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RADIOLOGICAL PATTERNS OF HYSTEROSALPINGOGRAPHY (HSG) AMONG WOMEN ATTENDING USMANU DANFODIYO UNIVERSITY TEACHING HOSPITAL SOKOTO NIGERIA FROM A ONE HEALTH PERSPECTIVE

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Abstract

Background: Hysterosalpingography (HSG) remains a primary diagnostic tool for evaluating female infertility in resource-limited settings.

Objectives: This study identified common radiological findings on HSG at a Nigerian tertiary hospital and explored their correlation with patient age through a One Health lens.

Materials and Methods: A retrospective cross-sectional study analyzed 171 HSG reports from January 2016 to June 2018. Results: The predominant age group was 26–30 years (26.9%). Normal findings were observed in 47.95% of cases, while abnormalities were present in another 47.95%. Uterine pathologies (30.41%) were more frequent than tubal abnormalities (17.54%). Uterine adhesions (10.53%) and bilateral tubal blockage (5.85%) were the leading specific pathologies. Myomas were most prevalent in the 31–35 age group.

Conclusion: High rates of acquired uterine and tubal pathologies suggest that community-level factors, including environmental stressors and zoonotic-related infections, significantly influence reproductive health outcomes in Sokoto.

Keywords: Pattern, Radiological Findings, Hysterosalpingography, Infertility, One Health.

INTRODUCTION

Hysterosalpingography (HSG) is a widely utilized radiological technique for evaluating pathologies of the uterine cavity and fallopian tubes, and remains a key diagnostic tool in the assessment of female infertility (Ramzan et al., 2015). Infertility is defined as the inability of a reproductive-aged couple to conceive after 12 months or more of regular, unprotected intercourse. Globally, an estimated 5–15% of couples face infertility challenges, including in developing countries such as Nigeria (P. Ibinaiye et al., 2015). Although infertility is commonly assumed to be primarily a clinical issue of human health, the One Health concept acknowledges that reproduction can be affected by common environmental and biological determinants. In sub-Saharan Africa, particularly in northwestern Nigeria, the presence of uterine and tubal pathologies could be associated with exposure to environmental contaminants (e.g., heavy metal pollution in soil or water) as well as zoonotic transmissions responsible for pelvic inflammatory disease. Through this crosscutting perspective, an analysis of the HSG radiological patterns and their relationship to local-scale environmental stressors (or community-level exposures) can help elucidate how some environment community factors that operate locally influence women's health or cause HSG toxic factor types. Causes of infertility related to the uterus and fallopian tubes may be congenital or acquired, involving both anatomical and physiological abnormalities (Rondón et al., 2014).

Common indications for HSG include postoperative assessment following tubal ligation or reversal, and recurrent pregnancy loss (Naqi et al., 2016). The primary role of HSG is to determine tubal patency (Nampakdianan et al., 2016).

While various imaging modalities such as sonohysterography, laparoscopy, and hysteroscopy are employed in infertility evaluation worldwide, conventional HSG remains widely accessible and offers high-resolution imaging of tubal structures, particularly in resource-limited settings (Eleje et al., 2012). Tubal abnormalities, such as hydrosalpinx and pyosalpinx—resulting from distal tubal obstruction—can lead to infertility and abnormal implantation, including ectopic pregnancy (P. O. Ibinaiye et al., 2015). Endometrial pathologies and filling defects detected on HSG may reflect congenital anomalies, uterine fibroids, polyps, or intrauterine adhesions (Itanyi & Oluseyi, 2017). In addition to its diagnostic value, HSG may have therapeutic benefits, such as flushing and potentially unblocking occluded fallopian tubes (Moi et al., 2017). However, limitations of the procedure include pain due to poor technique or contrast injection, exposure to ionizing radiation, and the potential for false findings (Haifa A et al., 2016). Despite risks including infection, uterine perforation, contrast intravasation, and allergic reactions (Bhattarai & Ghimire, 2017). HSG remains a minimally invasive, safe, and rapid first-line investigation for evaluating uterine and tubal anatomy. Rare indications include assessing tubal ligation efficacy and investigating abnormal uterine bleeding (Ibekwe et al., 2010). Although advanced imaging techniques like MRI, ultrasound, laparoscopy, and hysteroscopy are emerging, HSG continues to be an essential tool for infertility workup in developing regions (Danfulani et al., 2014) Previous studies have reported tubal pathologies as the most common findings; however, the relationship between radiological findings and patient age remains

underexplored. This study aims to identify the most frequent radiological findings observed via HSG and assess their correlation with the age of participants.

