The Economic Burden of Common Hospital Acquired Infections at Princes Bassma Hospital (PBH) in Jordan in 2019: A Review

Ali. A. A Rawabdeh

Health Planning and Management, Faculty of Economics and Administrative Sciences/Health Services Management Program,
Yarmouk University, Irbid, Jordan

Received September 25, 2021; Revised December 22, 2021; Accepted January 16, 2022

Cite This Paper in the following Citation Styles

(a): [1] Ali. A. A Rawabdeh , "The Economic Burden of Common Hospital Acquired Infections at Princes Bassma Hospital (PBH) in Jordan in 2019: A Review," *Universal Journal of Public Health*, Vol. 10, No. 1, pp. 34 - 42, 2022. DOI: 10.13189/ujph.2022.100104.

(b): Ali. A. A Rawabdeh (2022). *The Economic Burden of Common Hospital Acquired Infections at Princes Bassma Hospital (PBH) in Jordan in 2019: A Review*. *Universal Journal of Public Health*, 10(1), 34 - 42. DOI: 10.13189/ujph.2022.100104.

Copyright©2022 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

Abstract Nosocomial infections (NIs) are hospital-acquired infections that occur after 48 hours of admission or discharge, which have ended up a major issue to the hospital industry. The purpose of this study was to examine the economic burden of Nosocomial infection at PBH. It was a retrospective study for the purpose of providing structured opportunities for PBH to reduce the economic burden, prevention, and management of NIs. To measure the cost of NI indorsed, a random sample of 700 patient records was considered in 2019 and retrospectively studied, coordinated with the essential highlights. The cost was estimated and calculated by using a step-down method, and the unit cost was measured in terms of additional hospitalization days. Among 22772 admissions to PBH in 2019, the distribution of 137 conceivable nosocomial contamination cases was found. The internal medicine and surgical wards were seen as the main host of NI in the hospital (medical ward 59.12% and 22.63% in the surgical ward). *Escherichia coli* was ranked the most prevalent infectious pathogen and discovered in 31 (22.63%); MRSA was found the least dominant (4.38%) of the infected patients. The evidence demonstrates obviously the economic burden of Jordanian Dinar JD10232.53 in PBH in Year 2019, the additional cost of NI in PBH annual budgeted financial requirements, which have to be considered avoidable cost in case of compelling infection control program worked successfully. Compliance with local and

global standards for sanitization and sterilization to prevent the spread of hospital-acquired infections need to be investigated carefully.

Keywords Economic Burden, Cost Measurement, Nosocomial Infections, Infection Control, Step Down Method

1. Introduction

Nosocomial diseases are infection(s) acquired among the method of providing health care in the health facility that was not displayed at the time of admission rather, they must develop at least 48 hours after admission and after discharge. They may happen completely in different areas in the health care delivery system i.e., hospitals, long-term care facilities, etc. NI moreover incorporates occupational infections which will influence staff. NIs are the preeminent common adversarial event in-hospital care that impacts patient safety. They contribute to basic mortality morbidity, and financial burden on patients, families, and healthcare system.

The impact of Nosocomial infections may be evaluated in terms of morbidity, mortality, disability and economic value. Patients with nosocomial infections (NIs) require a longer time within the hospital, more care, extra length of

stay, and, conceivably, readmission and support examinations. The combined direct and indirect costs of treating NIs may be extremely high. The direct costs of NIs incorporate a longer length of stay, readmission, outpatient and emergency visits, backing surgery, and overdue anti-microbial treatment. Other direct costs emerge from ancillary and support hospital services i.e., lab test, physician and nursing fees etc. The indirect cost which is troublesome to evaluate, incorporates misplaced efficiency, i.e., Maintenance, Laundry and Linen etc. The cost of NIs increments with the profundity of the contamination. That is, the costs related with shallow incisional NIs are generally low, but increment with deep NIs, and particularly when organ or space contamination is displayed [1].

There's no sufficient financial information about the NI within the public sector in Jordan appears in the annual statistical reports of the Ministry of health. Therefore, changing the approach of administration in the health system to expand training over costing and cost accounting is significant. Also, there's no motivating forces for health administrators to stress around the cost of NIs as an additional day went through by the client in hospital has small impact on the running costs. In fact, new patient will cost more than patients remaining within the hospital due to routine services received [1]. Cost measurement can be seen in four ways; in terms of traceability: direct and indirect cost; behaviorability: variable cost, fixed cost, semi-variable, and semi-fixed costs; controllability: controllable and non-controllable cost; and in terms of future: avoidable cost, sunk cost, etc. This article measured the cost in terms of traceability: direct and indirect cost. One of the foremost appropriate ways of cost measurement in terms of traceability is the step-down method and/or double apportionment method [2,3].

Aims and objectives

The purpose of this study was to examine the economic burden, prevention and management of Nosocomial infection at Princes Bassma hospital in Jordan.

