Research Article

Epidemiological Characteristics Of Intestinal Parasitic And Bacterial Infections And Community Surveillance Barriers In Diyala Governorate, Iraq

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ABSTACT

Background: Parasitic and bacterial intestinal infections in Diyala are a social health issue, which is aggravated by the lack of proper health infrastructure and underreporting.

Aim of study: To determine the effectiveness of community surveillance, define the technical/logistical issues, and examine the social determinants related to the spread of infections.

Methodology: A cross-sectional descriptive research of 350 participants comprising of adults in seven general hospitals through questionnaires, examinations and bacterial records. Data collection were assessed with regard to awareness, preventative actions, and detection of the infection through General Stool Examination (GSE) and review of records.

Results: Insufficient resources, privacy issues, and lack of community cooperation emerged as the main factors affecting community-based surveillance. The prevalence rate of infection was found to be significantly lower in participants who had completed their education (10.2%) compared with those who did not (22.2%). The prevalence was lower in participants employed in the health sector (5.8%) than in those who were self-employed (26.7%) ($P<0.05$). Those who had previous knowledge about intestinal infections (9.9% vs. 25.9%), experience in the health sector (4.7% vs. 16.3%), and knowledge of transmission pathways (12.3% vs. 26.2%) showed significantly lower infection rates ($P<0.05$). No statistically significant association was detected between infection rate and participant age or sex.

Conclusion: Community participation and health awareness determine the risk and prevention of intestinal infections.

Keywords: Community-based surveillance, Enteric infections, Intestinal parasitic infections, Diagnostic barriers, Disease underreporting.

INTRODUCTION

Local environments frequently lead to health epidemics and in this case, members of the community would be able to notice changes in health before they become official [1,2].

Community-based surveillance (CBS) happens to be an important early warning system, particularly in communities with issues in health infrastructure like Diyala Governorate [3]. Parasitic and bacterial infections of the intestines persist in being a significant burden on the public health status globally. Estimates of the global prevalence of diarrhoea-related infections indicated an estimated one million deaths and 59 million disability-adjusted life years (DALYs) in 2021, thereby affirming that such infections are a source of morbidity and early death globally [4]. Infections of the intestines are highly prevalent in developing countries as a result of poor water quality, lack of appropriate sanitation practices, crowded living conditions, absence of laboratories, and delayed health services.

In addition to their impact on causing acute illnesses, infections of the intestines can contribute to chronic diseases. Intestinal parasitic infections were linked with malnutrition, stunted growth, and reduced physical development of infected people, especially those from vulnerable communities [5]. Therefore, it is vital that infections of the intestines be considered not only as clinical illnesses but also as evidence of weak environmental and public health conditions.

The prevalence of parasitic infections of the intestine continues to represent a public health problem in Iraq. In a recent epidemiologic study from Erbil, the presence of intestinal parasites continues to be found in public health care centers, Entamoeba histolytica/dispar and Giardia lamblia among the most frequently recorded protozoa [6]. Unfortunately, regional epidemiologic data are fragmentary, and the extent of the problem is likely underestimated since not all cases are lab-tested and/or reported through routine surveillance.

It is particularly difficult to make accurate diagnoses of infections affecting the intestines due to numerous reasons, including insufficient lab resources in many locations, reliance on traditional parasitological techniques,

lack of trained personnel, inconsistency of the diagnostic approach, and delays in seeking medical help. According to recent reviews of diagnostics for parasitic diseases of the intestine, conventional methods are subject to operator error, require prolonged time, and are not sensitive enough in detecting light forms of infection, while modern molecular diagnostic techniques might be unattainable in endemic or resource-poor settings [7,8].

Effective surveillance systems are therefore essential for controlling intestinal parasitic and bacterial infections. Disease surveillance enables early case detection, timely reporting, outbreak recognition, and evidence-based public health response. In low- and middle-income countries, however, surveillance systems are often weakened by underreporting, inconsistent case definitions, limited digital infrastructure, insufficient laboratory support, and weak feedback mechanisms [9]. Community-based surveillance provides a complementary approach by engaging community members in the detection and reporting of public health events, thereby improving early warning capacity and reducing the gap between facility-based records and the actual community burden of disease [10, 11].

