Assessment of Health Information System of Diseases Surveillance At Al-Azhar University Hospitals in Cairo

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Abstract: Background: Developing effective and efficient surveillance and response systems is important for national, regional and global health security. Furthermore, functioning surveillance systems are necessary for the success of global health initiatives. Objectives: To upgrade health information system in Al-Azhar University Hospitals and maximizing its role in diseases surveillance and utilization of collected data through assessment of the multidimensional aspects of health information system and reinforcing its role in support of diseases surveillance. Subjects and methods: A cross-sectional study was conducted in Elhussien and Bab-elshearia university hospitals selected randomly from Al-azhar university hospitals in Cairo. The sample included 56 non-medical personnel which were responsible for diseases surveillance and 360 doctors & nurses selected by stratified random sample from selected departments which are related to notifiable diseases. Results: The results of the present study showed weak functionality levels of data analysis, dissemination of information, feedback and presentation of information. The overall levels of utilization of information, supervision and training in disease surveillance are also weak. All departments send paper forms to the higher levels and don't use electronic information system in disease surveillance. The majority of the studied doctors and nurses notified the health authorities on notifiable diseases but only about have of them follow the guidelines and ever saw a disease notification form. Recommendations: The study highlighted the need to assign adequate human resources for disease surveillance units within departments and should be equipped with basic information & communication technology equipment. Continuous training for the medical and non-medical staff should be given regularly in a planned manner.
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1. Introduction

According to ***Wager et al., (2009)*** Health information system (HIS) refers to a system that captures, stores, manages or transmits information related to the health of individuals or the activities of organizations that work in the health sector**.**

Health information systems are a key building block of the health system ***(WHO, 2007).*** They are responsible for generating timely and reliable data which is essential for evidence-based health service delivery and management. While there is growing recognition that 'informed decisions are better decisions' ***(Abusayeed et al., 2010),*** the sound health information required for decision-making is often unavailable and underused in low- and middle-income countries ***(Chaulagai et al., 2005).***

A health information system provides information for the management of health programs and services. In particular it is essential for monitoring the health situation, the performance of promotive, preventive and curative health services and activities, and the availability and utilization of health resources ***(WHO, 2000: a).***

The information obtainable through health information system may be usefully categorized into these interrelated and possibly overlapping subsystems:

- Epidemiological surveillance (e.g. case and outbreak notifications);
- Service records and reporting (from community health workers and health care delivery facilities);
- Program monitoring and evaluation.
- Administration and resource management information systems (e.g. budget, personnel, supplies, etc.);
- Vital registration (e.g. births and deaths) ***(WHO, 2000).***

Gaumer et al., (2008) stated that most attempts to improve health systems include some attention to the collection and retrieval of better data on patients. Anecdotes suggest that the failure to implement these elaborate designs relates to many factors, including cost, management requirements, and the reluctance of providers to comply with reporting requirements. This reluctance can stem from failure to see benefits for doing so, and extra burdens stemming from redundant reporting requirements. This has certainly been the case in Egypt.

Egyptian health information system (HIS) was started before 1989. It was a core process designed from the bottom up and covering only facilities operated by the Ministry lacking the capacity to incorporate data from other health care providers. The new information system is designed from the top down to incorporate some programs such as urban and rural health care systems based on their information demand ***(Cressman, 2000).***

Surveillance in medical practice is "the ongoing systematic collection, analysis, interpretation and dissemination of data regarding a health-related event" ***(Choi, 2012).***

Arana (2009) pointed out that Surveillance is the foundation of all efforts to understand and control & prevent disease. Once a health-related event occurs, such as infectious, chronic or zoonotic disease, injury, adverse exposure, risk factor or protective behavior, or other surveilled events, the cases will be identified and analyzed by place, person, and time. Then the report generation and dissemination will be initiated.

Developing effective and efficient surveillance and response systems is important for national, regional and global health security. Furthermore, functioning surveillance systems are necessary for the success of global health initiatives ***(Ibrahim & Al Bar, 2009***).

This study is significant as it may assist health information staff, health program managers, hospitals managers, supervisors and clinicians to optimize the quality of information, strengthen best practices and identify and rectify areas that need improvement in data management.

The present study focuses mainly on health information system assessment in order to assess the multidimensional aspects related to health information system of diseases surveillance to maximize its role in decision making concerning prevention and control of these diseases. Also, the results of the study may be used as a guideline in developing and/or implementing action plans for utilization of collected data of diseases surveillance or other health information concerns.

2. Personnel and Methods

The present study deals with assessment of health information system of diseases surveillance at Al-azhar university hospitals in Cairo.

Research Setting

This study was conducted in two university hospitals which are selected randomly from Al-Azhar university hospitals in Cairo: Elhussien, Bab-Elshearia, Elzahraa and Madinet Nasr Specialist Hospital. The two chosen hospitals were:

- Elhussien university hospital: one of the largest hospitals in Cairo, 1023 beds, it is also one of the teaching hospitals affiliated with Al-Azhar University.
- Bab-Elshearia university hospital: also one of the largest hospitals in Cairo, 1075 beds, it is also one of the teaching hospitals affiliated with Al-Azhar University.

Research design

A cross-sectional descriptive study design was carried out to investigate and assess the current topic and the related study variables.

Target population:

- Medical personnel: Physicians and nurses whose duties involved disease surveillance related aspects.
- Non-medical personnel: participating in data manipulation or compilation of diseases surveillance data from various departments.

Variables of the study:

- Personnel: demographic and professional characteristics.
- Adequacy of resources.
- Data collection.
- Accuracy of data.
- Completeness and timeliness of reporting.
- Transmission of data.
- Analysis of data.
- Presentation of data.
- Utilization of information.
- Supervision and training.
- Knowledge, attitude and practice of medical personnel towards disease surveillance.

Tools of the study:

1- **Facility checklist**: to provide information about the availability of health information system resources (equipment & availability of registers, forms and human resources).

2- **Researcher administered standardized and pre-coded questionnaire to disease surveillance personnel:** The items of the questionnaire were guided by the WHO framework for monitoring and evaluating surveillance and response systems for communicable diseases and PRISM framework after modification to be suitable for university hospitals.

- The questionnaire items covered the following aspects:

- Demographic and professional characteristics of the studied personnel.
- Assessment of quality of data (accuracy of data, completeness and timeliness of reporting.
- Assessment of health information system processes (case detection, registration, reporting & transmission, processes for checking data quality and analysis of data).

- Assessment of utilization of information (dissemination of information, presentation of information, feedback and action taken).
- Assessment of supportive functions (usage of surveillance manual, supervision and training).

3- Self-administered questionnaire to physicians and nurses:

- The questionnaire items covered the following four aspects:

a) Demographic and professional characteristics of the studied physicians and nurses.

b) Knowledge: defined as the cognitive aspects doctors and nurses have about disease surveillance, these aspects subdivided into: disease surveillance components, targets of diseases surveillance and their knowledge about diseases which need immediate or weekly notification.

