

A Comparative Study of WHO Hand Hygiene Guidelines, Gel Sanitizer Adherence, and Microbial Load among Healthcare Professionals in Dadra and Nagar Haveli

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ABSTRACT

BACK GROUND OF THE STUDY: A hospital is a vital social and medical institution that provides comprehensive curative and preventive healthcare while serving as a hub for medical training and biosocial research. Within these facilities, a multidisciplinary team of healthcare professionals collaborates to deliver quality care to diverse patient populations. However, healthcare-associated infections (HAIs) frequently emerge during treatment from external or internal microbial sources, commonly manifesting as urinary tract, surgical site, bloodstream, or ventilator-associated infections. These nosocomial complications are primarily driven by rapid bacterial proliferation involving pathogens such as *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. Consequently, understanding microbial pathways is essential for maintaining strict infection control standards within healthcare environments.

METHOD: Total 100 (experimental group-50 and control group-50) samples selected as per inclusion and exclusion criteria. A quasi-experimental non-randomized control group design. 100 health care workers selected by using non probability quota sampling technique.

RESULT: The analysis showed that in the experimental group, bacterial load decreased from 62% low, 30% moderate, and 8% high to complete elimination post-intervention, while the control group showed reduction (38% low, 44% moderate, 18% high) but not elimination. Mean pre-test loads for doctors (16.83), nurses (12.77), MTS (36.50), and sweepers (14.77) dropped to zero post-test ($p < 0.05$), whereas in the control group, loads reduced but persisted (doctors 21.69 to 5.69, nurses 35.50 to 4.92, MTS 38.92 to 4, sweepers 32.25 to 6.42; $p < 0.001$). Compliance was 100% in the experimental group versus 92% high, 6% moderate, and 2% low in the control group. No significant association was found between pre-test bacterial load and demographic variables ($p > 0.05$).

CONCLUSION: The study demonstrated that gel-based hand sanitizer is highly effective at reducing bacterial loads among healthcare workers. Post-intervention bacterial loads fell to zero across all categories in the experimental group, whereas the control group achieved only partial reduction through routine practices. Furthermore, hand hygiene compliance was significantly higher and more consistent in the experimental cohort. Although most demographic factors—including age, gender, education, and clinical experience—showed no significant correlation with bacterial reduction, staff designation was significantly associated with outcomes in the experimental group. Overall, these findings confirm that

structured gel-based hand hygiene practices significantly minimize microbial burden and maximize compliance, thereby optimizing infection control within clinical environments.

Keywords: Hand hygiene, Gel-based hand sanitizer, Bacterial load, Healthcare workers, Compliance.

INTRODUCTION

A hospital operates as an essential social and medical institution tasked with delivering comprehensive curative and preventive healthcare services while functioning as a critical center for professional training and biosocial research. Within these contemporary facilities, a multidisciplinary network of healthcare professionals—including physicians, nurses, and allied support staff—collaborates to execute specialized care plans across diverse patient populations. Despite optimal clinical interventions, healthcare-associated infections (HAIs), or nosocomial infections, frequently emerge during patient management from external or internal microbial sources, commonly presenting as catheter-associated urinary tract infections, surgical site infections, central line-associated bloodstream infections, or ventilator-associated pneumonia. These complications are predominantly driven by rapid prokaryotic proliferation involving opportunistic pathogens such as *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.

Globally, HAIs present an escalating public health challenge, maintaining a steady annual incidence increase. Marked disparities exist between resource-rich and resource-limited settings. In developed countries, HAIs affect a significant percentage of hospitalized individuals and intensive care unit (ICU) patients, placing immense financial burdens on healthcare systems and directly contributing to substantial annual mortality. Conversely, the burden is profoundly magnified in developing nations, where the pooled hospital-wide HAI prevalence and ICU infection densities soar to rates more than three times the figures observed in the United States. In these resource-constrained settings, high-quality studies indicate that actual infection rates remain exceptionally elevated, with surgical site and urinary tract infections constituting the major clinical presentations.

In India, surveillance data mirrors this critical challenge. Pooled ICU infection rates reflect high densities of device-associated complications, including elevated central line-associated bloodstream infections and corresponding catheter-associated urinary tract risks. Furthermore, epidemiological data from regional multi-specialty facilities in Gujarat indicates a distinct male predominance among infected patients, with urinary tract infections identified as the leading nosocomial complication, followed closely by surgical site infections and sepsis. Compounding this clinical burden is the high prevalence of antimicrobial resistance among nosocomial pathogens in low- and middle-income countries, characterized by widespread resistance to third-generation cephalosporins and carbapenems among *Klebsiella*, *Acinetobacter*, and *Pseudomonas* species.