Cost measurement in health care can be done in four ways. To be more specific, it can be measured in terms of treatable center (traceability): direct and indirect cost; cost-behavior (behaviorability): variable cost, fixed cost, semi-variable, and semi-fixed costs; controllability: controllable and non-controllable cost; and in terms of future: avoidable cost, sunk cost ...etc. This article measured the cost in terms of traceability: direct and indirect cost. One of the foremost appropriate suitable ways of cost measurement in terms of traceability is the step-down method and/or double apportionment method [2,3].

This article used the step-down method to measure the NI cost. The assessed costs of managing NIs shift broadly in Prince Basma Hospital (PBH) shift from the (lowest)

cost of JD6.36 per case in the internal medicine ward to (highest) JD 67.46 per case in the operating theater (Average cost per surgery) (see Table 2). For the hospital to treat NIs, it places extreme money related strain on care assets. It is conceivable that treating high-risk surgical patients restoratively will demonstrate to be more cost-effective than repeated operations.

Prospective NIs location stays a major source of sickness and a less causes of mortality in hospital industry. These infections account for 137 cases Y2019 in PBH, among of which 22% where found in surgical wards, 59% in internal medicine, 6% in in the orthopedic, 8 in the ENT, and 3% in the ophthalmic ward, which may constitute another source of infection and resulted in longer hospitalization and higher costs, PBH got to keep an eye on them to avoid cross contaminations and condense their costs to the least conceivable levels. These costs and the length of stay without a question lower these days for most restorative procedures. In any case, major complications such as significant abdominal and cardiovascular maladies continue to have a grave influence, increasing the length of hospitalization as much as three extra days of brought of hospitalization. Any NIs results in a net loss repayment to the hospital compared with uninfected cases, a figure that ought to oblige the hospital administrators to curtail the incidence and prevalence of NIs [4].

The confirmations illustrate clearly the financial burden of preventable maladies constitute extra cost on health facility, which need to be considered avoidable by compelling contamination control program worked effectively, hence a consistent examination and security measures could diminish the burden. Despite of the prove around the adequacy of disinfectants to expect nosocomial infections, compliance with neighborhood and global guidelines for sanitization and sterilization to avoid the spread of hospital acquired infection ought to be explored carefully [4].

2. Material and Methods

PBH is a community hospital (government hospital) with 236 beds provides secondary health services for more than two million populations. A random sample of 400 patient medical records and 300 microbiology log-records in the hospital were accessed to determine the effectiveness of the infection control program employed and measure the cost of hospital acquired infection and their impact on the hospital viability. The medical notes were critically observed and cross matched with nursing notes and the lab tests results in the same file by the researcher and two research assistants (Registered Nurse students in the master program of health services management). The medical and nursing staff in daily duties served the researcher and the assistants to clarify the confusions in infections documented manually. At the

time of checking the patient records where there are no recorded notes of NIs to consider, the researcher and colleagues used to consult the professional in the ward to affirm and confirm the cases for research consideration.

The selected NIs cases were verified from different sources, hard copies of case notes, case file, manually entered registers and computerized database. Patient characteristics and patterns of NIs were identified. A sample of 10 patient records were revised and reassessed to check with the previously coded data to determine the pattern of records and extent of inaccuracy. Analysis of data conducted by using descriptive statistics coupled with quantitative measure of cost measurement- step down method. Step-down method involves arranging the non-revenue producing department in accordance with the level of services they provided to the other departments in the hospital. The slightest department consumes services from other departments, allocates its cost first, or the cost of the non-revenue department serving the most departments (revenue and none revenue-producing departments are distributed first, the none-revenue department serving the second largest number of departments is distributed next, and so on.

3. Literature Review

Nosocomial infections (NIs)

Nosocomial diseases are infection(s) acquired among the method of providing health care in the health facility that were not displayed at the time of admission rather, it must develop at least 48 hours after admission and after discharge. They may happen completely in different areas in the health care delivery system i.e., hospitals, long-term care facilities etc. NIs moreover incorporate occupational infections which will influence staff [4].

Contamination happens when pathogen spreads to a susceptible host i.e., patient, health staff etc. In advanced healthcare, pushy methods and surgery, indwelling restorative gadgets, and prosthetic gadgets are related with these contaminations. The etiology of NIs is based on the source or type of disease and the infectious pathogen, which might be bacterial, viral, or parasitic [4-6].

NIs is the preeminent common adversarial event in hospital care that impacts patient safety. They contribute to basic mortality morbidity, and financial burden on patients, families, and healthcare framework. The rise of anti-microbial resistance is additionally seen as another complication with NIs. NIs affects quite a large number of susceptible hosts in the developing and developed world. The financial burden of NIs around the world is obscure due to need of data. In any case, there has been a great effort by control programs to computerized exploration system and disease control strategies [7-8].

