Extent of microbiological contamination among swabs drawn from selected wards and kitchens at AL -Yarmouk Teaching Hospital in Baghdad –Iraq


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Abstract:

Objective: To evaluate the level of contamination in different hospital’s wards and kitchens in AL-Yarmouk teaching hospital in Baghdad -Iraq.

Method: The study was done from the 1st of January, 2017 to the 30th of June, 2019. A total of 7742 sterile cotton swabs were collected randomly from the following wards: Burns, RCU, CCU, NICU, (Dialysis, Bronchoscopy, Endoscopy) unites and Kitchens. Samples were cultured in different agars and incubated for 24-48 hrs at 25 °C and 37 °C for fungi and bacterial growth, respectively.

Results: Out of 7742 sample, 1227 swabs were reported positive. By 2017, Gram-positive bacteria were more prevalent with 59.5%, and Bacillus was the most common isolated. The rates of Gram-negative bacteria became more predominant with 54.9% and 69.4% in 2018 and 2019, respectively and E. coli was the main isolated bacteria with prevalence rates of 32.1% in (2018) and 42.4% in (2019). The most contaminated wards were CCU (36.6%) in 2017, RCU (32.8%) in 2018, and NICU (10.6%) in 2019, while Peritoneal dialysis showed a continuous increase of contamination from (3%) in 2017 to (9.8 %) in 2019.

Conclusion: Gram-negative bacteria prevalence is increasing. Taking measures to decrease the contamination is essential by following the guidelines and the recommended practices.
Significance and Impact: Should have clear guidelines and strengthening the current infection control strategies. Further studies to monitor the contamination prevalence and to evaluate periodically the cleaning techniques.

Key words: antiseptic, bacteria, hospital kitchens, Infection control, nosocomial infection, swabs, sterilization material and wards contamination.


1. Introduction

Hospital environment is the highest disseminated reservoir for pathogenic microbes, Muhammad et al.(2013) particularly in terms of nosocomial infections or Healthcare-Associated Infections (HAI) which are responsible for significant morbidities and mortalities Gebremariam, and Declaro (2014) because hospital contains diverse of microorganisms, however, bacteria are considered the most concerning organism, Getachew et al.(2018). In developed countries, nosocomial infections affect (5% to 10% and may reach up to 25%) of hospitalized patients, Lalami et al.(2016).

Hospital environment represents the external source of HAI. Air, food, water floors, walls, ceiling, doors, windows, electronic equipment and specific hospital articles in use for assistance to patients, Hammadi et al.(2017) considered as reservoirs for pathogens transmission directly or indirectly to patients Otter et al.(2013).

The air contamination varies qualitatively and quantitatively in the hospital, depending on the wards within the same hospital, as well as patient’s health and practiced health techniques Bekkari et al.(2016). On the other hand and according to the Centre for Diseases Control and Prevention (CDC), outbreaks of HAI linked to the contamination of Endoscope device when compared with the other medical device Hygiena.com/endoscopy(2019), simultaneously, most hospitals prepare patient's food in the hospital kitchens, then distribute it throughout the different wards, if the cleaning and disinfection process to the instruments and equipment is not done properly, so it's considered, as a direct sources of food infection Bagherpour et al.(2015). In the same context, Al-Awsi reported, significant presence of Gram-negative and Gram-positive bacteria in one of the hospitals kitchens Al-Awsi et al.(2018).

Cleaning and disinfecting surfaces in different hospital units is important to evaluate microbial infections and monitoring the activity of the cleaning and disinfecting practices Bouchra et al.(2017); therefore, increasing the number of novel adjunctive technologies, as well as, training the health staff to enhance, develop and support the health system is much needed Chai et al.(2018)
In this current study, we aimed to identify the types and degree of microbial contamination in seven different wards, and kitchens in AL-Yarmouk Teaching Hospital in Baghdad -Iraq.

