-4}	[22.3, 31.1]	0.043	1.2	6.0 X 10^{-4}	[21.9, 31.5]
GI	9	2.1 X 10^{-4}	[6.2, 11.8]	0.029	1.1	2.3 X10^{-4}	[6.0, 12.0]

Of 104 subjects with ILI, 41%, 48% and 11% of them were aged 5-17 years (n=43), 18-54 years (n=50) and above 54 years (n=11), respectively. Similarly, 34%, 49% and 17% of 35 subjects with GI syndrome were aged 5-17 years (n=12), 18-54 years (n=17) and above 54 years (n=6), respectively. Separately, subjects aged 18-54 years were more likely to attain ILI and GI syndrome relative to other age categories. There was no significant difference in prevalence across 2 syndromes among aged 5-17 years (p=0.59), 18-54 y (p=0.88), and above 54 years (p=0.47).

Figure 2 shows the prevalence of ILI and GI syndromes and their confidence limits by the study regions, revealing that the bottom left, and top regions had a higher prevalence of ILI syndrome. On the other hand, both bottom regions had a higher prevalence of the GI syndrome relative to the top region. However, these differences were not the statistically significant (p>0.05).

The occurrence of reported symptoms by independent variables

Malaise was the most frequently reported symptom by ~88% of the subjects who attained ILI syndrome, followed by fever, cough, and mucoid nasal discharge (Figure 3). Stomach pain was the most frequently reported symptom by ~90% of the subjects who attained GI syndrome, followed by fever, diarrhea, and nausea/vomiting (Figure 3).

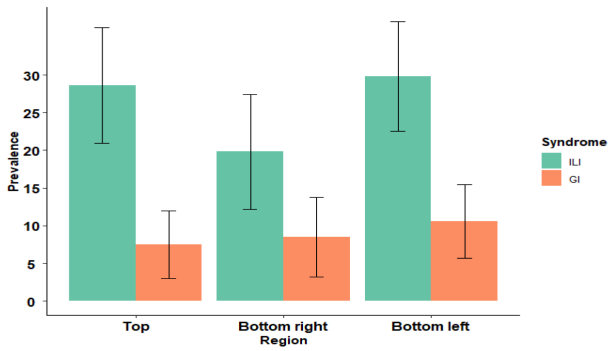

Figure 2: Prevalence (95% CI) of ILI and GI syndrome by region.

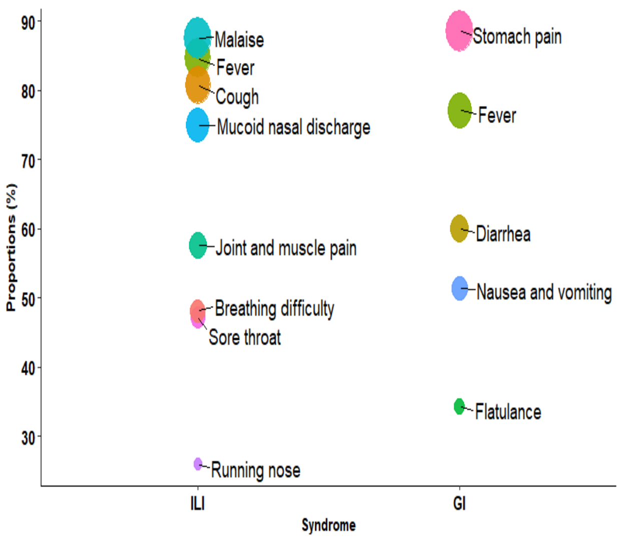

Figure 3: Proportion (%) of symptoms reported by study participants attaining ILI and GI syndromes.

Among those who attained ILI syndrome, persistent running nose and coughs were more likely to be reported by study subjects of childhood years aged ≤18 years relative to those aged ≥18 years. On the contrary, malaise, joint, and muscle pains were more likely to be reported among adults aged ≥18 years.

Among those who attained GI syndrome, diarrhea was more likely to be reported regardless of age. Nonetheless, stomach pain, fever, nausea/vomiting, and flatulence were more likely to be reported among adults aged ≥18 years relative to those aged ≤18 years.