Cost and cost measurements

To estimate and measure a health program's costs, it is

necessary to classify its components. Cost elements can be broken down in several ways. It must be relevant to the particular situation; not overlap; and must cover all possibilities. Economists define cost as: "The value of resources used to produce something". Cost information is produced by cost accounting system. It accepts the principles of financial accounting because it is shaped by it. Knowledge of costs is critical to sound management decision making. One cannot control costs without knowing what they are. For the hospital and/or health facility to survive, the prices it charges must be at least greater than the cost [9].

Classification of costs

There are four major categories within which costs can be classified: 1: Traceable to the object being costed; 2: Behavior of cost to output or activity; 3: Management responsibility for control; and, 4: Future costs versus historical costs [10] Traceable costs: Direct: Traceable to a given cost object; and Indirect: costs cannot be traced to a given cost object.

Cost behavior: Variable cost: changes as output or volume changes in constant. That is if an output increases by 10%, costs should increase by 10%, that is there is some cost increment per unit of output. Fixed cost: cost does not change in response to changes in volume. It is a function of a passage of time not output. Semi-fixed (step) cost: cost does not change with respect to change in output, but it is not proportional. Semi-variable cost: includes both fixed and variable costs. Utility costs are good examples. [9-10]

Controllability: One of the primary purposes of gathering cost information is to aid the management control process. Costs therefore, should be assigned to individual responsibility center, usually departments, where a designed manager is responsible for cost control. Controllable cost: can be defined as the total costs charged to the department, and may be limited to the direct costs or can be as only those costs that are direct and variable. [9-10]

Future cost: Actual historical cost is useful as a base for projecting future costs. Four types of costs are the basic to the process of setting among alternatives in the decision making process. *Avoidable costs*: They are costs that can be eliminated or saved if activity is discontinued. Example: if the hospital was considering curtailing its volume by 50% in response to cost containment pressures, what it would save? The answer it saves the cost that is avoidable. In most situation: current and average cost per unit of output (patient days or admissions) multiplied by the projected change in output = avoidable costs. Variable costs are subset of avoidable costs. Sometimes some fixed costs may be included. *Sunk costs*: a large portion of costs (depreciation, administration, salaries, insurance, others) is sunk costs or not avoidable in the proposed 50% reduction in volume. The distinction between fixed cost and variable costs, on the one hand, and the sunk and

avoidable costs, on the other hand, is not perfect. Sunk cost are almost subset of fixed costs, but not all fixed costs need to be sunk (e.g. closing a hospital, costs would be eliminated and therefore would be categorized as avoidable not sunk with respect to the closure decision). *Opportunity costs*: are values forgone by using a resource in a particular way instead of in its next best alternative. *Incremental costs*: represent the change in costs that results from a specific management action. There is a strong relationship between incremental costs and avoidable costs. They can be thought as a different side of the same coin. The term incremental costs reference the change in costs that results from a management action that increases volume. The term avoidable costs define as the change in costs that results from a management action that reduces volume [11-12].

Cost Measurement

This article attentive on the measurement of the first category of cost (Traceability: Direct and indirect cost). Direct and indirect full cost. In cost accounting system, cost is classified by department or responsibility center or object of expenditure (I.e., salaries, rent.). Direct and indirect (costs) departments depend on whether or not provide services directly to the patient. The cost of the indirect, nonrevenue departments need to be allocated to the direct revenue departments for many decision making process [3,9].

Pricing decisions need to be based on full costs, not just direct cost. Costs of indirect departments are in most cases not traceable to direct depts. Therefore, they should be allocated to the direct departments in a systematic and rational manner. Sometimes the terms revenue and nonrevenue are substituted to direct and indirect. Three acceptable methods of cost allocation: Step-down method; Double distribution method; and Simultaneous equation method. The step-down method: Most Health care facilities used step-down method to allocate costs. In this method, the INDIRECT department that receives the least amount of service from other indirect department and provides the most services to other departments allocates its first Double distribution method: It is just a refinement of the step-down method. Instead of closing the individual department after allocating its costs, it is kept open and receives the costs of other indirect department. After one complete allocation sequence, the former departments are then closed, using the normal step-down method. Simultaneous equation method: A system of equation is established and mathematically correct allocation is computed [13].

Step-Down Method

The step-down method is the universally used method

for allocating indirect costs (department), that has indirect contact with hospitalized patients (Non-revenue producing departments, i.e., housekeeping, laundry and Lenin, dietary etc.). Beneath this method, indirect departments are ranked in terms of decreasing amounts of service offered to other departments (revenue producing and non-revenue producing), and their costs are allocated in a systematic and rational manner one at a time in descending order. An indirect cost department is considered "closed", once its cost is allocated, no other cost department can assign costs to it. The step-down, or sequential method, ignores self-services, but allows for a partial recognition of reciprocal services. The step-down method is also accomplished in two steps. In the first step, a set of equations is developed to represent the relationships between the non-revenue producing departments and the other revenue producing departments. Then the equations for the revenue producing departments must be solved before the allocations to the revenue producing departments can be completed. The non-revenue producing department equations reflect the fact that the number of allocations to each nonrevenue producing department changes as the departments are closed in sequence [13-14].

