

# Wristwatches as the Potential Sources of Hospital-Acquired Infections

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## ABSTRACT

**Background:** Nosocomial pathogens can survive on inanimate surfaces for long periods of time. Therefore, the personal items which are used by HCWs such as mobile phones, wristwatches and pens can be continuous sources for the transmission of infections in the absence of regular surface disinfection practices.

**Aims:** The aim of the study was to measure the rate of bacterial hand and wrist contamination, particularly that which was caused by *Staphylococcus aureus*, amongst healthcare workers (HCWs) who wore wristwatches.

**Methods and Materials:** The wrists and the hands of hospital-based healthcare workers (HCWs) were sampled for bacterial contamination in two consecutive, cross-sectional cohort studies of wristwatch wearers and non-wristwatch wearers. In the first study, the wrists were sampled by using skin swabs and the hands were sampled by direct plate inoculation. In the second study, the wrists were sampled after each HCW removed the watch immediately prior to the sampling.

**Results:** *Staphylococcus aureus* was found on the hands of 64% wristwatch wearers and 36% non-wristwatch wearers in the first study. The watch wearers had higher counts of bacteria on their wrists than on their hands. In the second study, the removal of the watch prior to the sampling resulted in increased counts of bacteria on both the hands as well as on the watch wrist as compared to that in the non-watch wearers. Wearing a wristwatch results in an increase in the bacterial contamination on the wrist, but excess hand contamination does not occur unless the watch is manipulated.

**Conclusions:** Wearing a wristwatch results in an increase in the bacterial contamination on the wrist, but excess hand contamination does not occur unless the watch is manipulated. This study emphasizes the importance of increased hand hygiene compliance and the surface disinfection of the personal items which are used by the HCWs. The regular surface disinfection of these items and also regular hand washing can contribute to a reduction in the transmission of nosocomial pathogens in the health care setting.

**Key Words:** Nosocomial pathogens, Hospital Acquired Infection, Health Care Workers, wristwatches, Hand hygiene

## INTRODUCTION

Hospital-acquired infections remain an important problem, which cause significant morbidity and economic costs [1]. The health care workers' (HCWs') hands are frequently contaminated with potential pathogens [2], which increases the risk of antimicrobial-resistant organism transmission.

Items such as stethoscopes, tourniquets and white coats can become contaminated with microbes including *Staphylococcus aureus* and they can act as a vectors for the spread of infections, either directly or via the health care workers (HCWs') hands. Wearing wristwatches and rings has been shown to increase the hand carriage of potential pathogens [3].

However, though wristwatches have been shown to harbour bacterial pathogens, their effect on the carriage of such bacteria on the hands has not been demonstrated [4]. Recently, hospitals in the UK have been asked to implement a policy of 'bare below the elbows', which includes the banning of wristwatches [5].

This study was undertaken to investigate whether wearing a wristwatch influenced the rate of the carriage of *Staphylococcus aureus* and other bacteria on the hands of the HCWs.

## SUBJECTS AND METHODS

### Study design and settings

100 HCWs who were working in the ICU at the Tirunelveli Medical College hospital were recruited for this cross-sectional cohort

study which was done for a period of six months (April 2010 to September 2010). For each wristwatch wearer who was identified, a non-wristwatch wearer was recruited from the same clinical area. This study was approved by the institutional ethical committee. After obtaining the informed consent, we put up cultures of convenience samples of the HCWs' hands during their routine work hours, always after a patient care episode.

### Sampling Methods

Two consecutive studies on the wristwatch wearers and the non-wristwatch wearers were conducted amongst the samples of HCWs. In the first study, both the hands were sampled by taking a direct imprint of each fingertip on to bacterial culture plates. The watches were removed and the wrists were sampled by swabbing the watch-bearing wrist. In case of the controls (non-wristwatch wearers), the non-dominant arm was swabbed. Demographic and other data were obtained from the subjects at the time of the sample collection.

In the second study, the subjects were asked to remove their watch immediately prior to the sampling, thus allowing the assessment of the effect of handling a watch, moments before or during patient contact. Both the hands and wrists were sampled.

### Laboratory Methods

Each subject placed their fingertips onto bacterial culture media like Nutrient agar, MacConkey agar, Blood agar, Mannitol salt agar

and Oxacillin Screen agar. The subjects wrists were sampled after the watch removal in a standardised manner by using a swab which was dampened by dipping it in sterile saline. The swab was rolled over the area of the skin at the point of the watch contact, or in the equivalent area of the non-dominant arm of the non-wristwatch wearers and all the swabs were streaked out on the media.