- **Criteria for assessment:**

This domain consisted of 20 questions, five questions for components of diseases surveillance, ten questions to ask about targets of diseases surveillance and the last five questions to ask about timing of notification. Correct answers received one point and incorrect answers received no score. The total scores of each of the respondents were grouped by applying Bloom's method into three levels using the following criteria ***(Bloom et al., 1971)***:

- Low knowledge level: Less than 60%
- Moderate knowledge level: 60-80%
- High knowledge level: 81-100%.

c) Practices: defined as the actions taken by doctors and nurses towards diseases surveillance and notification. There were 4 yes/no items, covering recommended and non-recommended practices and one item about method of notification.

Sample Design:

a. Sample frame:

In order to have a representative sample design, the sample frame of medical personnel working at the hospital under study was obtained. It includes (1380) doctors and (2375) nurses. It was preferred to make the stratification of the target medical personnel based on their career. This sample frame will provide an access to a proper sample selection.

b. Sample technique:

Allocated Stratified random sampling was used to select the study physicians and nurses with proportionate stratification.

c. Sample size:

- All focal personnel of diseases surveillance (56) personnel from various medical departments and medical statistics department of Bab-elsheria hospital were selected.
- Elhussien hospital didn't contain surveillance units and medical statistics department didn't do disease surveillance.
- The proposed sample size of physicians and nurses is (348). It was selected from doctors and nurses of selected departments which are related to notifiable diseases in Egypt from the selected hospitals using "Epi Info 7" based on the following information:

a. Total number doctors and nurses = 3755
b. Expected knowledge percentage = 50%
c. Confidence limit = 5%

- However the researcher distributed 360 questionnaires to doctors and nurses in the selected hospitals.
- The sample size was represented (9.6%) of the staff, accordingly the number of staff that selected as follow:
- 9.6% of doctors = (9.6 x 1380)/100= 132
- 9.6% of nurses = (9.6 x 2375)/100 = 228

Ethical Considerations:

a. Ethical approval for this study was obtained from the Research and Ethics Committee of Al-azhar faculty of medicine to conduct the research.

b. Concerning the hospital entry and to avoid any problem that may occur during the field work, a written permission was taken from Dean of Al-azhar faculty of medicine and hospitals administrators and an agreement was taken about the final tools of this study prior to its implementation.

c. Verbal consent was taken from the interviewed personnel who participated in the study**.**

d. Respect of data confidentiality was taken in consideration during all study phases.

Pre-test Study:

a. A pre-test study was carried out during June 2016, on personnel of medical and administrative departments of Bab-Elshearia hospital. During the pilot test, preliminarily questionnaires were given to 20 medical and 5 non-medical respondents and two checklists were also examined in 3 departments of Bab-Elshearia hospital. This was followed by a discussion with my supervisors. This helped to check whether or not the data collection instruments and measurement questions met the need to achieve the research objectives. The questionnaires were then revised accordingly, taking particular attention to the flaws and problems identified during pilot testing. The revised instrument was then distributed to the respondents.

b. The instrument of data collection which concerns doctors and nurses was subjected to appraise its validity by:

- Inviting experts to comment on the content validity; the content validity ratio's formula (CVR)

was developed by **Lawshe (1975).** According to Lawshe's table, the critical value in case of 9 experts starts from 0.78. The result of content validity appraisal revealed that all items of this scale were ranged between 0.78 and 1 of content validity ratio.

- Visiting physicians and nurses to test the questionnaire face validity. These procedures were used with the objective of improving the validity and feasibility of the questionnaire

The aim of pre-test study:

- To elicit any linguistic difficulties in the final forms of the questionnaires.
- To determine the time needed to complete the filling of the questionnaire.
- To assess subjects' impression, reaction and cooperation with the study.

Data collection:

- This phase took about 1 year (from beginning of July 2016 to the end of June 2017).
- The data was collected through hospital visits by using the tools of the study.
- The questionnaires were personally distributed by the researcher to selected respondents.
- The selected respondents were requested to complete the questionnaires and assistance was rendered by the researcher.
- The researcher completed the facility checklist by observation of health information system resources (equipment & availability of registers, forms and human resources).
- The researcher carried out about two visits per week for the studied hospitals to collect data.

Data quality control:

In order to ensure the quality and the accuracy of the collected data and to avoid any bias that may occur during the data collection, the data was collected under observation of the researcher himself and under supervision of the supervisors and was reviewed before leaving the sites of data collection.

Data management and analysis:

- The collected data was coded, processed and analyzed by using SPSS {Statistical Package for Social Science} version 18.
- Description of qualitative indicators and additional information obtained during interaction with health workers.
- Mean, standard deviation, range, frequency, and percentage were used as descriptive statistics.
- ANOVA and Chi square tests were used as tests of significance.
- The results were considered significant at $p < 0.05$.
- The results were represented in a tabular forms and charts by using Microsoft word and excel programs.

Limitations and difficulties of the study:

- Some staff members were not cooperative with the researcher since they claimed being busy and not appreciate properly the significance of Health information system.

3. Results

Table (1) shows that, regarding human resources, none of the units contained doctors, nurses or health inspectors, whereas, 100% contains secretaries and only 8.7% contains health information personnel. On the other hand, registers and forms of disease surveillance are found available in all of the studied units. Regarding equipment, regular telephone was found available in all of the studied units whereas none of the units contained fax, access to the internet or electronic information system.

Table (2) shows that 75% of the studied subjects prepare accurate reports and these reports were typically like that in registers. On the other hand 89.3% of the subjects report regularly, 78.6% of them write all items of disease surveillance report and about 96.4% of them send zero report if there were no notifiable cases. Regarding timeliness of reporting, 82.1% of the respondents report monthly before the 5th day of the month, but only 21.4% of them never has been delayed for more than 24 hours to send an urgent notification.

Table (1) Percentage of resources available at surveillance units within departments

Resources	Frequency (N =23)	Percent
Availability of human resources		
Secretary	23	**100.0%**
Statistician	11	**47.8%**
Health information personnel	2	**8.7%**
Doctors, nurses & health inspectors	0	**0.0%**
Equipment		
Regular telephone	23	**100.0%**
Calculator	22	**95.7%**
Computer	16	**69.6%**
Printer	7	**30.4%**
Data Back-up Unit (e.g. floppy, CD)	3	**13.0%**
Fax, access to the internet & Electronic information system	0	**0.0%**
Availability of registers & forms		
Admission register	23	**100.0%**
Discharge register	23	**100.0%**
Monthly surveillance form	23	**100.0%**

Table (2) Distribution of the studied non-medical personnel according to items of quality of data

Quality of data		Frequency (N =56)	Percent
Data Accuracy			
Observed accurate reporting	**Yes**	42	75.0
	No	14	25.0
Reports as presented in register	**Yes**	42	75.0
	No	14	25.0
Data Completeness			
Reporting regularly	**Yes**	50	89.3
	No	6	10.7
Observed completeness of items	**Yes**	44	78.6
	No	12	21.4
Presence of zero reporting	**Yes**	54	96.4
	No	2	3.6
Timeliness of reporting			
Observed reporting before deadline	**Yes**	46	82.1
	No	10	17.9
Urgent notification never been delayed	**Yes**	12	21.4
	No	44	78.6