4. Results

Out of the 400 patient and 300 microbiology examined records, 137 conceivable nosocomial infection cases were found on the essential highlights of temporary conclusion and on the auxiliary highlight of gender within the five fundamental helpful wards in PBH campus. To maintain a strategic distance from bias, the enrolled cases within the therapeutic records were cross coordinated checked with the research facility tests joined to the therapeutic records and microbiology electronic records. Seven records were avoided due to obscure source of contaminations. Of the 137 NIs chosen cases, 31 (22%) patients within the surgical ward, 9 cases (6%) within the orthopedic, 11 (8%) cases within the ENT, 5 case (3%) within the ophthalmic, and 81 (59%) within the internal medicine wards.

The determined NIs areas remain the major source of ailment and less causes of mortality within the hospital facilities. These infections account for 137 cases Year 2019 in PBH, among of which 22.6% were found in surgical wards, 59.12% in internal medicine, 6.5% in within the orthopaedic, 8.3 within the ENT, and 3.6% within the ophthalmic ward, which may constitute another source of infections and brought about in longer hospitalization and higher costs. *Solving step-down method.*

The Economic Burden of Common Hospital Acquired Infections at Princes Bassma Hospital (PBH)
in Jordan in 2019: A Review

Table 1. Solving step-down method

	Departments	direct cost	Administration		Maintenance		Domestic		Hospital Stores		Nursing administration		Laundry		Research		Catering/Kitchen		Medical Records	Total	
			W/H		W/H		W/H		W/H		W/H		T/W		N/R		N/M		W/H		
Indirect Departments	Administration	700000	700000.00																		
	Maintenance	375000	4.9%	34300.00	409300.00																
	Domestic	290000	4.0%	28000.00	1.3%	5320.90	323320.90														
	Hospital Stores	33500	0.4%	2800.00	1.2%	4911.60	2.2%	711306.0%	48324.66												
	Nursing administration	124500	1.6%	11200.00	8.3%	33971.90	2.0%	646641.8%	2.0%	966.49	177104.81										
	Laundry	141500	1.8%	12600.00	4.0%	16372.00	7.0%	2263246.3%	6.0%	2899.48	1.0%	1771.05	197774.99								
	Research unit	140000	1.8%	12600.00	0.2%	818.60	3.0%	969962.7%	10.0%	4832.47	1.0%	1771.05	1.0%	1977.75	171699.49						
	Catering/Kitchen	360000	5.7%	39900.00	2.5%	10232.50	4.0%	1293283.6%	22.0%	10631.43	1.0%	1771.05	1.0%	1977.75	1.0%	1716.99	439162.55				
	Medical Records	70000	8.2%	57400.00	1.9%	7776.70	1.9%	614309.7%	0.5%	241.62	1.0%	1771.05	1.0%	1977.75	1.0%	1716.99	1.0%	4391.63	151418.84		
Direct Departments	Maternity	552500	7.7%	53900.00	11.1%	45227.65	11.0%	3556529.9%	6.1%	2947.80	16.0%	28336.77	7.6%	15030.90	15.0%	25754.92	22.0%	96615.76	13.0%	19684.45	875563.56
	Gynecology	320000	4.2%	29400.00	8.0%	32744.00	4.8%	1551940.3%	2.0%	966.49	11.0%	19481.53	15.0%	29666.25	12.0%	20603.94	18.0%	79049.26	12.0%	18170.26	565601.13
	Surgical Ward	650000	2.8%	19600.00	15.0%	61395.00	10.0%	3233209.0%	7.0%	3382.73	12.0%	21252.58	14.0%	27688.50	13.0%	22320.93	12.0%	52699.51	13.0%	19684.45	910355.78
	Pediatric Ward	360000	7.0%	49000.00	9.0%	36837.00	8.0%	2586567.2%	2.0%	966.49	13.0%	23023.63	13.5%	26699.62	14.0%	24037.93	16.7%	73340.15	11.0%	16656.07	636426.56
	Ophthalmology	190000	3.0%	21000.00	7.1%	29060.30	11.0%	3556529.9%	1.2%	579.90	7.0%	12397.34	14.0%	27688.50	12.0%	20603.94	5.0%	21958.13	14.0%	21198.64	380052.03
	Operating Theatre	900000	15.0%	105000.00	11.5%	47069.50	22.0%	7113059.8%	14.0%	6765.45	18.0%	31878.87	28.0%	55377.00	18.0%	30905.91	17.0%	74657.63	15.0%	22712.83	1345497.78
	Laboratory	480000	6.4%	44800.00	4.5%	18418.50	2.5%	808302.3%	9.5%	4590.84	3.0%	5313.14	0.4%	791.10	2.0%	3433.99	2.0%	8783.25	5.0%	7570.94	581784.79
	Radiology	315000	6.5%	45500.00	4.9%	20055.70	2.8%	905298.5%	12.0%	5798.96	4.0%	7084.19	0.5%	988.87	2.0%	3433.99	2.0%	8783.25	6.0%	9085.13	424783.08
	Physiotherapy	42,000	5.0%	35000.00	2.0%	8186.00	0.5%	161660.5%	2.0%	966.49	1.0%	1771.05	0.6%	1186.65	1.0%	1716.99	1.0%	4391.63	2.0%	3028.38	99863.79
	Mortuary	40000	5.0%	35000.00	2.0%	8186.00	0.5%	161660.5%	0.5%	241.62	1.0%	1771.05	0.4%	791.10	1.0%	1716.99	0.5%	2195.81	1.0%	1514.19	93033.37
	Medical Clinic	15000	2.0%	14000.00	0.5%	2046.50	0.8%	258656.7%	0.0%	0.00	3.0%	5313.14	0.5%	988.87	2.0%	3433.99	0.4%	1756.65	2.0%	3028.38	48154.10
	Psychiatric Clinic	11000	1.0%	7000.00	0.6%	2251.15	0.4%	129328.4%	0.0%	0.00	3.0%	5313.14	0.5%	988.87	2.0%	3433.99	0.4%	1756.65	1.0%	1514.19	34551.28
	pharmacy	90000	6.0%	42000.00	4.5%	18418.50	5.6%	1810597.0%	3.2%	1546.39	4.0%	7084.19	2.0%	3955.50	4.0%	6867.98	2.0%	8783.25	5.0%	7570.94	204332.72
	Total	6200000	100.0%	700000	100.00%	409300	100.00%	323320.9	100.0%	48324.66	100.0%	177104.81	100.0%	197774.99	100%	171699.49	100.0%	439162.55	100.0%	151418.84	6200000.00