**Materials & Methods:**

**Study Design and Setting**

This study was accomplished at AL-Yarmouk Teaching hospital in Baghdad capital of Iraq from the 1st of January 2017 to the 30th of June 2019, with a bed capacity of (600) beds. A total of 7742 sterile cotton swabs pre-moistened in a buffer solution(0.85%) were used for sampling surfaces and collected from the following wards: burns , ICU, CCU, Neonatal intensive care unit (NICU), Dialysis unit ( Peritoneal dialysis, Haemo-dialysis negative, haemodialysis HBV and HCV positive ), Bronchoscopy unite , Endoscopy unite and kitchens. These swabs were grouped as the following: 2017(2596, 530); 2018 (2606, 601) and 2019 (1129, 280) wards and kitchen swabs respectively. Samples were collected in the early morning and on random days during the week to estimate the effectiveness of routine cleaning detergent and disinfection practices. Neither cleaning workers nor staffs in wards were informed about the time of sampling collection. Sterilizing and disinfectant materials include seven types were used in the wards and kitchens, which are: 2% glutaraldehyde solution, N-(3-aminopropyl) -N-dodecylpropane-1, Ethanol (222,4mg/g), Ethanol(700mg/g), (N° CAS 64-17-5 : 226 mg/g), Quaternary ammonium propionate from (ANIOS-FRANCE) and 3-6% sodium hypochlorite (NaOCL),May (2011)

**Collection of Samples**

Monthly swabs were cultured and identified in the hospital’s laboratory(microbiology), andone week swabs with Stuart Transport Medium sent to the central public health laboratory (CPLH) Ministry of health/Baghdad-Iraq as a control sample, Singh et al. (2013). 6331 swabs were collected from different sites related to the medical devices, instruments and utensils used in the wards like; set of surgical instruments, sphygmomanometer, ventilator machines, sets and stands for intravenous (IV) fluid, oxygen masks, carts, monitors, weight scale, incubators, patient chairs, cooling and heating devices shower, beds, floors, walls, windows and doors handles, wooden furniture's, tables, cabinets, Curtains, sinks, refrigerator and medicines carts were also taken. While, 1411 randomized swabs were also taken from the kitchen as follows: refrigerators, dishwashing utensils machine, portioning and serving areas, and the clean surfaces which the food is exposed to were swabbed before food production activities begins, which include: pans, meat cutting boards, salad cutting boards, tea/water kettles, ovens, tables, sinks, vacuums, plates tools used for preparing food and food carts. Additionally, swabs were also taken from the floor, walls, windows and door handles.

**Cultural Media**

The swabs were labelled, then transferred to the Microbiology Laboratory at the hospital for culture, which inoculated onto Blood and MacConkey agars for bacteria and Sabouraud dextrose agar for fungi , being prepared according to the manufacturing companies, all culture media plates incubated for 24-48 hrs at (25 °C, 37 °C for fungi and bacterial growth) respectively. Sserwadda et al. (2018).

**Bacterial and Fungal Isolation, Identification and Biochemical Tests**
Next day, pure isolated colonies were differentiated by Gram stain and then biochemically identified using Coagulase test, Mannitol salt agar, Catalase test, Api 20 Staph, Api 20 Strept (Biomereumix-France) for Gram positive bacteria, while Urease tests, Indol, KIg, Simmon citrate, Oxidase test, Api 20 E and Api Candida (Biomereumix-France) for Gram negative bacteria and fungi respectively, (Bekkari et al. 2016; Hammadi et al. 2017).

Statistical
Data was entered in a computer using Statistical Package for the Social Sciences (SPSS) version 23 software. The data was tabulated and expressed as frequencies and percentages. P-value of less than 0.05 was considered as significant value.

Results:
A total of 7642 samples were taken from the wards and kitchen, 1227 swabs were reported positive, 642 of these positive swabs were Gram positive bacteria, 573 were Gram negative and only 12 of them were positive for fungi.