MATERIALS AND METHODS

Ethical Consideration

The ethical clearance to conduct this study was obtained from the ethical clearance committee of Usmanu Danfodiyo University Teaching Hospital, (UDUTH) Sokoto with clearance number UDUTH/HREC/2018/No. 705

Study Design

Retrospective, cross-sectional.

Source of Data / Study Area

Secondary source of data. Study was conducted in Radiology Department, Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto.

Study Population

The study population was all existing/reported documents of HSG performed in Radiology Department of UDUTH from January, 2016 – June, 2018

Sample Size / Sampling Technique

Sample size: the sample size was determined using Taylor's formula, which is as follows;

$$n = z^2 pq / E^2$$

Where;

n=minimum sample size,

Z=Standard normal deviation corresponding to 95% confidence level i.e 1.96

P= prevalence obtained from previous study is 85.8%= 0.858 (Eduwem et al., 2016).

q= complementary probability= 1-p

E=margin of error, which is 5% and equivalent to 0.05

Therefore, $n = 1.96^2 \times 0.858 \times (1 - 0.858) / 0.05^2$

$$n = 3.8416 \times 0.858 \times 0.142 / 0.0025$$

$$n = 187.2 \quad n = 187.$$

RECRUITMENT OF SUBJECTS

Inclusion Criteria

Existing/reported documents of HSG performed in Radiology Department of UDUTH Sokoto.

Exclusion Criteria

Existing/reported or unreported documents of HSG outside the study period

Method and Instrument of Data Collection

Study of existing/reported documents of HSG examinations was retrieved from the archive of Radiology Department. Data capture sheet with rows and column containing serial number, x-ray number, age of the patients, indication/Clinical History and Findings of HSG (Conclusion) was used as instrument for data collection instrument.

Data Analysis

Microsoft Excel and Descriptive statistics (mean, standard deviation, frequencies and parentages).

RESULTS

Although the calculated minimum sample size required for statistical significance was 187, a total of 171 available and eligible reports were retrieved from the archives during the study period. This represents 91.4% of the target sample, providing a strong basis for analysis within this setting. A total of 171 reports were reviewed and the age range was between 17 and 43 years with a mean of 28 ± 6 years as shown in table 1. The commonest age group was 26-30 years with a total number of 46 (26.9%) hystero-grams followed by the age range of 21-25 accounting for 42 (24.56%) and then the least age group was 41-45 accounting for 2 (1.18%) as shown in figure 1. Out of the 171 reports that were reviewed; 82 (47.95%) had normal findings, 82 (47.95%) showed abnormalities while 7 (4.10%) missing radiologist report. Uterine pathologies were the commonest abnormalities and accounting for 52 (30.41%) as shown in table 2 and figure 3. Of these, uterine adhesions were the most reported uterine abnormalities; accounting for 18 (10.53%) of all the reports. Uterine myoma was reported in 17 (9.94%) reports while congenital abnormalities of the uterus (Arcuate uterus) and Asherman's syndrome were the least uterine abnormalities accounting for 2 (1.17%) and 5 (2.92%) respectively. The next most common group of abnormalities were seen in the uterine tubes with 30 (17.54%). They were mostly bilateral tubal blockage and bilateral hydrosalpinx accounting for 10 (5.85%) and 5 (2.92%) respectively as shown in figure 2.

On table 3; the normal findings was highest within the range of 21-25 and 26-30 years, uterine myoma was the highest reported uterine abnormality within the age range of 31-35, followed by uterine adhesions within the age range of 21-25. On uterine tube abnormalities, bilateral tubal blockage was the highest abnormality and commonest within the age range of 26-30, the least findings were among the patients within the age range of 41-45.