Intestinal microbes, giardia, and amoeba are parasitic and intestinal bacterial infections that create a significant burden on the health of publics and are directly related to environmental and social determinants and malnutrition [12-14].

Although a surveillance system founded on health institutions (FBS) exists, the lack of knowledge due to the fact that cases not reaching hospitals are underreported [15]. While there is an acknowledged burden of infection from parasites and bacteria in Iraq, there is inadequate documentation about how effective community-based surveillance can be for detection and surveillance of such infections within the communities themselves. Many of the existing reports on disease surveillance in Iraq focus mainly on facility-based notification systems, and the results could provide underestimations of the disease burden, since some people who are infected either don't visit any health facilities or fail to be diagnosed with their diseases. Moreover, there is scant literature available on the role played by trust and awareness levels within the community, among others, in the success of surveillance practices within Diyala Governorate.

The aim of study:

To determine the effectiveness of the community surveillance against parasitic and bacterial infections in Diyala Governorate, Iraq. This study also intended to determine the significant barriers encountered in conducting the surveillance process as well as examining the relationship between demographic factors, health knowledge, preventive practices, and infection rate among the subjects of the study.

Methodology

Study design

This study was designed as a hospital-based cross-sectional analytical study conducted to assess the epidemiological characteristics of intestinal parasitic and bacterial infections and to evaluate the barriers affecting disease surveillance in Diyala Governorate, Iraq. The study examined demographic characteristics, health awareness, preventive practices, and surveillance-related factors associated with infection occurrence.

Scope and approvals:

Location: Diyala Governorate (7 health institutions, comprising of hospitals located in Baquba, Khalis, Muqdadiyah, Baladruz, Jalula, Khanaqin, and the Public Health Department). Women and children hospitals were not included to make sure that it is General and multi-specialty hospitals.

Ethical approval: The University of Middle Euphrates and the Diyala Health Department gave administrative approvals following the ethics and informed consent of participants. Ethical approval was obtained from the Research Ethics Committee of Wasit University/Al-Zahraa Teaching Hospital. Written informed consent was obtained from all participants before enrollment in the study. All procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Study sample:

A total of 350 participants were initially recruited from the selected healthcare institutions during the study period. Thirty-six participants were excluded because they did not meet the eligibility criteria or declined participation. Consequently, 314 participants were included in the final statistical analysis.

Sampling procedure:
Eligible participants were recruited using a convenience sampling technique from seven governmental healthcare institutions in Diyala Governorate. Recruitment was performed consecutively throughout the study period until the required sample size was achieved.

Sample size: 350 individuals with 36 individuals being excluded due to failure to meet the requirements or unwilling to take part

Time limit: From 1st December 2025 to 1st March 2026.

Inclusion and exclusion criteria:
- **Inclusion:** Adults (aged 18 years and above) having intestinal symptoms.
- **Exclusion:** Patients who are below 18 years old, patients who have taken antibiotics or antiparasitic drugs in the recent past and patients who are in a critical condition.

Data collection tools:

Questionnaire
A structured questionnaire was developed after reviewing relevant published literature. The questionnaire consisted of eight domains covering demographic characteristics, health awareness, preventive practices, knowledge of infection transmission, disease severity perception, community participation, trust in health services, and barriers affecting disease reporting. Content validity was assessed by specialists in epidemiology and public health. Internal consistency was acceptable with a Cronbach's alpha coefficient of 0.824.

Laboratory Assessment
Stool specimens were collected from eligible participants presenting with intestinal symptoms. Samples were examined using direct wet-mount microscopy according to standard parasitological procedures for the detection of intestinal parasites. In addition, microbiological laboratory records were reviewed to identify confirmed bacterial enteric infections reported during the study period. Laboratory findings were used to verify infection status and compare field observations with officially reported surveillance data.

