

## **Invasive procedures and Hospital Acquired Infection (HAI) in A large hospital in Northern Uganda.**

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**Background:** *Hospital Acquired Infection (HAI) increases morbidity, mortality and decreases quality of life of patients. It also increases the cost of patient care, both direct and indirect, through the need for additional and expensive drugs, laboratory and other diagnostic test. Lacor hospital which, carries-out on average 16 major surgical operations per day and has C/section rate of 14% could provide a conducive hub for HAI unless it strictly adheres to universal procedure and Standard precautions. Hence there is need to continuously monitor HAI rate for all invasive procedure done in the hospital.*

**Methods:** *Through a across sectional descriptive study done in March 2014 on all in patients in the hospital to determine HAI rates. Using WHO standards, HAI was determined in the following invasive procedures; intravenous line sepsis, surgical site infection, urinary tract infection, Lower respiratory tract infection. Data collected was entered and analyzed using SPSS version 15.*

**Results:** *Approximately 129 patients fulfilled the WHO inclusion criteria for HAI survey out of which, 18 patients (14%) were found to be having HAI as according to WHO guideline. Of the 18, 10 had been catheterized and there was a significant correlation between catheterization and HAI ( $r=0.319$ ,  $P=0.00$ ) but Urinary tract infection (UTI) rate in hospital was 38%. The rate of surgical site infection (SSI) was 21.9% and there was significant correlation between surgical intervention and development of HAI (P value of 0.003,  $r=0.259$ ). However, only 3 (3%) of the patients with intravenous (IV) line had IV line infection and the average duration of IV line in-situ in the hospital was 2.4days.*

**Conclusion:** *Overall the HAI in Lacor hospital is 14% and is comparable to the levels seen in other regional facilities. Many hospitals can monitor their rate of hospital infection rate and use it to improve quality of services.*

**Recommendation:** *All health facility should have an infection control committee which monitors rates of hospital acquired infection at least once a year and disseminate for critical reflection and decision making.*

### **Introduction**

Hospital Acquired Infection (HAI) increases morbidity, mortality and decreases quality of life of patients. It also increases the cost of patient care, both direct and indirect, through the need for additional and expensive drugs, laboratory and other diagnostic test in addition to the extra expenditure levied on the family and hospital due prolonged hospitalization.

A HAI relates to infection that is not present at admission but occurs more than 48hours after admission<sup>1</sup>. Invasive procedures like surgery, urethral, intravenous catheterization are amongst the most common predisposing variables to HAI. According to WHO guideline, a urinary tract infection (UTI) relates to local pain or burning in patients with an indwelling urinary catheter<sup>1</sup>. Bloodstream infection (BSI) manifest as either a phlebitis on the site of insertion of a vascular cannula or clinically evident septicemia not attributable to the patient's underlying disease<sup>1</sup>. A respiratory tract infection (RTI) following endotracheal intubation relates to clinical or radiographic evidence of pneumonia or bronchitis.<sup>1</sup>. A surgical site infection (SSI) often manifest as any purulent discharge, pyrexia, edema, serosity or cellulitis at the surgical site following a surgical intervention within the previous week<sup>2</sup>.

Studies in the USA reveal that as many as 4 million nosocomial infections occur per year<sup>3</sup> and mortality rate attributed to hospital acquired bacteremic from [urinary tract infection](#) is as high as 12.7 per cent<sup>4</sup>. Furthermore, surgical site infections accounts for 20% of HAI in the US, however for ICU patient with SSI, their death rate is estimated at 11% and 25% for bloodstream infections<sup>5</sup>. In the UK, hospital acquired surgical site infection (SSI) rate for limb amputation is estimated to be 14.3 SSIs per 100 operations and it was further discovered that SSI causes additional hospital stay of 3.3 to 21 days with an additional cost ranging from 959 to 6103 pounds<sup>6</sup>. However A meta-analysis of 220 articles found an overall health-care-associated infection density in adult intensive-care units to be 47.9 per 1000 patient-days (95% CI 36.7-59.1), with Surgical-site infection being the leading infection in hospitals<sup>7</sup>.

In Africa, hospital-wide HAI prevalence varies between 2.5% and 14.8% in Algeria, Burkina Faso, Senegal and the United Republic of Tanzania<sup>8</sup>. It was found that Surgical site infection is the most common infection encountered among surgical patients with an overall cumulative incidence in surgical wards ranging from 5.7% to 45.8% in studies conducted in Ethiopia and Nigeria<sup>8</sup>. Similarly study from Burkina Faso on HAI prevalence among surgical patients reported surgical site infection as being the most common type, followed by urinary tract infection and hospital-acquired pneumonia<sup>8</sup>.