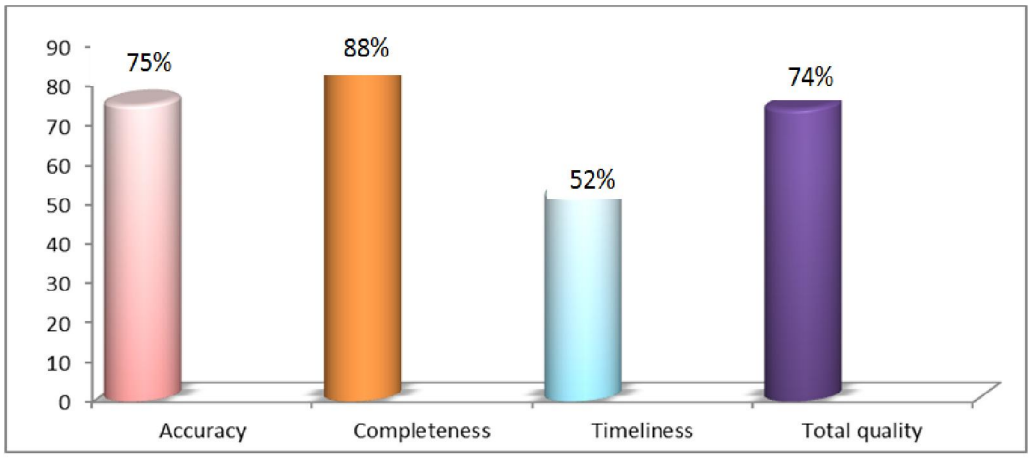

Figure (1): Percent distribution of functionality level of items of quality of data

Figure (1) shows that the highest functionality level of items of data quality was that for completeness of data which representing 88% from the total score and the lowest mean score was that for timeliness of reporting which representing 52% from the total score. The total functionality level was representing 74% from the total score.

Table (3) shows that regarding dissemination of information, 60.7% of the study subjects reported that their hospital produces surveillance reports monthly, 50% reported that their hospital produces surveillance reports quarterly, while none of the subjects reported that the hospital disseminates reports to the departments or to internet and mass media. Regarding presentation of information, only 3.6% of the subjects reported that their hospital displays surveillance information in tables, only 7.1% reported that their hospital displays surveillance information in charts or grafts and no one reported that health information system hospital displays surveillance information in maps. Regarding feedback only 51.8% of the studied subjects received feedback reports in last 3 months, and 42.9% of them received feedback reports that provide directives or recommendations, 17.9% for mobilization or shifting of resources. Regarding discussion and decisions about use of information, all respondents reported that the hospital performs routine meetings for reviewing managerial or administrative matters, 89.3% of them said that official records of these meetings is maintained at their departments, 60.7% of them mentioned that these meetings made discussion about management of disease surveillance, 43% of them mentioned that these meetings made discussion about disease surveillance findings, 25% of them mentioned that these meetings made decisions based on the above discussions and follow-up actions have taken place on the decisions made during these meetings.

Table (3) Distribution of the studied non-medical personnel according to utilization of information

Utilization of information		Frequency (N =56)	Percent
Dissemination of information			
Hospital formulates surveillance reports monthly	**Yes**	34	60.7
	No	22	39.1
Hospital formulates surveillance reports quarterly	**Yes**	28	50.0
	No	28	50.0
Hospital formulates surveillance reports annually	**Yes**	26	46.4
	No	30	53.6
Disseminate reports to all departments	**Yes**	0	0.0
	No	56	100.0
Disseminate reports to internet and mass media	**Yes**	0	0.0
	No	56	100.0
Presentation of information			
Display in tables	**Yes**	2	3.6
	No	54	96.4
Display in charts/ graphs	**Yes**	4	7.1
	No	52	92.9
Display in maps	**Yes**	0	0.0
	No	56	100.0
Feedback			
Received feedback reports in last 3 months	**Yes**	29	51.8
	No	27	48.2
Feedback reports provide directives/ recommendations for actions?	**Yes**	24	42.9
	No	32	57.1
Revision of policies?	**Yes**	18	32.1
	No	38	67.9
Revision of personnel performance?	**Yes**	24	42.9
	No	32	57.1
Discussion and decisions about use of information			
Hospital performs routine meetings for reviewing managerial or administrative matters	**Yes**	56	100.0
	No	0	0.0
Official record of meetings is maintained	**Yes**	50	89.3
	No	6	10.9
Discussion about management of surveillance	**Yes**	34	60.7
	No	22	39.3
Discussion about disease surveillance findings	**Yes**	24	42.9
	No	32	57.1
Made decisions based on the above discussions	**Yes**	14	25.0
	No	42	75.0
Follow-up actions have taken place on the decisions made during the previous meetings	**Yes**	14	25.0
	No	42	75.0

Figure (2) shows that the highest functionality level of health information system processes was that for case registration which representing 84% from the total score and the lowest functionality level was that for analysis of data which representing 46.2% from the total score.

Figure (3) shows that the highest functionality level of items of use of information was that for decision making representing 57.2% from the total score and the lowest functionality level was that for presentation of information which representing 3.66% from the total score. The total functionality level was representing 36.7% from the total score.

Table (4) shows that the mean score of surveillance manual usage was 3.14 ± 1.39 which representing 78.5%, while the mean score of supervision was 2.43 ± 2.25 which representing 40.5% and the mean score of training was 0.46 ± 0.68 which representing only 23%.

Table (5) shows that the mean age of the studied subjects was (30.38 ± 3.38) & (34.01 ± 8.31) for doctors and nurses respectively. All doctors were below 40 years while about 22% of the nurses were

above 40 years. The mean year of work experience was (6.09 ± 3.21) years for doctors and (11.61 ± 8.88) for nurses. Regarding qualification, the higher percentage of doctors (57.6%) obtained master degree while the higher percentage of nurses (97.4%) obtained intermediate education. Concerning departments, (71.2%) and (60.5%) of doctors and nurses respectively were selected from medical departments. Concerning training in diseases surveillance, only (22.7%) and (43.9%) of doctors and nurses respectively had been trained. Regarding previous experience in diseases surveillance, only (10.6%) and (20.2%) of doctors and nurses respectively involved in diseases surveillance activities.

Figure (4) shows that the higher percentage of the studied doctors (93.2%) & nurses (85.1%) reported correct answer regarding timing of notification about meningitis. On the other hand, timing of notification about rubella shows the least proportion of sound knowledge (33.3%) & (34.2%) for doctors and nurses respectively.

Table (6) shows that 37.1% of respondents from medical departments were highly knowledgeable compared to 12.5% of respondents from surgical departments and the association was statistically significant.

Table (7) illustrates that the highest percentage of the studied doctors (86.4%) and nurses (89.5%) notified the health authorities on notifiable diseases. Only 50.6% of them follow the guidelines on reporting of notifiable diseases. On the other hand, only 34.8% of doctors and 35.1% of nurses filled disease notification forms in the past one year.