In 2017, 734 swabs were positive for growth, 437 (59.5%) of them were Gram positive, 290 (39.5%) were Gram negative and only 7 (1%) were fungi (Figure 1). However, despite decrease in the number of isolates in the subsequent two years (408 in 2018 and 85 in 2019), but the percentages of Gram negative bacteria were rising to 224 (54.9%) in 2018 and to 59 (69.4%) in 2019 compared to the percentages of Gram positive which have declined to 179 (43.9%) in 2018 and to 26 (30.6%) in 2019.
18 types of microorganisms were identified in the isolates in 2017 (Table 1), however this number declined by the subsequent years reaching only 7 bacterial organisms.

In 2017, *Bacillus* as a Gram positive was the most common bacteria repetitively isolated 197 (26.8%), followed by *E. Coli* as a Gram negative with 158 (21.5%). However, by 2018 and 2019 the number of *Bacillus* noticeably declined to reach in 2018 to 101 (24.8%) and 14 (16.5%) in 2019. While *E. coli* isolates increased to 131 (32.1%) and to 36 (42.4%) in 2018 and 2019 respectively. On the other hand, *Pseudomonas aeruginosa* as a Gram negative was the third commonest bacteria found positive in our cultures during the observed period, with the following percentages 95 (12.9%), 66 (16.2%), and 17 (20%) respectively. Moreover, we came to find that *Staphylococcus epidermidis* and *Staphylococcus saprophyticus* were almost reported equally in numbers throughout the study years. On the other hand, the following bacteria (*Staphylococcus aureus, Streptococcus pneumonia, Citrobacter* spp, and G -ve bacilli) were present in 2017 isolates, and never reported positive again by 2018 and 2019. Moreover, *Staphylococcus* spp, *Diphtheroid*, *Proteus mirabilis, Acinetobacter baumannii, Moraxella catarrhalis, Pantoea* spp, and Fungi were reported negative in 2019 isolates.
The highest contamination rates were recorded in nearly all areas in year of 2017 (Figure 2) and noticeably seen in CCU (36.3%) followed by HCV and RCU with a similar percentage (28.2%). Kitchen and Burns unit had almost close figures with (18.8 %) and (17.8%) respectively.

However, in 2018 the degree of contamination has almost decreased in most of the areas, except RCU, Endoscopy Units, Peritoneal dialysis, and HBV, where the figures raised more than it was in 2017 reaching to (32.8%), (13.3%), (8.4%) and (36.2%) respectively. Peritoneal Dialysis showed a continuous increase in the number of positive swabs over the shown period from 3% in 2017 to 9.8 % in 2019. Moreover, the highest rates of contamination in 2019 was seen in NICU with 10.6 %, and the least contamination rates during the 3 years of the study were in Bronchoscopy units (4.5% in 2017) in which it declined further to 1% in 2019.
Table 2: Total number of positive swabs and their percentages taken from selected high-risk areas of the hospital distributed according to months in the year of 2017.

<table>
<thead>
<tr>
<th>2017</th>
<th>1st quarter January - February-March</th>
<th>2nd quarter April - May -June</th>
<th>3rd quarter July - August - September</th>
<th>4th quarter October - November - December</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Swabs</td>
<td>Positive swabs</td>
<td>%</td>
<td>Swabs</td>
<td>Positive swabs</td>
</tr>
<tr>
<td>Burns Units</td>
<td>126</td>
<td>29</td>
<td>23</td>
<td>88</td>
<td>15</td>
</tr>
<tr>
<td>RCU</td>
<td>70</td>
<td>22</td>
<td>31.4</td>
<td>70</td>
<td>12</td>
</tr>
<tr>
<td>CCU</td>
<td>78</td>
<td>24</td>
<td>30.8</td>
<td>64</td>
<td>24</td>
</tr>
<tr>
<td>Kitchen</td>
<td>132</td>
<td>19</td>
<td>14.4</td>
<td>132</td>
<td>28</td>
</tr>
<tr>
<td>Endoscopy</td>
<td>33</td>
<td>4</td>
<td>12.1</td>
<td>55</td>
<td>2</td>
</tr>
<tr>
<td>Bronchoscopy</td>
<td>43</td>
<td>1</td>
<td>2.3</td>
<td>63</td>
<td>2</td>
</tr>
<tr>
<td>NICU</td>
<td>43</td>
<td>5</td>
<td>11.6</td>
<td>66</td>
<td>4</td>
</tr>
<tr>
<td>Peritoneal Dialysis</td>
<td>43</td>
<td>14</td>
<td>32.6</td>
<td>51</td>
<td>13</td>
</tr>
<tr>
<td>Dialysis Unit</td>
<td>63</td>
<td>17</td>
<td>27</td>
<td>49</td>
<td>8</td>
</tr>
<tr>
<td>HCV</td>
<td>38</td>
<td>14</td>
<td>36.8</td>
<td>49</td>
<td>10</td>
</tr>
<tr>
<td>HBV</td>
<td>44</td>
<td>12</td>
<td>27.3</td>
<td>51</td>
<td>8</td>
</tr>
</tbody>
</table>

