of patient days during the term of surveillance.[2]

During the term of surveillance, 184 cases of nosocomial infections were identified (116 males and 68 females), 8,285 patients were discharged, and the total number of patient-days was 229,568. The overall nosocomial infection rates were 2.2/100 discharges and 0.80/1,000 patient-days. The rate of infections/100 discharges was highest in the digestive surgery ward (7.5), followed by the neonatal intensive care unit (6.2), the brain surgery ward (5.9), and hematology-gastroenterology ward (5.8), and the patient-day infection rate was highest in the digestive surgery ward (2.15/1,000 patient-days), followed by emergency center (1.68), the brain surgery ward (1.59), and the hematology-gastroenterology ward (1.45). The distribution by infection site is shown in the Table.

Overall, 190 pathogens were isolated or suspected as causative agents. These included 106 MRSA isolates (56%), 6 methicillin-sensitive *S aureus* isolates (3.2%), 5 *Staphylococcus epidermidis* isolates (2.6%), 8 *Enterococcus* species (4.2%), 5 *Pseudomonas aeruginosa* (2.6%), 8 *Enterobacter* species (4.2%), 4 *Serratia marcescens* isolates (2.1%), 3 *Klebsiella pneumoniae* isolates (1.5%), 2 *Citrobacter* (1.1%), 1 *Escherichia coli* (0.5%), 1 *Haemophilus influenzae* (0.5%), 7 fungi (3.7%), 13 adenovirus (6.8%), and 3 cases of scabies (1.6%).

Although the surveillance showed that MRSA was the major pathogen responsible for nosocomial infections at our hospital, our use of limited sources (ie, the bacteriology lists of MRSA isolates and the isolates from blood cultures) to identify the nosocomial infections in ward rounds might have caused a bias favoring the detection of MRSA infections. Consequently, we performed additional surveillance from April 1997 to March 1998, which showed a 51.3% incidence of MRSA among the causative pathogens of nosocomial infections.

This surveillance was performed based on the complete bacteriology report (the list of all isolates at our hospital) automatically prepared by the clinical laboratory computer. In addition, we carried out targeted surveillance from June 1998 to March 1999 according to the National Nosocomial Infection Surveillance System method.[3] Again, we found that MRSA isolates were the most prevalent type, both surgical-site infections (39.6%) and catheter-associated bloodstream infections (32.6%).

In conclusion, for the primary strategy of infection control, we believe that all the healthcare workers must take further steps to practice and master methods to care for their patients using both Standard Precautions and Contact Precautions[4] to contain MRSA, the major nosocomial pathogen in our hospital.

TABLE
OCCURRENCE OF NOSOCOMIAL INFECTIONS FROM JUNE 1995 TO MARCH 1996, FUKUOKA UNIVERSITY HOSPITAL

Type of Infection	NI	% of Total	Infection Rate*
BSI	42	(22.8)	2.8
SSI	29	(15.8)	1.9
Pneumonia	37	(20.1)	2.4
RTI	3	(1.6)	0.2
UTI	27	(14.7)	1.8
GI	22	(12)	1.4
Scabies	3	(1.6)	0.2
EKC	13	(7.1)	0.9
Meningitis	2	(1.1)	0.1
Skin infection	4	(2.2)	0.3
Arthritis	1	(0.5)	0.1
Otitis media	1	(0.5)	0.1
Total	184	(100)	2.2

Abbreviations: BSI, bloodstream infection; EKC, endemic keratoconjunctivitis; GI, gastrointestinal system infection; NI, nosocomial infection; RTI, respiratory tract infection; SSI, surgical-site infection; UTI, urinary tract infection.
* Nosocomial infection rate=number of nosocomial infections×100/total number of patients discharged.

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Outbreak of *Enterobacter cloacae* Related to Understaffing, Overcrowding, and Poor Hygiene Practices

To the Editor:

In their report about an *Enterobacter cloacae* outbreak in a neonatal intensive care unit (ICU), Harbarth et al discussed the influence of understaffing, overcrowding, and hand washing.[1] Harbarth et al included among their references the findings some years earlier of Haley et al,[2] who concluded, after an outbreak of staphylococcal infection in a neonatal special care unit, that overcrowding and understaffing in neonatal nurseries were significantly associated with cross-infection, because of the near impossibility of frequent hand washing between handling different infants.

That is why in the editorial the question was raised of whether "Too Many or Too Few Hands?"[3] that is, hand washing, or its lack, was really responsible for outbreaks of nosocomial diseases.