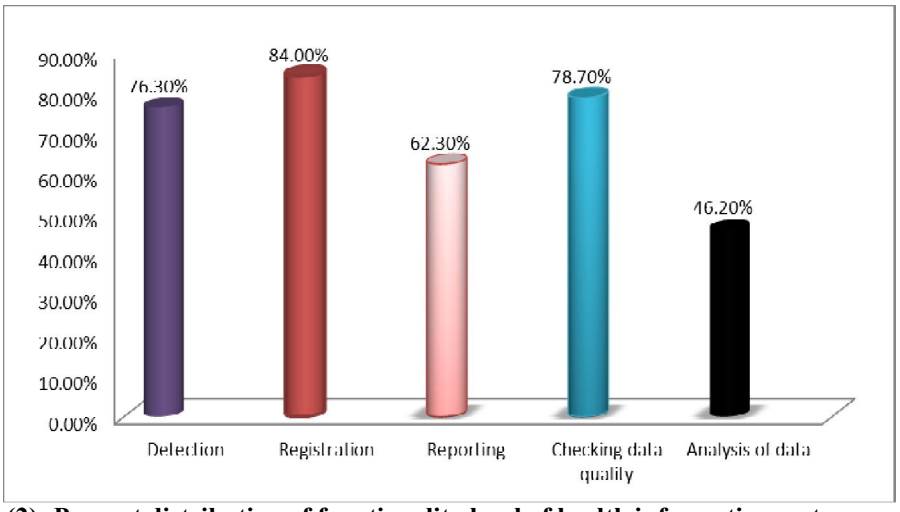

Figure (2): Percent distribution of functionality level of health information system processes

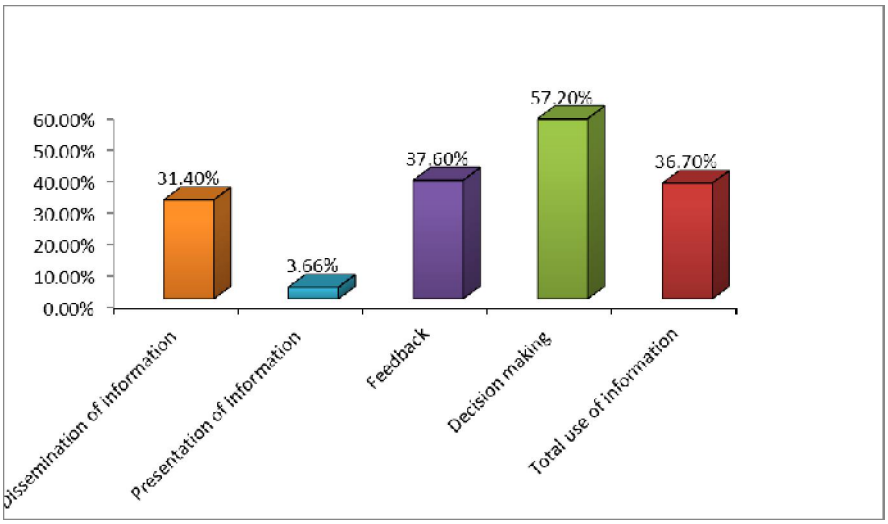

Figure (3): Percent distribution of functionality level of items of use of information

Table (4): Mean scores of supportive functions obtained by the studied sample

Items	Mean ± SD	Percent from total score
Surveillance manual usage (4 points)	3.14 ± 1.39	78.5
Supervision (6 points)	2.43 ± 2.25	40.5
Training (2 points)	0.46 ± 0.68	23.0

Table (5) Distribution of the studied medical personnel according to their characteristics

Characteristics		Doctors	Nurses
		No. (%)	No. (%)
Age (years)	**20-40**	132 (100.0)	178 (78.1)
	<40-60	0 (0.0)	50 (21.9)
	Range	22-37	21-57
	Mean ± SD	30.38 ± 3.38	34.01 ± 8.31
Work experience (years)	1-10	114 (86.4)	140 (61.4)
	<10	18(13.6)	88 (38.6)
	Range	1-13	1-36
	Mean ± SD	6.09 ± 3.21	11.61 ± 8.88
Qualification	Intermediate	-	222 (97.4%)
	Bachelor	28 (21.2%)	6 (2.6%)
	Master	76 (57.6%)	6 (2.6%)
	Doctorate	28 (21.2%)	-
Department	Medical	94 (71.2%)	138 (60.5%)
	Surgical	38 (28.8%)	90 (39.5%)
Training	Yes	30 (22.7%)	100 (43.9%)
	No	102 (77.3%)	128 (56.1%)
Experience in surveillance	Yes	14 (10.6%)	46 (20.2%)
	No	**118 (89.4%)**	**182 (79.8%)**

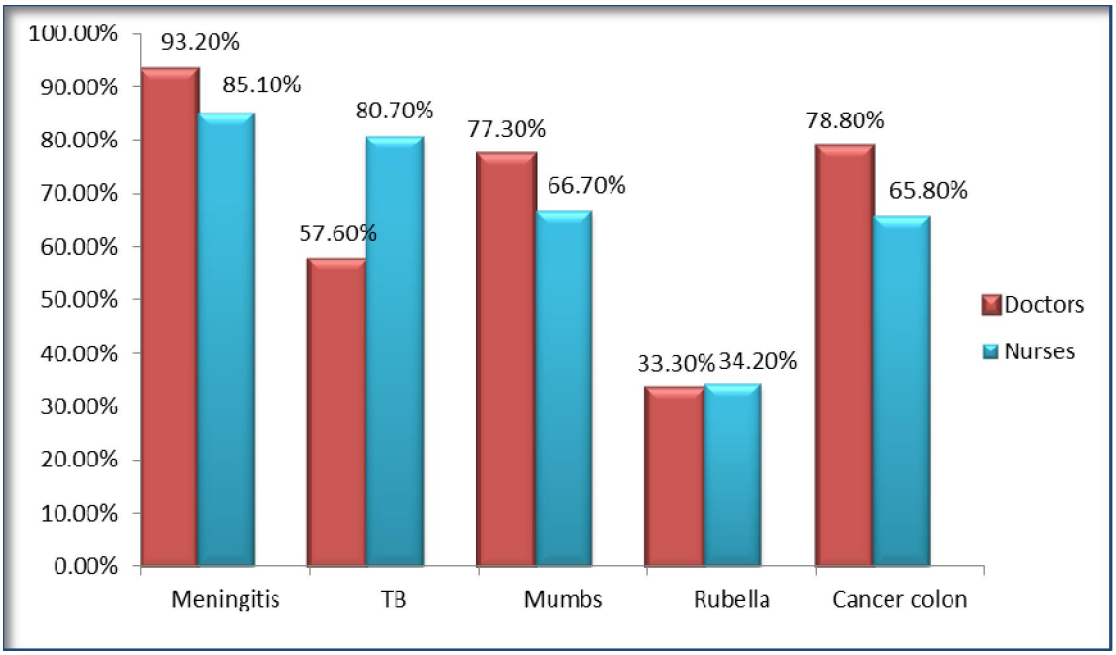

Figure (4): Knowledge of the studied medical personnel about timing of notification regarding certain diseases

Table (6) Knowledge of the studied medical personnel about disease surveillance and notification according to their departments

Department	Knowledge of DSN						χ^2	P
	High		Moderate		Low			
	No.	%	No.	%	No.	%		
Medical	86	37.1%	104	44.8%	42	18.1%	107.6	0.00*
Surgical	16	12.5%	34	26.6%	78	60.9%		

Table (7) Practices of the studied medical personnel of disease surveillance and notification