Table 1: Frequency distribution of age showing age group 26 – 30 has the highest hystero-grams

Age	Frequency (N)	Percent
17-20	15	8.77
21-25	42	24.56
26-30	46	26.90
31-35	26	15.20
36-40	17	9.94
41-45	2	1.18

Missing	23	13.45
Total	171	100

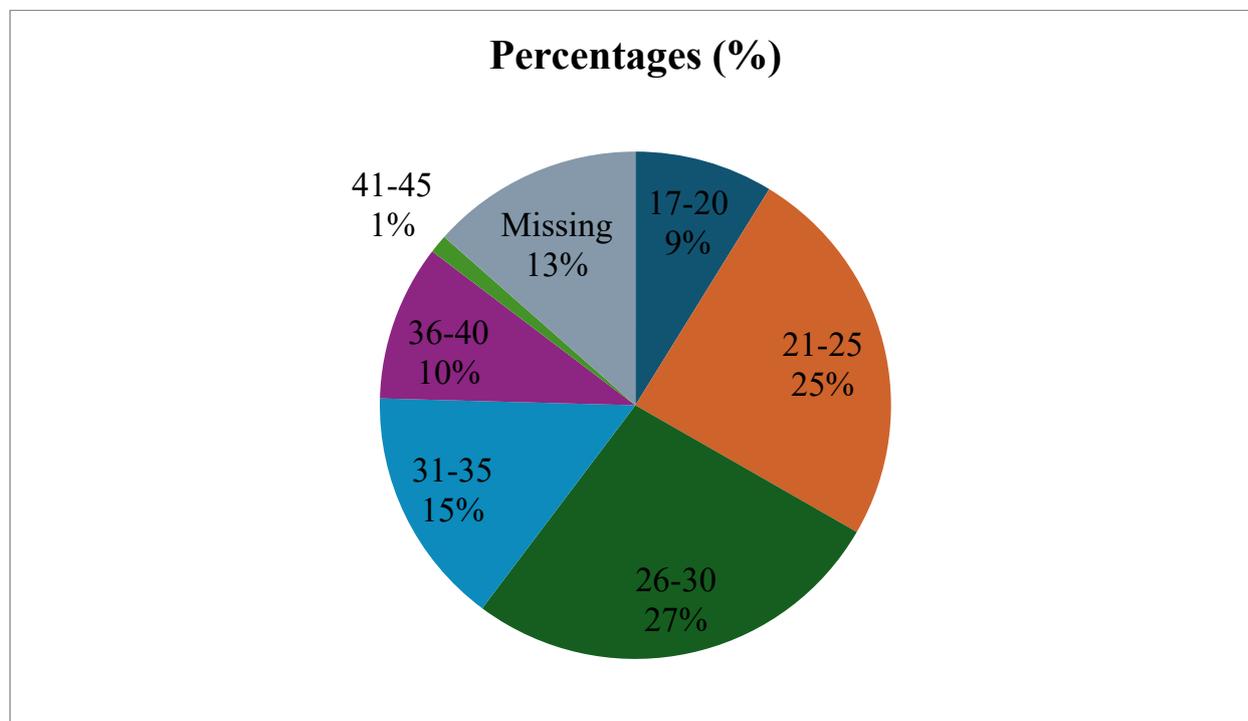


Figure 1 Age distribution of the participants showing age group 41 – 45 years having the least

Table 2 Frequency distribution of HSG findings showing normal examination as the highest finding.

Findings	Frequency (N)	Percent
Normal	82	47.95
Uterine abnormalities		
Arcuate uterus	2	1.17
Uterine adhesion	18	10.53
Uterine myoma	17	9.94
Asherman's syndrome	5	2.92
Cervico-uterine adhesion	4	2.34
Cervical adhesion	6	3.51
	52	30.41

Uterine tube abnormalities

Right tubal blockage	4	2.34
Left tubal blockage	4	2.34
Bilateral tubal blockage	10	5.85
Right sided hydrosalpinx	3	1.75
Left sided hydrosalpinx	4	2.34
Bilateral hydrosalpinx	5	2.92
	30	17.54
Missing	7	4.10
Total	171	100

