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BACTERIAL CONTAMINATION ON NURSES' UNIFORMS IN HUSM MEDICAL WARDS: AN EXPERIMENTAL STUDY

by

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CERTIFICATE

This is to certify that the dissertation entitled Bacterial Contamination on Nurses' Uniform in HUSM Medical Wards: An Experimental Study is the bona fide record of research work done by Cathy Wellny Sumping 81522 during the period of Julai, 2007 to April, 2008 under my supervision. This dissertation submitted in partial fulfillment for the degree of Bachelor of Health Sciences (Nursing). Research work and collection of data belong to Universiti Sains Malaysia.

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BACTERIAL CONTAMINATION ON NURSES' UNIFORMS IN HUSM MEDICAL WARDS: AN EXPERIMENTAL STUDY

ABSTRACT

Several studies have demonstrated that healthcare personnel's uniforms especially nurses' uniforms could become contaminated by certain dangerous microorganisms whilst carrying out clinical duties and uniforms could be a vehicle for the transmission of infection for example *Methicillin-resistant Staphylococcus aureus* (MRSA), *Staphylococcus aureus (S. aureus), vancomycin-resistant enterococci*, and *Clostridium difficile (C. difficile)*. These bacteria can caused several types of infection and may lead to mortality. The uniforms are also contaminated because of proper managing of the uniforms is not adhered. In this experimental cross sectional study, dominant hand's sleeve, pocket, and abdominal area of 28 nurses were swabbed at the start and end of duty and transferred to petrifilm and incubated under 35^0C +/- 1^0C and *Escherichia coli (E. coli)* and *S. aureus* colony count were quantified after 48 hours. The purpose of this study was to examine the degree of *E. coli* and *S. aureus* contamination present on nurses' uniforms at the start and at the end span of duty. Results demonstrated that there was a significant difference of *E. coli* and *S. aureus* contamination on nurses' uniforms at the start and at the end of duty ($p=0.017$, $\alpha=0.05$); $p=0.049$, $\alpha=0.05$ respectively). The results also demonstrated that there is a reduction of bacterial contamination on nurses' uniforms at the end of duty. The results also demonstrated that there was a significant difference of *E. coli* contamination on dominant hand's sleeve,

pocket, and abdominal area at the start of duty. However, there was no difference of *E. coli* contamination on dominant hand's sleeve, pocket, and abdominal area at the end of duty and *S. aureus* contamination between dominant hand's sleeve, pocket and abdominal area on nurses' uniform at the start and end of duty was equal. Hence, it is important for the nurses, and hospital to take action in order to minimize bacterial contamination on the uniforms to prevent transmission of infection from nurses' uniforms to patient and vice versa.

KONTAMINASI BAKTERIA KE ATAS PAKAIAN SERAGAM JURURAWAT YANG BEKERJA DI MEDIKAL WAD HUSM

ABSTRAK

Beberapa kajian yang lalu telah menunjukkan bahawa pakaian ahli profesyenal kesihatan terutamanya pakaian seragam jururawat boleh dicemari oleh mikroorganisma berbahaya semasa melakukan aktiviti perawatan kepada pesakit seperti *Methicillin-resistant Staphylococcus aureus* (MRSA), *Staphylococcus aureus (S. aureus), vancomycin-resistant enterococci*, and *Clostridium difficile (C. difficile)*. Bakteria-bakteria ini boleh menyebabkan infeksi dan boleh menyebabkan kematian. Pakaian seragam tersebut juga dicemari oleh bacteria kerana pengurusan pakaian seragam yang sempurna tidak diamalkan. Pakaian seragam tersebut boleh menjadi perantara kepada infeksi. Dalam kajian ini, lengan tangan dominan, poket, dan kawasan abdomen pakaian seragam 28 orang jururawat telah dicalit sebelum dan selepas waktu bekerja/syif dan sampel tersebut telah dipindahkan ke petrifilm dan dieramkan di dalam inkubator pada suhu 35°C +/- 1°C selama 48 jam sebelum bilangan koloni *Escherichia coli (E. coli)* dan *S. aureus* dikira. Tujuan kajian ini adalah untuk menilai perbezaan tahap kontaminasi *E. coli* dan *S. aureus* ke atas pakaian seragam jururawat sebelum dan selepas waktu bekerja/syif. Keputusan menunjukkan terdapat perbezaan yang signifikan pada kontaminasi *E. coli* dan *S. aureus* ke atas pakaian seragam jururawat sebelum dan selepas waktu bekerja (masing-masing $p=0.017$, $\alpha=0.05$); $p=0.049$, $\alpha=0.05$). Keputusan juga menunjukkan bahawa terdapat pengurangan kontaminasi bakteria ke atas

