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Evaluation of the Salmonella Surveillance System in Baku Azerbaijan, 2006-2008

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Abstract

According to the U.S. Centers for Disease Control and Prevention, 1.4 million people are infected each year with salmonella in the USA. During the 2006-2008 period, 1,333 cases of salmonella were registered in Azerbaijan, 98% were in children under 14 years. We evaluated the salmonella surveillance system to identify the reliability of existing surveillance data for salmonellosis from Baku, Azerbaijan. We examined the 2006-2008 surveillance data on gastroenteritis notifications from the three children's infectious disease hospitals in Baku, and the three corresponding district Centers of Hygiene and Epidemiology (CHE) and the Republican CHE (RCHE). Assessment of the laboratory Quality system in the hospital laboratories CHE and RCHE laboratories were conducted using the CLSI questioners on 12 quality system essentials. In the 3 Baku hospitals, 1% of 8,669 suspected cases of gastroenteritis were confirmed as salmonella infections. Twelve other pathogens were confirmed in 13 % of cases including *Proteus, Escherichia, Streptococcus, Staphylococcus, Pseudomonas, Citrobacter, Klebsiella, Vibrio, Hafnia and Candida* species. In 86% of all suspect cases no pathogens were found and these cases were registered as gastroenteritis of unknown etiology. Analysis of the data shows that of 25,936 primary notifications, 20% were received late (>2days). Among these, 257 (0.99%) were notifications of salmonellosis. Laboratories were found to lack quality system. Case definition for salmonellosis was absent..

Key words: salmonella, Widal test, case definition, RCHE, laboratory quality system Word count: 268

Introduction

According to the Centers for Disease Control (CDC) each year 1.4 million people are infected with salmonella in the USA (http://www.cdc.gov) 1,333 cases of salmonella were register in Azerbaijan during 2006-2008. Among them, 98% are children under 14 years (https://www.stat.gov.az).

Salmonellos is acute intestinal infection that affects gastro-intestinal system with the development of intoxication and water-electrolytic disbalance, rarely manifesting as a Typhoid or septicopyemic form. Causative agent - gram-negative motile bacillus from Salmonella genus, family Enterobacteriaceae, which contains more than 2300 serovars, separated by a set of somatic O-antigens in 46 serogroups. The structure of H-antigen defines about 2,500 serovars.The mechanism of transmission - through fecal-oral, the main route of transmission - contact, water, food, mainly through animal products (https://www.ncbi.nlm.nih.gov/books/NBK8435).

There is also an investigation of the transition of animals from dry fodder to their owners (Behravesh et al., 2010; CDC, 2008).

A 2006-2009 cohort study of non-Typhi Salmonella in Malaria-endemic villages and towns with a population of 55,000 in Kenya yielded NTS >85% isolates (Tabu et al., 2012).

One of the methods used in the diagnosis of Salmonella Paratyphi A is multilocus sequence typing (MLST), which has not proven itself according to the results of a study conducted in China. So, MLST method showed low discrimination power (Han et al., 2010).

In Brazil, Salmonella ser. A study of the antibiogramm of Typhimurium DT193 strains shows that antibiotic resistance persists for years, and it is important to monitor it closely (dos Reis et al., 2011).

A Norwegian study suggests that domestic Salmonella control should include tourists, and epidemiological assessment of tourist hotspots may help prevent potential outbreaks (Emberland et al., 2012).

Infections often reported only in the tourists' home countries and public health authorities in the tourist destinations may not be aware of the problem. Further collaboration between national institutes of public health in Europe is needed to detect outbreaks occurring among tourists (Guerin et al., 2006; Nygard et al., 2004).

In one of the studies conducted in western Europe, it is shown that drastic changes have occurred between the phage types of Salmonella enterica Enteritidis serovars, which can have a great impact on public health (Fisher, 2004).