Pathogen transmission via the hands of healthcare workers remains the primary vector for nosocomial dissemination. While the World Health Organization (WHO) mandates hand hygiene compliance rates exceeding ninety percent to guarantee patient safety, international and domestic adherence levels remain profoundly suboptimal. Pooled compliance rates across low- and middle-income nations remain low, dropping even further among specific support staff. In India, multi-center data shows a concerning low compliance range, with notable deficits recorded prior to direct patient contact. Even within specialized intensive care environments, complete adherence prior to targeted interventions has been documented at critical single-digit percentages.

Given that hand colonization by multi-drug resistant bacteria acts as a critical intermediary in hospital cross-infection, systematic surveillance of hand hygiene compliance is vital. The current inquiry was initiated to evaluate existing hand hygiene practices, assess the specific efficacy of gel-based sanitizers against WHO criteria, and analyze the baseline bacterial load among healthcare professionals within a selected hospital in Dadra and Nagar Haveli. Generating this localized evidence is essential to close the gap between clinical guidelines and actual nursing practice, reduce the institutional burden of HAIs, and optimize patient safety.

STATEMENT OF THE STUDY

A Comparative Study of WHO Hand Hygiene Guidelines, Gel Sanitizer Adherence, and Microbial Load Among Healthcare Professionals in Dadra and Nagar Haveli

OBJECTIVES OF THE STUDY TO:

- To assess the level of bacterial load in hand before the hand hygiene practice with gel based hand sanitizer among experimental and control group of health care workers.
- To assess the level of hand hygiene practice with gel based hand sanitizer among experimental and control group of health care workers.
- To assess the level of bacterial load in hand after hand hygienic practice with gel based hand sanitizer among experimental and control group of health care workers.
- To determine the compliance of hand hygiene practice by comparing level of bacterial load in hand before and after hand hygiene practice with gel based hand sanitizer among experimental and control group of health care workers.
- To find association between bacterial load at hand before hand hygiene and selected demographic variables of health care workers.

HYPOTHESIS

Null Hypotheses

- H01: There is no significant difference between the level of bacterial load in hand before and after hand hygiene practice with hand sanitizer among experimental and control group of health care workers.
- H02: There is no significant association between level of bacterial load at hand with selected demographic variables of experimental and control group of health care workers

Alternative Hypotheses

- HA1: There is a significant difference between the level of bacterial load in the hand before and after the hand hygiene practice with hand sanitizer among the experimental and control group of health care workers.
- HA2: There is no significant association between level of bacterial load at hand with selected demographic variables of experimental and control group of health care workers

ASSUMPTION

- A structured approach using gel-based hand sanitizer may significantly lower the microbial load on the hands of healthcare professionals.

- Aligning practices with WHO hand hygiene guidelines may positively change the compliance and adherence levels of healthcare workers.
- Healthcare professionals may already possess some variations in baseline bacterial colonization and hand hygiene awareness prior to evaluation.

OPERATIONAL DEFINITIONS

Assess: In this study, assess refers to systematic process of measuring and analyzing the level of microbial load on healthcare worker's hands before and after the hand sanitizer

Hand hygiene: In this study, hand hygiene refers to the process of cleaning hand to remove dirt, bacteria and virus to prevent the spread of infection.

Practice: It refers to the observable action and behaviors of healthcare workers related to hand hygiene using gel based hand sanitizer according to the world health organization's recommended five moments for hand hygiene and using the correct step rubbing technique.

Gel based hand sanitizer: It refers to an alcohol based antiseptic solution used which contains gel and ethanol IP 85% which is manufactured by RAMAN AND WEIL Pvt. Ltd to disinfect hand and reduce microbial load

WHO Guideline: It refers to WHO recommended "five movement of hand hygiene" by applying alcohol based gel sanitizer on hand to ensure effective infection control and reduction of bacterial load.

Compliance: It refers to the degree to which healthcare workers follow hand hygiene guidelines by properly using hand sanitizer.

Healthcare workers: It refers to an individual who provide direct or indirect care and services to patients in a healthcare setting include doctors, nurses, Multi Tasking Staff and sweeper.

Bacterial load: It refers to the number or concentration of bacterial microorganisms present on the surface of the hands, usually quantified as colony forming unit per square centimetre before and after the use of gel based hand sanitizer.