The plates were incubated for 24 hours at 37°C. The semi-quantitative bacterial colony counts were calculated. The *Staphylococcus aureus* isolates were identified by using standard bacterial protocols after 48 hours of culture. The colonies with a morphology which was consistent with that of *Staphylococcus aureus* were sub-cultured onto blood agar plates and the plates were re-incubated. The confirmatory identification of *Staphylococcus aureus* was made by the tube coagulase test and by the demonstration of mannitol fermentation. The identification of Methicillin Resistant *Staphylococcus aureus* (MRSA) was made by subculturing the grown colonies onto Oxacillin screen agar.

Gram negative bacilli were identified by doing a battery of biochemical tests like the catalase test, the oxidase test, the Indole test, the citrate utilization test, the urease test, the triple sugar iron test and the Oxidation –Fermentation test and by checking for growth at 44°C.

## RESULTS

The baseline characteristics of the first study group are shown in [Table/Fig-1].

*Staphylococcus aureus* was isolated from the hands of 64% watch wearers and 36% non-watch wearers. There were 32 isolates of Methicillin Resistant *Staphylococcus aureus* (MRSA), of which 22 were isolated from the hands of the watch wearers and 10 were from the non watch wearers. The amount of bacteria in the watch wearers from the ipsilateral and contralateral hands before the watch removal was more than that which was found in the non-watch wearers [Table/Fig-2a & 2b].

The organisms which were isolated from the wrist area of the watch-wearers before the watch removal were *Acinetobacter spp*, *Klebsiella pneumoniae*, *Pseudomonas spp.* and *Escherichia coli*, whereas those which were isolated from the non-watch-wearers were *Acinetobacter spp* and *Klebsiella pneumoniae* [Table/Fig-3].

Again, the watch-wearers had a greater number of bacteria on their wrists than in the non-watch wearers [Table/Fig-4].

In the second study, the watches were removed (and therefore handled) by the HCWs immediately prior to the sampling. The amount of bacteria on both the hands as well as the watch wrist (the wrist from which the watch was removed) was significantly increased in the watch wearers as compared to the non watch-wearers [Table/Fig-5 a,b,c]. *Staphylococcus aureus* was the only organism which was isolated from the hands of the HCWs before the watch removal. After manipulation, in addition to *Staphylococcus aureus*, the gram negative bacilli that were present on the wrists of the study group were also isolated.

## DISCUSSION

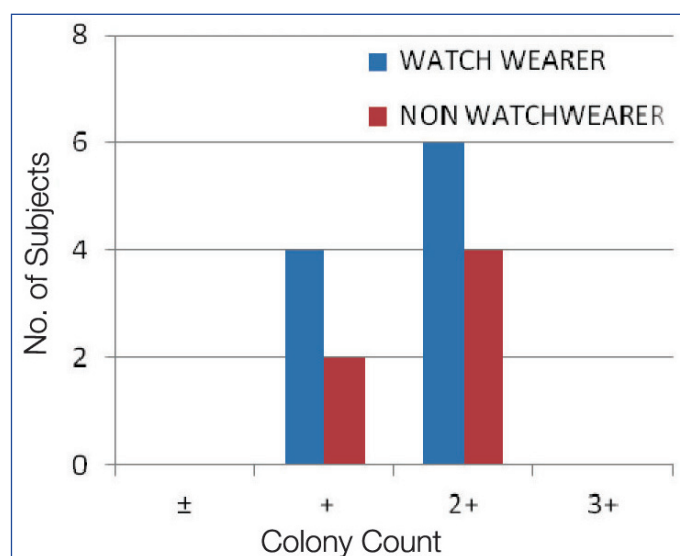
This study has shown that wristwatch wearing was associated with the increased bacterial colonization of the wrists and not the hands of the HCWs. Furthermore, the data also showed that removing the watch easily transferred the wrist bacteria onto the hands [6]. These data reinforce the notion that wristwatch wearing is a potential infection control hazard.

