

MRSA Prevention and Control

--- A guide for nursing home

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ABSTRACT

This practical based guide's original purpose is to provide a comprehensive, understandable guideline for nursing homes' workers and students in English, on the topic of MRSA prevention and control.

Author searches related information from mainly internet, the used search engines are: the school library masto-finna, PubMed, Medic, ScienceDirect. Later on, more information was gathered through websites: European Centre for Disease Prevention and Control, Eurosurveillance, the journal of hospital infection, Nice clinical guideline centre, WHO, and THL. Most of current MRSA prevention guidelines and qualified studies are based on hospitals, only a few of guidelines and researches are for long term healthcare facilities, and no qualified, reliable, practical guideline was found for nursing home.

Thus, on the basis of most popular and reliable guidelines for long term care facilities (published by WHO, CDC), author combines nursing home practice (from own work experience and communication with other workers) and latest nursing home articles/studies, proposed a nursing guide for nursing homes with MRSA residents, inferred a few practical problems on the basis of facts of nursing homes, assumed possible reasons, made an short brochure, to be more simple and applicable.

Key words: MRSA, Methicillin-resistant Staphylococcus aureus, prevention, guideline, hand hygiene, contact isolation, nursing home, long term healthcare facility

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1 INTRODUCTION

MRSA, short for Methicillin-Resistant/Multiple-resistant *Staphylococcus Aureus*, is a strain of *Staphylococcus aureus* which is resistant to most commonly used antibiotics. Currently, MRSA has been identified as one of major pathogens which cause difficult-to-treat nosocomial infection. Nosocomial infection, also known as hospital acquired infection, is nowadays a global problem. Nosocomial infection will cause a sharp increasing in medical cost, moreover, it also increase patient mortality in a significant level. (Baddour 2010, Kolendi 2010, Kerttula 2007)

In Europe, MRSA rates has been stable for many years. It was acknowledged as a hospital pathogen (Hospital Acquired MRSA), however, it was reported recently in long-term facilities (for instant, nursing homes) and communities which showed to be no association with any health care unities (named as Community Acquired MRSA). In Finland, according to National Infectious Disease Register, the annual MRSA case has increased year by year. On the basis of Terveystieteiden tutkimuskeskus, the reported new MRSA case in 2015 is 1274, and in 2016 is 1700. (Kerttula 2007, THL 2017)

According to European Centre For Disease Prevention And Control, an agency of the European Union, there are about 4.2 million healthcare-associated infection cases in European long-term care facilities every year. Nursing homes, residential homes and mixed facilities are included to long term health care facilities, most of these facilities are for elderly care. (European Centre for Disease Prevention and Control 2014)

2 AIM AND PURPOSE

The aim of the guide is to provide nursing homes' workers and students a comprehensive, understandable guide in English, on the topic of MRSA prevention and control. The guide will be manifested in a brochure, in order to be brief, simple, interesting, and easy to implement, and be allowed to future supplement. The guideline can be found extremely useful for new workers, students, and temporary workers in nursing homes, to help them to reach an understanding of MRSA and MRSA care.

The purpose of the guide is to emphasize the importance of preventing MRSA and performing hand hygiene, to improve healthcare associated staff's consciousness of infection prevention and hand hygiene.

3 MRSA

MRSA is defined as a strain of gram-positive staphylococcus aureus, which be capable of resistant to several beta-lactam antibiotics, including penicillase-resistant penicillins, methicillin, cephalos, etc. (Kolendi 2010.)

3.1 MRSA Emergence

MRSA originates from ordinary staphylococcus aureus. Staphylococcus aureus existent widely in natural environment and human bodies. It is gram-positive potential pathogen, causes infections when the host gets decrease in immunity. Penicillin was applied into treat staphylococcus aureus infections in 1942, 2 years later, penicillin-resistant staphylococcus aureus isolate was firstly observed. Until 1960, 80% of staphylococcus aureus developed to penicillin-resistance. Then in 1961, the first methicillin-resistant staphylococcus aureus strain was reported in London, only 1 years after methicillin was introduced into use. (Kolendi 2010.)

3.2 HA-MRSA and CA-MRSA

HA-MRSA is short for healthcare associated MRSA or hospital acquired MRSA. CA-MRSA is short for community associated/acquired MRSA.

For ages, MRSA were detected only in hospitals or healthcare related facilities. Since the first MRSA strain emerged in 1961 in London, MRSA has been reported in world round hospitals and caused few worldwide epidemics, became the major pathogen caused nosocomial infection. (Kilned 2010.)

In the mid-1990s, CA-MRSA was firstly reported in a community which didn't have any significant connection with hospitals or any other health care facilities. This new kind of MRSA infections was named community-acquired MRSA. Later on, CA-MRSA isolates were reported world widely. (Kolendi 2010.)

Generally, CA-MRSA and HA-MRSA have different high-risk population and popular pathogen type. However, as recently reported, CA-MRSA strains have also been detected in hospitals. (Kolendi 2010.)

Here are table 1 which briefly described the differences between CA-MRSA and HA-MRSA:

Table 1 Differences between CA-MRSA and HA-MRSA (Kolendi 2010)

Characteristic	CA-MRSA	HA-MRSA
At risk populations	Children, athletes, prisoners, soldiers, selected ethnic populations (native American, Alaskan natives, Pacific islanders), intravenous drug users, men who have sex with men	Outbreaks are healthcare associated* (will describe in the following chapter)
Clinical infections	Skin and soft tissue infections (furuncles, skin abscesses); post influenza necrotizing pneumonia	Pneumonia, urinary tract infections, catheter-related or bloodstream infections, surgical sites infections
Underlying conditions	None	Healthcare-associated risk factors*
Age group	Younger	Older
Race/ethnicity	Non-white	White
Chloramphenicol	Usually susceptible	Frequently resistant

Clindamycin	Usually susceptible	Frequently resistant
Toxin production	More	Less

Note: SCC: staphylococcal chromosome cassette; *: Isolation of MRSA \geq 2 days post-hospitalization; history of hospitalization; surgery; dialysis; residence in long-term care facility; permanent indwelling catheter or percutaneous device; previous MRSA isolation.