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During 2017 year (Table 2), a total of 3126 swabs were taken, the highest number of swabs were taken in the 4th quarter (870 swabs). Despite the fluctuation in the numbers of positive isolates, but there was an overall decrease in the contamination rates over the year of 2017. However, Dialysis units, CCU and RCU considered the highest contaminated units in all quarters. During the 1st quarter in 2017, Dialysis units, precisely HCV showed (36.8%) of contamination followed by peritoneal dialysis (32.6%), RCU and CCU had close percentages with (31.4%) and (30.8%) respectively. During the subsequent quarters, more swabs were taken from the units. However, the figures in the 2nd quarter came down in all units except in CCU which kept increasing to (37.5%), kitchen (21.2%) and Bronchoscopy unit (3.2%). Importantly to mention that the 3rd quarter is considered the worst compared with the others as the contamination rates were very high in all units (CCU 40.8%, RCU 29.6%). Rates of contamination have decreased in all units in the 4th quarter; however, this didn’t apply for RCU (33.8%) and Endoscopy units (8.6%) which kept increasing. Bronchoscopy unit was the only unit with the least contamination rates, despite the steady increase in its percentages over the year to reach 5.4%.
In comparison to the previous year, (Table 3) more swabs were taken in the year of 2018 (3207 swabs) however only 391 swabs were positive, which explains that contamination rates are less in this year. Similarly, to the previous year, Dialysis unit (64%), RCU (32.3%), and CCU (22.0% p-value=0.030) are considered the most dangerous units as the highest percentages of isolates were found there. Moreover, RCU contamination rates were even higher than it was in 2017, with the following percentages 44.1% (1st quarter), 29.6% (2nd quarter), 39.7% (3rd quarter). In the 4th quarter, CCU was more contaminated with 28.6%. Similarly to 2017, Bronchoscopy unit showed the least positive isolates, with zero positive swabs in the second and fourth quarters. While, endoscopy units showed significant contamination with (13.3%, p-value= 0.016). despite the high figures reported in dialysis units, but only Negative dialysis and HBV units were significantly contaminated with (p-values 0.032 and 0.015) respectively.
Table -4- - Total number of positive swabs and their percentages taken from selected high-risk area of the hospital distributed according to months in the year of 2019.