A separate study denoted the prevalence of hospital acquired infection to range between 3.0 to 20.7%, and it pointed out that most hospitals in developing countries especially Africa, have no effective infection control program due to lack of awareness of the problem, lack of personnel, poor water supply, erratic electricity supply, ineffective antibiotic policies with emergence of multiply antibiotic resistant microbes, poor laboratory backup, poor funding and non-adherence to safe practices by health workers<sup>9</sup>. In Morocco, the prevalence of HAI was found to be 17.8%, of which the most frequently infected sites was urinary tract (35%) and surgical wounds (32.5%) and it also indicated that HAI is linked to the surgical category, a hospital stay of more than 10 days, and the use of intravascular and urinary devices<sup>10</sup>.

In Nigeria, hospital acquired Urinary tract infection (UTI) rate was found to be 43.9% while surgical site infection rate was 30.7% and these were the most prevalent HAI. Whilst UTIs were significantly higher in surgical and medical wards, surgical site infections were highest in obstetrics and gynecology wards<sup>11</sup>. In another study, Kolawole, Kolawole, Kandaki-Olukemi, et al (2009) found hospital acquired UTI rate to be 43.33% using microscopic examination of the centrifuged urine, for significant pyuria (pus cells of 5 cell/ hpf) and they also further reported that the Peak of UTI age was 21-25 and 26-30 years for both male and female sex with quinolones being the most potent of all the antibiotics<sup>12</sup>.

In 2011, surgical site infection (SSI) rate was detected in 26.0% patients in Tanzania and the risk for SSI was further increased by use of iodine alone for skin preparation, pre-morbid illness, cigarette smoking, duration of operation and placement of surgical drains<sup>13</sup>. However a separate study by [Eriksen](#), [Chugulu](#), [Kondo](#) and [Lingaas](#) found that 19.4% of the patients develop SSI and out of which 36.4% of such infection were apparent only after discharge from hospital<sup>14</sup>. According to the researchers, prophylactic antibiotic use was not protective against SSI and furthermore there was significant risk of developing SSI when the operations was classified as contaminated or dirty, or if operations lasted more than 50 minutes.<sup>14</sup>

Regarding hospital acquired blood stream infection, Centers for Disease Control and Prevention (CDC) estimated that a total of 250 000 cases of Blood Stream Infection occur annually and out of which, 62,000 deaths occur among patients in hospitals<sup>15</sup>. In Uganda a study by Nahirya, Byarugaba, Kiguli and Kaddu-Mulindwa (2008) found intravascular catheter related infections in children in Mulago National referral hospital to be 20.7% with an associated phlebitis rate of 17.4% on the paediatric wards of Mulago hospital, Uganda<sup>16</sup>. In Lacor Hospital, Greco in 2010 found the prevalence of hospital acquired infections (HAI) to be 28%, but a repeat survey 1 year

later (Greco, 2011) found a 50% reduction in the HAI rate of 14%<sup>17</sup>. Lacor hospital which is a big hospital located in Northern Uganda admits 67 patients daily, carries-out on average 16 major surgical operations per day and has C/section rate of 14%<sup>17</sup> could provide a conducive hub for HAI for every invasive procedure unless it strictly adheres to universal procedure and Standard precautions. There is need to continuously monitor HAI rate for all invasive procedure done in the hospital.

The main objective of this study was to determine the overall prevalence of hospital acquired infection (HAI) and stratify it by the commonly done invasive procedure in the hospital amongst in patients.

### **Material and Methods**

A across sectional descriptive study to determine the prevalence of HAI was done in March 2014 in St Mary's hospital Lacor which is a 483 bed rural based health facility and a University teaching hospital for Gulu medical school. HAI diagnosis was formulated by the investigation team according to WHO guidelines in collaboration with unit's staff in all inpatients. The HAI variables that were appraised in the investigation consisted of the following invasive procedures; intravenous line sepsis, surgical wound infection, urinary tract infection, Lower respiratory tract infection.