The fact that eggs, which are the first food consumer products in the United States, cause the spread of salmonella serotypes, once again emphasizes that this problem is a serious public health problem. Thus, developing countries should take

comprehensive measures against salmonella and organize control (Hogue et al., 1997)

	2006	2007	2008
Azerbaijan	-	4.98	4.8
Georgia	4.96	7.42	3.67
Armenia	9.37	9.73	12.85
Kazakhstan	-	20.91	15.45
Kirgizstan	-	13.13	10.3
Russia	31.94	35.66	35.87
Bulgaria	13.73	15.43	21.39
France	-	9.13	11.79
UK and Northern Ireland	22.54	21.56	18.85

Salmonella is one of the most common food borne disease of human, as well as an important cause of morbidity, mortality and economic losses worldwide. Significant increase of morbidity associated with the spread of bacteria (*Salmonella enterica*) has been registered during recent years. The highest incidence rate is among young children. Currently, the main sources of infection of typhoid fever worldwide are chronic carriers of the bacteria. The bacteria are released into the environment with excrement and are spread through water, milk, food. Unlike most enteric infections salmonellosis is spread in large cities of developed countries that allow us to assign them to a group of "diseases of civilization". The most common nosocomial spread of salmonella is linked to direct transsmition trougth contact of antibiotic-resistant strains of *Salmonella typhimurium* or *S. haifa*. Differential diagnosis of intestinal diseases is difficult because of nonspecific clinical symptoms. Therefore, to confirm the diagnosis an isolation of salmonella either from the blood (within 1-2 weeks of illness) or from the urine and feces - in 2-3 weeks is necessary. During the manifestation of the disease roseola, spinal, duodenal fluid, pus, sputum also has diagnostic value (Youssef et al., 2010).

According to surveillance data the incidence of salmonellosis is low in Azerbaijan.

However, the true burden of salmonellosis is likely higher because of a large proportion of Acute Gastrointestinal Infection (AGI) with unidentified causative pathogens (Table 1).

In 2006 and 2007, 95 % from total of the enteritis was registered among children under 14 years, and in 2008 - 40-87, 5 %.
We have evaluated the surveillance system on Salmonella infection to identify the reliability of existing surveillance data on salmonellosis.

Table 1. Incidence rates for different diarrheal diseases (Cases per 1000population), Azerbaijan, 2006-2008

Table 2. Incidence of salmonellosis in different countries of CIS and Europe for 2006-2008 years (cases per 100 000 population) (http://data.euro.who.int/cisid).

Names of diseases	2006	2007	2008
Salmonellosis	0.06	0.05	0.04
Dysentery	0.03	0.03	0.01
AGI with determined agent	0.2	0.3	0.3
AGI without determined agent	1.1	1.3	1.1
typhoid fever	-	4.98	4.8

Materials and methods

Evaluation of the surveillance system was conducted using the U.S. CDC guidelines. In addition, data on notifications of enteritis were obtained from the three children's infections disease hospitals in Baku and the three corresponding district Centers of Hygiene and Epidemiology (CHE) and Republican CHE.

Subsequently in this article, these facilities will be mention as hospitals 1,2, 3.

In each hospital notifications of suspected and laboratory confirmed cases of enteritis have been analyzed for 2006-2008 year and portion of confirmed Salmonella among them was determined.

In the district CHE corresponding those hospitals, same data for the same years were obtain. In the hospitals data was obtained from hospital and laboratory registration books.

Assessment of the quality Control in the hospitals laboratories and CHE laboratories were conducted using the questioners which were created by WHO on 12 elements of quality. Elements of Quality Control in laboratories were evaluated based on guidelines “Laboratory Quality Control Management System in services which were developed by Centre for Disease Control and Prevention (CDC) in collaboration with WHO and Clinical and Laboratory Standard Institution (CLSI).

Results

Description of the System

Routine surveillance for acute intestinal diseases exists in the country carried out. All medical facilities that admit patients with AGI, were involved in the surveillance.

All medical-prophylactic facilities of the Ministry of Health are accessible to the population. Supervisory Authority, responsible for the personnel at the operational level, are municipal Health Departments, heads of Regional Hospitals, directors municipal or regional Centers of Hygiene and Epidemiology. Medical services are provided according to the catchment areas, based on geographical distribution of the population, and also entire population has an access to specialized medical institutions. In addition, there are medical facilities providing medical service to the Ministry of Internal Affairs, National Security, rail, air, water transport, oil campaigns, as well as private medical facilities. Case definition for various diarrheal diseases, including salmonellosis does not exist. According to the International Statistical Classification of Diseases (ICD-10 revision 1995), following diseases are registered in the group of AGI:

1. Typhoid fever and paratyphoid fever – A, B, C
2. Other Salmonella infections;
3. Shigellosis;

Other bacterial intestinal infections, including rotavirus and intestinal Yersiniosis infections;

5. AGI caused by unidentified pathogens.

The form №1 of the State Statistical Committee, the State form № 03112220, approved in 04.12.2000 № 72 g / 5. Shelf life - 25 years. The Ministry of Health developed a guideline for Surveillance and Control of Infectious Diseases in Azerbaijan in 2010, which includes case definitions of the 14 infectious diseases, including salmonella, but the document is not adopted yet.

