Glove removal method and distance: What else can affect contamination?

To the Editor:

Editor, I read the recent published work on glove removal method and distance with a great interest.[1] Lai et al concluded that ''The impact of the glove removal procedure and the distance to the bin in which used gloves are discarded should be taken into consideration on a daily basis''.[1] I would like to add some more factors that are reported to be relating to the hand contamination in glove usage. Olsen et al published in *JAMA* that latex gloves were less frequently associated with hand contamination.[2] The environment in a room occupied by a patient colonized by bacteria is also another factor that affects the hand contamination.[3] Finally, although the use of florescent staining is a good contamination determination technique, there are some technical issues of concern.[4] This technique cannot completely cover all kinds of contaminations, especially for viruses. Also, it might have incorrect diagnosis—the false negative—if the staining is not properly and adequately performed.

Conflicts of interest: None to report.

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Bacterial contamination of glucose test strips: Not to be neglected

To the Editor:

The role of fomites in bacterial transmission is still debated and need further investigations.[1] Involved in hepatitis C and B virus infection, the glucose meters have also been reported to be contaminated during outbreak by multidrug-resistant (MDR) bacteria as *Acinetobacter baumannii*.[2-4] However, the potential role of glucose test strips (GTS) manipulation in the transmission of micro-organisms was poorly studied. We investigated the bacterial contamination of GTS in our 400-bed teaching hospital. During January 2010, a new glucose meter was introduced (Nova StatStrip Xpress; Nova Biomedical, Courtaboeuf, France) in our hospital; presumably for economic purposes, the corresponding test strips were no longer unitarily packaged but were in a 50-unit container. During 6 consecutively weeks, we investigated the bacterial load of GTS in 4 different wards: the surgical intensive care unit, the neonatal intensive care unit, the hepatology and gastroenterology ward, and the geriatric medicine ward. In the 2 ICUs, a single vial was used individually for each patient and remained in the patient's room and was discarded after his discharge; in the last 2 wards, a vial was shared between the different hospitalised patients, except those being in contact precautions. The vials and strips were exclusively manipulated by the nurses without any specific recommendations. Weekly, a single GTS was aseptically sampled with a sterilized clip in each opened vial; as an indicator of the number of successive uses, the remaining amount of strips was visually estimated into 4 categories (inferior to 25% of the initial 50 units count, between 25% and 50%, between 50% and 75%, and superior to 75%). In the laboratory, each strip was placing in 1 mL of 0.9% NaCl and vortexed for 30 seconds. One hundred microliters of the suspension was cultured on Colombia colistin nalidixic acid and Drigaslki agar; in the case of MDR (ie, extended-spectrum β-lactamase *Enterobacteriaceae* or methicillin-resistant *Staphylococcus aureus*) or *Clostridium difficile* carriers, additional selective medium were inoculated according to the manufacturer's recommendations. Viable bacteria were counted after 24 hours and 48 hours of culture at 37°C. Microorganisms recovered were identified by standard microbiologic methods. The initial bacterial load of the strips, commercialized in sealed but nonsterile vials, was measured using the same procedure. The intrinsic antibacterial activity of the strip was also evaluated in plating it on a Mueller Hinton agar plate previously inoculated with a 0.5 MacFarland suspension of ATCC29213 *Staphylococcus aureus*. To estimate the relationship between

Table 1. Frequencies, nature, and quantitative analysis of bacterial contamination of glucose strip tests: n = 148

Type of ward	Number of positive culture (%)	Number of positive culture with skin flora (%)*	Number of positive culture with enteric flora (%)†	Range of bacterial load for positive strip (UFC/strip)	Mean bacterial load among positive strip (UFC/strip)
SICU	6/36 (16.6)	5/36 (13.9)	1/36 (2.7)	10-20	13
NICU	21/78 (26.9)	21/78 (26.9)	0	10-50	15
HGW	6/20 (30)	5/20 (25)	1/20 (5)	20-280	69
MGW	5/14 (35.7)	5/14 (35.7)	0	10-190	48
Total	38/148 (25.7)	36/148 (24.3)	2/148 (1.4)	10-280	27

GMW, geriatric medicine ward; *HGW*, hepatology and gastroenterology ward; *NICU*, neonatal intensive care unit; *SICU*, surgical intensive care unit.
**Staphylococcus* spp, *Corynebacterium* spp.
†*Enterobacteriaceae*, enterococci.

the amount of utilizations or the type of use (single or multipatient) in one hand and the level of contamination in the other hand, the statistical association between the bacterial load and the number of remaining strips or the single patient use was evaluated by using a χ^2 test, with a level of significance of .05.

During the study period, 148 strips were collected and cultured: 36 from surgical intensive care unit, 78 from neonatal intensive care unit, 20 from hepatology and gastroenterology ward, and 14 from geriatric medicine ward; 25.7% yield a positive culture (38/148). Frequencies, nature, and quantitative analysis of bacterial contamination are reported in Table 1. All specific cultures for MDR bacteria were negative. The strips showed neither initial bacterial contamination nor intrinsic antibacterial activity (data not shown). The distribution of filling rates at the time of sampling was $< 25\%$, between 25% and 50%, between 50% and 75% and $> 75\%$, for 28.4%, 34.4%, 14.9%, and 22.3% of the vials, respectively. Neither a filling rate $\leq 50\%$ nor the multipatient use was statically associated with a bacterial contamination of the GTS ($P = .73$ and $P = .31$, respectively).