A Setting of 6 survey teams consisting of specialist, medical officers, pharmacist, laboratory technicians, and Registered nurses were trained on the questionnaire filling format and case definition for one day. All patients present in hospital wards in March 2014 and those admitted not less than two days before the survey, were recruited in the survey. Sampling was done by quota method whereby cases included all patients who were admitted and fulfilled the inclusion criteria and has had intervention like catheterization, intravenous line, surgery, surgical drain tube insertion or endotracheal intubation. The clinical signs and laboratory data relating to HAI was collected in a standardized questionnaire and presence of HAI was diagnosed according to WHO standard criteria and definition. Furthermore, presence of an HAI was evaluated from the clinical record and the discussion with the ward doctor or nurse according to the HAI case definition. All patients with a urinary catheter had urine sample sent to laboratory for chemical and microscopic analysis and a proxy of Urinary tract infection was reached if urinalysis showed  $\geq 5$  pus cells per high power objective. Other study variable evaluated consisted of age, sex, type of intervention and evidence of hospital acquired infection, while in the Hospital to get prevalence.

### **Data collection and analysis**

Data generated was checked for relevance, correctness and completeness on the day of the survey. The Statistical Data package SPSS version 10 was used to input data. Analysis was done in a descriptive way offering statistical tables with observed frequencies and statistical test where necessary

### **Results**

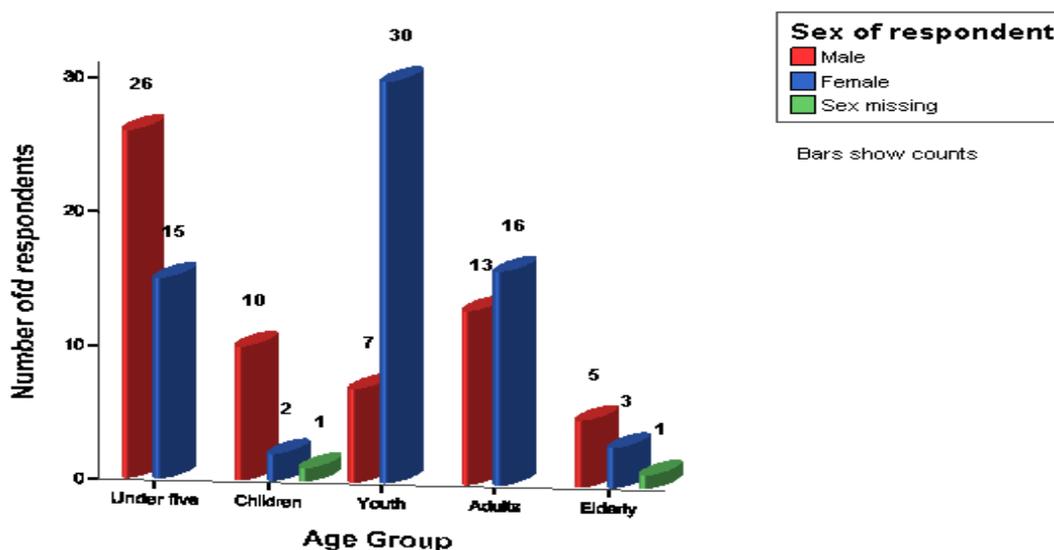
A total of 403 inpatients were surveyed in the hospital and of these, 129 (32 %) patients fulfilled the WHO inclusion criteria for the survey because they were exposed to an invasive intervention of these while in hospital and had spent 48hrs since admission. Of the 129 cases, 18 patients (14%) were found to be having HAI as according to WHO guideline. Therefore the HAI rate in Lacor Hospital was 14% (Table 1 ). There was no patient with endotracheal tube and hospital acquired pneumonia found during the survey.

**Table1.** Prevalence of Hospital Acquired infections

		Prevalenc of HAI in 2014	
		Frequency	Percent
Valid	Has HAI	18	14.0
	No HAI	111	86.0
	Total	129	100.0

**Age/sex Distribution:**

Whilst children below 18yrs formed the bulk of cases studied, 54 out of 129 (41%), the youth (19-35yrs) were also a significant contributor to morbidity comprising 37(28.8%). However the majority of the youth in the study were females compared to children below 18yrs who were predominated by males. The adults (36-65yrs) of age comprised 29 out of 129 (22%) and had almost equal proportion of males and female. Elderly patients over 65 years were few. This is because in most sub-Saharan hospitals the young with acute illness are the predominant occupiers of hospital compared to the elderly with chronic disease (Figure 1). However when the sex distribution was compared, it was found that 66 (51.2%) of the total were female and 61(47.3) were males. There were no significant different in the sex of the patients studied (P=0.8)