All medical facilities, all districts CHEs and MOH are involved in the surveillance system (Diagram #1)

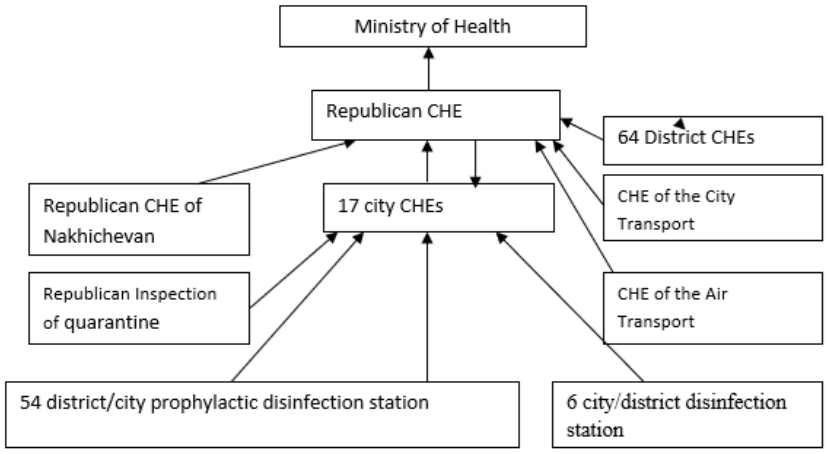

Figure 1. Agencies involved in the surveillance system.

Patient admitted to hospital with AGI, is hospitalized at the same day and is registered in the logbook № 60 /y (A4 paper size, 96 pages retention period - 3 years.) and clinical specimen is collected. The primary notification is sent to the district or republican CHE. Once the patient is diagnosed, secondary notification is sent to the district or republican CHE. Republican CHE registers primary notifications as well as secondary notifications. District CHE initiates passive Epi investigation if 3 cases of diarrhea are reported before confirmation; contacts are under monitoring within 7 days. Passive Epi investigation is held for a single diagnosed case. IF of 5 or more cases of salmonellosis are registered an active Epi investigation is conducted. Test results are issued within 18-24 hours. For examination of contacts their stool specimens is cultured. By order of the # 1282. 29/Xİİ/1978. (Item 2,1-2,3) "Order of registration of persons subject to a individual reporting in the Sanitary and Epidemiological Centers “all emergency notifications (#058 / y, paper size A5, shelf life 1 year) is promptly reported by phone and notification has to be sent within 12 hours (paragraph3.2) to the Territorial Sanitary and Epidemiological center regardless of place of residence the patient.

Sometimes there are deviations from this regulation. If the patient is a resident of the same district where the hospital is located, the primary and secondary notifications are filled in two copies for Republican or district CHE. One of the copies is sent to the district CHE, and the second one – to the republican CHE.

If the patient is the resident of other area then messages by phone both primary and secondary urgent notifications by hospital are sent only in RCHE, and RCHE in turn informs territorial CHE by phone. Laboratories of hospitals do not have the responsibility to notify cases independently. (Diagram 2, 3.)

Types of epidemiological investigation depend on number and type of diarrhea cases (Figure 2).