RESEARCH METHODOLOGY

Research Approach: Quantitative Research Approach

Research Design: Quasi-experimental research design

Variables:

- **Independent Variable** - Hand hygiene technique with gel based hand sanitizer
- **Dependent Variable** - bacterial load on the hands of healthcare workers.
- **Demographic Variables:**

age, gender, marital status, educational qualification, designation, years of clinical experience, department, previously undergone in-service education on hand hygiene

Research Setting: Selected hospital of Dadra and Nagar Haveli

Population And Sample:

Population: populations were healthcare workers currently employed in a selected hospital located in Silvassa, Dadra and Nagar Haveli.

Sample: sample size was 100 health care workers include Doctors (25), Nurses (25), Multi Tasking Staff (25), and Sweeper (25)

Sampling technique: Non probability quota sampling technique

Inclusion criteria:

- health care worker who are working in selected hospital, Silvassa, Dadra and Nagar Haveli
- Healthcare Workers: Includes doctors, nurses, multi tasking staff and sweepers directly involved in patient care.
- Healthcare workers are having at least 6 months of work experience in the hospital.
- Healthcare workers Who are able to comprehend Hindi, Gujarati and English

Exclusion criteria :

- Health care Workers on prolonged leave or unable to participate due to medical conditions.
- Health care Workers who decline to participate or withdraw consent during the study.
- Health care Workers Who is having allergy to chemical use for hand rub.
- Health care Workers Who is having injury or infection in hand.

DESCRIPTION OF THE TOOL:**SECTION- I: DEMOGRAPHIC DATA**

Demographic perform collects data about the characteristics of the sample population. The items included were age, gender, marital status, educational qualification, designation, years of clinical experience, department or unit and previously undergone in-service education on hand hygiene.

SECTION-II: OBSERVATIONAL CHECKLIST

An observational checklist used to assess the hand hygiene practice performed by the healthcare workers. The score was 11 to 13 scores means high compliance, 7 to 10 scores means moderate compliance and less than 6 means low compliance.

Table 1: scoring of checklist to assess the hand hygiene practice by using gel based hand sanitizer

Sr. No.	Score	Compliance.
1	11 to 13	High compliance
2	7 to 10	Moderate compliance
3	0 to 6	Low compliance

SECTION-III: STERILE SWAB CULTURE METHOD

Sterile swab culture method was developed to assess the bacterial load in hand of health care worker.

Table 2: scoring of bacterial load in hand among healthcare workers

Sr. No.	Score	Bacterial Load
1	0	No Growth
2	1 To 20	Low Contamination
3	21 To 50	Moderate Contamination
4	> 50	High Contamination

RESULT**DATA ANALYSIS AND INTERPRETATION****SECTION I : Frequency And Percentage Distribution Based On The Demographic Variables Of Health Care Workers**

**Table 3: Frequency And Percentage Distribution Of Demographic Variables Among Health Care Workers
n=100**

Sr. no.	Demographic variable		Experimental group		Control group	
			Frequency	Percentage	Frequency	Percentage
1	Age in year	21-30years	39	78	28	56
		31-40 years	10	20	18	36
		41-50 years	0	0	4	8
		Above 50 years	1	2	0	0
2	Gender	Male	13	26	20	40
		Female	37	74	30	60
3	Marital status	Unmarried	12	24	15	30
		Married	38	76	32	64
		Divorced	0	0	1	2
		Widowed	0	0	2	4
4	Educational	<10 th	3	6	4	8
		10 th	7	14	14	28
		12 th	15	30	7	14
		G.N.M	11	22	12	24
		B.Sc.	2	4	0	0
		M.B.B.S	12	24	13	26
5	Designation	Doctor	12	24	13	26
		Nursing officer	13	26	12	24
		MTS	12	24	13	26
		Sweeper	13	26	12	24
6	Years of Clinical experience	6months -1year	8	16	10	20
		1-5 year	29	58	19	38
		6-10 years	9	18	13	26
		>10 years	4	8	8	16
7	Department	Medical	19	38	26	52
		Surgical	9	18	13	26
		Pediatric	5	10	3	6
		Gynec ward	8	16	4	8
		ICU	5	10	1	2
		OPD	0	0	0	0
		Orthopedic	4	8	3	6
8	In-service education	No	10	20	9	18
		Yes	40	80	41	82