**Figure 1.** Sex\_and Age distribution of respondents

**Urinary Tract Infection(UTI) in Patients with Catheter**

As shown in Table 2, of the 129 studied, the 21 (16.2%) patients had urinary catheter on day of survey; their average duration of catheterization was 4.16days with a range of 2-90day. However 8 out of the 21 (38.1%) patients had laboratory findings of UTI hence HAI evidenced by their urinalysis showing  $\geq 5$ pus cell per high power microscopy (Table 1). Of the 21 patients who were catheterized, 12 (57%) were in surgical ward, 5 (24%) were in gynecology and 3 (14%) in ICU respectively Therefore, urinary tract infection (UTI) rate in hospital was 38%. Of the 18 patients who were found with HAI, 10 had been catheterized and there was a very significant correlation between catheterization and HAI ( $r=0.319$ ,  $P=0.00$ ).

**Table 2.** Urinary Tract infection

How much WBC/Pus cells was in the urine			
	Below 5 cells/ml	More than 5cells /ml	Total
Catheterized patient	13	8	21
Proportion	61.9%	38.1%	100.0%

**Intravenous line**

Out total of 129 surveyed, 98(76.7%) patients had IV line cannulas out of which 3 (3%) had IV line infection; this finding was not significant (P=0.859). However the average duration of IV line was 2.4days. Importantly all the 3 patients whose IV line was infected were from medicine ward (Table 3). Therefore Intravenous catheterization is not an important cause of HAI in Lacor Hospital nor in pediatric ward

**. Table 3.****Intravenous line Put and was the IV line infected**

			Is the IV line infected?		Total
			Yes	No	
Was IV line Put?	Yes	Count	3	95	98
		% within Was IV line Put?	3.1%	96.9%	100.0%
	No	Count	0	1	1
		% within Was IV line Put?	.0%	100.0%	100.0%
Total		Count	3	96	99
		% within Was IV line Put?	3.0%	97.0%	100.0%

**Surgical Site Infection (SSI)**

Out of the 129 patients surveyed, 20 (15.5%) had major elective surgery, 9 (7%) had major emergency surgery, 7(5.4%) had minor elective surgery and minor emergency surgeries were 3%. Therefore a total of 40 (31%) patient had undergone surgery on the day of survey and 89 (69%) were non post operatives cases.

**Table 4.** Surgery and HAI

Surgery Done	Was there HAI?		Total No
	Yes No. (%)	No No. (%)	
Major elective	5 (25.0%)	15 (75.0%)	20
Minor elective	2 (28.6%)	5(71.4%)	7
Major emergency	4 (44.4%)	5 (55.6%)	9
Minor emergency	1 (25.0%)	3	4
No surgery	6 (6.7%)	83 (93.3%)	89
<b>Total</b>	18 (14.0%)	111(86.0%)	129

**Table 5.** Pearson correlation between Surgery and Development of HAI

		Is there HAI	Surgery was done
Is there HAI	Pearson Correlation	1	.259(**)
	Sig. (2-tailed)		.003
	N	129	129
Surgery was done	Pearson Correlation	.259(**)	1
	Sig. (2-tailed)	.003	
	Number	129	129

Of the 20 patient who underwent major elective surgeries, 5 (25%) developed surgical site infection (SSI) and of the 9 who underwent major emergency surgeries, 4 (44.4%) developed SSI. However of the 7 patients who had minor elective surgeries 2 developed SSI and of the 4 who had minor emergency surgery 1 got SSI (Table 4). Note that 6 patients had HAI from other sources other than surgery and some patients had the double tragedy of UTI and SSI

Overall the rate of SSI was 21.9%, therefore surgical interventions increased the proportion of patients with HAI as seen above and the types of intervention also affected the prevalence of HAI. Maternity ward had the highest rate of surgical wound infection (71.4%) attributable to emergency Caesarian-section. There was significant correlation between surgical intervention and development of HAI (P value of 0.003,  $r=0.259$ ) (Table 5).

### Discussion

Notwithstanding the prevailing challenges of conducting a HAI survey, the impact of HAI in terms of prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobials, a massive additional financial burden for health systems, high costs for patients and their families, and excess deaths<sup>18</sup> calls for efforts to monitor and manage all predisposing factor to HAI. The fact that higher frequency of infection is associated with the use of invasive devices, in particular central lines, urinary catheters, ventilators<sup>18</sup> and during surgical intervention calls for strict adherence to universal precaution and monitoring of infection arising from such invasive procedure.