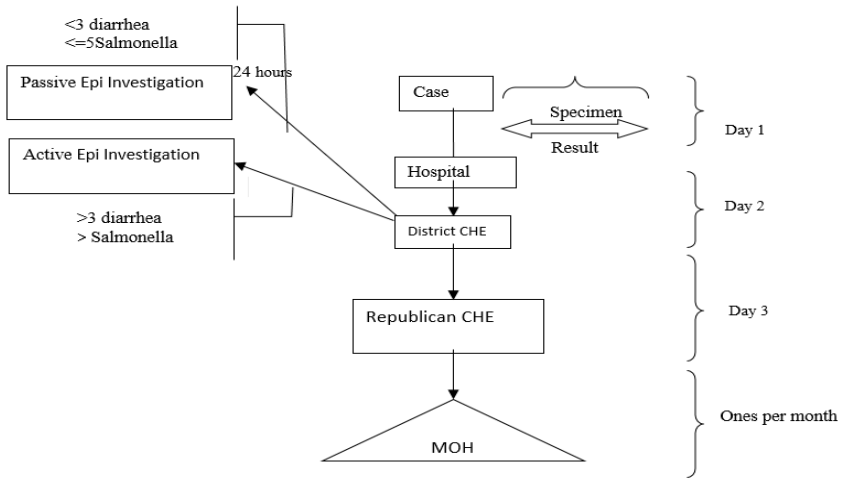

Figure 2. How the cases get to the system

In addition to the infectious disease hospitals of Baku that send primary and secondary notifications direct to RCHE, all district infectious hospitals send primary and secondary notifications direct to RCHE through District RHE. Primary and secondary notifications are sent to district and RCHE. (Figure 3).

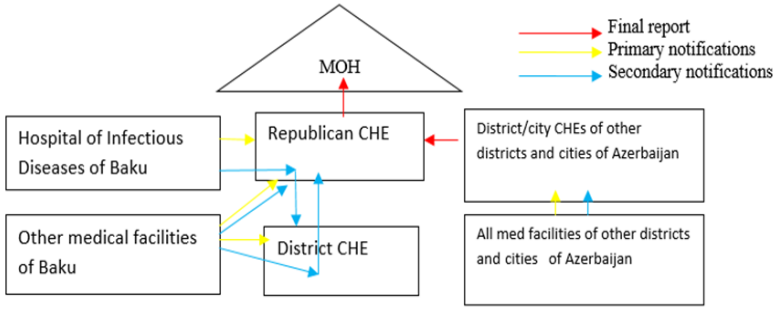

Figure 3. Information flow

The surveillance covers the entire population. Data collection takes no more than 3 days. There are 6-8 epidemiologists employed at the epidemiological departments of the regional CSEs. Each epidemiologist has determined place under their supervision and for every case of enteritis, caused by Salmonella or any other enteritis unknown etiology, they have to conduct epidemiological investigation together with their assistants. When the investigation is finished they draw up a statement. But there are no existing regulations on reporting.

All information is stored in paper form. Electronic system (EIDSS) to transfer information currently exists at the inception stage. Enteric Department of the RCHE provides data analysis. Head of Enteric Department at the RCHE analyzes the data on extensive indicators (growth, reduction of the disease) monthly, intensive indicators, such as age and social groups, are analyzed annually (for 100000 population). The RCHE prepares monthly and annual reports and sends them to the Ministry of Health on Form #1. The Department of Statistics at the Ministry of Health analyses these reports and if it is necessary, publishes in the journal "Medicine".

Results of the evaluation of laboratory diagnostics

Laboratory confirmation of Salmonella was based on serology or culture. However, after serology no culture was done. Although, serology test is not considered as confirmatory test, results of analysis classified as confirmatory results, as well as in culture.

The laboratories of Baku for diagnostic purposes use Vidal serological reaction and indirect hemagglutination reaction with O, H, and Vi-erythrocyte diagnostic (PHA). During the Vidal test bacilli are bound (agglutinated) by patient's sera in two weeks. Although PHA in comparison with Vidal reaction is more sensitive and easy to perform, the diagnostic value of Vidal test is inferior to the isolation of the agent. If the isolated cultures of this testing dissolve lactose or urea of the media within the first day, the investigation is testing can be completed and test result is considered negative. Otherwise, testing continues and on day 3 and obtained data allows coordination of the testing results. All strains suspected as pathogens, can be checked for agglutination with appropriate antiserum. Comparisons of all the signs derived from the testing, morphological, cultural and biochemical characteristics allow selecting the serum for the final identification of culture of agglutination tests.

For patients with diarrhea and fiver blood serological tests, such as Vidal Test and PHA, are required. For patients without fiver stool culture is considered as a "gold standard". Blood usually collected at the hospital and tested at the hospital laboratory. However, when its necessary samples sent to other places for testing. The hospital laboratory doesn't perform stool culture. There is not algorithm for salmonella testing in place.

Based on performed studies[5] sensitivity and specificity of the Vidal test are very low, very often gives cross-reactions. It is considered as a screening test. Without isolation of the causative agent, it is impossible to evaluate result as confirmed for Salmonella.