pakaian seragam jururawat selepas waktu bekerja. Keputusan juga menunjukkan terdapat perbezaan yang signifikan pada kontaminasi *E. coli* di antara lengan tangan dominant, poket, dan kawasan abdomen pakaian seragam jururawat sebelum waktu bekerja bermula. Walaubagaimanapun, tiada perbezaan pada kontaminasi *E. coli* di antara lengan tangan dominant, poket, dan kawasan abdomen pakaian seragam jururawat selepas waktu bekerja dan kontaminasi *S. aureus* di antara lengan tangan dominant, poket, dan kawasan abdomen pakaian seragam jururawat sebelum dan selepas waktu bekerja. Oleh yang demikian, tindakan jururawat dan hospital dalam meminimumkan kontaminasi bakteria ke atas pakaian seragam dalam mengurangkan kejadian transmisi infeksi melalui pakaian seragam kepada pesakit dan sebaliknya adalah sangat penting.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

While hand hygiene is well acknowledged as the single most significant factor in the prevention of cross infection, contact transfer of bacteria from uniforms leading to infection has also been illustrated. Several studies have demonstrated that healthcare personnel's uniforms especially nurses' uniforms could become contaminated by certain microorganisms whilst carrying out clinical duties for example dressing a septic wound and bedmaking (Perry, Marshal & Jones, 2001; Speers, Shooter, Gaya, Patel & Hewitt, 1969; Allen & Henshaw, n.d.). Maximum contamination occurs in areas mostly upon hand contact, for example sleeves, apron area, and pocket area (Loh, Ng & Holton, 2000; Speers *et al*, 1969). These studies could imply that washed hand may be re-contaminated by microorganisms that preset on that cuff of the uniform.

Methicillin-resistant Staphylococcus aureus (MRSA), *Staphylococcus aureus (S. aureus), vancomycin-resistant enterococci*, and *Clostridium difficile (C. difficile)* are bacteria commonly isolated from nurses' uniforms (Perry, Marshall & Jones, 2001; Loh, Ng & Holton, 2000; Speers *et al*, 1969). These bacteria can caused several types of infection and may lead to mortality. *S. aureus* was most frequently isolated organisms in hospital-acquired infections (HAIs) done in Moroccon University hospital (Jroundi, Khoudri, Azzouzi, Zeggwagh, Benbrahim, Hassouni, Qualine & Abouqal, 2007). Hadju, Samodova, Carlsson, Voinova, Nazarenko, Tjurikov, Petrova, Tulisov, Andresen

and Eriksen, (2007) found that bloodstream infection or septicemia due to *S. aureus* contribute to the risk of hospital mortality.

Contamination of skin or 'splashes' or touch by microorganisms is practically unavoidable in hospitals. Nurses' attitude in managing the uniforms such as not properly decontaminate the uniforms and wearing the uniforms from home also contribute to the contamination of the uniforms. Hence, nurses' uniforms have a great potential to be contaminated with bacteria and may increase the risk of patients developing HAIs.