According to our findings (Table 1 and Fig 1) the overall HAI rate was 14%. This is similar to the findings of other authors in Argentina<sup>19</sup>, Algeria, Burkina Faso, Senegal and the United Republic of Tanzania<sup>8</sup> and in Morocco<sup>10</sup> and other African countries<sup>9</sup>. Whilst children below 18yrs formed the bulk of cases studied, 54 out of 129 (41%) followed by the youth (19-35yrs) (28.8%), this is because most children are treated with intravenous drugs in the hospital, and they formed the bulk of cases who had intravenous catheterization. However, there was no significant sex difference amongst the cases studied as also reported previously in another study by Kolawole, *et al* (2009)<sup>12</sup>

Our study found a urinary tract infection rate of 38% and there was a significant correlation ship between catheterization and HAI ( $r=0.319$ ,  $P=0.00$ ). Hence if we do not use aseptic technique and universal precaution we are likely to introduce UTI during catheterization. Our findings matches that in Morocco but lower that in Nigeria<sup>11,12</sup>. The slightly lower rate of UTI in our setting could be due to the reduce average duration of catheterization of only 4days.

Whilst intravenous catherisation is known to cause blood stream infection and death of 62,000 annually<sup>15</sup> and in Uganda it cause 20.7% infection and 17.4% phlebitis in patients<sup>16</sup>, our study found only 3% rate of IV line infection; this finding was not significant ( $P=0.859$ ). The significant reduction in Intravenous line infection is due to reduce average duration of leaving cannulea insitu of 2.4days and improve asepsis during placement of intravenous catheters and reduced frequency of IV cannula insertion. A previous study by Greco and Magombe (2011)<sup>20</sup> which found a 14% rate of intravenous line infection in the hospital also led to the

institutionalization of infection control committee and many reforms in infection control measure. Contrary to the notion that developing countries have no effective infection control program due to lack of awareness of the problem, lack of personnel, ineffective antibiotic policies with emergence of multiply antibiotic resistant microbes, poor laboratory backup, poor funding and non-adherence to safe practices by health workers<sup>9</sup>. Lacor hospital has an Infection control committee (ICC) as a part of the general quality assurance /quality improvement initiative at Lacor Hospital. As noted by Saxena and Mani<sup>21</sup>, the hospital infection control committed is a fundamental shift in approach to infection control in critical care that we must not shy away from.

Overall our study found surgical site infection (SSI) rate of 21.9% and there was significant correlation between surgical intervention and development of HAI (P value of 0.003,  $r=0.259$ ). This finding is similar to what was found by; Klevens, Jonathan, Chesley *et al*<sup>5</sup> in the USA, Mawalla, Mshana, Chalya, Imirzalioglu and Mahalu<sup>13</sup>, and Eriksen, Chugulu, Kondo and Lingaas<sup>14</sup> separately in Tanzania.

### Conclusions

Overall the HAI in Lacor hospital 14% and is comparable to the levels seen in other regional facilities thus is in itself an achievement that need not be undervalued but rather built on by succeeding generations of clinicians armed with knowledge attitudes and interventions in this field. Much as we have succeeded in reducing blood stream infection from intravenous catheterization we still experience a relatively high rate of hospital acquired in invasive procedure that causes a UTI rate 38% and SSI of 21.9%, and it remains the driver of HAI.

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### References

1. Greco D, Ogwang M, Paramatti D, Okello T.R, Ochola E, et al (2013), "Prevalence of hospital-associated infections can be effectively decreased in developing countries", Journal of Hospital Infection, Jan 2013
2. Mangram A.J, Horan T.C, Pearson M.L, Silver L.C, William R. J, (1999) "Guideline for Prevention of Surgical Site Infection", AJIC Volume 27, Number 2 1999
3. Haley, R.W, Culver D.H, John W. White, Meade Morgan W And Emori T.G, (n.d) "The Nationwide Nosocomial Infection Rate A New Need For Vital Statistics" American Journal Of Epidemiology Volume 121, Issue 2 Pp. 159-167.)
4. Bryan CS, Reynolds KL (1948), The Journal of Urology [1984, 132(3):494-498], Type: Journal Article
5. Klevens R.M Jonathan R. E Chesley L. R et al (2007), Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002, Public Health Rep. 2007 Mar-Apr; 122(2): 160-166.
6. Coello R, Charlett A, Wilson J<sup>3</sup>, Ward V Pearson A, P. Borriello P (2005); "Adverse impact of surgical site infections in English hospitals" Journal of Hospital Infection Volume 60, Issue 2, June 2005, Pages 93-103, DOI: 10.1016/j.jhin.2004.10.019
7. Benedetta A, Sepideh B. N, Combescure C, et al (2011) "Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis", The Lancet Volume 377, Issue 9761, 15-21 January 2011, Pages 228-241