Univariable analysis

Five variables were significantly associated with the prevalence of ILI syndrome at p≤0.1. These included employment statuses, making a visit outside the sub-county of residence, household size, house wall type, and household trash disposal method (Table 4). On the other hand, four variables turned significant for the prevalence of GI syndrome at p≤0.1. These included employment statuses, making a visit outside the sub-county of residence, household size, and active medical insurance.

Table 4: P values obtained from univariable analysis for ILI and GI syndromes at a significance level of p<0.1.

Category	ILI	GI
Individual-level variables		
Age	0.349	0.207
Gender	0.788	0.668
Employment	0.099	0.031
Education level	0.951	0.868
Visits outside the local sub-county	0.001	0.001
Household-level variables		
Household size	0.027	0.080
Household income	0.765	0.810
Household insurance coverage	0.181	0.008
House floor type	0.582	0.418
House wall type	0.074	0.895
House roofing	0.398	0.656
Household drinking source	0.933	0.301
Household treating drinking water	0.593	0.914
Drinking water treatment method	0.553	0.937
Predominant human waste destination	0.919	0.789
Household trash disposal	0.038	0.200
Household ownership of a domestic animal	0.886	0.817
No. of domestic animal species	0.922	0.534
Area level variables		
Regions	0.169	0.652

Multivariable analysis

Subjects who made a visit outside the sub-county of residence were 2.3 times more likely to attain the ILI syndrome threshold relative to those who did not (p=0.001) (Table 5). Subjects who made a visit made outside the sub-county of residence were 3.4 times more likely to attain GI syndrome relative to those who did not (p=0.001) (Table 5). Local individual movements, largely furnishing trade and market needs, have been linked to the spread of diseases in low resource settings.[18]

Further, subjects within households with active medical insurance were 88% less likely to attain the GI syndrome threshold relative to those who did not own the insurance, independent of making a visit outside the sub-county of residence (p=0.005) (Table 5). Although this survey was cross-sectional, these findings suggest the usefulness of medical insurance at the household level. Active medical insurance coverage is low in Kenya, which is mitigated by the growing commitment to universal health coverage currently piloted in four counties.

Table 5: Multivariable analysis showing independent variables associated with the syndromes (p<0.05).

Syndrome	Variable	Levels	OR*	95% CI (OR)	LRT** p
ILI	A visit made outside sub-county of residence	Yes	2.3	[1.4, 3.7]	<0.001
		No	-		
GI	A visit made outside sub-county of residence	Yes	3.4	[1.6, 6.9]	<0.001
		No	-		
	Active medical insurance	Yes	0.12	[0.02, 0.94]	0.005
		No	-		

*OR-odds ratio; **LRT-likelihood ratio test.

DISCUSSION

Besides determining the prevalence and correlates of ILI and GI syndromes, this study assessed the utility of case definitions built from self-reported symptoms that consistently defined either syndrome at the individual level without formal clinical and laboratory diagnosis. Consenting to the challenges of employing case definitions in absence of universally agreed-on gold standards, we here highlight that our study be viewed largely as a suitable approach for clustering study participants based on clinical symptoms for the purpose of advancing public health rather than diagnoses of disease processes. Specifically, aggregation of clinical symptoms at both the household and individual levels may reveal clusters of households in which the risk of exposure and/or infection is higher. Subsequently, micro-targeting of the high-risk households, serving as foci of disease transmissions, may be instituted under existing and new community health care strategies.[19,20] In pursuing these goals, we had the advantage of conducting the study among participants aged between 5 and 83 years in community settings which essentially reflect what primary health care face in their routine disease surveillance and diagnosis.

The broader range of the eight ILI symptoms relative to the five GI symptoms that we studied perhaps increased the per capita likelihood of attaining ILI syndrome. Yet, we could not rule out a higher burden of ILI relative to GI illnesses consistent with the global burden of disease studies.[1] However, we could not find studies that classified symptoms into syndromes using an approach similar to ours, and therefore, direct comparisons with other studies were not straightforward.