Furthermore the microorganisms are usually invisible through naked eyes. It is also not known the existence of such microorganisms on clothing. Moreover, the prevalence of HAIs are on the rise (Jroundi *et al*, 2007; Hadju *et al*, 2007; Gravel, Taylor, Ofner, Johnson, Loeb, Roth, Stegenga, Bryce, Matlow, 2007), so the role of environmental factor in spreading the infection was being examined. Since *S. aureus* and *Escherichia coli (E. coli)* have been found on the nurses' uniforms, the uniforms were assessed to determine the degree of *S. aureus* and *E. coli* contamination present on nurses' uniforms during time span of duty in order to assess the risk of spreading of nosocomial infections by such contact in a hospital setting.

1.2 Problem Statement

Wearing nurses' uniforms in a hospital setting has been an established practice for many years as mode of identification by patients and other health personnel. Uniforms give nurses a recognizable identity, which promotes public trust and confidence (Nair, Attia, Mears & Hitchcock, 2002). Although the uniforms are good in that particular matter but it has an unpalatable fact

because Perry, Marshall and Jones, (2001) had clearly demonstrated that nurses uniforms were contaminated with disease causing pathogens. The potential on spreading bacteria in hospital through nurses' uniforms exist because they are frequently in contact with patients. Hedin (1993) had demonstrated in his study that indirect contact with staff clothing found to be a route for cross-infection in the clinical setting.

The theory of gravity, adhesion, and mode of transmission explain how the bacteria would contaminate nurses' uniforms and transfer it to other surfaces. Allen and Henshaw (n.d) said that bacteria will deposits onto surfaces by gravity or adhesion due to air current in the normal course of event. Bacteria will also deposits onto surfaces when differences of electric charges between two elements exist (Allen & Henshaw, n.d). Physical contact also is also one way of the bacteria can be deposited on surfaces (Loh, Ng & Holton, 2000). Hence, nurses' uniforms will be potentially contaminated by bacteria because of being exposed to the environment over time whether from the hospital or outside hospital. Nurses wearing the contaminated uniforms then attended the patient to give care and would then transfer the bacteria to the patient by direct or indirect contact. Direct or indirect contact is one type of route of transmission in theory mode of transmission. (Free Dictionary Wikipedia, n.d). Direct and indirect contact are classified in contact route.

Worse, nurses wear the same uniforms when they move between wards, isolation area and the outside of the wards. Nurses wearing uniforms are frequently seen outside ward such as, commercial premises for example cafeteria, market; walking on the road, driving a car and et cetera. They could be carrying infections on their uniforms as they move between wards and even

as they travel to and from work. On their way work, they may spread or acquire the bacteria and increase the risk of infection. In addition, nurses in *Hospital Universiti Sains Malaysia* (HUSM) mostly wear uniforms that being laundered at home. They probably did not decontaminate the uniforms in a proper way and from the research conducted by Calderdale and Huddersield (2008), it was mentioned that domestic washing machine is not suitable or adequate to decontaminate the uniforms.

Furthermore, HAIs are now recognized as a major and increasing problem. HAIs defined by Walker (2002) is an infection that was neither present nor incubation at the time of patient's admission to hospital (Chalmers & Straub, 2006). It is a collective term covering a variety of problems such as urinary tract infection, surgical wound infection, lower respiratory tract infection, and skin infection. Those at most risk including the elderly, the very young, those are vulnerable as a result of severe disease or complex treatment, and women undergoing surgery especially when they require a temporary catheter. Thus, nurses' uniforms could be one of the causes of HAIs since they are personnel that frequently get into contact with them (Wilson, Loveday, Hoffman & Pratt, 2007).

HAIs give foremost impact to human and financial costs. The prevalence of HAIs are varies from 11.6% to 17.8% (Jroundi *et al*, 2007; Hadju *et al*, 2007; Gravel *et al*, 2007). From these studies, the prevalence of HAIs was higher in developing country compared to developed country. Hospital also spends a large sum of money for HAIs. In Scotland alone, the annual cost by this problem was estimated to be around 186 millions pounds (Chalmer & Straub, 2006). Plowman, Graves, Griffin, Roberts, Swan, Cookson and Taylor, (2001) also

reported that infected patient costs the hospital 2.9 times higher than uninfected person. Preventing HAIs could save financial costs and prevent unnecessary problem.

