Ambulance personnel adherence to hygiene routines: still protecting ourselves but not the patient

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**Objectives** It is well known that adherence to hygiene routines leads to increased quality of care and safety for patients and personnel in hospitals. However, there have been few studies describing hygiene in ambulances, despite the fact that many patients receive advanced medical care and treatment from ambulance services before arriving at an emergency department. Therefore, the purpose of this study was to describe the adherence of ambulance personnel to hygiene routines in the ambulances.

**Methods** A participant observation study in the County of Värmland (Sweden) was conducted over 1 day in November 2010. Seven hygiene-related variables were collected during the observations: disinfection of hands before and after patient contact; correct use of gloves, gowns and short-sleeved uniforms; no rings, watches, or bracelets; and short or tied back hair during patient care.

**Result** A total of 68 observed ambulance assignments were analyzed in terms of the adherence of personnel to hygiene routines. In 34% of the observed cases, hand rub was used before patient care and, in 72% of the observed cases, the ambulance personnel used hand rub after patient care. Correct adherence to the rule requiring use of a short-sleeved uniform was found in 28% of the observations. Correct adherence to the rule regarding short or tied back hair was found in 91% of the observations.

**Conclusion** The ambulance personnel were found to have relatively good adherence to some hygiene routines, but not all. The adherence by ambulance personnel to all of the seven observed variables was correct in only 3% of the assignments. *European Journal of Emergency Medicine* 00:000–000 @ 2012 Wolters Kluwer Health | Lippincott Williams & Wilkins.

**Keywords:** ambulance, emergency medical services, hygiene routines, observation study

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**Introduction** Health care-associated infection is a significant source of concern to patients and it is costly for the healthcare service [1]. An assumption may be that adherence to hygiene routines leads to increased quality of care and safety for patients and personnel working in healthcare services [2]. It is evident that procedures to ensure hand hygiene is the single most effective way to prevent infections in healthcare, but adherence to hygiene routines remains low by the healthcare personnel [3]. The features associated with this low adherence seem to be multifactorial, including sex of the healthcare worker, accessibility of alcohol-based hand rub, and workload [2]. However, there have been few studies describing hygiene in ambulance services, despite the fact that many patients receive advanced medical care and treatment from ambulance services before arriving at an emergency department [4]. Previous studies on hygiene and ambulance services have focused on ambulance personnel’s knowledge of hygiene [5] and the presence of bacteria at specific areas in ambulances [6,7]. According to previous studies, ambulance personnel compliance to general medical protocols and guidelines varies [8,9].

Regarding hygiene routines, the ambulance personnel rated themselves as adhering to hygiene routines 100% of the time; however, they did not know how and when to use personal protection equipment, and gloves were used just in case and not in accordance with the hygiene routines described [5]. Nonadherence to the hygiene routines may indicate that ambulance personnel cannot protect themselves or their patients from transmission of pathogenic microorganisms. However, no identified studies describe the possible incidence of infections caused by ambulance personnel. A previous study described how the working area of ambulance personnel in ambulances is the area most contaminated with bacteria [7]. In most ambulances, bacterial contamination is reduced by cleaning. However, in some cases, bacterial contamination was found to be actually increased after cleaning of the equipment in ambulances; whether this was caused by inadequate cleaning routines or a lack of knowledge is unclear [6]. Despite these previous studies [6,7], there is still a lack of studies investigating ambulance personnel adherence to hygiene routines; therefore, the aim of this study was to describe the adherence of personnel to hygiene routines in ambulance care.
Materials and methods
To achieve the aim of this study a participant observation study was conducted in the ambulance services of the County of Värmland (Sweden). The study was approved by the local institutional review board.

Setting
This study was conducted in the County of Värmland (area 18 201 km²), with a population of ~273,000 inhabitants. The county covers both rural communities and cities [10]. The regional County Council is responsible for emergency medical services, and these services are provided by various organizations within the county. The county has three emergency hospitals and 24 ambulances based at 11 local ambulance stations throughout the area. The total number of ambulance assignments is ~87/24 h. The ambulances are staffed by one or two registered nurses (RNs) or one RN and one emergency medical technician (EMT). The RN has 4 years of training and, according to the Swedish National Health and Welfare Board, is permitted to administer drugs. The EMT has 2 years of training and knowledge of using semiautomated defibrillators, but cannot administer any drugs. During the study, there were a total of 168 employees in the ambulance services: 123 RNs and 45 EMTs.