Results of quality control in visited hospitals Laboratories.
Process control

In laboratory do not have SOPs (standard operational procedures) on gathering of tests. Also there is no separate room for reception of the blood specimens. Labeling blood specimens differs in different hospitals. Patient's name and surname, or the specimen number written on the specimen and on a piece of paper name, surname of the patient. Amount of the specimens received. Positive specimens are stored in the refrigerator approximately. After reception of the blood, specimens did not processed immediately, until certain for a week. Destructions of samples made in 3 % solution chloramines. Side-altars for positive and negative controls are not established. Values of the analysis it is not supervised with use of a card of Levi-Dzhesinga or, with what or other cards.

Each control isn't carried out within 30 days. Also, the average and standard deviation of control materials (1SD, 2SD, and 3SD) isn't measured.

Assessment

Neither external, nor internal audit is conducted in laboratories. There is no quality assurance manager, and specifications of Standard Operational Procedures (SOP). The information on confirming assurance of quality and its comparison with previous monitoring of quality is not conducted. Disruption of the system or a deviation from procedures is not defined.

The equipment

In the visited laboratories the following equipment was found: the autoclave, thermostats 37C, a centrifuge, the Phage-meter, but the plan on equipment service is absent. In all three hospitals control over equipment parameters is made when failure in equipment system occurs. Regular control is not made. The tables of a temperature mode for the thermostat are not checked, accuracy of indications of the indicator of the thermostat are not checked either. Equipment preventive maintenance (regular cleaning, adjustment, replacement of parts) isn't carried out. Documents or the written reports registering regular service, check of work, calibration, debugging, and service of manufacturers do not exist.

Purchases and inventories

In all three hospitals the no any program on inventory and control over inventory exists. The usages of materials aren't always available and balance between presence of reagents and the validity expiry of aren't. In the absence of reagents testing is refused. Only in hospital 1 was collected studying of requirements for

testing was spent, and a list of all analyses conducted in the laboratory and, the quantity of reagents for each analysis was counted up, however, no other expendable materials were counted,

Documents and Records

In all visited hospitals records of admitted patients, specimens and record on the personnel were detailed, exact and clear. Records on maintenance service, equipment listings did not correspond to standards. Records on quality assurance and on SOP were absent. In two of three visited hospitals archive of documents and records partly corresponded to existing regulations. In of the one hospital all documents were stored, or were, scattered on different rooms and tracking of documents was difficult. In all hospitals their losses of records were occurring.

Occurrence Managements

The plan for emergency situations does not exist in any hospital.

Information Managements

In all three hospitals, the basic information is stored in the paper form. The information on patients accessible, exact, timely, but unprotected and not confidential. There are no unique identifiers.

The referral form on the analysis does not meet the requirements ISO 15189 and includes the name and a surname of the patient and the doctor, an establishment name, date of a direction and the test name includes. However, it does not contain specimen collection date, contact numbers of the doctor, the patient and establishment.

Laboratory registers had 90 % of all components, including identification number, specimen collection date, referral date, testing date, name, surname and age of the patient, the test name, test result, date of result and the signature of the doctor. However, there is no name a surname of the laboratory doctor and contact numbers of the patient in the forms.

In information management there were following gaps in all hospitals:

1. Incomplete data entry
2. Not clear handwriting
3. Not readable traces from an inscription on other side of the paper
4. Archive did not correspond to quality requirements
5. Forms are incomplete

Process improvement

In none of these hospitals the sources of errors identified, and no plan is established for improvement and internal audit carried out.

Industrial resources and safety

Registration tables are in laboratory in the hospitals №2 and №3. Patients are allowed to enter the laboratory, and the door remains opened for a long time. There is no room for a specimen collection. Ceilings low and the ventilating system does not work. The surface of walls and ceilings corresponds norms. Walls are the covered with washable paints. Floors are from a material that can be easily washable and treatable. Laboratory tables are easily washable, resistant to chemical substances and disinfection means. There is no cleaning schedule. Procedures on safety and the general protection do not exist. Patient and specimen movement within the laboratory inadmissible according to standards. Patients and specimens have overlapping tracks. The laboratory project does not correspond to 2th level biosafety.