8. Sepideh Bagheri Nejad Benedetta Allegranzi <sup>a</sup>, Shamsuzzoha B Syed <sup>b</sup>, Benjamin Ellis <sup>c</sup> & Didier Pittet (2011) Health-care-associated infection in Africa: a systematic review, *Bulletin of the World Health Organization* 2011;89:757-765. doi: 10.2471/BLT.11.088179
9. Samuel S.O, Kayode,O.O, Musa O.I, Nwigwe G.C, et al (2010 ) “Nosocomial infections and the challenges of control in developing countries”. *African Journal of Clinical and Experimental Microbiology* Vol 11, No 2 (2010)
10. Jroundi I, Khoudri I, Azzouzi A, Zeggwagh A.A, Benbrahim, N.F, et al (2007) “Prevalence of hospital-acquired infection in a Moroccan university hospital”, *American Journal of Infection Control* Volume 35, Issue 6, August 2007, Pages 412–416
11. Ige O.K, Adesanmi A.A, and Asuzu M.C. (2011). “Hospital-acquired infections in a Nigerian tertiary health facility: An audit of surveillance reports” *Niger Med J.* 2011 Oct-Dec; 52(4): 239–243. doi: 10.4103/0300-1652.93796
12. Kolawole, A. S, Kolawole, O. M, Kandaki-Olukemi, Y. T, Babatunde, S. K, Durowade K. A and Kolawole, C. F, (2009), “Prevalence of urinary tract infections (UTI) among patients attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State, Nigeria” *International Journal of Medicine and Medical Sciences* Vol 1. (5) pp.163-167, May, 2009
13. Mawalla B, Mshana S.E, Chalya L.P, Can Imirzalioglu and Mahalu W, (2011), “Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern Tanzania” *BMC Surgery* 2011, 11:21 doi:10.1186/1471-2482-11-21
14. Eriksen H.M, Chugulu S, Kondo S, Lingaas E, (2003), “Surgical-site infections at Kilimanjaro Christian Medical Center” *Journal of Hospital Infection* Volume 55, Issue 1, September 2003, Pages 14–20 DOI: 10.1016/S0195-6701(03)00225-1
15. WHO (n.d.), Preventing bloodstream infections from central line venous catheters, [www.who.int/patientsafety/.../bsi/en/](http://www.who.int/patientsafety/.../bsi/en/) retrieved 17<sup>th</sup>/ 06/2014.
16. Nahirya, P Byarugaba, J<sup>2</sup> Kiguli S, and Kaddu-Mulindwa D (2008), “Intravascular catheter related infections in children admitted on the paediatric wards of Mulago hospital, Uganda” *Afr Health Sci.* Dec 2008; 8(4): 206–216.
17. St. Mary’s hospital Lacor Annual report year 2012/2013. Nov. 2013, [www.lacorhospital.org](http://www.lacorhospital.org)
18. WHO (n.d), Report on the Burden of Endemic Health Care-Associated Infection Worldwide, [www.who.int/iris/bitstream](http://www.who.int/iris/bitstream), ISBN 978 92 4 150150 7,
19. Durlacha R, McIlvenny G, Newcombe R.G, Reid G, Doherty L et al (2012), “Prevalence survey of healthcare-associated infections in Argentina; comparison with England, Wales”, *Journal of Hospital Infection* xxx (2012) 1-7
20. Greco D and Magombe I (2011), “Hospital Acquired Infection in a large Northern Ugandan Hospital”, *J PREV MED HYG* 2011; 52:55-58
21. Saxena P and Raj Kumar Mani (2014), Preventing hospital acquired infections: A challenge we must accept, *Indian J Crit Care Med.* Mar 2014; 18(3): 125–126. doi: 10.4103/0972-5229.128699