W/H: Working Hours, T/W: Ton of Work, N/R: Number of researches; N/M: Number of Meals.

Step-down method involves arranging the nonrevenue producing department with accordance to their level of services they provided to the other departments in the hospital. The slightest department consumes services from other departments, allocate its cost first, Or the cost of the nonrevenue department serving the most departments (revenue and none revenue producing departments are distributed first, the none revenue department serving the second largest number of departments is distributed next, and so on.

As in Table 1 list of all departments, Column 3 gives the estimated direct cost of each department, Cullum 4 shows the administration department cost with the percentages of working hours. The JD7 700000.00 was distributed in a rational and systematic manner to the following revenue and nonrevenue department by doling out a rates of administration working hours given to them. As in Colum 4, maintenance utilizes 4.9% of administration working hours, hospital stores, 4.0%, nursing 1,6% and at the end pharmacy, 6%. As the maintenance department utilizes 4.9% percent of the administration working hours, 4.9% of the total direct cost 700,000 of the administration department will be allocated to the maintenance department which is obviously appears in Colum 4 by 34300.00, domestic 28000.00, and pharmacy 42000.00. The step-down process will continue through Colum 12 in Table 1 till the thirteenth pharmaceutical departments have absorbed their appropriate share of cost of

non-revenue producing departments plus their own operating costs which are totaled in Colum 13, which shows all other revenue producing departments that absorbed their allotted hare of the cost of non-revenue producing department of the hospital. The sum of orthopedic wards in Colum 13 (JD875563.56), and the pharmaceuticals department (JD204332.72). It is obviously that the main criticism to this method of cost measurement as not allowing fully for interdepartmental charges between the different none revenue producing department.

As in Table 2, the average cost per patient per day in PBH's therapeutic wards surgery, medicine, ophthalmology etc. is JD21.34. The average cost of every surgery is JD67.46; and, the lab tests and radiological films JD1.0 and JD1.3 respectively.

As a governmental hospital provided a secondary service to the community of Jordan at JD21.34 as an estimated cost per patient per day whereby the hospital charged actually JD2.5 per hospitalization day, this indicates that the hospital loses approximately JD20 per patient day. This will impact the hospital viability and thus the budgeted financial requirement. As a governmental hospital that is financed by the government, there will be no impact at the hospital financial condition instead of the MOH financial retunes, and therefore the annual budget planning of the hospital.