Practice		Doctors		Nurses		Total	
		No. (%)		No. (%)		No. (%)	
Notified the health authorities on notifiable disease	**Yes**	114	86.4	204	89.5	318	**88.3**
	No	18	13.6	24	10.5	42	**11.7**
Follow guidelines on reporting of notifiable diseases	**Yes**	68	51.5	114	50.0	182	**50.6**
	No	64	48.5	114	50.0	178	**49.4**
Awareness about disease notification form	**Yes**	54	40.9	124	54.4	178	**49.4**
	No	78	59.1	104	45.6	182	**50.6**
Filling a disease notification form previously	**Yes**	46	34.8	80	35.1	126	**35.0**
	No	86	65.2	148	64.9	234	**65.0**
Presence of register for probable and confirmed notifiable cases	**Yes**	76	57.6	160	70.2	236	**65.6**
	No	56	42.4	68	29.8	124	**34.4**

4. Discussion

A cross-sectional descriptive study was conducted in Elhussien and Bab-elshearia university hospitals to assess the aspects of health information system & its role in support of diseases surveillance, utilization of collected data in medical services, knowledge, attitude & practice of physicians & nurses towards notifiable diseases surveillance and to propose suitable corrective measures that should be undertaken; if needed.

The interpretation of results of the study by the researcher yielded the following:

i- Resources available at surveillance units within departments:

With exception of internets and fax machine in the study, hospitals are equipped with the essential equipment, however utilization of the existing equipment in processing of routine health information system (data collection, processing, analysis, display, transmission, and quality checking) is found to be very poor.

The present study revealed that health departments were more likely to have calculators available (95.7%) than any other data management tool. This was more than findings in a study in Nigeria conducted by **Abubakar, et al. (2013)** which reported (62%) and more than the figures of the 2001 assessment of surveillance in Nigeria, where 47% of health facilities had calculators available **(FMOH, 2001).** The findings were also more than in Uganda, where 78% of health facilities had calculators **(CDC, 2000),** but less than other study conducted in Tanzania by **Nsubuga et al. (2002),** where calculators were available for data analyses at all the regional and district medical offices.

Data management tools like calculators are an important resource, as they can be used for simple calculations and data analysis at the various departments.

Out of surveyed departments (69.6%) have computers, (30.4%) have printers, no internet connection or fax machine. These were less than findings in **Mebrahtu (2010)** where (99.5%) have computers, (73.6%) have printers, (10.4%) have internet connection and (5.2 %) have fax machine. Also unlike previous research in India conducted by **Harikumar (2012)** that showed almost one third of the facilities (32%) reported inadequate access to computers and internet connection was reported to be slow and inadequate by 72 percent of institutions.

The present study shows that 100% of units had admission registers, discharge registers and monthly surveillance forms. These findings are in line with a previous study in Anambra state, Nigeria conducted by **Nnebue et al. (2012)** where majority (92.6%) of the health care facilities had facility records; all the primary and tertiary health care facilities had facility records, whereas 81% of the secondary health care facilities had records. About 83.3% of the facilities had disease surveillance forms.

The finding of the quantitative survey is contrary to that of **Bawa et al. (2003)** where only 8.0% of the facilities had disease surveillance forms. It also differs from that of **Adindu (1995)** which showed that health

care facilities had inadequate supply of disease surveillance forms.

Somda et al. (2009), stated that availability of resources is critical as it affects the confidence, motivation and processes involved and is considered as the root of surveillance performance.

However, according to the respondents, resources for surveillance were inadequate in terms of financial, human, infrastructure and material. Also transfer and turnover of the staff had negative effects on the disease surveillance system.

ii- Assessment of health information system performance of diseases surveillance:

HIS performance, the output of the information system, is measured by four criteria. They are levels of:

a) data quality,
b) HIS processes,
c) use of information and;
d) Supportive functions.

a) Data Quality

Data quality is measured on dimensions of data accuracy, completeness and timeliness.

The overall data quality score was 74% which is more than the evaluation of HMIS in Kerala state conducted by **Harikuar (2012).** This difference is attributed to the high levels of accuracy 75% and completeness of data 88%.

Data accuracy

Data accuracy was measured by the accurate filling and comparing the actual monthly reports with the registers.

In the present study, accuracy was found to be 75% which is less than a previous study in Mexico which is conducted by **Aqil et al. (2010)** and another study in China by **Aqil et al. (2007)** where accuracy was above 95%. However, this study surpasses the evaluation of HMIS in Kerala state which found that the accuracy of information (29%) was very low.

This study also surpasses many developing countries such as Cote d' Ivore in a study conducted by **Gnassou et al. (2008)**, Haiti by **Boone & Aqil (2008)**, South Africa by **MEASURE Evaluation (2005)**, Pakistan by **Hozumi et al. (2002)** and Uganda by **Aqil et al. (2008)** where data accuracy was found to be less than 60%.

Completeness

Completeness was assessed by the proportion of unfilled data items pertaining to disease surveillance and the proportion of selected personnel in various departments in the hospital that send the reports regularly.

The average proportion of completed data elements among the departments studied was 78.6%; this finding is similar to **Harikumar (2012)** and **Aqil et al. (2010)** but it is much more than **Deepa & Gopinath (2016)** where only (15.1%) of reporting formats were completely filled.

On the other hand 89.3% of the respondents had sent the reports regularly; this finding is less than **Harikumar (2012)** and **Aqil et al. (2010)** where 100% of the facilities in each district had sent the reports. Another study conducted in North Gondar by **Andargie & Addisse (2007),** showed that 33.90% and 38.36% of the departments at the Health Centers and District Health Offices respectively reported within their schedules. Study conducted in Uganda, showed that an average 88% of the districts reported in their schedules **(Kintu et al., 2005).** The study conducted in Papua New Guinea showed that in 2004 reporting rates were 73% **(Cibulskis & Hiawalyer, 2002)**.

The overall completeness score is 88% which is more than an evaluation of HMIS in Kerala state conducted by **Harikumar (2012)** which found that the completeness percentage was (37%) and an evaluation of the district health information systems in Kenya by **Odhiambo-Otieno (2005)** which found low rates for completeness (19%).

Timeliness

Another dimension of data quality is timeliness. Timeliness of data was to be assessed by the proportion of personnel in various departments that had sent the reports by the specified deadline (24 hours for notifiable diseases and the 5th day of the month for the monthly report). It was 52% in this study which is less than **Aqil et al. (2010)** where 62.7% of facilities met the deadline.

This study was comparable to that of the North Gondar study conducted by **Andargie & Addisse (2007)** where majority of the reports arrives late. This is due to loss of timely concrete feedbacks, scarcity and non-standardized tools, lack of guidelines, manually filled formats, absence of access for data network for data transmission and lack of commitments by the staff.

b) health information system processes

This was assessed on dimensions of case detection, registration, data reporting & transmission, processes for checking data quality and analysis of data.

Case Detection:

The use of the Standard Case Definitions (SCDs) was poor (46.4%) hinting that the syndromic SCDs need clarifications. By in depth interview and observation, the case definition manual has not been updated since 2006. This means that system guidelines do not include new emerging diseases such as Ebola, SARS and avian influenza. Updated written guidelines are a very vital tool for performing perfect disease surveillance everywhere and more specifically in developing countries where the turnover of staff is very high and on-the-job training is not available all

the time. So the presence of written updated guidelines might serve as a substitute for on-the-job training and may help in performing to keep up a good quality system.