<table>
<thead>
<tr>
<th>2019</th>
<th>1\textsuperscript{st} quarter January-February-March</th>
<th>2\textsuperscript{nd} quarter April-May-June</th>
<th>Total</th>
<th>Number of swabs</th>
<th>Positive swabs</th>
<th>%</th>
<th>Number of swabs</th>
<th>Positive swabs</th>
<th>%</th>
<th>Number of swabs</th>
<th>Positive swabs</th>
<th>%</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns Units</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>4</td>
<td>5.0</td>
<td>74</td>
<td>3</td>
<td>4.1</td>
<td>155</td>
<td>7</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td>0.800</td>
</tr>
<tr>
<td>RCU</td>
<td>72</td>
<td>9</td>
<td>12.5</td>
<td>66</td>
<td>5</td>
<td>7.6</td>
<td>138</td>
<td>14</td>
<td>10.1</td>
<td></td>
<td></td>
<td></td>
<td>0.368</td>
</tr>
<tr>
<td>CCU</td>
<td>48</td>
<td>9</td>
<td>18.8</td>
<td>54</td>
<td>1</td>
<td>1.9</td>
<td>102</td>
<td>10</td>
<td>9.8</td>
<td></td>
<td></td>
<td></td>
<td>0.009</td>
</tr>
<tr>
<td>Kitchen</td>
<td>145</td>
<td>2</td>
<td>1.4</td>
<td>135</td>
<td>13</td>
<td>9.6</td>
<td>280</td>
<td>15</td>
<td>5.4</td>
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<td></td>
<td></td>
<td>0.003</td>
</tr>
<tr>
<td>Endoscopy</td>
<td>20</td>
<td>1</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>20</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Bronchoscopy</td>
<td>50</td>
<td>1</td>
<td>2.0</td>
<td>50</td>
<td>0</td>
<td>-</td>
<td>100</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>NICU</td>
<td>68</td>
<td>10</td>
<td>14.7</td>
<td>83</td>
<td>6</td>
<td>7.2</td>
<td>151</td>
<td>16</td>
<td>10.6</td>
<td></td>
<td></td>
<td></td>
<td>0.182</td>
</tr>
<tr>
<td>Peritoneal Dialysis</td>
<td>61</td>
<td>8</td>
<td>13.1</td>
<td>61</td>
<td>4</td>
<td>6.6</td>
<td>122</td>
<td>12</td>
<td>9.8</td>
<td></td>
<td></td>
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<td>0.270</td>
</tr>
<tr>
<td>Negative dialysis</td>
<td>59</td>
<td>3</td>
<td>5.1</td>
<td>56</td>
<td>1</td>
<td>1.8</td>
<td>115</td>
<td>4</td>
<td>3.4</td>
<td></td>
<td></td>
<td></td>
<td>0.351</td>
</tr>
<tr>
<td>Dialysis Unit</td>
<td>HCV</td>
<td>61</td>
<td>3</td>
<td>5.0</td>
<td>54</td>
<td>1</td>
<td>1.9</td>
<td>115</td>
<td>4</td>
<td>3.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HBV</td>
<td>57</td>
<td>1</td>
<td>1.8</td>
<td>54</td>
<td>1</td>
<td>1.9</td>
<td>111</td>
<td>2</td>
<td>1.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1409 samples were taken in 2019, (Table 4) showed that contamination rates were furthered decreased, yet CCU and kitchen were significantly contaminated (p-value=0.009 and p-value=0.03) respectively. During the first observed quarter, CCU contamination reported (18.8%) but decreased in the 2\textsuperscript{nd} quarter, recording 1.9% only. Furthermore, infection in the NICU came to be (14.7%), which is the highest percentage ever recorded in our NICU during the observed period.
Figure- 3- Summarise the amount of sterilizing and disinfectant materials used over the observed period

During the studied years, (Figure 3) demonstrated that the total amount of disinfection products was 140.181ml (2017), 144.124ml (2018) and 72.191ml (2019). In 2017, Endoscopy unit was receiving the largest portions of the products, a total of 86.0 ml was used for sterilization and cleaning, this explains the low contamination rates (6.8%). Dialysis units and CCU received nearly the same quantities 29.0 ml and 26.0 ml, respectively.

By 2018, the total amount of disinfectant was less than the previous year, however, Dialysis units received 10.0 ml more in 2018, and RCU was supplied with the double amount as well. However, there was a decrease in the total contamination rates in dialysis units to 64% (78.9 % in 2017), and a noticeable increase in RCU contamination (32.3%).