Table 2. Unit cost in PBH (2019)

1	2	3	4	5	6	7	Unite cost
Revenue producing departments	Total Expenditures = capital Expenditures + recurrent Expenditures (3+4)(JD)	Capital Expenditures (JD)	Recurrent Expenditures (JD)	No. Patients	Average length of stay	No. of patient days	Average cost per patient per day= Total Expenditures - Capital Expenditures / patient days (4/7)
Orthopedic Ward	875563	583,709	291,854	3214	3.3	10606	27.51
ENT	565601	543,734	21,867	1128	2.3	2594	8.42
Surgical Ward	910355	606,904	303,451	8818	3.6	33808	8.97
Internal Medicine Ward	636426	424,284	212,142	8768	3.8	33318	6.36
Ophthalmology Ward	380052	253,368	126,684	1005	2.8	2814	45.01
Operating Theatre	1345497	896,998	448,499	6648 surgeries	-	6648	67.46
Laboratory	581784	387,856	193,928	308027 6 tests	-	3080276	1.0
Radiology	424783	283,189	141,594	108999 films	-	108999	1.3
Pharmaceuticals	204332	169,555	34,777	-	-	-	-
Total	5924393	3,866,763	1,774,796			83140	21.34

Total Expenditures= capital Expenditures + recurrent Expenditures (3+4)

Average cost per patient per day= Total Expenditures - Capital Expenditures / patient days (4/7)

5. Discussions

PBH is a community hospital – governmental hospital- has 236 beds with 5 fundamental restorative wards in campus, provided secondary health services, admitted 2272 patients in 2019. The highest admission rate was found in the surgery and internal medicine wards, which account for 8818 patient's surgery and 8768 patients in internal medicine. 174 passing cases out of 8818 admissions to the surgical ward which represent 1.97% which is below the average death rate in the Ministry of health hospitals in the country of 2.5% (Table 3); though 386 passing cases out of 8768 admissions to the internal medicine ward which represent 4.4% death rate, and is

above the average death rate.

As in Table 4, it shows up to be that the surgical and internal medicine wards account for the biggest passing rate within the hospital (174, 386 respectively) which may be due to restorative complications, COVID-19, and NIs predominant irresistible pathogens etc. As the internal medicine ward involves the unprecedented and largest passing rate within the hospital which may be credited to the current pickle, the hospital has to be activate the circumstances to decide the causes of death, and because it was exceptionally troublesome to for the analyst to choose due to need of data accessible within the hospital, and set up fitting strategies to decrease the passing rate to least conceivable levels.

Table 3. General demographics of study population

Indicator	Patient days/	Physician /population n (10,000)	Nurse/population (10,000)	Allied health personnel/ population (10,000)	Pharmacist/ population (10,000)	Average length of stay/patient	Average admission rate/100 population
Rate/Ratio	80574	27.4	24.0	3.2	11.4	3.5	10.6
Indicator		Average visit /person	Bed rotation	Occupancy Rate	Average increase rate of surgery	Nurse/physician	Average Death Rate
Rate/Ratio		2.2	54.2%	93.5%	26.2	2.5	2.5%
Surgeries	6648						
Visits	554992						

Source: MOH annual statistical report, 2019

Table 4. Distribution of patients by Patient-Wards characteristics

Ward	Gender	No. Beds	Admissions	Discharge		Patient days	Occupancy rate	Average length of stay	No. NIs	NIs%
				Live	Died					
Surgery	M	-	5579	5484	96	20295	-	3.6	18	
	F	-	3239	3163	78	11668	-	3.6	13	
	Total	108	8818	8647	174	31963	81.5	3.6	31	22.63
Orthopedic	M	-	2212	2208	3	7302	-	3.3	5	
	F	-	1002	999	0	3314	-	3.3	4	
	Total	30	3214	3207	3	10616	96.9	3.3	9	6.57
ENT	M	-	691	692	0	1556	-	2.3	6	
	F	-	437	439	0	1029	-	2.3	5	
	Total	10	1128	1131	0	2585	70.8	2.3	11	8.03
Ophthalmology	M	-	483	482	0	1385	-	2.8	0	
	F	-	361	360	0	1005	-	2.8	5	
	Total	10	844	842	0	2390	65.5	2.8	5	3.65
Internal Medicine	M	0	5181	4979	205	19649	-	3.8	54	
	F	0	3587	3410	181	13371	-	3.7	27	
	Total	78	8768	8389	386	33020	115.2	3.8	81	59.12
Total	M	-	14146	13845	304	50187	-	3.5	83	
	F	-	8626	8371	259	30387	-	3.5	54	
	Total	236	22772	22216	563	80574	93.5	3.5	137	100

Source: MOH annual statistical report, 2019

As within the (Table 5), *Escherichia coli* was positioned the foremost predominant irresistible pathogen of NIs in PBH and found in 31 (22.63%) patients; *Pseudomonas aeruginosa* the moment most irresistible pathogen 19.71%; thirdly *Staphylococcus aureus* 18.25%; *Acinetobacter baumannii* 17.62%; fifthly, *Klebsiella pneumonia* 12.41%; and finally MRSA was found the slightest prevailing one which speaks to 4.38% of the tainted patients within the inspected populace in year 2019.