Although our study showed a clear association between the wrist-watch wearers and the bacterial colonization of the wrists and hands, we are attaching some reservations to our conclusion. The period of time which elapsed from the most recent episode of the hand de-contamination until the sampling was unevenly distributed, with a higher proportion of the non-wristwatch wearers having decontaminated their hands within the preceding 30 minutes. This may represent a better adherence to the hand hygiene precautions of this group and it is a potential confounding factor.

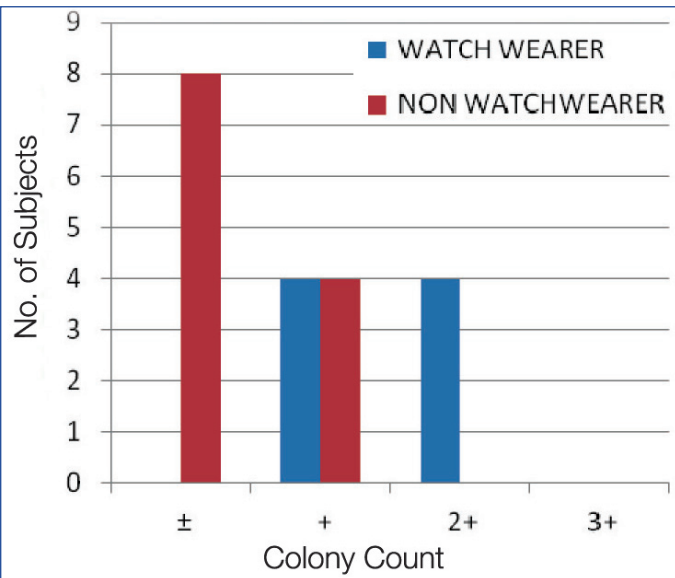
A further reservation is that, for the ease of the sample collection, only the fingertips of each subject were sampled rather than the

Subject characteristics	Watch wearers n - 50	Non Watch wearers n- 50
Male	8	5
Female	42	45
Age		
16-25	15	10
26-35	11	14
36-50	24	23
51-65		3
>= 66		
Occupation		
Nurse	26	11
Doctor	3	2
Emergency care technician	7	15
Nursing students	14	22
Handedness		
Right	48	49
Left	2	1
Skin disease on hands	0	
Last hand decontamination in mts		
< 30	12	24
31-120	20	19
> 120	18	7

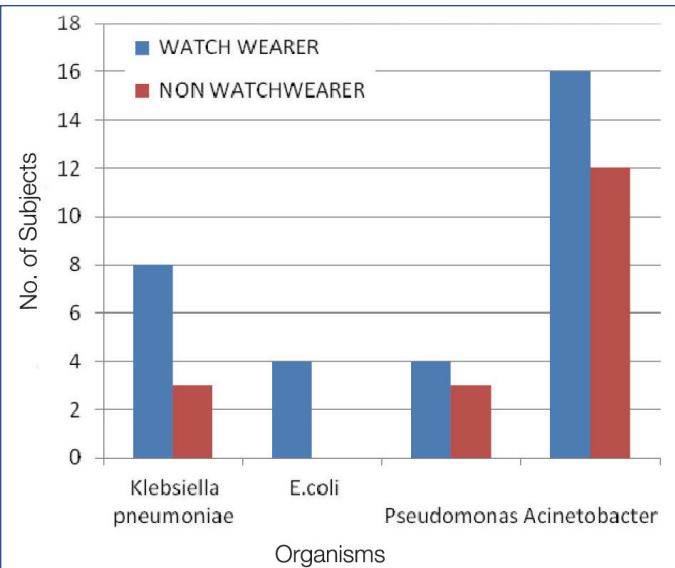
[Table/Fig-1]: Baseline characteristics of the study group



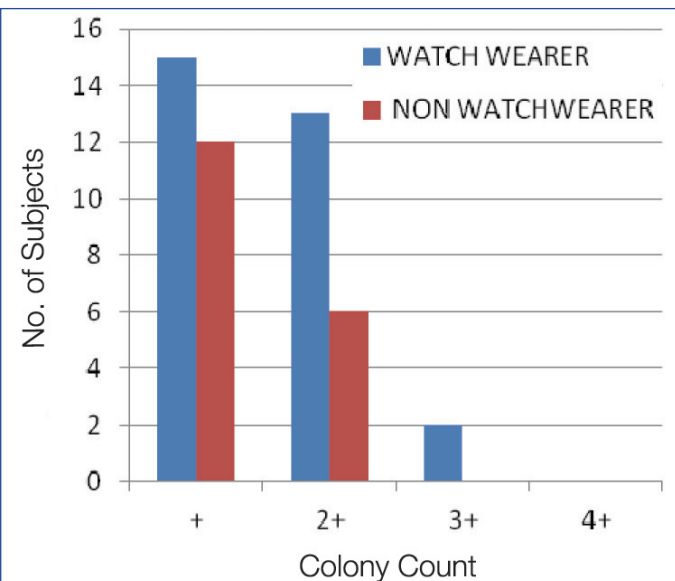
[Table/Fig-2a]: Semiquantitative Colony count of Ipsilateral hand of Watch wearer (WW) before watch removal compared with colony count of Ipsilateral hand of Non watch wearer (NWW)