The organization

The laboratory organization is clearly defined, but there are no functional charts with accurate distributions of duties. Implementation and monitoring of elements of quality assurance in laboratories is not carried out. There is no evaluation sheet with records of discrepancies and the gap analysis.

The personnel

In laboratories 2 laboratory doctors, 3-4 laboratories, 1 cleaner on the average work. There are no duty regulations and duties of each employee (ISO 15189:2007) and written rules and the procedures written by the management. Certification of employees is not conducted. All the employees are sent to the training courses every 5 years. Employees do not receive the award, privileges, gratitude and have no flexible schedule. Direct supervision over records, results of professional testing or recheck and a competency evaluation aren't carried out.

Customer Service

For satisfaction of all requirements of customers it is necessary to have not only skilled and competent professionals, but also precisely and strictly corresponding system to all world standard requirements.

Data from the hospitals:

In the 3 hospitals 1% salmonella confirmed cases was registered among all suspected cases of enteritis. Other 12 pathogens were confirmed in 15 % of cases. In 84% cases none of the pathogens had been found and these cases were registered as enteritis of unknown etiology. The information transfer structure is carried out on three levels. The time spent on the diagnostics was maximum 3 days.

Timeliness

An equal number of notifications in 2006 were selected from all the hospitals to assess the timeliness. The notifications were divided into 4 groups. (Table 1, Chart 1)

Analysis of the data shows that of 25 936 primary notifications 20% were received late, along with secondary notifications. Among those, 0.99% (257) of them were notifications of salmonellosis. 30% (7780) of reported cases of salmonellosis were residents of Baku, and 70% (18 156) cases were from other regions of Azerbaijan, who come to Baku for treatment.

Table 3. Comparisons of timeliness of notification in the three hospitals, Azerbaijan, 2006.

Timeliness of notification	**Number of notifications**	
	N	%
Reported in the same day	36	12
Notification with 1 day of delay	92	30
Notifications with 2 days of delays	47	15
Notification with 3 and more days of delays	125	41

Hospital 2 and 3 has more number of notifications with delay of more than 3 days in comparison with hospital 1 (Chart 1).

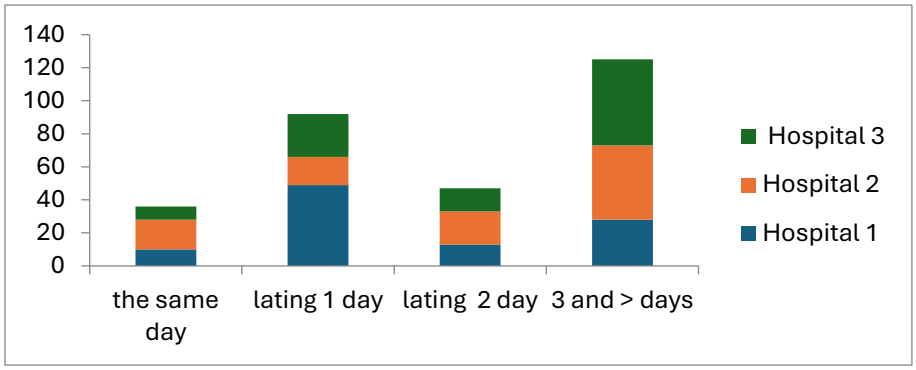

Figure 4. Comparisons of timeliness of notification for 2006 from three hospitals, Azerbaijan, Baku 2010

In each hospital the data on suspected and laboratory-confirmed cases with a specific diagnosis was reviewed. The highest rate of detection of Salmonella (6,5%) was in the hospital № 2. (Table 2, Chart 2).However, the number of admitted patients with OCF in the hospital № 2 was lower than in the hospital № 3.

Table 4. The proportion of laboratory-confirmed Salmonella enteritis among suspected cases in the three children's hospitals for the 2006-2008 year, Azerbaijan

Hospital Name	Suspect cases	Salmonellosis		Other organisms		Enteritis unknown etiology	
		n	%	n	%	n	%
Hospital1	7440	31	0,4	824	11	6585	88
Hospital 2	1024	67	6,5	324	31	633	62
Hospital 3	1223	3	0,3	335	27	885	72
Total	9687	101	1	1483	15	8103	84

Hospital №3 is located in the center of the city and most urban patients as well as patients from the region are seeking care there. Although, the site for medical services is selected by the patients, notifications occur according the territorial principle.