By 2019, more quantities of cleaning products were used compared to 2017 and 2018, however, no products were supplied to Bronchoscopy, Endoscopy units during this year74.0ml of the cleaning products were used in renal dialysis units, which justifies the decline to 18.4% in bacterial isolates. Although NICU, was supplied with 74.0 ml in the first quarter, the contamination rates were higher than the previous years and among the other units in the same year with 10.6%. While in the second quarter, only 1.0 ml was used for sterilization, but 7.2% was the contamination rate.

Kitchens on the other hands, were receiving 3000.0 ml weekly of bleach materials as detergents, in which total of (140,000 ml) were used in 2017, (144,000 ml) in 2018, and nearly half of the amount (72,000 ml) were consumed in 2019.
Discussion:

Hospital atmosphere, items and instruments, medical staff and patients are expected to be colonized with different micro-organisms; these organisms are considered threat to the patients, resulting in increasing the risks of mortalities and morbidities, Bhatta et al. (2018). This study was established to create an insight about the frequency, degree of contamination and the bacterial load in one of the busiest hospitals in Baghdad over a period for 2 years and a half.

In 2017, 18 different microorganisms were identified in our isolates, in which 59.5% of the isolates were Gram-positive, 39.5% were Gram-negative and only 1% were fungi. Our findings regarding the Gram-positive were lower than the study by Getachew et al.(2018) where a total of 356 swabs were taken, and 81.6% of the isolates were Gram-positive. During this year, the most identified organism in our wards was Gram-positive Bacillus 26.8% (n=197). Bacillus is very pathogenic and could develop fatal infections, mainly in neonatal and immunocompromised patients ,Zhang et al.(2019). Moreover, Bacillus cereus could cause gastrointestinal bleeding, necrosis and fatty changes in liver, Dhafer (2018). However, our findings were similar to the ones published in 2012 at Thi-Qar city - Iraq, when the author concluded that Bacillus and Enterobacter were the most cultured organisms and found mainly in ICU ,Nasser et al.(2013).

Prevalence of Gram-negative has grown up in our hospital from 39.5% in 2017 to 54.9% in 2018 and to 69.4% in 2019. E. coli was the second most common identified Gram-negative bacteria in 2017 after Bacillus with 21.5% (n=158), and the main isolated organism in 2018 and 2019 with 32.1 % (n=131) and 42.4% (n=36) respectively. These are critical findings, as Gram-negative considered the most known antibiotic resistant micro-organism, can survive for a long time regardless of living in dry or wet surfaces, responsible for increasing the rates of NI (nosocomial infections) and increasing the duration of hospitalization ,Khan et al.(2017). Gram-negative, is in charge of many NI, including UTI (43.6%) in wards, pneumonia (35.1%) in ICU, and wound infection (14.5%). These NI mainly caused by Enterobacter, E. coli, Pseudomonas aeruginosa, and Coagulase-positive Staphylococci with (59.8%, 34.5%, 25.3% and 14.9%) respectively, Assar et al.(2012).

The level of contamination by Gram-negative in our hospital is higher than the results found in Iran, in which 30.35% was the prevalence of Gram-negative bacilli, Ayatollahi et al.(2017).

Pseudomonas aeruginosa on the other hand, was the third commonest G-ve bacteria frequently isolated in our hospital (Table2). Compared to another study at Al-Hilla teaching hospital, Pseudomonas aeruginosa was the main prevalent organism isolated from the kitchen, Al-Awsi et al.(2018), the complication rates in the admitted patients caused by Pseudomonas aeruginosa is significantly increasing ,Zabihi and Goneirani(2017). This dramatic growth in contamination level was explained by the accelerated growth in antibiotic resistance which mainly seen by Gram-negative organisms. Mehradet al. (2015).