[Table/Fig-2b]: Semiquantitative colony count of Contralateral hand of Watch wearer(WW) before watch removal compared with colony count of Contralateral hand of Non watch wearer (NWW)



[Table/Fig-3]: Organisms in Wrist

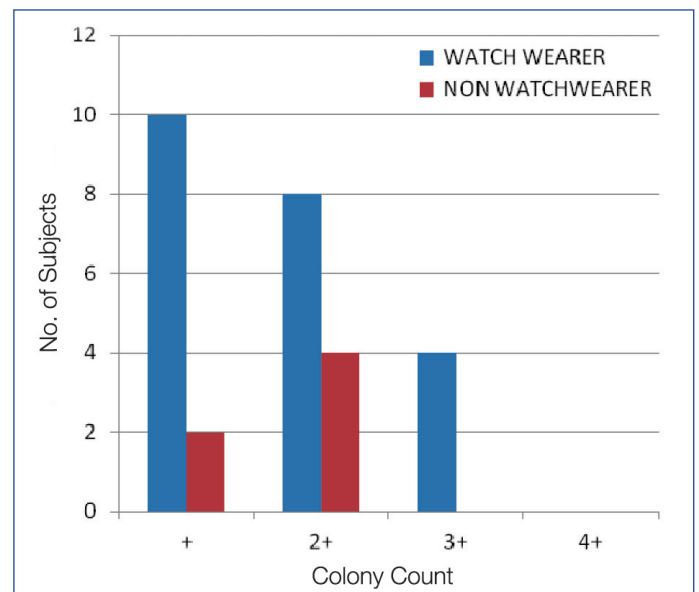


[Table/Fig-4]: Semiquantitative bacterial colony counts following culture of samples taken from the Ipsilateral wrist of the Watch wearer (WW) before watch removal compared with colony counts obtained from Ipsilateral wrist of Non watch wearer (NWW)

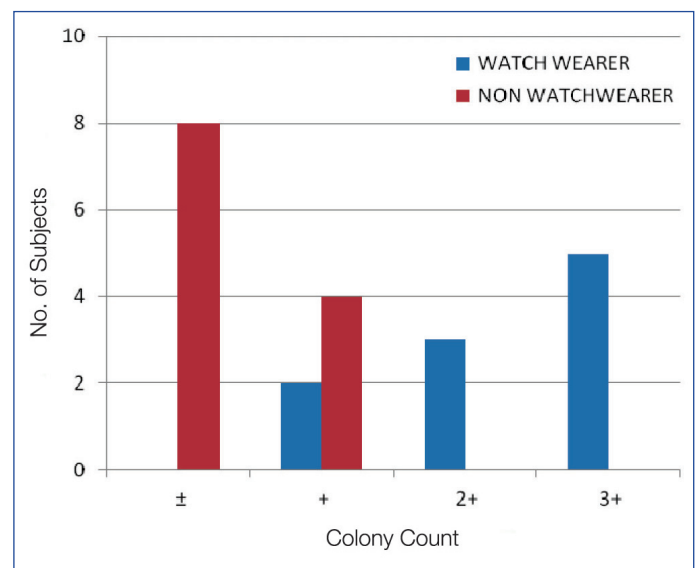
whole hand. An increase in the bacterial contamination of the palms in the wristwatch wearers may have been missed by our method, perhaps due to the contaminated wash water which was running down to the palms following hand washing. However, it would be expected that any such palm contamination would quickly spread to the fingertips through the natural closing movements of the hands and this had not occurred.