Patient care equipment and devices could lead to bacterial transmission; dedicated material was required for patient on transmission-based precautions, and disinfection must be always performed before use on another patient.[5] No specific recommendations existed for GTS use, especially when they are packaged in multiuse vials; indeed, the narrow opening of the vial forced health care professionals to successive manual contamination of strips by fingers and vice versa. In the present study, the bacterial contamination of GTS was characterized as originated from hands or enteric reservoir. Although no MDR bacterium was identified from strips, this putative way of cross contamination was then established. The single patient use or the discard of remained strips hindered the financial advantages of multiunits vials. The lack of statistical relationship between the filling rates and the bacterial counts showed that internal vial contamination was not a fatality and could be delayed or avoided in performing strict hand hygiene before manipulations. Until such behaviors were uniformly implemented and because individual vials were as contaminated as shared ones, it seems legitimate to us that opened GTS vials would be discarded after the discharge of a patient in isolation precautions. In addition, we asked manufacturers to provide distributors that would provide dispensable single units that could be used in a no-touch procedure.

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The long-term outcome of a multifaceted intervention to reduce ventilator-associated pneumonia: Can zero really be achieved?

To the Editor:

Can ''zero'' ventilator-associated pneumonia (VAP) be achieved? We would like to provide the long-term outcome associated with our intervention to reduce VAP in a medical intensive care unit (MICU) in Thailand.[1] At Thammasat University Hospital, the ''WHAP VAP'' bundle, in which W stood for ''daily weaning trial for patients on ventilator,'' H for ''hand hygiene,'' A for ''aspiration precautions,'' and P for ''prevent contamination'' was implemented beginning January 1, 2004, and ended December 31, 2006 (period 1). Although ''zero'' was not achieved, this intervention reduced VAP rate by 79% (VAP rate reduced from 20.6 to 4.2 per 1,000 ventilator-days). From January 1, 2007, to December 31, 2009 (period 2), chlorhexidine-based oral care performed every shift was added as a component of ''WHAP VAP'' bundle. Continuous monitoring of VAP process of care was performed twice weekly as previously described,[1] and analysis of VAP cases to identify factors associated with VAP was routinely performed. The VAP definition was derived from US Centers for Diseases Control and Prevention definition.[2] In this study, a sustain ''zero'' VAP rate was defined as no VAP for $>$ 12 consecutive months. Data collected included demographics, underlying diseases, severity of illness, VAP onset, VAP process of care, compliance with components of ''WHAP VAP'' bundle, total number of ventilator-days, and VAP rates. Multivariate analysis was performed to evaluate factors associated with VAP among MICU patients during both study periods.

There were 1,445 and 1,480 patients enrolled during period 1 and period 2, respectively. The patient characteristics, VAP process of care, and compliance to components of ''WHAP VAP'' bundle is shown in Table 1. During period 2, although not statistically significant, VAP rate was reduced by 37% compared with period 1 (from 4.2 to 3.36 per 1,000 ventilator-days; P = .45). Notable, the longest consecutive month that MICU achieved ''zero'' VAP rate was detected in 8 months during period 2. There were a total of 46 patients with VAP during the 6-year follow-up period. By multivariate analysis, ''failure of daily weaning trial (patient failed weaning)'' (adjusted odds ratio, 4.2; 95% confidence interval: 1.4-14.5; P = .005) and presence of cerebrovascular or other neurologic diseases (adjusted odds ratio, 2.6; 95% confidence interval: 1.09-29.4; P = .04) were predictors for VAP.

Despite increase compliance to ''WHAP VAP'' bundle and higher adherence to VAP process of care in our study, ''zero'' VAP rate, albeit achievable, was not sustainable. Our findings that ''failure of daily weaning

Table 1. Patients characteristics, VAP process of care, and compliance to components of ''WHAP VAP'' bundle

Characteristics	Period 1 (n = 1,445)	Period 2 (n = 1,480)
Age, mean yr ± SD	51 + 8.9	52 + 9.1
Female sex	650 (45)	710 (48)
Underlying diseases		
Cardiovascular disease	433 (30)	414 (28)
Gastrointestinal diseases	361 (25)	385 (26)
Diabetes	505 (34)	444 (30)
Neurologic diseases	273 (19)	296 (20)
Pulmonary diseases	433 (30)	459 (31)
Immunocompromised status	303 (21)	296 (20)
APACHE-II, mean ± SD	18 ± 4	17 ± 5
VAP onset*		
Early	217 (15)	192 (13)
Late	1,228 (85)	1,288 (87)
Process of care		
Emptying of ventilator circuit condensate	1,185 (82)	1,302 (88)
Maintaining semirecumbent head position	1,214 (84)	1,273 (86)
Keeping gastric residual at low volume	1,156 (80)	1,243 (84)
Chlorhexidine oral care	NA	1,243 (84)
Compliance to ''WHAP VAP'' bundle		
Daily weaning trial	1,156 (80)	1,273 (86)
Hand hygiene	1,185 (83)	1,302 (88)
Aspiration precaution	1,214 (84)	1,228 (83)
Prevention of cross contamination	1,170 (81)	1,243 (84)
VAP rate (per 1,000 ventilator-days)	4.1	3.36
Total ventilator-days	6,345	6,404

NOTE. Data are number (%), unless indicated otherwise. Period 1 = January 1, 2004, to December 31, 2006 (24 months); period 2 = January 1, 2007, to December 31, 2009 (24 months).
NA, non-applicable.
*Early-onset VAP was defined as occurring <7 days after medical intensive care unit admission, and late-onset VAP was defined as occurring ≥7 days after admission.