Case Definition
A participant was considered infected when at least one intestinal parasite was identified by stool microscopic examination or when a confirmed bacterial enteric infection was documented in the laboratory records.

Statistical Analysis
Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 23. Descriptive statistics were expressed as frequencies and percentages. Associations between categorical variables were assessed using Pearson's Chi-square test. Odds ratios (ORs) with 95% confidence intervals (CI) were calculated where appropriate. A P-value of less than 0.05 was considered statistically significant.

RESULTS
Table (1): shows the prevailing key issues of health surveillance systems. One of the key findings is that Lack of resources and equipment is seen as a significant issue (P = 0.001) even in those who hold High Trust (24.4%), which suggests that the general population is aware that there is a lack of resources and equipment that prevent effective healthcare. In addition, community cooperation is also associated with a significant correlation (P = 0.001), but at the moment, it is inconsistent (Sometime), which suggests that more permanent trust-building practices are required. Interestingly, one of the statistically significant barriers was found to be the Privacy

concerns (P = 0.008), which demonstrates data confidentiality as a fundamental element of the community trust. Funny enough, there were other factors that were not statistically significant (P = 0.405) and that included things such as Shortage of healthcare personnel which indicates that the factor is considered a general administrative problem and not a trust issue. In the end, the data highlights that the enhancement of community surveillance is a two-fold process that must be conducted through the provision of sufficient logistical facilities and the establishment of the strong privacy measures that would allow building the sustainable confidence of the population.

Table (1): Evaluation of Systemic and Social Obstacles Facing Health Surveillance in Relation to Public Trust

		Trust in Health Information Sources						P-Value
		Low Trust		Moderate Trust		High Trust		
		N	%	N	%	N	%	
What are the most significant challenges facing community surveillance?	Insufficient government funding	4	4.8%	74	88.1%	6	7.1%	0.001
	Poor inter-institutional cooperation	7	7.2%	86	88.7%	4	4.1%	
	Lack of resources and equipment	8	9.3%	57	66.3%	21	24.4%	
	Weak community awareness	3	4.9%	53	86.9%	5	8.2%	
	Lack of trust in health services	3	13.6%	15	68.2%	4	18.2%	
Do you believe the community cooperates with health teams in reporting infections?	Yes	2	3.7%	45	83.3%	7	13.0%	0.001
	Sometime	8	4.2%	169	88.0%	15	7.8%	
	No	15	14.4%	71	68.3%	18	17.3%	
What are the most prominent obstacles facing awareness campaigns?	Poor community responsiveness	7	5.5%	108	85.0%	12	9.4%	0.405
	Shortage of healthcare personnel	11	8.3%	101	76.5%	20	15.2%	
	Funding shortages	7	7.7%	76	83.5%	8	8.8%	
Have you or any of your family members experienced a recurrent infection recently?	Yes	0	0.0%	12	100.0%	0	0.0%	0.242
	No	25	7.4%	273	80.8%	40	11.8%	
Did "privacy concerns" prevent you from early reporting your infection?	Yes	12	6.6%	159	86.9%	12	6.6%	0.008
	No	13	7.8%	126	75.4%	28	16.8%	
Did you receive any prior notification/alerts regarding water contamination in your area?	Yes	0	0.0%	7	100.0%	0	0.0%	0.443
	No	25	7.3%	278	81.0%	40	11.7%	

Table (2): on the one hand, there is a significant statistical correlation (P=0.001) between the level of education and occupation and, on the other hand, the parasite infection rates. The data show that the rate of infections declines with the level of education with the highest level of education being 10.2 and the lowest level of education being 22.2 amid the rate of 10.2 recorded in the individuals of higher education with 1-5 years of university and higher education and the highest rate of 22.2 in the illiterate individuals. Regarding occupational activity, the most susceptible to infection was the self-employed category with a rate of 26.7, then the housewives followed with 19.8 and the highest levels of protection were recorded by the employees with not more than 5.8. Conversely, age and gender variables did not demonstrate statistically significant impact on the risk of infection (P > 0.05), which validates the idea that socio-economic and knowledge influencing variables are the primary driving forces behind the risk of infection in this sample.