Eighty two percent of respondents reported that their departments had at least one standard case definition available; this was higher than **Abubakar, et al. (2013)** where 62% of health facilities had standard case definitions; 67% reported by **Phalkey et al (2013);** 35% reported in Tanzania by **Nsubuga et al. (2002)** and similar to findings by **Rumisha et al. (2007)** in Tanzania, where case definitions were not used for recording diagnosis in registers by 53.6%. Another study in Tanzania by **Mghamba et al. (2004)** found case definitions to be insufficient in the health facilities**.** In Ghana, standard case definition pamphlets are distributed to health facilities for diagnosis and this increased the availability and use of case definitions at health facilities **(Franco et al., 2006).** However, this differed from the assessment of surveillance in Nigeria in 2001, where no health facility had any case definition for any of the priority diseases **(FMOH, 2001),** and the 2009 assessment of disease surveillance system where 68% of health facilities did not have case definitions for any of the priority diseases **(FMOH, 2009).**

Use of standard case definitions is very important as it allows for standardization of reporting across the country from all health facilities. Nonuse of standard case definitions would not allow proper tracking of the priority diseases across the country.

Case registration:

Case registration files were more complete for clinical data and diagnosis, a finding similar to other studies from Mozambique by **Mozambique MOH (2006)** and Uganda by **Uganda MOH (2004)** and India by **Phalkey et al. (2013).**

Unlike **Phalkey et al. (2013)** where no disease surveillance registers at sub-centers but records of patients attended were maintained in a daily diary, in our study there were case registers at all departments.

Registration files were completely filled according to 64.3% of respondents. This is contradictory to **Phalkey et al. (2013)** where registers were incomplete in larger facilities particularly with respect to the diagnosis and address of the patient reportedly due to the high volume of patients and unavailability of computer literate staff.

Data reporting

All respondents report to medical statistics department or hospital administration by hand delivery, although other studies have reported increasing use of electronic reporting of surveillance data by email **(WHO, 2000: b).** This may be connected to the unavailability of internet facilities at all levels.

This study was comparable to that of south west Ethiopia conducted by **Abajebel et al. (2011)** where all the data were collected using manually filled formats and registrations and only hard copy were sent to the next levels.

This is contradictory to **Abubakar et al. (2013)** where some information was also transmitted by mobile phone and also unlike **Phalkey et al. (2013)** where (68%) districts additionally accepted verbal reporting via mobile/cell phones without a formal mechanism to document it.

Other challenges were presented in this study In concordance with **Abubakar et al. (2013),** included that reports are time consuming as reported by 50% of respondents, irregular reporting of urgent notifications by 75% and shortage of reporting forms as reported by 14.3%, which are less than **Tsedale et al. (2017)** where (33%) of respondents replied that there was shortage of recording tools.

Checking data quality

The process of checking data quality involves checking for accuracy, completeness and timeliness. The functionality level of the processes of checking accuracy, completeness and timely transmission of data in the departments was 85.7%, 75% and 75% respectively. These findings are less than **Harikumar (2012)** which reported 79%, 79% and 88% for checking accuracy, completeness and timely transmission of data respectively.

The overall percentage of receiving a directive in the last three months for checking data quality was 78.7%, which is more than **Aqil et al. (2010)**, where the functionality level of checking data quality was 40%.

Data analysis

Weak data analysis at every level was observed on our study (46.2%), this is similar to findings from a study conducted in Lesotho by **Lesotho MOH, (2004),** Tanzania conducted by **Mghamba et al. (2004),** Uganda conducted by **Lukwago et al. (2012),** Kaduna conducted by **Abubakar et al. (2013)** and in other states of India conducted by **Sathyanarayana (2010).**

Developing clear guidelines for data entry, management and analysis at each level should be considered **(Nsubuga et al., 2010).** Additionally, regular in-service training supported by adequate supervision of the surveillance staff at all levels should be incorporated **(Mozambique MOH, 2006).**

This finding is less than **Abubakar et al. (2013)** where 90% of the health facilities had a form of data analysis on surveillance data available. This was higher than the 10% and 17% reported in Uganda **(CDC, 2000)** and Nigeria **(FMOH, 2001)** respectively and more than the 32% reported in Tanzania by **Mghamba et al. (2004)** and the 20% reported in

Nigeria by **FMOH (2009)** and Kenya by **Rumisha et al. (2007)** and the 34.9% reported in **Harikumar (2012)** but much lower than the 78% reported in Ghana by **Franco et al. (2006).**

Analysis and interpretation of data at the health facility is important and is one of the determinants of integrated disease surveillance and response (IDSR) implementation. It allows for practical use of the data collected for surveillance at the health facility.

In the integrated disease surveillance strategy, the data collected should be analyzed and used for action, especially at the health facility level **(WHO, 2000: b).** Decreasing amount of data analysis leads to the absence of proper scientific interpretation of the collected data. Continuous, systematic and more detailed analysis of all data reported at departments should be done to keep track of the disease situation in the area and to maximize and strengthen the disease surveillance effectiveness. Without special attention to the lower levels like hospital departments, they simply become a channel for data collection instead of surveillance.

c) Use of information

The use of information, another aspect of health information system performance of disease surveillance, was assessed using, the availability of any kind of report (feedback, quarterly, annually etc.) and reviewing them for use of information, by observing records of hospital meetings on discussion of disease surveillance findings and decisions made based on those discussions and by display of information in tables, graphs/charts or maps.

Use of information was found to be low in the present study. Production of reports, display of information, feedback and action taken were very low in the hospitals. Most of the departments were just compiling the data and forwarding it. Data is being collected mainly for onward transmission rather than for locally relevant decision making.

The overall level of use of information is 36.7% which is similar to **Harikumar (2012)** but less than **Tsedale et al. (2017)** where the general utilization on health management information rate was found to be 41.1%.

Evaluation of the health management information system in a province of Mexico using the PRISM tools also found a low level of use of information **(Aqil et al., 2010).**

Even though most of the developing countries have low utilization rate, finding of utilization of information in this study was slightly higher as compared to the results of a study done in North Gonder by **Gashaw (2006)** in which, the utilization rate of 22.5% in all the study units and 8% in HIV/AIDS units and **Mebrahtu (2010)** in Ethiobia which found that utilization rate of HMIS information at the facility level is 22.2%. Moreover, **Campbell (1996)** in Ghana, **Musoke et al. (2000)** in Uganda and **Abajebel et al. (2011)** in south west Ethiopia as identified 10%, 20% and 32.9% of the health system utilize the health information for decision making and evaluating and controlling. From these we can understand that, still the utilization of information at the facility was not improved.

All respondents reported that the hospital performs routine meetings for reviewing managerial or administrative matters, 89.3% of them said that official records of these meetings is maintained at their departments. This is less than **Harikumar (2012)** where meeting records were available in 92% of facilities but more than **Aqil et al. (2010)** which reported 55%.

About 60.7% of them mentioned that these meetings made discussion about management of disease surveillance. This finding is higher than **Harikumar (2012)** where 34% of facilities had discussion about HMIS data quality.