SECTION II: Frequency And Percentage Distribution Of Pre Test And Post Test Level Of Bacterial Load In Hand Among Control Group And Experimental Group Of Health Care Workers

Table 4: Frequency And Percentage Distribution Based On Pre Test And Post Test Score Of Bacterial Load Among Experimental And Control Group Of Health Care Workers
n=100

Sr. no	Health care worker	Experimental group						Control group					
		Low Contamination		Moderate Contamination		High Contamination		Low Contamination		Moderate Contamination		High Contamination	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Doctors	8	66.67	4	33.33	0	0	7	53.85	6	46.15	0	0
2	Nursing officer	10	76.92	3	23.08	0	0	4	33.33	6	50	2	16.67
3	MTS	3	25	6	50	3	25	4	30.77	5	38.46	4	30.77
4	Sweeper	10	76.92	2	15.38	1	7.69	4	33.33	5	41.67	3	25
	Overall	31	62	15	30	4	8	19	38	22	44	9	18

SECTION III: Frequency And Percentage Distribution Based On Hand Hygiene Practice Level Among Experimental And Control Group Of Health Care Workers.

Table 5: Frequency And Percentage Distribution Based On Hand Hygiene Practice Among Experimental And Control Group Of Health Care Workers.
n=100

Sr. no	Health care worker	Experimental group						Control group					
		Low compliance		Moderate compliance		High compliance		Low compliance		Moderate compliance		High compliance	
		F	%	F	%	f	%	F	%	f	%	F	%
1	Doctors	0	0	0	0	12	100	1	7.69	12	92.31	0	0
2	Nursing officer	0	0	0	0	13	100	0	0	10	83.3	2	16.67
3	MTS	0	0	0	0	12	100	0	0	12	92.31	1	15.38
4	Sweeper	0	0	0	0	13	100	0	0	12	100	0	0
	Overall	0	0	0	0	50	100	1	2	46	92	3	6

SECTION IV: Comparison Of Pre Test And Post Test Level Of Bacterial Load In Hand Among Experimental Group Of Health Care Workers

Table 6: Comparison Of Pre Test And Post Test Bacterial Load In Hand Among Experimental Group Of Health Care Worker

Sr. No	Health care workers	Experimental group				t- test	P value	LOS
		Pre test bacterial load		Post test bacterial load				
		Mean	SD	Mean	SD			
1	Doctors	16.63	7.11	0	0	8.2	0.00001	S
2	Nursing officer	12.77	8.1	0	0	5.69	0.0001	S
3	MTS	36.50	23.28	0	0	5.43	0.00021	S
4	Sweeper	14.77	15.4	0	0	3.46	0.00473	S
	Overall	19.96	17.24	0	0	3.68	0.0347	S

SECTION V :Comparison Of Pre Test And Post Test Level Of Bacterial Load In Hand Among Control Group Of Health Care Workers

Table 7: Comparison of pre test and post test bacterial load in hand among control group of health care worker
n=50

Sr. no.	Health care worker	Control group				t- test	P value	LOS
		Pre test bacterial load		Post test bacterial load				
		Mean	SD	Mean	SD			
1	Doctors	21.69	11.45	5.69	3.99	6.13	0.00005	HS
2	Nursing officer	35.50	17.89	4.92	2.07	6.21	0.00007	HS
3	MTS	38.92	24.33	4	2.74	5.02	0.0003	HS
4	Sweeper	32.25	20.02	6.42	6.53	5.69	0.00014	HS
	Overall	32.02	19.56	5.24	4.13	23.05	0.00119	HS

SECTION VI : Analysis Of Pre Test And Post Test Bacterial Load Score Among Experimental And Control Group Of Health Care Workers

Table 8: Comparison Of Pre Test And Post Test Bacterial Load Score Among Experimental And Control Group

	Group	Mean	Standard deviation	t- test	p -value	Level of significance
Pre test	experimental group	19.96	17.24	3.27	0.0007	Significance
	Control group	32.02	19.56			
Post test	experimental group	0	0	8.96	0.00001	Significance
	Control group	5.24	4.13			

SECTION VII: Association For Pretest Score Of Bacterial Load In Hand Of Control Group And Selected Demographic Variable Of Healthcare Workers

Table 9: Analysis Of Chi-Square Test To Find Association Between Pre Test Score Of Bacterial Load In Hand Of Control Group And Selected Demographic Data Of Health Care Worker