Table 5. Distribution of different types of organism in PBH in the Year 2019

Organism	N0. of cases	% of cases	Rank
<i>Escherichia coli</i>	31	22.63	1
<i>Klebsiella pneumonia</i>	17	12.41	5
<i>Pseudomonas aeruginosa</i>	27	19.71	2
<i>Staphylococcus aureus</i>	25	18.25	3
MRSA	6	4.38	7
<i>Enterococcus faecalis</i>	7	5.10	6
<i>Acinetobacter baumannii</i>	24	17.52	4
Total	137	100%	

Source: Findings from the sampled population

The cost of hospital infection may constitute an extraordinary stress for the hospital admiration as an additional day spent by the patient and has an impact on the running cost of PBH (recurrent cost/expenditures). In fact, new patient will cost more than the remaining patients which may not require surgery or new medical investigations.

The direct cost of hospital infection is defending as the precise costs brought about in treating the infection, which can be measured by the increased length of stay as well as the additional examinations, consumables and drugs required. Due to need of data in observation records this article concluded to decide the increased cost in terms of the length of stay.

As far as the number of patients founded with nosocomial infection is 137 and the average length of stay in the hospital is 3.5 (Table 3 & Table 4), subsequently the number of patient days can be measured by multiplying them and that will yield ($137 * 3.5 = 479.5$). This 479.5 patient day multiplied by the average cost per patient per day 21.34 (Table 3) will yield JD10232.53 additional cost (economic burden) of nosocomial infections in PBH annual budgeted financial requirements, which have to be considered avoidable cost in case compelling infection control program worked successfully.

5. Conclusion

Among of 22772 admissions to PBH in 2019, the distribution rates of NIs as in Table 4, were 137

conceivable nosocomial contamination cases found on the basic highlights of brief conclusion and on the assistant highlight of gender within five essential supportive wards in PBH campus. Out of 8818 confirmations to the surgical wards, 31 (22.63) patients were found with NIs; 3214 affirmations to the orthopedic ward, 9 cases (6.57) with NIs; 1128 confirmations to the ENT, 11 (8.03) cases with NIs; 844 confirmations to ophthalmic ward 5 case (3.65) with NI; and at long last, 8768 affirmations to the medical division, 81 (59.12) with Nis.

The internal medicine and surgical wards were seen the main host of NIs in the hospital. The highest prevalence rate of infections was seen in the medical word 59.12% and 22.63% in the surgical word. *Escherichia coli* was ranked the most prevalent infectious pathogen of NIs in PBH and discovered in (22.63%); and MRSA was found the least dominant one which represents 4.38% of the infected patients in the sampled population in year 2019.

The total number of patients with acquired infection at PBH is 137; and, the average length of stay is 3.5, subsequently the number of patient days can be measured by multiplying the number of patients by the average length of stay which crop $479.5 (137 * 3.5 = 479.5)$. These 479.5 patient days multiplied by the average cost per patient per day of 21.34 will produce JD10232.53 additional cost (economic burden) of nosocomial infections in PBH annual budgeted financial requirements, which have to be considered avoidable cost in case compelling infection control program worked successfully.

The routine conventions of observation of NIs at PBH have to be work reasonably to decrease the economic burden of NIs in conjunction with national and international criteria to reduce the incidence and prevalence rates levels in a general sense based on all-inclusive criteria (incidence rate= 6%, prevalence = 18%) [15]. Since most contaminations clearly show up after releasing whereby exceptionally uncommon cases return back to PBH, the ordinary procedures of perception are finished up not satisfactory, in case if not incorrect. Therefore, hand cleanliness; sanitation of surfaces, tools and equipment; continuous screening of patients with/ or at risk of NIs in agreement with the hospital contamination conventions; and, the application of crucial and additional preventive measures strategies is badly needed in the hospital to reduce the economic burden [16,17].

Realizing decontamination through the utilization of disinfectants and sterilization strategies is pivotal to anticipate cross infection rates (transmission of infectious pathogens to patients, staff and communities). Since it isn't fundamental to sterilize each patient-care item, PBH policy arrangements ought to distinguish whether cleaning, disinfection and sterilization is demonstrated based essentially on the items' expecting utilize. Lack of compliance with the scientific-based rules will lead to various flare-ups [15,18].

Sterilization can be accomplished through the disposal of all shapes of microbial life by either physical or chemical forms. Like all other hospitals, steam beneath weight, dry warm, ethylene oxide (ETO) gas, hydrogen peroxide gas plasma, and fluid chemicals are the foremost sterilizing operators utilized in (PBH). In spite of the accessible prove around the adequacy of disinfectants to anticipate nosocomial diseases, the need of compliance with the built up rules for sanitization and sterilization, improper timing, selection and access duration of administration of antimicrobial prophylaxes for patients to prevent the spread of hospital acquired infections need to be investigated carefully [18].

This article recommended further studies over the infectious agent itself, the environmental factors of the hospital, the patient susceptibility, and bacterial resistance.

Ethical Issues

There are no ethics issues within the research.