If medical personnel have to work in a situation of understaffing and overcrowding, do they really

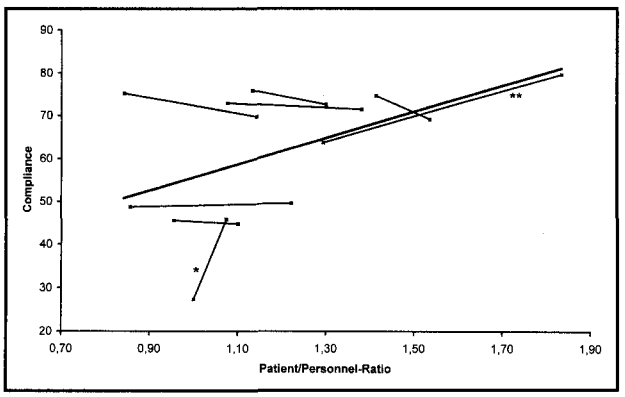

FIGURE. Compliance with hand disinfection or hand washing according to patient:personnel ratio from two observation periods in eight individual intensive care units.

reduce their frequency of hand washing due to their lack of time?

To proffer further material for this discussion, we wish here to report on our experience.

Within an interval of 2 years, we performed two observational studies in eight medical-surgical ICUs in medium-sized hospitals in Germany. The same medical student documented the frequency of hand disinfection or hand washing by medical personnel performing patient device manipulation that requires this procedure, according to most guidelines for the prevention of infection in ICUs. Manipulation of respiratory equipment, vascular catheters, and urinary catheters was included, as well as the changing of dressings. The investigator spent two 8-hour working days during each observation study in the ICUs. In addition, she recorded the number of patients and personnel on each observation day. Compliance was calculated as the quotient of hand disinfection or handwashing procedures for all device manipulations.

A total of 2,170 observations were recorded, with between 72 and 318 during a single observation period. The overall compliance with hand disinfection or hand washing was 61.7%, ranging widely from 27.4% to 79.8% between units and observation periods. The overall patient:personnel ratio was 1.20, ranging from 0.84 to 1.8. In the Figure, compliance is plotted against the patient:personnel ratio. The data from the two observation periods in an individual ICU are connected by lines. In six hospitals, almost no change of compliance was observed with varying patient:personnel ratio. In one hospital (marked with one star), despite a similar patient:personnel ratio, a remarkable increase of compliance was found, but in another hospital (marked with two stars), the compliance also increased with a more unfavorable patient:personnel ratio. In general, no trend for decrease of compliance with increase of the patient:personnel ratio was observed (thick line).

Of course, our results should be interpreted carefully:

1. The situation in adult ICUs may be different from neonatal ICUs where newborn babies are cared for in isolators.

2. The more often observed practice of hand disinfection as opposed to hand washing in German ICUs may indeed be connected with behavioral patterns on the part of the medical personnel when subjected to understaffing or overcrowding situations.

3. In calculating the crude patient:personnel ratio, the qualification of personnel was not considered. It is possible that, among a high number of personnel, a high percentage were not well trained, and thus, despite a large number of personnel, many mistakes in patient care could arise.

4. The number of observations is small, and the observation periods were short, so our results may perhaps be somewhat random.

In all, however, the question of the influence of understaffing and overcrowding on the frequency of hand disinfection or hand washing remains unsolved. It may even be possible that staff are more fully aware of the requirement of hand disinfection or hand washing in these exceptional and particular situations, thereby heightening their normal compliance with hygiene directives.

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The authors reply.

We are indebted to our German colleagues for taking the trouble to comment on our article[1] and earlier work performed by Haley and Bergman[2] about understaffing and overcrowding and their relation to poor compliance with hand-hygiene practices and transmission of nosocomial pathogens. Being mindful of space limitations, we will not attempt to reply to all issues related to this complex topic. However, we would like to address the following points:

1. The overall compliance with hand hygiene in the observed German intensive care units (ICUs) was astonishingly high compared to our[3] and others' observations in different types of ICUs. In our outbreak investigation,[1] compliance with hand hygiene before device contact was 25% during the work-load peak and increased to 70% after the end of the understaffing and overcrowding period. We believe that the availability of bedside hand disinfection contributed to the favorable findings in the German ICUs and agree with Eckmanns et al that fast-acting alcohol-based hand disinfection solutions within close patient range may limit noncompliance, especially in periods of increased time pressure and work load. We recently reported the encouraging results of a large hospitalwide promotion campaign,[4] based on better understanding of major risk factors for poor compliance[3]: among several key components, the availability of alcohol-based hand rub at the patient