Demographic variable	Control group						X ²	p-value
	Pre test							
	Mild		Moderate		High			
	F	%	F	%	F	%		
Age in year							5.778 df-4	0.216
21-30years	12	24	14	28	2	4		
31-40 years	5	10	7	14	6	12		
41-50 years	2	4	1	2	1	2		
Gender							0.718 df-2	0.698
Male	9	18	8	16	3	6		
Female	10	20	14	28	6	12		
Marital status							10.46 df-6	0.106
Unmarried	9	18	5	10	1	2		
Married	8	16	16	32	8	16		
Divorced	0	0	1	2	0	0		
Widowed	2	4	0	0	0	0		
Education							8.208 df-8	0.41
<10	0	0	3	6	1	2		
10 th	6	12	4	8	4	8		
12 th	2	4	3	6	2	4		
G.N.M	4	8	6	12	2	4		
M.B.B.S	7	14	6	12	0	0		
Designation							5.249 df-6	0.51
Doctor	7	14	6	12	0	0		
Nursing officer	4	8	6	12	2	4		
MTS	4	8	5	10	4	8		
Sweeper	4	8	5	10	3	6		
clinical experience							7.4 df-6	0.28
< 1year	5	10	5	10	0	0		
1-5 year	7	14	9	18	3	6		
6-10 years	3	6	7	14	3	6		
>10 years	4	8	1	2	3	6		
Department							16.06 df-10	0.098
Medical	10	20	15	30	2	4		
Surgical	5	10	6	12	2	4		
Pediatric	2	4	1	2	0	0		

Gynec ward	1	2	1	2	2	4		
ICU	0	0	0	0	1	2		
Orthopedic	1	2	0	0	2	4		
undergone in-service education							0.56 df-2	0.756
No	0	0	3	6	6	12		
Yes	15	30	17	34	9	18		

SECTION VIII : Association For Pretest Score Of Bacterial Load In Hand Of Experimental Group And Selected Demographic Variable Of Healthcare Workers

Table 10: Analysis of chi-square test to find association between pre test score of bacterial load in hand of experimental group and selected demographic data of health care workers

n=100

Demographic variable	Experimental group						X ²	p-value
	Pre test							
	Mild		Moderate		High			
	F	%	F	%	F	%		
Age in year							5.45 df-4	0.24
21-30years	27	54	9	18	3	6		
31-40 years	4	8	5	10	1	2		
>50 years	0	0	1	2	0	0		
Gender							0.43 df-2	0.806
Male	9	18	3	6	1	2		
Female	22	44	12	24	3	6		
Marital status							1.368 df-2	0.505
Unmarried	9	18	2	2	1	2		
Married	22	44	13	26	3	6		
Education							9.91df-10	0.44
<10	3	6	0	0	0	0		
10 th	3	6	3	6	1	2		
12 th	7	14	5	10	3	6		
G.N.M	9	18	2	4	0	0		
B.Sc.	1	2	1	2	0	0		
M.B.B.S	8	16	4	8	0	0		

Designation							12.74 df-6	0.047
Doctor	8	16	4	8	0	0		
Nursing officer	10	20	3	6	0	0		
MTS	3	6	6	12	3	6		
Sweeper	10	20	2	4	1	2		
clinical experience							7.948 df-6	0.24
< 1 year	8	16	0	0	0	0		
1-5 year	17	34	10	20	2	4		
6-10 years	4	8	4	8	1	2		
>10 years	2	4	1	2	1	2		
Department							9.13 df-10	0.519
Medical	13	26	5	10	1	2		
Surgical	4	8	3	6	2	4		
Pediatric	3	6	2	4	0	0		
Gynec ward	4	8	4	8	0	0		
ICU	3	6	1	2	1	2		
Orthopedic	4	8	0	0	0	0		
undergone in-service education							1.006 df-2	0.60
No								
Yes	7	14	1	2	2	4		
	17	34	15	30	8	16		

DISCUSSION

In this present study, doctors and nursing officers in the experimental group mostly showed low contamination (66.67% and 76.92% respectively), whereas the control group had comparatively fewer in the low category and more with moderate or high contamination. Among MTS, both groups showed higher levels of moderate to high contamination, though the experimental group had a slightly better distribution. Sweepers in the experimental group demonstrated a clear advantage, with 76.92% showing low contamination compared to only 33.33% in the control group. Overall, the experimental group showed lower levels of contamination across most categories, while the control group had a higher proportion with moderate and high contamination. In the present study, all participants in the experimental group (100%) showed high hand hygiene compliance post-intervention. In contrast, the control group had only 6% with high compliance, 92% with moderate, and 2% with low compliance, indicating lower adherence without intervention. In this present study Calculated pre-test, Among the healthcare workers, MTS had the highest pre-test bacterial load (36.50 ± 23.28), while nursing officers had the lowest (12.77 ± 8.1), with doctors and sweepers showing intermediate levels; after intervention, the bacterial load reduced to zero in all groups.