Only 43% of the studied sample reported that these meetings made discussion about disease surveillance findings. This is less than **Harikumar (2012)** where 74% of facilities discussed HMIS findings and **Aqil et al. (2010)** which reported 65.9%.

On the other hand, 25% of the respondents mentioned that these meetings made decisions based on the above discussions, which indicates a low capacity to make decisions or the decisions are of a kind that needs approval from a higher level. This is less than **Harikumar (2012)** which reported 37% and **Aqil et al. (2010)** which reported 68.7%.

Also 25% of them mentioned that follow-up actions have taken place on the decisions made during these meetings. This finding is more than **Harikumar (2012)** where none of the meeting records showed any follow-up actions regarding prior decisions.

Presentation of information

Presentation of information helps in comparative analysis, monitoring progress over time and improving transparency along with providing a visual image of the work done. In the present study, the level of presentation of information is very low 3.66%. This may be due to the low level of supervision quality observed in the study and a lack of adequate time and training.

This finding is contradictory to **Harikumar (2012)** where the display of data related to disease surveillance was 73.7% of facilities and updated data for disease surveillance was 44.7 %.

Feedback

Feedback is an essential component for maintaining involvement and motivation of surveillance staff **(Gueye et al., 2006; Sathyanarayana, 2010).**

Feedback from higher levels was reported by 37.6% of the selected respondents. This is similar to **Harikumar (2012)** which reported 39.5% and less than **Tsedale et al. (2017)** which reported (51%) of the health institutions received feedback from sub city.

In another study in South Sudan conducted by **pond et al. (2011),** only (11%) of the health departments visited reported that it had received any written feedback from the state or national level regarding its surveillance reports.

In northern Ghana according to **Adokiya et al. (2015),** nearly all the respondents (17/18) reported that no real feedback to the periphery level exists.

In the absence of feedback, regular standardized supervision provides quality checks and job training, but it inhibits achieving the recommended goals and is also a waste of resources within health information systems. Defective feedback system made disease surveillance system miss one of the major core activities. This defect might induce a problem in the commitment of the staff at lower levels as they have lost their link to higher levels. A step towards a better future of the surveillance system needs an updated standard regular feedback system.

d) Supportive activities:

This was assessed on dimensions of presence & use of Surveillance manual, using information technology in disease surveillance, supervision and training.

Surveillance manual

For the question whether there was guidelines for surveillance in health departments or not, (87.5%) of the respondents replied that their departments had guidelines and user manuals. These findings were more than **Tsedale et al. (2017)** where (51.7%) of the respondents replied that the health facilities had guidelines and user manuals to run their activities effectively.

Surveillance manuals were up-to date according to 71.4% of the studied sample and were easy to use according to 73.2%. These finding are contradictory to **Phalkey et al (2013)** which found that surveillance manuals were not up-to date and difficult to understand.

Using information technology in disease surveillance

Currently all departments send paper forms to the higher levels and the data volume significantly overburdens the staff. Introduction of advanced technology for data reporting, introduction of a computer system, usage of network for sending disease surveillance reports as well as provision of professional personnel or data reporting at locality level are likely to lead to increased data accuracy, strengthening the surveillance system to the levels comparable to developed countries. Advanced technology is urgently needed; however, it might face many obstacles in terms of available resources, manpower and its continuity.

According to **Mboera et al. (2005)**, electronic data processing is a major advantage in surveillance**.** However, the hospitals fail to get optimum benefits due to absence of internet services, poor staff training and lack of data entry operators.

Supervision

Supervision is vital to provide adequate support to the health workers and also helps in training and continued improvement.

The quality of supervision was assessed on the basis of whether the supervisor checked data quality, discussed performance, helped in decision making and send feedback reports. The overall level of supervision quality was 40.5%, which is less than **Harikumar (2012)** which reported 44.2%.

In northern Ghana, **Adokiya et al. (2015)** demonstrate that supervision for surveillance at the periphery of the Ghana health system is rather poor and inadequate and such visits were irregular and also not purposely for disease surveillance except during epidemics, which supports previous findings in **Nsubugaet al. (2010).**

Supervision is probably part of the general supervision and may not be oriented towards disease surveillance tasks such as checking data quality and use of information. There were no guidelines on the required/expected number of supervisory visits at any level. Common reasons identified for inadequate and irregular supervisions could be additional responsibilities, lack of funds, lack of staff and not mandatory.

Training

The level of training is frequently not adequate for effective and efficient disease surveillance with average score 23%. Training activities are also limited to data collection and statistics. There are no mechanisms for planned training on an ongoing basis. This may be due to lack of competent trainers, lack of initiative from higher levels or lack of finances. The lack of ongoing training and supervision quality at the hospitals restricts the available opportunities for continuous improvement.

High attrition of trained staff was another reason for lack of trained personnel in our study as previous studies in Ethiopia and Lesotho **(Ethiopia MOH, 2005; Lesotho MOH, 2004).**

Institutionalizing training for integrated disease surveillance in regular medical and paramedical curricula is considered the most sustainable strategy and should be incorporated **(Nigeria MOH, 2010).** Practical on-site in-service trainings for surveillance and lab staff should be mandatorily planned as an

annual activity **(Sow et al., 2010; Mboera et al., 2001).**

This study was comparable to that of the North Gondar study conducted by **Andargie & Addisse (2007)** which stated that only 23.8% of the individual were given training on health information system.

In a previous study conducted in Tanzania by **Nsubuga et al., (2002),** 70% of personnel using the systems at health facilities had received some training in surveillance, which consisted mainly of workshops on how to use the surveillance systems.

In Addis Ababa study which conducted by **Tsedale et al., (2017),** showed that 74.3% of focal persons were trained on HMIS. The difference may be due to supportive NGOs Tulane University given training health workers.

Another study in Addis Ababa conducted by **Mebrahtu (2010)** stated that people who are responsible for managing health data have some formal training in collection, analysis and presenting the information. A study conducted in Tanzania and Mozambique by **Lungo (2003)** indicated that 81% of health workers have been trained on completing registers.

iii- Socio-demographic characteristics of the medical personnel sample:

The higher percentage of the medical sample in this study was female 62.8%. This is coinciding with a previous study conducted in Washington by **Turnberg et al. (2010)** where 65% of the respondents were female.

These findings differ from previous studies conducted in Benin by **Awunor et al. (2014)** and Taiwan by **Tan et al. (2009)** and the findings of a survey among resident doctors in Sagamu, Nigeria conducted by **Adefuye et al. (2009)** where the majority of the respondents were males which reflects the sex distribution in most residency training institutions in these countries.

This difference is attributed to that this study and Washington study by **Turnberg et al. (2010)** included nurses which were not included in the other studies as most of nurses in these studies were females.

The highest proportion of respondents in this study came from the medical departments (64.4%). This finding differs from a previous study that was conducted in Benin city by **Awunor et al. (2014)** in which the highest proportion of respondents came from the departments of Surgery. This was also contradictory to the findings in an earlier study among doctors in Edo state in Benin conducted by **Ofili et al. (2003)**. A reason for this difference could be the number of sub specialties under medical departments such as Internal medicine, Pediatrics, Endemic diseases, Pulmonology, Dermatology, Clinical pathology and Neurology who were eligible as respondents and the fact that they represent the largest departments in the studied hospitals.