1.3 Objectives of the Study

1.3.1 General Objective

To study the degree of *E. coli* and *S. aureus* contamination present on nurses' uniforms during time span of duty.

1.3.2 Specific Objectives

I. To explore the degree of *E. coli* and *S. aureus* contamination present on nurses' uniforms at the start and end of duty.

II. To investigate the difference of degree of *E. coli* and *S. aureus* contamination present on nurses' uniforms at the start and end of duty.

III. To investigate the difference of degree of *E. coli* and *S. aureus* contamination present between dominant hand's sleeve, pocket, and abdominal area the start and end of duty.

1.4 Research questions

I. What is the degree of *E. coli* and *S. aureus* contamination present on nurses' uniforms at the start and end of duty?

II. What is the difference of degree of *E. coli* and *S. aureus* contamination present on nurses' uniforms at the start and end of duty?

III. What is the difference of degree of *E. coli* and *S. aureus* contamination present between dominant hand's sleeve, pocket, and abdominal area the start and end of duty?

1.5 Hypothesis

Hypothesis 1

H_o: There was no difference between the degree of *E. coli* contamination present on nurses' uniforms at the start and end of duty.

H_a: There was a difference between the degree of *E. coli* contamination present on nurses' uniforms at the start and end of duty.

Hypothesis 2

H_o: There was no difference between the degree of *S. aureus* contamination present on nurses' uniforms at the start and end of duty.

H_a: There was a difference between the degree of *S. aureus* contamination present on nurses' uniforms at the start and end of duty.

Hypothesis 3

H_o: There was no difference in degree of *E. coli* contamination present between dominant hand's sleeve, pocket, and abdominal area at the start of duty.

H_a: There was a difference in degree of *E. coli* contamination present between dominant hand's sleeve, pocket, and abdominal area at the start of duty.

Hypothesis 4

H_o: There was no difference in degree of *E. coli* contamination present between dominant hand's sleeve, pocket, and abdominal area at the end of duty.

H_a: There was a difference in degree of *E. coli* contamination present between dominant hand's sleeve, pocket, and abdominal area at the end of duty.

Hypothesis 5

H_o: There was no difference in degree of *S. aureus* contamination present between dominant hand's sleeve, pocket, and abdominal area at the start of duty.

H_a: There was a difference in degree of *S. aureus* contamination present between dominant hand's sleeve, pocket, and abdominal area at the start of duty.

Hypothesis 6

H_o: There was no difference in degree of *S. aureus* contamination present between dominant hand's sleeve, pocket, and abdominal area at the end of duty.

H_a: There was no difference in degree of *S. aureus* contamination present between dominant hand's sleeve, pocket, and abdominal area at the end of duty.

1.6 Definition of Terms

Contamination is the soiling or deposition of other substance in any place where it is not desired (Dorland' Pocket Medical Dictionary, 2001).

Microorganisms are microscopic organisms in medical interest including bacteria, rickettsiae, viruses, fungi, and protozoa (Dorland' Pocket Medical Dictionary, 2001).

Bacteria are plural noun of bacterium. It is a microscopic organisms, which lack of a distinct nuclear membrane and most of which have a cell wall of unique composition. Some parasitic bacteria cause disease by producing poisons (Oxford Student's Dictionary of English, 2001).

Escherichia coli (E. coli) is a gram-negative bacterium. It is a species constituting the greater part of the normal intestinal flora of man and other animals. It can be grown easily. It's genetic comparatively simple and easily manipulated (Dorland' Pocket Medical Dictionary, 2001). (Figure 1.1 and 1.2, Appendix D).