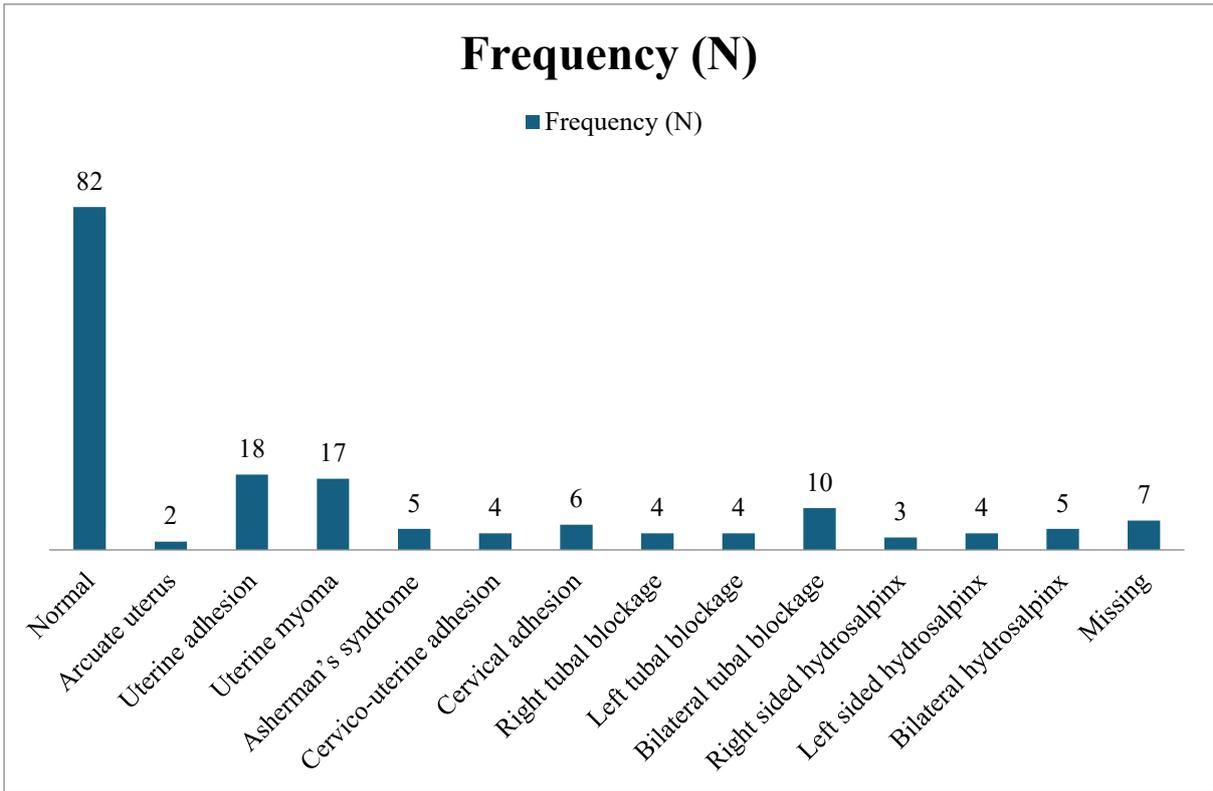


Figure 2: Frequency Distribution of HSG findings showing congenital anomaly of Arcuate uterus as the least finding