In this present study Calculated pre-test, In the control group, MTS had the highest pre-test bacterial load (38.92 ± 24.33), followed by nursing officers (35.50 ± 17.89), while post-test scores showed the highest remaining bacterial load among sweepers (6.42 ± 6.53).

The results show a significant reduction in bacterial load using gel-based hand sanitizer with WHO hand hygiene techniques. The experimental group had significantly lower pre- and post-test scores compared to the control group (pre-test: $t = 3.27$, $p = 0.00007$; post-test: $t = -8.96$, $p = 0.00001$), indicating the method's superior effectiveness in removing bacteria.

In the present study the analysis of demographic variables in the control group showed no statistically significant association between age, gender, marital status, education, designation, clinical experience, department, or in-service education and the level of bacterial contamination ($p > 0.05$ in all cases). This means that contamination levels were not influenced by demographic characteristics, but rather by external factors such as hand hygiene practices and environmental exposure.

In the present study, the only significant factor was designation ($p = 0.047$), meaning the type of job (doctor, nurse, MTS, sweeper) influenced the level of contamination.

CONCLUSION

The study concluded that gel-based hand sanitizer was highly effective in reducing bacterial load on the hands of healthcare workers. In the experimental group, bacterial load reduced to zero in all categories after the intervention, whereas the control group showed only partial reduction, indicating routine practices were less effective. Hand hygiene compliance was higher and more consistent in the experimental group, with fewer cases of low compliance compared to the control group. While demographic factors such as age, gender, marital status, education, clinical experience, department, and in-service education showed no significant association with bacterial load, designation was found to be significantly associated in the experimental group. Overall, the findings strongly support that proper hand hygiene practice using gel-based hand sanitizer significantly improves bacterial load reduction and compliance among healthcare workers, thereby enhancing infection control in clinical settings.

REFERENCE

1. Taylor C, Lynn P, Bartlett JL, "Fundamentals of Nursing: The Art and Science of Person-Centered Care", South Asian Edition, Vol. 1, Wolters Kluwer.
2. Gupte S, "The Short Textbook of Medical Microbiology (Including Parasitology)", 10th ed., Jaypee Brothers Medical Publishers.
3. Raoofi S, Pashazadeh Kan F, Rafiei S, Hosseinipalangi Z, Noorani Mejareh Z, Khani S, et al., "Global Prevalence of Nosocomial Infection: A Systematic Review and Meta-analysis", PLoS One, January 2023, 18(1), e0274248. DOI:10.1371/journal.pone.0274248.
4. World Alliance for Patient Safety, "The Global Patient Safety Challenge 2005–2006: Clean Care is Safer Care", World Health Organization, Geneva, 2005. Available from: <http://www.who.int/gpsc/en/>
5. Vincent JL, "Nosocomial Infections in Adult Intensive Care Units", The Lancet, June 2003, 361, 2068–2077.
6. Kim JM, Park ES, Jeong JS, Kim KM, Kim JM, Oh HS, et al., "Multicenter Surveillance Study for Nosocomial Infections in Major Hospitals in Korea", American Journal of Infection Control, December 2000, 28(6), 454–458.

7. Klevens RM, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA, et al., "Estimating Health Care–Associated Infections and Deaths in U.S. Hospitals, 2002", *Public Health Reports*, March–April 2007, 122(2), 160–166.
8. Klavs I, Bufon Lužnik T, Skerl M, Grgic-Vitek M, Lejko-Zupanc T, Dolinšek M, et al., "Prevalence of and Risk Factors for Hospital-Acquired Infections in Slovenia: Results of the First National Survey, 2001", *Journal of Hospital Infection*, June 2003, 54(2), 149–157.
9. Eriksen HM, Iversen BG, Aavitsland P, "Prevalence of Nosocomial Infections in Hospitals in Norway, 2002 and 2003", *Journal of Hospital Infection*, May 2005, 60(1), 40–45.
10. The French Prevalence Study Group, "Prevalence of Nosocomial Infections in France: Results of the Nationwide Survey in 1996", *Journal of Hospital Infection*, October 2000, 46(3), 186–193.