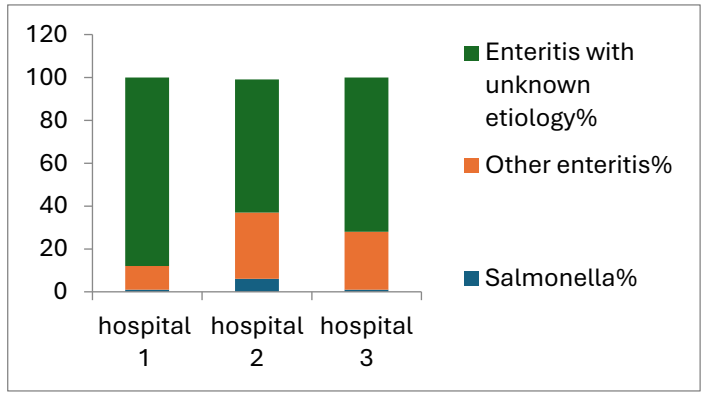

Figure 5. Proportion of laboratory-confirmed salmonellosis among suspect cases of enteritis in three city children's hospitals in Baku, Azerbaijan, 2006-2008.

The analysis of primary and secondary notices from these three hospitals at level of corresponding RCHE during 2006-2008 has shown distinctions with the data about notification submitted from these hospitals. (Table 3, Chart 3).

Table 5. The proportion of confirmed Salmonella enteritis among suspect cases of enteritis in three district CHE of Baku, Azerbaijan, 2006-2008.

Name of CHE	Suspect cases from the corresponding hospital	Salmonella		Other pathogens		Enteritis of unknown etiology	
		n	%	n	%	n	%
RCHE 1	3058	93	3	1229	40	1736	57
RCHE 2	2031	37	1	1132	56	862	43
RCHE 3	3402	36	1	3326	98	40	1
TOTAL	8491	166	2	5687	67	2638	31

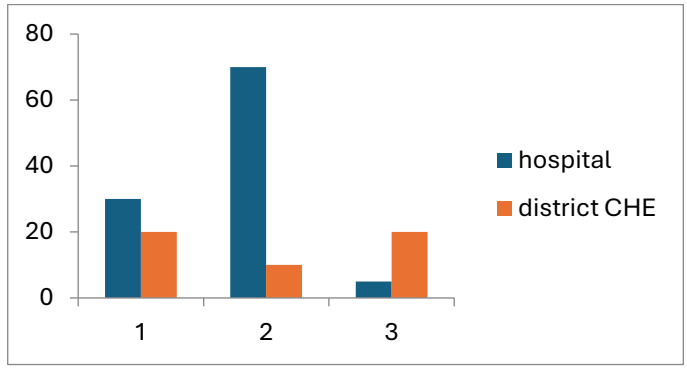

Figure 6. Comparison of notifications from the hospitals and the corresponding district CHE-s.

Quality of the data

In hospitals no standard notification form s is used or required. Besides, forms are incomplete that influences the quality of the data. In hospital 1 notification with 16 variables were used, and out of 100 notifications 72% were completely filled out. In other 2 hospitals were used the notifications with 5-6 variables that was not readable. Out of such 100 notifications only 23% were completely filled in hospital 2 and 16 % - in hospital 3. For some period of time monthly and annual reports on age groups were missing.

Acceptability

Each medical institution works under own discretion, and there are no legal state requirements on providing all reports at all levels. Low salary (150-200 manat) of physicians influences the acceptability of system of timely notification.

Representativeness

Being based on that fact that the Vidal test is a screening test with low sensitivity and specificity, the probability of losing of true cases is high. The number of the

cases registered in hospitals significantly differs from number of the notifications receives in RCHE and DCHE. If differences were in reduction (in hospitals more than RCHE or DCHE less) it would be possible to think that cases simply are not informed completely. But the number of notification changes in reduction and in increase.

Simplicity

The three-level structure of information flow complicates system, slowing down efficiency of actions.

Usefulness

Defines the tendencies, identifies occurrence of disease, and detects outbreaks. Triggers epidemiological investigations directed on control and preventive measures.

But does not reveal the risk factors associated with occurrence of disease and

does not allow to estimate efficiency of actions for control. Low simplicity and acceptability allows considering that usefulness of system surveillance is not high.