REFERENCES

- [1] Patricia W. Stone, "Systematic review of economic analyses of health care-associated infections", *American Journal of Infection Control*, 33, (9), pp: 501-509, 2005, DOI: <https://doi.org/10.1016/j.ajic.2005.04.246>.
- [2] Howard J.B; Lewis E. Weeks; and, Steven F. Kula, *The financial management of hospital*, sixth edition, Health Administration Press, Ann Arbor: Michigan, 1986, pp: 117-148.
- [3] Trine Strand Bergmo, "How to Measure Costs and Benefits of eHealth Interventions: An Overview of Methods and Frameworks", *J Med Internet Res.*; 17(11), e254. 2015, doi: 10.2196/jmir.4521.
- [4] Hassan Ahmed Khan; Fatima KanwalBaig; and, RiffatMehboob, "Nosocomial infections: Epidemiology, prevention, control and surveillance", *Asian Pacific Journal of Tropical Biomedicine* 7(5), pp:478-482, 2017.
- [5] Asensio Vegasi; V. Monge Jodra; and, M. Lizan Garcia, "Nosocomial Infection in surgery ward: a controlled study of increased duration of hospital stays and direct cost of hospitalization", *European Journal of Epidemiology*, 9(5), pp: 504-510, 1993.
- [6] Jan Muhammad Shaikh; Bikha Ram Devrajani; Syed Zulfiquar Ali Shah; and, Tauseefullah Akhund, Ishrat Bibi, "Frequency, Pattern and Etiology of Nosocomila Infection in Intensive Care Unit: an experience at a tertiary care hospital", *J Ayub Med Coll Abbottabad* 2008;20(4), pp:37-40, 2008.
- [7] Nichols RL., "Postoperative infections in the age of drug-resistant gram-positive bacteria". *Am J Med* 104(5), pp:11S-16S, 1998, DOI: [https://doi.org/10.1016/S0002-9343\(98\)00150-8](https://doi.org/10.1016/S0002-9343(98)00150-8).
- [8] Richard Platt; Deborah S. Yokoe; Kenneth E. Sands; and the CDC Eastern Massachusetts Prevention Epicenter Investigators, "Automated Methods for Surveillance of Surgical Site Infections", *Emerging Infectious Diseases*, 7(2), pp:212-216, 2001.
- [9] Edward Meinert, Abrar Alturkistani, Kimberley A Foley, David Brindley; and Josip Car, "Examining Cost Measurements in Production and Delivery of Three Case Studies Using E-Learning for Applied Health Sciences: Cross-Case Synthesis", *J Med Internet Res.* 21(6): e13574, 2019.
- [10] Nathan Carroll, "The Growing Importance of Cost Accounting for Hospitals", *J Health Care Finance.* 2016 Fall; 43(2): pp:172-185, 2016.
- [11] Mikko Peltola, "Patient classification and hospital cost of care for stroke in 10 European countries", *Health Econ.* 21(Suppl. 2) pp: 129-140, 2012.
- [12] Niek Stadhoudersa; Xander Koolmanb; Marit Tankea; Hans Maarsec; and Patrick Jeurisse, "Policy options to contain healthcare costs: a review and classification", *Health Policy*, 120 (5), pp: 486-494, 2016.
- [13] Robert A. Carels, Robert A. Carels,a, Debra A. Hoffmann, Nova Hinman, Jacob M. Burmeister, Afton Koball,a Lisham Ashrafioun, Marissa W. Oehlhof, Erin Bannon, Michelle LeRoy, and Lynn Darbyb," Step-down approach to behavioural weight loss treatment: A pilot of a randomised clinical trial", *Psychol Health*; 28(10), 2013, doi: 10.1080/08870446.2013.789875.
- [14] Suleyman Yukcu and Hakan Ozkaya, "Comparison of methods for allocation of service departments' costs to operating departments: A Monte Carlo simulation", *African Journal of Business Management* 4 (5), pp: 764-769, 2010.
- [15] Haley RW, Culver DH, White JW, Morgan WM, Emori TG., "The nationwide nosocomial infection rate: a new need for vital statistics", *Am J Epidemiol*; 121 (2), pp:159-67, 1985, doi: 10.1093/oxfordjournals.aje.a113988.
- [16] Aurora Bueno-Cavanillas; Miguel Delgado-Rodríguez; Pablo Lardelli-Claret; Alfredo López-Luque; and, Dr Ramón Gálvez-Vargas, "Difficulties in assessing community-acquired infection as a risk factor for nosocomial infection at an intensive care unit", *European Journal of Epidemiology*, 10(1), pp: 51-56, 1994.
- [17] Mangram AJ, Horan TC, Pearson ML, et al., "Guideline for prevention of surgical site infection", *Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol.*, 27(2), pp:250-278, 1999.
- [18] Kristopher Page; Michael Wilson; and, Ivan P. Parkin, "Antimicrobial surfaces and their potential in reducing the role of the inanimate environment in the incidence of hospital-acquired infections", *Journal of Materials Chemistry*, RSC Publication, 19(23), pp: 3819-3831, 2009. DOI: 10.1039/ b818698g