Concerning training in diseases surveillance, only (22.7%) and (43.9%) of doctors and nurses respectively had been trained. This in concordance with **Awunor et al. (2014)** where just (17.4%) of respondents reported a previous training in DSN and **Bawa et al. (2003)** where a majority of the respondents had no previous training in disease surveillance and notification. Another study in Nigeria conducted by **Aniwada & Obionu (2016)** showed that, very few health workers in both public and private centres respectively have attended training/course in disease surveillance. The ones that had training/course took place over five years ago.

The World Health Organization and other partner agencies have been providing technical assistance to the nation most especially in capacity building of surveillance officers at the district (local government) and state level but not at facility level though the training is supposed to be stepped down to facility by respective DSNO **(Dairo et al., 2010).**

iv- Knowledge of the studied medical personnel about DSN

A) Knowledge of the studied medical personnel about timing of notification of certain diseases:

The majority of the studied doctors and nurses reported correct answers towards timing of notification of meningitis, mumps, TB and cancer colon, but only about 34% of them reported correct answers towards timing of notification of rubella. This finding gives the fact that some notifiable diseases might not be correctly recognized as reportable by medical personnel.

In a previous study which is conducted in Taiwan by **Tan et al. (2009),** less than half of the private doctors knew that measles, tetanus, chickenpox, and rubella were reportable diseases. Previous studies in South Africa conducted by **Abdool Karim & Dilraj, (1996),** Australia conducted by **Allen & Ferson (2000)** and UK conducted by **Durrheim & Thomas (1994)** have also found that the list of notifiable diseases is not well known by the medical personnel.

In a recent study in Nigeria conducted by **Ilesanmi & Babasola (2017)** presents poor knowledge of notifiable disease among the respondents with only 30% listing measles as a notifiable disease. In conformity with other studies which showed poor knowledge of health workers on reporting of infectious diseases and notifiable conditions, **(Bawa et al., 2003; Adindu, 1995; Oyegbite, 1992)** only 20% of these respondents know that malaria is one of the notifiable diseases. This might be due to the common perception that malaria is 'ordinary' in the Nigerian society.

These findings stress the need to repeatedly inform doctors and nurses about the notifiable disease surveillance system.

B) Knowledge of the studied medical personnel about DSN according to their departments:

There was a statistically significant association between the department of respondents and their knowledge of DSN and was observed that 37.1% of respondents from medical departments were highly knowledgeable compared to 12.5% of respondents from surgical departments**.**

These findings are in line with **Awunor et al. (2014)** where resident doctors in the medical departments (Department of Community Health 81.8%, followed by residents in Family Medicine 71.4%) found to have a good knowledge of DSN, when compared with respondents from other departments while the resident doctors in surgical Departments (Obstetrics & Gynecology 48.5% then Dentistry 17.9%) had the least level of knowledge of DSN.

This could be due to the fact that the personnel of medical departments had greater contact with notifiable diseases than surgical departments. This difference also may be attributed to the fact that the resident doctors in medical departments have to study community health as part of their post graduate curriculum that includes Disease Surveillance and Notification. It could also be due to inclusion of DSN in the postgraduate training curriculum in these two Faculties.

VII. Practices of the studied medical personnel of DSN:

In case of detecting any notifiable disease or outbreak, this study reveals that, the highest percentage of the studied doctors (86.4%) and nurses (89.5%) notified the health authorities on notifiable diseases. This finding is slightly more than a study conducted in Riyadh city to assess knowledge, attitudes, and practices of physicians in private dispensaries and hospitals towards the surveillance system conducted by **Al-Zahrani et al. (2007)**, where 78% of participating physicians notifiable disease or outbreak to the MOH and another study conducted in Taiwan by **Tan et al. (2009),** where (83.5%) have the experiences of reporting.

Another study in Nigeria conducted by **Aniwada & Obionu (2016),** showed that (85%) of public and (40%) of private health care workers report diseases in their facility.

The failure to notify by some respondents could be due to their being unaware of the notifiable diseases list and their standard case definitions. It could also be as a result of not being trained to know how and to whom to notify beside lack of time and lack of motivation.

Worldwide, notifiable disease surveillance often suffers from incomplete reporting; many difficulties can be faced by physicians during reporting which can lead to underreporting, some of these difficulties may be related to physicians themselves, some related to patients, and some related to the surveillance system **(Doyle et al., 2002).**

In another study conducted in Saudi Arabia by **Al-Zahrani et al. (2007)**, the most frequent difficulties faced by physicians during reporting were due to uncooperative patients in giving the correct information about the disease, unclear notification system, the time for recording the information is not enough, and the patient didn't know health information system address.

Schull et al. (2004), in health information system study which conducted in Ontario, found two primary barriers to reporting; staff were not knowing what diseases were reportable, and their perception that the reporting process required too much time and effort.

In another study by **Friedman et al. (2006)**, the major barriers to reporting most frequently identified diseases included time required for notification, lack of knowledge regarding which diseases are reportable, and a belief that many notifiable diseases are too common or unimportant to merit the effort of reporting.

Conclusion

According to the results of this study and interpretation of these results, it could be concluded that:

i- Regarding surveillance units within departments:

- All units contain scretaries but non of them contain doctors, nurses or health inspectors.
- Registers and forms of disease surveillance are found available in all of the studied units.
- Regular telephone was found available in all of the studied units whereas none of the units contained fax or access to the internet.

ii- Regarding health information system performance of diseases surveillance:

- The majority of the studied non-medical personnel prepare accurate reports and these reports were typically like that in registers.
- The majority of them send regular completed reports & zero reports.
- The majority of them report monthly before the deadline but submit the urgent notification late.
- None of the subjects reported that the hospital disseminates reports to the departments or to internet and mass media.

- Weak functionality levels of data analysis, dissemination of information, feedback and very week level of presentation of information.
- The overall levels of utilization of information, supervision and training in disease surveillance are also weak.
- All departments send paper forms to the higher levels and don't use electronic information system in disease surveillance.

iii- Regarding knowledge and practices of the studied medical personnel about diseases surveillance and notification:

- The majority of the studied doctors and nurses reported correct answers towards timing of notification of meningitis, mumps, TB and cancer colon, but only about one third reported correct answers towards timing of notification of rubella.
- There were statistically significant associations between knowledge of medical respondents about DSN and their departments.
- The majority of the studied doctors and nurses notified the health authorities on notifiable diseases but only about have of them follow the guidelines and ever saw a disease notification form.

Recommendations

Based on the interpretation of the results; the present study recommends the following:

- Hospital management has to provide adequate human resources for disease surveillance units within departments and should be equipped with basic Information & communication technology equipment.
- Adequate pre-service & in-service training for the personnel involved in disease surveillance should be given regularly in a planned manner.
- Regular updating of guidelines of health information systems should be developed.
- Feedback and supervisory support to enhance staff motivation and commitment.
- The system should be supported by electronics and appropriate software to use for better data collection, analysis.
- Raising awareness and knowledge of medical staff about diseases surveillance and notification by regular training, seminars or workshops provided by highly qualified personnel.
- Strengthening motivational incentives for hospital staff dealing properly with disease surveillance and notification.

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