Limitations of surveillance evaluation

Absence of corresponding variables in the forms of different level does not allow evaluating all attributes of the system. Lack of completeness of the collected data and the analysis of the surveillance data makes difficult to identify true occurrence of salmonellosis.

Data is not stored for a long time, and not all the elements are completed. Surveillance data is accessible only with a formal permission that takes quite a long time.

Discussion and Recommendations

The proportion of laboratory confirmed salmonellosis by surveillance data is low compared to the data from other countries. However, the gaps found during evaluation of surveillance puts this data under suspicion. Due to existing gaps in data collection, lack of timeliness of notification, the big difference in number of notification between hospitals and corresponding CHE, testing specimens with screening test (Vidal) for confirmation of salmonellosis, allows to suggest much more high burden of salmonellosis than was revealed by surveillance.

The differences found in number of notifications between hospitals and CHE can be explained by duplication, and by the fact that patients are going to regional CHE laboratory without the referral from hospitals. This fact should increase the number of reported l cases. However, the number increases and decreases. The decrease (in

hospitals more than RCHE) possible to explain differences by failure to notify all cases. In all three visited hospitals a high proportion (41 %) notifications were delayed more than 3 days. This reduces the timeliness of surveillance system, thus, reducing an efficiency of implemented measures. There is no approved confirmatory test for the country. All system is based on screening Vidal test with low sensitivity and specificity. In addition, if cases with negative testing results registered, would allow calculating a PPC of physician's diagnosis.

Identified gaps in the quality assurance system of laboratories also affect low detections of cases of salmonellosis.

Development of case based database would help in outbreak investigation. The electronic notifications of cases would allow improving timeliness. Implementation of EIDSS system would improve the surveillance system. EIDSS includes data collection of case-based data on diseases, including the demographic and geographical information, the data of the laboratory testing, preventive measures, and transfer to other administrative levels. The information is stored safely and can be used for retrospective analysis. EIDSS has modular structure and contains 8 modules.

Development of the law granting the right to laboratories independently to notify cases of the disease and increasing of motivation of physicians would raise number of notified cases.

The approval of the confirmatory test would improve revealing true cases of salmonellosis. Since no more sensitive screening test exist, implementation of more sensitive case definition would increase of detections salmonellosis and would catch the cases missed by physicians.

Development of suspected and confirmed case definitions for salmonellosis would reduce false negative cases.

Adopting the law obliging reporting of outbreak investigational would improve analyses, evaluated a quality of investigation, and to create maps of regional distribution of outbreaks, reveal tendencies and seasonal distribution.

In laboratories it is necessary to create a database with following variables: date and a place of primary reference, date and a place of a primary direction, primary diagnosis. It would help in revealing of facilities with the delayed diagnosis and misdiagnosis. The name and a surname of the doctor who made the present diagnosis would held in identifying competency degree of doctors.

For revealing of timeliness of patient's seeking medical care, in the notification form and in the form of laboratory results is necessary to add following variables: date of a primary symptoms, date of the primary referral. The knowledge of the reasons for

not seeking medical care would help to learn public opinion and degree of trust to the existing surveillance system which, in turn, would help to reveal gaps in supervision system.

Introduction of such variables as, place of seeking medical care, date of the primary diagnosis, date and a place of laboratory referral, and also, result and date of result of the primary testing would help to find out in what facilities and on what degree primary suspicions of doctors prove to be true.

Adding of variables on confirmation or rejection of early diagnosis at the admission to the hospital would allow finding the reason for high proportion of suspected cases. Development of registration book on outbreak investigations and preventive measures primary notification would allow to evaluated efficiency of the surveillance system.

Recommendations about control by quality in laboratories

The reference laboratory with appropriate QMS standards is already built in Azerbaijan. Presumably, the Reference laboratory will operational in 2012.

To maintain control of process development of SOPs for all procedures in the laboratory, from transportation of the specimen until destruction, and storage of SOPs in an accessible place for all employees (on a wall etc.) is necessary. It is necessary to allocate also a separate room for specimen collection. Implementation of identification number and maintenance of confidentiality of labels, and testing immediately after receives of the specimens would provide protection of the data and reliability of results.

Establishment of limits for positive and negative controls, use of Levi-Jennings charts for controls and monitoring the performance of controls during 30 days period, would increase the reliability of results.

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