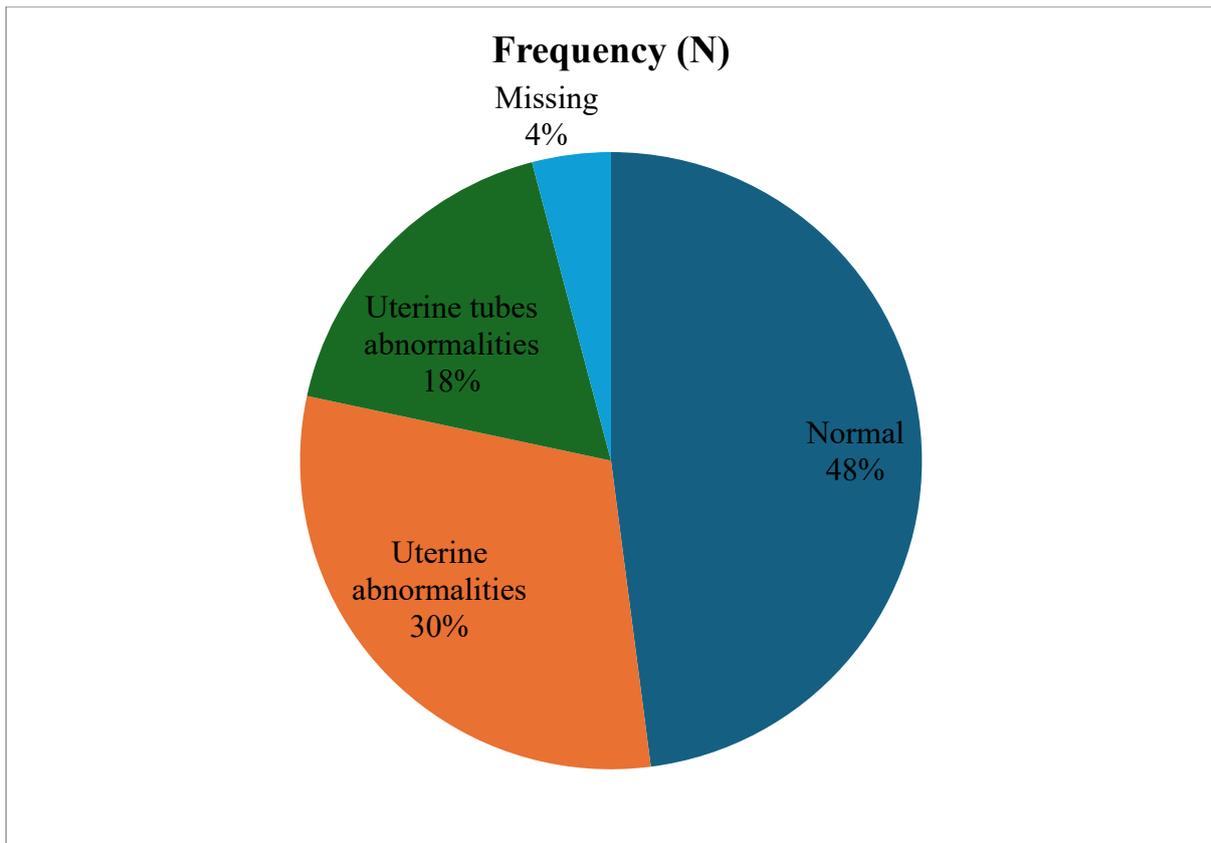


Figure 3: Showing distribution of normal findings, uterine/tubal abnormalities, and those with missing radiologist reports.

Table 3 Relationship between Age and HSG findings

	17-20	21-25	26-30	31-35	36-40	41-45	Missing	Total
Normal	9	24	24	7	7	0	11	82
Arcuate uterus	0	1	0	0	0	0	1	2
Uterine adhesion	3	4	2	3	3	0	3	18
Uterine myoma	0	3	1	5	4	2	2	17
Aherman's syndrome	0	0	1	3	0	0	1	5
Cervico-uterine adhesion	1	0	1	1	0	0	1	4
Cervical adhesion	0	1	2	2	1	0	0	6
Right tubal blockage	0	2	2	0	0	0	0	4
Left tubal blockage	0	2	1	1	0	0	0	4
Bilateral tubal blockage	2	2	5	1	0	0	0	10

Right sided hydrosalpinx	0	1	0	0	0	0	2	3
Left sided hydrosalpinx	0	0	2	1	1	0	0	4
Bilateral hydrosalpinx	0	0	2	1	0	0	2	5
Missing	0	2	3	1	1	0	0	7
Total	15	42	46	26	17	2	23	171