Data collection
The study was conducted over 1 day in November 2010. All employers in the ambulance services in the county were informed of the aim and procedure of the participant observation study through a local web-based information system. Ambulance personnel who were not willing to participate in the study were encouraged to contact the managers; no employees contacted the managers to withdraw from the study. The ambulance personnel were not informed of the date of the study. On the day of the study, the ambulance manager at each ambulance station appointed one of the personnel in the ambulance team to be the observer and one to be observed. No criteria were defined for the selection of observers, but the RNs and EMTs were evenly distributed as observers according to the employees in the ambulance care in Värmland (45 RNs and 23 EMTs). The selected observer received information and an observation protocol from the local ambulance manager. The observations were performed during bedside work, all patient cases were included, and no recording was made regarding the type of ambulance assignment. Every ambulance assignment during the working shift was included and assessed as a single observation period. The observed ambulance personnel were unaware of the observation. The observer completed the handwritten protocol after each assignment. After the end of the shift, the observer sent the protocol by letter directly to the authors of this paper.

Variables and analysis
There were seven different hygiene-related variables that were observed during each ambulance assignment. The observed variables were based on the National Board of Health and Welfare definition of hygiene routines [15]. The variables were: disinfection of hands with an alcohol-based hand rub, before (variable 1) and after patient contact (variable 2); correct use of gloves, defined as using gloves when there was a risk of contact with blood and other biological fluids and changing gloves between treatment interventions in patient care (variable 3); correct use of gowns, defined as using gowns when there was a risk of contact with blood and other biological fluids (variable 4); correct use of short-sleeved uniforms when possible (variable 5); no wearing of rings, watches, or bracelets during patient care (variable 6); and short or tied back hair (variable 7). The observer was instructed to record whether the performance of each variable was ‘correct’, ‘not correct’, or ‘not relevant to the situation’. In the analyses, ‘not relevant to the situation’ was interpreted as ‘correct’ as described in the instructions in the national study protocol [11]. A checklist was also designed to explore whether the ambulance personnel had access to equipment that enabled them to work in accordance with the hygiene routines. The checklist included identifying whether alcohol-based hand rub, gloves, gowns, and eye protection were available in the patient care area in the ambulance and in the emergency backpack.
Descriptive statistical analyses were carried out using the program SPSS version 18.0 (SPSS Inc., Chicago, Illinois, USA).

**Result**
A total of 71 observation situations from 21 different ambulances were initially included. Data from three ambulances were missing; one ambulance had no assignment and no protocols were recorded and sent to the authors in two ambulances. Three protocols (observation situations) were excluded because the observational protocol was not carried out in accordance with the instructions. A total of 68 observation situations were analyzed. A total of 22 checklists answering whether the ambulance personnel had access to equipment that enabled them to work in accordance with the hygiene routines were analyzed, one of which was from an ambulance station with no ambulance assignments during the observation period. Checklists from two ambulances were missing; no protocols were recorded and sent to the authors.

**Adherence**
In 34% \((n = 23)\) of the observations, hand rub was used before patient care, and in 72% \((n = 49)\) of the observations, the ambulance personnel used hand rub after patient care. The use of gloves was correct in 69% \((n = 47)\) of the observations. The use of gowns was correct in 91% \((n = 62)\) of the observations. Adherence to the rule regarding the use of a short-sleeved uniform was correct in 28% \((n = 19)\) of the observations. The ambulance personnel were not wearing rings, watches, or bracelets during patient care in 74% \((n = 50)\) of the observations. Correct adherence to the rule regarding short or tied back hair was observed in 91% \((n = 62)\) of the observations. Adherence to all seven variables was observed in 3% \((n = 2)\) of the ambulance assignments.

**Checklist**
The access of ambulance personnel to equipment that enabled them to adhere to the hygiene routines is shown in Fig. 1.