The widespread occurrence of infectious and non-infectious etiologies of ILI in rural settings in Africa perhaps explains the high prevalence of ILI in this study.[21] Besides, the higher prevalence of ILI syndrome among those aged 18-54 years (13%) contrasts with findings from other studies in Kenya and Ethiopia, where children<18 years reported a high prevalence of ILI cases (16% versus 25%) relative to those aged >18 years.[22,23] Established infectious etiologies of ILI include bacteria, viruses, and non-infectious etiologies.[24,25] Among the 27% of subjects with ILI syndrome, malaise was the most frequently reported symptom, co-occurring with symptoms that mainly characterize upper respiratory illnesses. In developing countries including Kenya, respiratory illnesses co-occur with farming, the use of firewood for cooking, and exposure to various allergens.[25,26] These insights call for interventional studies that reduce the effects of these exposures.

The 9% prevalence of GI syndrome that we found suggested the existence of risk factors for their occurrence in the study area, key among them being lack of safe water, poor sanitation, and hygiene, warm temperatures, high humidity, and crowded housing.[27] Studies in developing countries that reported the use of surface and groundwater for drinking, as reported in this study, have associated these factors with diarrheal cases.[28]

We found that stomach pains, flatulence, fever, and diarrhea mainly contributed to the 9% prevalence of GI syndrome, consistent with other studies that associated high prevalence (18%) of diarrhea and stomach pain with GI illnesses in sub-Saharan Africa.[29] Nevertheless, gaps in quantifying the prevalence of GI symptomatology exist, which is what this study attempted to address. For instance, there are two types of stomach pain: dyspepsia and epigastric pain.[30] Greater than 25% of the global population has experienced dyspepsia, whose key risk factor is *Helicobacter pylori* infection, including in Kenya.[30] Epigastric pain experienced shortly following meals is a common symptom of either gastric or duodenal ulcers.[30]

In this study, 24 subjects attained a threshold of both syndromes implying that the more authentic prevalence of ILI, GI, and multimorbidity with both syndromes was 21%, 3%, and 6%, respectively. Multimorbidity, whether concurrent or successive, is perhaps a reflection of a clustered risk factor profile among the affected subjects.[31] Compared to male subjects, female subjects accounted for 57% and 60% of those with ILI and GI syndromes, respectively. More women reported symptoms under each of the syndromes compared to men, consistent with previous studies that demonstrated a gender divergence in patterns of multimorbidity.[32]

ANOVA analyses returned low values of intra-class correlation coefficients (ICC), indicating little or no clustering for each syndrome between households (Table S1). Mixed-effects logistic models also failed to detect the clustering of the studied syndromes at the household level. The primary reason for this could be the non-specificity of the outcomes of interest, defined as reporting of any ≥4 or ≥3 of prespecified symptoms to attain ILI and GI syndromes, respectively. We were expecting subjects residing in the same household to share risk factors, and more so, be dependent upon each other in the context of transmission of communicable diseases. Perhaps, detection of clustering would have been probable had our analyses been pathogen or disease-specific or carried out in longitudinal study design. Besides, had we increased the sensitivity of the case definition by lowering threshold of attaining a syndrome, there could have been more similarity among household members leading to detection of clustering and vice versa. An investigation of clustering patterns in the longitudinal survey that followed the current study will be pursued.

Limitations

Self-reported data in the absence of confirmatory diagnoses remains tentative and is prone to recall bias as well. Furthermore, the cross-sectional nature of our data had cause-and-effect interpretational challenges. In addition, the utility of a case definition for a syndrome differs with context, including socio-demographic characteristics and socioeconomic status.

CONCLUSION

The study concluded the existence of a higher burden of ILI relative to GI syndrome. Subjects who made a visit outside the sub-county of residence were more likely to attain the ILI and GI syndrome threshold relative to those who did not. Further, subjects within households with active medical insurance were less likely to attain the GI syndrome relative to those who did not own the insurance. Moreover, this study advances the knowledge and understanding in the field by supporting the use of syndromic surveillance in settings with inadequate clinical and laboratory diagnostic capacity. Indeed, self-reported data are currently finding use in health-care policy decisions besides assessing health economic outcomes. The grouping of illnesses into syndromes supports utility in informing clinical surveillance, health care management, and precision public health.

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