DISCUSSION

In terms of One Health, the prevalence of uterine adhesions (10.53%) and tubal blockages (5.85%) found within our study might be indicative of broader issues within the environment and systemic problems within the healthcare sector on a larger scale. In areas of the world like Sokoto, with widespread agrarian culture and lifestyle, issues of environmental pollution due to high nitrate and pesticide content in water sources have been previously shown to contribute to uterine problems, namely the development of myomas. In addition to uterine adhesions and tubal blockages, the tubal pathologies found are typically due to infection and would suggest that issues of community-acquired diseases, possibly due to close proximity to livestock and systemic sanitation problems within the community, contribute to tubal occlusion within a One Health paradigm. Hysterosalpingography is the examination of choice for detection of the uterus and fallopian tubes pathologies and also infertility can be assessed with the help of HSG (RAMZAN et al., 2015). It is considered the most common used technique for assessment of uterine cavity and tubal abnormalities (Eleje et al., 2012). Infection is the commonest and important cause of infertility in this environment (Case & Pierson, 2003). This retrospective, cross sectional study was carried out to document the pattern of findings in HSG among women attending Usmanu Danfodiyo University Teaching Hospital Sokoto, which shows cervical, uterine and tubal abnormalities to be the findings reported. The results of this study show normal findings accounting for 47.95% as the most common findings. The abnormal finding were uterine adhesion (10.53%), uterine myoma (9.94%) and bilateral tubal blockage (5.85%). This is similar to the study conducted in Akwa-Ibom State – Nigeria (Moi et al., 2017) which reported myoma as the most common pathology (36.0%) followed by tubal blockage (18.0%). Our study reported normal findings as the most common finding with 48%, and uterine abnormalities as the most common pathology with 30% which is similar to the study conducted in Bangladesh (Shermin et al., 2024) which revealed hysterosalpingography report was normal in 62% patients while among the rest of the patients 34.7% had either uterine or tubal pathology and 3.3% patients had abnormalities in both uterus and fallopian tubes, but contrary to the study conducted in Portharcourt Rivers state – Nigeria (Onwuchekwa & Oriji, 2017) which reported that out of the 299 hystero grams evaluated 73 (29.2%) had no pathology, whereas 177 (70.8%) had pathologies. The existence of

inconclusive results in 4.10% of the data may arguably be linked to administrative matters, such as the absence of primary reports written by radiologists in physical archival storage systems within the hospital setting. It is important to improve digital record systems to facilitate easier longitudinal monitoring in infertility treatment. The possible cause of why uterine adhesion has the overall highest number of findings may be attributed to infections and post-instrumentations (Dilatation and Curettage). The finding of this study is also similar with the findings of the study conducted in Calabar Cross River state – Nigeria (Eduwem et al., 2016) which reported that uterine pathologies was the most common pathology responsible for infertility and is contrary to the study conducted in Sokoto – Nigeria (Danfulani et al., 2014), in Accra – Ghana (Botwe et al., 2015) and a study conducted all the six states of south-south geopolitical zone of Nigeria (Ukpong et al., 2024) in which they all reported tubal pathologies as the most common pathology responsible for infertility. This study reported uterine adhesion as the most prevalent uterine pathology. The most affected age group were the age group of 26-30 years (26.9%) and 21-25 years (24.56%). These findings are similar with a little difference to the study conducted in Bangladesh (Shermin et al., 2024) which reported the age group of 25 – 29 with the highest pathology but contrary to that conducted in Rivers State – Nigeria (Eduwem et al., 2016) which reported the age group of 31-35 years as the most affected. Our study reported unilateral and bilateral fallopian tube blockage to be 4.68% and 5.85% respectively which is lower to the study conducted in India (Salroo et al., 2024) which reported unilateral and bilateral tubal blockage to be seen in 18.75% and 14.06% of cases respectively.

The normal findings showed the highest reported findings within the range of 21-25 and 26-30 years, this might be because these age groups are within their early reproductive age. Uterine myoma showed the highest reported uterine abnormality within the age range of 31-35, so also uterine adhesion showed the second occurring uterine abnormality within the age range of 21-25, this might be because of the aforementioned reason that uterine adhesion is mostly caused by infection and post-instrumentation (Dilatation and Curettage) of recent unwanted pregnancy and probably most of the age group that undergo this dilatation and curettage falls within these age groups. On uterine tube abnormalities, bilateral tubal blockage showed the highest reported abnormality within the age range of 26-30, this might be possibly because of infection. And the least HSG findings fall within the age range of 41-45, because, most patients or women that are within these age ranges have reached the stage of menopause.

CONCLUSION

The findings of this study suggest that infertility in the Sokoto metropolis is heavily influenced by acquired anatomical disruptions rather than purely congenital factors. The high prevalence of uterine adhesions and tubal blockages indicates a significant burden of chronic pelvic inflammation, likely stemming from a combination of community-acquired infections and environmental determinants. From a One Health perspective, these patterns

suggest that local environmental sanitation, proximity to livestock, and potential water-source contaminants may be silent drivers of reproductive morbidity. Consequently, mitigating female infertility in this region requires a shift from isolated clinical interventions toward integrated public health strategies that address environmental hygiene and interdisciplinary disease surveillance.

Conflict of Interest

The authors declare that there is no conflict of interest

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