Table (2): relationship between demographic characteristics and parasite infection rates.

	Parasite		P-Value
	No	Yes	

		N	%	N	%	
Age Group	>20	5	100.0%	0	0.0%	0.527
	20-29	114	83.2%	23	16.8%	
	30-39	103	88.0%	14	12.0%	
	40-49	43	86.0%	7	14.0%	
	50-59	23	85.2%	4	14.8%	
	>=60	10	71.4%	4	28.6%	
Sex	male	133	85.8%	22	14.2%	0.756
	female	165	84.6%	30	15.4%	
Educational Level	Illiterate	28	77.8%	8	22.2%	0.001
	Primary	38	69.1%	17	30.9%	
	Secondary	91	89.2%	11	10.8%	
	University or higher	141	89.8%	16	10.2%	
Occupation	Student	53	82.8%	11	17.2%	0.001
	Employee	129	94.2%	8	5.8%	
	Self- employed	44	73.3%	16	26.7%	
	Housewife	69	80.2%	17	19.8%	
	Unemployed / Retired	3	100.0%	0	0.0%	

Table (3) : demonstrate that the health awareness is also significant in lowering the rate of infection as the differences (P=0.0001) between those people who have known about parasites (infection rate of 9.9) and those who have not (infection rate of 25.9) are highly statistically significant. The health sector is also a good place to gain practical experience, and the workers of this sphere can boast the lowest rate of infection of 4.7. The aspects of behaviour and knowledge are better seen when examining the routes of transmission since lack of understanding of the routes of transmission promoted the rate of infection to 26.2 (P=0.005). Moreover, the lack of faith in the usefulness of community surveillance was linked to the steep rise in the infection rate to 29.4, which means that the dissemination of the knowledge about the pathways of the infection and detection methods are critical in curbing the spread of parasite infections in the sphere.

Table (3):The relationship between knowledge level, preventive practices, and actual parasite infection.

		Parasites				P-Value
		No		Yes		
		N	%	N	%	
Have you ever learned anything about parasitic or microbial infection	Yes	218	90.1%	24	9.9%	0.0001
	No	80	74.1%	28	25.9%	
Do you have experience or have you ever worked in the healthcare field?	Yes	41	95.3%	2	4.7%	0.045
	No	257	83.7%	50	16.3%	
Do you know what parasitic and microbial infections are?	Yes	181	91.0%	18	9.0%	0.0001
	No	117	77.5%	34	22.5%	
If yes, what is your main source of knowledge?	School/University	90	85.7%	15	14.3%	0.1
	Media	24	96.0%	1	4.0%	
	Family	19	100.0%	0	0.0%	
	Health centers	30	96.8%	1	3.2%	
	Internet	18	94.7%	1	5.3%	
Do you think that community-based surveillance can help reduce infection-related mortality	Yes	193	90.6%	20	9.4%	0.0001
	No	36	70.6%	15	29.4%	
	I don't know	69	80.2%	17	19.8%	
How severe do you think infections ARE?	Low	9	81.8%	2	18.2%	0.156

	Moderate	120	81.1%	28	18.9%	
	High	169	88.5%	22	11.5%	
Do you know the modes of transmission	Yes	250	87.7%	35	12.3%	0.005
	No	48	73.8%	17	26.2%	
Do you know the common symptoms of infections	Yes	249	85.9%	41	14.1%	0.406
	No	49	81.7%	11	18.3%	
*Significant difference between percentages using Pearson Chi-square test (χ2-test) at 0.05 level.						