**Discussion**
The results of this study show that ambulance personnel adherence to hygiene routines is low. The ambulance personnel performed all seven of the hygiene routines correctly in only 3% of the assignments. The goal defined by the County Council of Värmland is 100% adherence to the hygiene routines [16]. Given that the ambulance personnel are also required by law [17–20] to adhere to a good hygiene standard in prehospital settings, the overall results were remarkably disappointing. There are no personal penalties for lack of adherence to hygiene procedures, but the Swedish National Board of Health requires compliance with the regulations. However, the level of access of ambulance personnel to equipment that enables them to adhere to the hygiene routines was not always ideal. The result of the checklist showed that
ambulance personnel had access to such equipment when working in their ambulance, but when taking care of a patient at other locations, they did not have the same access since the emergency backpack in several ambulances did not contain gloves and hand rub (Fig. 1). The employer in the ambulances has the responsibility to ensure that personal protection equipment is available for work [18–20]. The result concerning the use of hand rub shows that more ambulance personnel used hand rub after patient care (72%) than before patient care (34%). This is in accordance with previous studies conducted in intrahospital settings [3]. The conditions during ambulance-based care are not the same as those in hospitals: there is no soap and water and the hand rub is not always available as the ambulance personnel sometimes work outdoors. One solution to this problem could be for all ambulance personnel to have a hand rub bottle in their own pocket. Wisniewski et al. [21] showed that hand rub bottles in the pockets of staff led to increased use of hand rub in hospitals. The failure to use hand rub in ambulances could be an attitude problem due to personnel dismissing its importance; it is possible that the ambulance personnel’s behavior is the same as in the 19th century, when Doctor Semmelweis reported that doctors thought that, rather than their cleaned hands preventing them from infecting the patient, they enabled the patient to infect them [22]. The use of gloves in the study was relatively high (69%). This may be the result of good knowledge of how to use gloves, but it could also be related to a finding from a previous study that ambulance personnel used gloves just in case and not in accordance with the described hygiene routines [5]. Further studies are needed to investigate this phenomenon of using gloves just in case. Concerning the use of gowns, the rate of adherence was very high, namely, 91%, but all of these observations were marked as ‘not relevant’ in the protocol, which was converted to the answer of ‘correct’ use, and this may have led to false-positive results. This result could also reflect that personnel did not know when and how to use a gown. Another explanation could be that there is no tradition of using gowns in ambulance settings. Our own experience is that personnel rarely/never use gowns in ambulance care. A previous study showed that ambulance personnel self-rated their adherence to hygiene routines as 100%, but they turned out to have major deficiencies in knowledge of using personal protection equipment [5]. There are inconsistencies in the results. The personnel used gloves just in case, but they did not use personal protection equipment gowns just in case. Further studies are needed to investigate how and why ambulance personnel use their personal protection equipment. The use of a short-sleeved uniform deviated from the National Board of Health and Welfare rule regarding working in short sleeves [15]. The local routine states that short-sleeved uniforms should be used if possible [14]. The adherence to this was very low, at only 28% (n = 19). However, this study was conducted in November when the outdoor temperature was 4 °C, so a short-sleeved uniform may not have been the first choice for ambulance personnel when taking care of patients outdoors. In terms of the variable concerning not wearing rings, watches, or bracelets, there was a good result in that the adherence was relatively high (74%). An explanation for this may be that the supervising hygiene nurse in the County of Värmland makes regular checks of the personnel during working shifts and patient care. Such regular checks could be an option for improving the overall adherence to hygiene routines.

**Methodological considerations**

This study has some limitations. It was a participation observation study, in which a colleague was the observer; this may have caused bias in the results if the observer did not want to explore bad habits concerning hygiene routines in their own ambulance. However, for safety reasons, there was no possibility to use an external observer. Another limitation is the use of a protocol not validated in an ambulance setting. The used protocol was developed and validated for settings within hospitals. Nevertheless, the overall hygiene routines should be the same in both ambulances and hospitals, even though the conditions are different. Using a protocol that is not validated for the ambulance setting may have caused errors in the results, and further studies are needed to develop protocols that can be used in the ambulance setting. The manager in the ambulance stations selected all observers in this study, which is another limitation. There was thus no possibility for the authors to give clarifying instructions concerning the protocol, and the managers may have caused selection bias. Another limitation was the construction of the protocols; the only possible responses were ‘yes’, ‘no’, and ‘not relevant’. The observer had no opportunity to describe the situation in the protocol. In addition, the response of ‘not relevant’ may also have caused a bias in the result, since this was interpreted as ‘correct’ adherence to the hygiene routines. For example, in the result concerning use of gowns, 91% of answers were ‘not relevant’, so the observer may not have known how to assess this owing to a knowledge gap. The strength of this study is that all types of patients, all categories of personnel, and all ambulances in the County of Värmland were included. It may also have been an advantage that the observed personnel were unaware of the study. However, we do not know whether the observer influenced the observed ambulance personnel during the study period; looking at the results, this seems unlikely.

**Conclusion**

The results of this study show that ambulance personnel were relatively good at some hygiene procedures, but not all. The ambulance personnel showed good adherence to the rule of not wearing rings, watches, or bracelets during
patient care. They were also good at using alcohol hand rub after patient care. However, the ambulance personnel adherence to all seven observed variables related to hygiene routines was correct in only 3% of the assignments.

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Conflicts of interest

There are no conflicts of interest.

References