Staphylococcus aureus (S. aureus) is a gram-positive bacterium that appears in grape-like clusters. It is a normal commensal of the skin and nose. The organisms multiply aerobically and anaerobically, are resistant to heating (up to 122^0F), drying, and high salt concentration, and can survive indefinitely on surfaces, clothing and on fomites (Grossman, 2003). (Figure 1.3 and 1.4, Appendix D).

Nurse is one of who is especially prepared in the scientific basis of nursing and who meets certain prescribed standards of education and clinical competence and registered on state board of nursing (Dorland' Pocket Medical Dictionary, 2001).

Uniform is the set of clothes worn at work by members of certain organizations or groups (Oxford Student's Dictionary English, 2001). In HUSM, nurses uniform consists of *tudung*, blouse, and trouses for muslim female and no *tudung* for non-muslim female. Uniform of male nurses consists of shirt and trousers. The researcher did not include *tudung* in assessing bacterial contamination in this study. (Figure 1.7, Appendix D).

Medical ward is treatment ward related to the science or practice of medicine or conditions that require attention of a physician rather than surgeon (Dictionary of Nursing, 2004).

Time span of duty of nurses in HUSM are divided to morning shift (7am – 2pm), evening shift (2pm – 9pm), night shift (9pm – 7am) and office hour (8am – 5pm). Samples are only taken from morning, evening, and night shift.

1.7 Significance of the Study

Nurses are personnel closer to patient than any other health personnel. Wade (1995) said, they accounted for about 80% of the direct care patients received and it often involves personal and intimate care activities such as bedmaking, dressing, catheterization, sponging, positioning, and other activities in wards (Storr & Clayton-Kent, 2004). Hence, nurses' uniforms became progressively contaminated with bacteria of low pathogenicity from the wearer and of mixed pathogenicity from clinical environment and patient (Wilson *et al*, 2007). Worse, nurses' uniforms were found to be a route of cross-infection by indirect contact (Hedin, 1993).

Unfortunately, Candlin and Stark (2005) had proven that nurses' knowledge of infection control is limited. Nurses' awareness on the potential of uniform being contaminated by microorganisms such as pathogenic bacteria while delivering care and how to decontaminate the uniform is limited. This statement supported by Nye, Leggett and Watterson (2005) on their study that very few nurses were provided by guidance on how to manage the uniforms safely. Nurses also wear uniforms to travel to or from work, between isolation

ward, and between wards. Nurses should play the role to break the potential risk of infection. Hence, this study could become a based knowledge in increasing the awareness of the nurses about the potential of uniforms being contaminated.

HAIs has long become problem as long as hospital existed. The very old, the very young and those who are immunocompromised being at greatest risk of contracting HAIs, the impact on the patient can manifest itself in slower recovery, longer hospital stay, loss of earnings, and disability (Chalmers & Straub, 2006). Walker (2001) added, hospital also will face delayed admission and discharge, closed hospital wards, cancelled surgery, from this problem (ibid). All of these factors add to diminishing public confidence to the healthcare professional.

Public perception on healthcare professional wearing uniform to travel to and from work might contribute to the spread of healthcare-associated infection has now become the focus of professional and media concern. In this study, the researcher had demonstrated that contamination of microorganism on nurses' uniforms had occurred. Thus, an authorized person may take further suitable action and indirectly increased nursing profession image.

Many studies were done to investigate the contamination of uniforms but most reported the presence of pathogens rather than the degree of contamination (Wilson *et al*, 2007).Furthermore, most studies were done to investigate all kind of bacteria on the uniform collectively but this study examined the degree of each specific bacterium *E. coli* and S. *aureus* present on nurses' uniforms. This study also examined the difference of degree of *E. coli* and *S. aureus* contamination at the start and end of duty.

This problem cannot be eradicated overnight and there is no single measure that can be taken to solve it. Contaminations of the uniforms are unavoidable but best practice is to minimize the problem. Based on the results in this study, further action should be taken whether continuing the old tradition wearing uniform to travel to or from hospital or starting a new safe practice to handle uniform. The finding from this study can be used as a guide to write a written guidance on how to properly manage the uniform.