DISCUSSION

This study offers insights into how intestinal parasites and bacteria affect Diyala Governorate from an epidemic and watch program standpoint. It found that who gets sick isn't just about demographics; factors like health knowledge, job, education, trust in public health, and fear of red tape play key roles too. What matters here is that we need to look beyond hospital visits to see the big picture of what's happening in our communities. This means lots of people might be sick without getting checked or treated properly.

The data of the current study demonstrate that how much public mistrust affects disease tracking. Things like a lack of gear, poor teamwork between agencies, mixed community involvement, and worry over privacy all make detecting illnesses harder. So, when numbers seem low in Diyala, that might not mean fewer sick folks. It could point more to glitches in our systems for catching and dealing with infections. Fixing those would surely paint us a clearer picture of the actual situation.

Community-based surveillance relies on people being willing to report their symptoms, work with health teams, and trust that their info is handled properly. According to McGowan et al. [16], it's super important to have community involvement, clear processes for reporting, regular updates, and a connection to formal health systems for it to succeed. Craig et al. [11] added that when communities are tied into the public health responses, these efforts can really enhance early detection of illnesses.

In the current study, privacy issues went hand in hand with how much trust folks had in the system. This matters a ton in epidemiology because the worry of sharing info might lead to stigma or misuse can hold people back from reporting. Especially with intestinal infections, which might be embarrassing. When they don't report due to these fears, the official numbers end up way off, making the actual health issue look less severe than it is in reality.

This aligns with recent surveillance literature that suggests public health reporting systems need to protect people's privacy and keep trust to get timely notifications and community help. Ingelbeen et al. [17] pointed out that good surveillance systems should blend risk watching with quick alert methods to cut down delays from exposure to when the issue is found and acted upon by public health teams.

A major problem in Diyala is the connection between scarce resources and the difficulties felt with surveillance. When stuff's lacking, it slows things way too much sample collecting, lab proofing, data putting in, reporting, and crisis handling. For stomach bugs, you've got extra hurdles since the tests call for pros, steady supply kits, and strict reporting setups. According to Alahmari et al. [18], reliable data moving smoothly, ongoing checks, and super-fast responding power up early warning systems. So fixing surveillance can't just mean raising public awareness; we have to bulk up the labs, report building, and team-up skills across health spots too.

In this study, having higher education links to a lower infection rate, but age and gender aren't factors. People with university degrees might have less infections because they know more about health stuff, practice good hygiene, and catch potential issues faster. On the flip side, those with less education often can't get to preventive info, and they might not be as aware of how to stay safe with water, food, and sanitation.

These results match up with Ahmed [19], who said preventing parasitic infections is all about hygiene, sanitation, safe food and water, and getting that info out to the public. Plus, Tekalign et al. [20] noted similar links between infections and environment along with preventive behavior in places still developing.

Occupation played a big role in infection rates too. Self-employed folks had the highest infection rate which could be due to their higher exposure in the environment, lack of steady access to health education, or involvement in occupations that deal with contaminated stuff like food and water. Employed individuals, on the other hand, had a lower infection rate likely because of easier access to info and stable economic situations that come with a regular job – and let's not forget, maybe they've got better hygiene supplies too. This really shows that getting sick isn't random; it follows social patterns. People in certain jobs need extra care, like being targeted for education and screening programs.

The study found no major link between infections and age or gender though. So it seems these enteric bug exposures hit pretty widely across different age groups and sexes in the area. Still, this doesn't downplay the importance of age and sex altogether – just not here. It means for prevention programs, focusing on education and awareness might hit closer to home since those seemed to have more impact in this instance. Age and sex alone won't do the trick if we want to tackle these infections effectively.

Having knowledge about infections seems to lower your chances of catching them. People who knew more about parasitic and microbial infections ended up with lower infection rates compared to those who didn't. Interestingly, folks with healthcare experience had the lowest rates of infection. It shows that learning about these things isn't just book knowledge; it helps people protect themselves in real life. They're more likely to wash their hands, handle food safely, avoid dirty water, and see a doctor when needed.