The rate of the carriage of *Staphylococcus aureus* (50%) on the health care workers' hands which was observed in our study was more as compared to that which was found in other studies which were done by Reagan et al., Williams et al., and Jeans et al. The rates of the carriage of *Staphylococcus aureus* in these studies were 39.7%, 30% and 24% respectively [7-9].

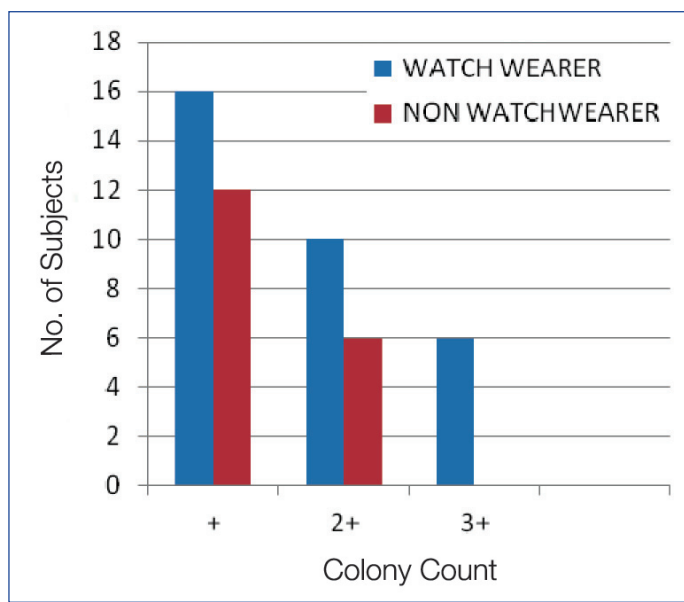
The rates in other published series varied, depending on the sampling technique, the population which was sampled, the time which had elapsed since the hand decontamination and the number of hands which were sampled from each subject. It can be seen from



[Table/Fig-5a]: Semiquantitative bacterial colony counts following culture of samples taken from the Ipsilateral hand of the Watch wearer(WW) after watch removal compared with colony counts obtained from Ipsilateral hand of Non watch wearer (NWW)



[Table/Fig-5b]: Semiquantitative bacterial colony counts following culture of samples taken from the Contralateral hand of the Watch wearer (WW) after watch removal compared with colony counts obtained from Contralateral hand of Non watch wearer (NWW)



**[Table/Fig-5c]:** Semi-quantitative bacterial colony counts following culture of samples taken from the Ipsilateral wrist of the Watch wearer (VW) after watch removal compared with colony counts obtained from Ipsilateral wrist of Non watch wearer (NWW)

our data that sampling more than one site increased the overall estimate of the carriage rate, as many subjects had *Staphylococcus aureus* detected on one hand but not on the other.

Among the 50 isolates of *Staphylococcus aureus* which were isolated, 32 were from the hands of the watch wearers and 18 were from the non-watch wearers. Among the 32 isolates from the watch wearers, 22 were Methicillin Resistant *Staphylococcus aureus* (MRSA) and 10 were Methicillin Sensitive *Staphylococcus aureus* (MSSA) and among the non-watch wearers, 10 were MRSA and 8 were MSSA. This was in contrast to the findings of the study which was done by Didier et al [10] in which coagulase negative *Staphylococci*, *Corynebacterium* species, and *Micrococcus* species were predominantly isolated and to those of Williams E Trick et al's study, in which Methicillin-resistant, coagulase-negative *Staphylococci* was the predominant organism which was isolated, followed by gram negative bacilli [8].

The gram negative bacilli which were isolated from the wrists of the health care workers in our study included *Acinetobacter*, *Klebsiella pneumoniae*, *Pseudomonas* and *Escherichia coli*. This was similar to the findings of the study which was done by William E Trick et al,

in which *Acinetobacter*, *Klebsiella*, *Pseudomonas*, *Escherichia coli* and *Proteus spp.* were isolated from the hands of nurses [8].

Our results support the policy of 'bare below the elbows', but they also suggest that using alternatives to wristwatches such as watch fobs or pocket watches may be an even greater infection control hazard. Such devices require handling to read the time, whereas wristwatches generally do not. Our study clearly demonstrated that the risk of hand contamination stemmed from the manipulation of the watch and not from simply wearing it. A ban on wristwatches might actually increase the contamination of the HCWs' hands if it led to the greater use of these alternative devices. Further research is therefore needed to examine this question before a stronger enforcement of a new infection control policy is implemented.

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