Further in this study, we identified that RCU, CCU, and renal dialysis unit were the highest contaminated areas in our hospitals. Patients who are admitted in these units, are facing higher risks of infection, mainly because their immunity is much weaker compared to other patients in other wards, having invasive interventions (like ventilation device, urinary catheter, central venous line) and receiving a wide spectrum of antibiotics ,Saedimehr et al. 2015. Russotto, reported in 2015 that infection rates in ICU was (36.78 %) which is higher than any of our recorded figure (32.3%) while infection rates in CCU was (1.72%) which is much lower than...
ours as the least percentage of CCU contamination we came to report in our hospital was (9.8% in 2019).

As illustrated in (Figure 2), all units that belong to renal dialysis showed considerable ratios of contamination, and it is known that death due to infections in renal patients is a common cause after cardiovascular events. Karkar et al. (2014), although the level of contamination in our hospital was decreasing over 2018 and 2019 (except in peritoneal Dialysis), but having a risk of infection can lead to increase morbidity in haemodialysis patient, mainly seen as Gram-negative bacteremia caused by E. coli. Vijayan and Boyce (2018). Murray, study revealed that (49.5%) of Gram-negative bacteremia caused by E. coli and (11.9%) of the patient had more than one E. coli sepsis. Murray et al. (2015).

Total eradication of infections may not be applicable, Pallabi (2018) but following policies, guidelines and recommended practices for disinfections, Tacconelli et al. (2014) and educating the staff and providing the needed instruments and material, Baghapour et al. (2015) may help to reduce the incidence of infections and eliminate pathogens as much as possible, especially when it comes to dealing with instruments like Endoscopies and Bronchoscopies which are heavily contaminated and much harder to disinfect (Kovaleva et al. 2013; Hygiena.com/endoscopy, 2019). However, providing information in the current study, about the shortage in cleaning products and disinfectant availability (Figure 3), puts a further explanation of the reported rates of contamination and another problem to solve in our hospital.

Despite the fact that NICU and RCU were supplied with a nearly equal number of products 7ml for (NICU) 5ml for (RCU), but the contamination rates were highly varied between the both, (28.2% in RCU) and (8.2% in NICU). And although 74 ml of detergents given in the first quarter of 2019 to disinfect the NICU the bacterial load was 10.6%, this can help us to conclude that providing more detergents doesn’t necessarily help to reduce the level of contamination in our hospital as there are other factors that should be identified and managed correctly. In Ethiopia, a study was established to identify the factors that could worsen the contamination rates in the hospitals, and results shown that room temperature (26.5–29.5 °C), humidity (64.5–85 %), poor ventilation system and poor waste management system all favour the bacterial growth. Gizaw et al. (2016). Other factors like non-processed food served to the ICP, Khamis and Hafez (2011), hand hygiene and increase people movements, Aladenika and Olaniyan (2014) improper and wrong food preparation procedures, Yousif et al. (2013), and contamination carried by the ICU doctors and nurses, where they have found that ICU Physicians carry (85%) of contamination risk followed by 79.3% nurses. The highest contamination sources were found in the uniforms for all the ICU workers, Abu Radwan and Ahmad (2017). Another study identified that bacterial load in the ICU medical charts was 2 to 4-fold higher than any other department, Chen et al. (2014). Further etiologies were listed by other physicians, in which they found that understaffed NICU puts pressure on the current workers, which results in decreasing the quality of care, increasing the errors and the rates of HI, ventilated patients who require more staffing are more predisposed to these complications, providing the perfect number of nurses can actually decrease the ventilator-associated pneumonia. Eren et al. (2017).
Conclusion and Recommendations:

The results of this study illustrate significant increase in the contamination rates by Gram- negative bacteria which is considered as a serious threat to the patients and to the medical staff, especially obtaining these micro-organisms in areas where it should be the cleanest and minimally infected.

Therefore, the necessity to have clear guidelines and strengthening the current infection control strategies, is much needed and not to omit the importance of proper hand sanitation, to decrease the transmission of infections as much as possible. Furthermore, as the rates of contamination are increasing in our hospital, further studies and surveillances are needed to monitor the contamination prevalence in our hospital and to evaluate periodically the cleaning techniques.

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