One study by Alemu et al. [21] found that having less knowledge about how to prevent infections made folks more vulnerable to intestinal schistosomasis. So, they suggested improving community health education and preventive programs.

Understanding how infections spread matters too. If you don't know the ways they can be transmitted, your risk of getting infected goes up. Pathogens like Giardia and Entamoeba, which spread through contaminated water and poor hygiene, are a big part of this issue. In line with that, Yulfi et al. [22] pointed out that intestinal parasite infections link closely with hygiene, water sources, and local practices.

So, the recent findings back up the idea that we need clearer health messages about how infections spread – easy-to-understand info that fits with cultural norms. An important thing the study found was that people who trusted community checks had a lower risk of dying from infections. This means trust isn't just about reporting; it's tied to actually staying healthy too. People see value in monitoring might be more willing to report issues, get tested, and listen to health experts. But those who don't think much of the system might delay getting help and avoid reporting sicknesses.

McClymont et al. [23] and Maddah et al. [24] stressed that to make modern tracking work well, we need quick info sharing and lots of community input, along with tech tools. Yet these methods won't succeed without strong public buy-in.

The diagnostic methods used in this study are worth considering too. Diagnosis mainly depended on routine stool microscopy and bacterial lab records. While microscopy is still widely used in areas with limited resources, it might actually underestimate the true prevalence of infections. This is especially the case when the amount of parasites is low, the specimen isn't great, or just one stool sample is checked.

Nevin et al. [25] found that molecular methods can spot more cases of gastrointestinal parasites compared to older techniques. Similarly, Robert-Gangneux et al. [26] showed that multiplex qPCR did better than traditional microscopy at diagnosing intestinal protozoa in a big study with lots of samples.

So, the actual number of intestinal infections in Diyala could be higher than what this study found.

The current findings indicate that intestinal infections in Diyala might be underreported due to various reasons. Limited resources hinder diagnostic and reporting abilities, while privacy concerns lower people's willingness to report. What's more, weak trust between communities and health workers curbs cooperation, and lack of awareness delays people from seeking help. All these factors can widen the gap between actual infection rates and reported cases. To address this, we need to boost community-based surveillance through technical improvements like ramping up lab capabilities and enhancing reporting tools. Social measures such as increasing trust, safeguarding privacy, offering community feedback, and pushing health education are crucial too.

Study Limitations

This study comes with several limits though. It was based in hospitals and used a cross-sectional design, making it hard to figure out causation. Also, it might not cover everyone since some folks don't go to health facilities. Plus, convenience sampling means results may not apply to the whole Diyala Governorate population. What's more, questionnaire data can suffer from recall or reporting biases.

Another issue is that they relied on standard lab tests; no molecular confirmation was done, which might have missed some infections. Still, the research does offer important local info. It connects intestinal infection rates to things like surveillance problems, trust issues, and low awareness.

The strength here is its dual epidemiological and surveillance angle. All this reinforces the case for a better, integrated community-based system in Diyala Governorate.

CONCLUSIONS

In conclusion, the study shows that for Diyala Governorate, the big influences on parasitic and bacterial infections are education, job exposure, awareness, how folks understand transmission, and barriers to surveillance, not age or gender. Key takeaways highlight underreporting linked to both health-system shortcomings and community stuff. To improve surveillance, we need to beef up lab and reporting systems, protect confidentiality, gain public trust, and add more health ed programs. This can help catch infections early, lower hidden cases, and make control of these illnesses much better in the governorate.

RECOMMENDATIONS

Community-based surveillance by the health authorities should be empowered through better resources, training of people and confidentiality of reporting facilities. Transmission routes, hygiene practices, and early reporting are some of the areas that should be increased through public health education programs to mitigate risk of infection.

AUTHORS CONTRIBUTIONS

FM collected samples and data, diagnosed the submitted samples, conducted tests, analyzed the data, and prepared the draft. RA supervised the study, developed the study design, assisted in data analysis, and corrected the manuscript.

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CONFLICT OF INTEREST

No conflict of interest in this study.

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