HA-MRSA risk factors are mainly associated to health care factors.

Personal factor include: severity of illness, underlying diseases, previous systemic antibiotic treatment, resident in a long term healthcare facility, previous experiences of hospital or clinic, indwelling catheters, pressure ulcers, postoperative wounds, IV treatment, dialysis, MRSA colonized or infected history. In addition, health care staff factors include: over workload, stressful work environment, insufficient and inconvenient sinks, inaccessible supplies, consciousness of hand hygiene, etc. (Manal 2010.)

Risk factors for CA-MRSA include: young children, day-care attendees, prison inmates, men-men sex, HIV infection, athletes, homeless, and IV drug users, tattoo recipients, selected ethnic populations (Native American, Alaskan natives, Pacific islanders). (Manal 2010, Kolendi 2010.)

3.3 Transmission Mechanism

A generally accepted opinion is, MRSA colonization happens in anterior nares firstly, without causing any infection when the host is in good health, however, if nasal colonization is not treated, when the host gets decrease in immunity, MRSA can cause various infections (Kolendi 2010).

MRSA bacteria spreads mainly through contact with a colonised or infected person, mainly from shedding skin debris. Indirect contact though nurses' hands is the main method. Contaminated environment is also an important factor. In addition to these, airborne spread happens only in

burn units, which is associated with huge defective of dermis and immunocompromised. (Ayliffe 1996, Kolendi 2010.)

Recent reports declared, a livestock associated MRSA CC398 was identified. CC398 mainly reserved in pigs, poultry and cattle, but can also infect or colonize horses, dogs and humans. (Cuny 2013.)

3.4 Colonization, Clinical Infections and Treatment

MRSA colonization indicates MRSA bacteria carriers without clinical infection. A generally accepted opinion is, anterior nares are the main reservoir sites. Skin infections are usually happens after nasal colonization. According to studies, if nasal carrier was treated, other body sites infections are usually resolved. When colonization cleared, the infection risk is also reduced. (Kolendi 2010.)

However, for CA-MRSA infections, data shows that, contact of skin-skin and skin-fomite plays a more important role than nasal colonization. This was supported by studies in CA-MRSA athlete teams, their colonization sites are more in axillae, inguinal, and rectum, seldom in nares. Their infections appeared to be results of exposures to broken skin or contaminated items. (Kolendi 2010.)

S. aureus pathogens, mainly cause skin infections, even septicaemia. HA-MRSA usually cause pneumonia, urinary tracts infections, sepsis, operative wounds infections. While CA-MRSA usually infect skin and soft tissues. HA-MRSA strains can usually be isolated from blood, respiratory and urinary tract secretions, but CA-MRSA strains are primarily found on skin or soft tissue infection sites. (Ayliffe 1996, Kolendi 2010.)

MRSA strains usually are resistant to all beta-lactam antibiotics, such as penicillin, cephalosporin and carbapenems. Presently, vancomycin is the first option for treating MRSA infections in clinical, even though there are already several studies referred resistant cases, poor pharmacokinetic properties and other limitations. (Kolendi 2010.)

The standard option for severe MRSA infections are glycopeptides, vancomycin, and teicoplanin, sometimes together with rifampicin. For complicated skin and soft tissue infections, which are suspected MRSA participated, daptomycin is allowed to use by European Medicines Agency, for it shows equality efficacy to vancomycin in treating MRSA infections. (Kolendi 2010.)

4 MRSA INFECTION CONTROL

An effective infection control program can reduce the risk of MRSA acquisition for residents, workers and visitors. The purpose of infection control is to prevent the MRSA propagation between healthcare workers and patients/residents. The responsibility of prevent infection belongs to all health care staff, every staff has the obligation to comply with offered guidelines. (Coia 2006, Office of Public Health 2008.)

4.1 Admission to LTCF

LTCF is short for long term care facilities, include nursing homes, rehabilitation facilities, inpatient behavioural health facilities, and long term chronic care hospitals. LTCF shouldn't deny the acceptance of a MRSA colonized or infected resident, if the facility be able to meet the medical needs of the resident. LTCF should make some symbols for visitors and new workers, to hint the fact that the resident is on contact isolation. The symbol can be a picture or words, placing on the door of the room, without exposure the resident's privacy. (Office of Public Health 2008, APIC 2009.)

MRSA risk assessment should be done to evaluate the risk level in a specific facility and to reduce the risk of MRSA transmission. Nowadays there still doesn't have a certain or detailed MRSA risk assessment table. Theoretically, the risk assessment should include resident's personal factor and data of MRSA prevalence in specific facility, community, state, and national rates. (APIC 2009.)

However, big data are still not available currently, but individual factors are collectable: severity of illness; aging; underlying diseases (diabetes, renal diseases, vascular diseases, immune system diseases, dialysis); previous systemic antibiotic treatment; previous experiences of hospital or clinic; IV treatment or drug use; broken skin (pressure ulcers, postoperative wounds); permanent indwelling catheter or percutaneous device; previous MRSA colonized or infected history. (APIC 2009.)

Besides, suitable room arrangement plays also an important role to prevent MRSA spreading: here are some basic principles, which are summarized and proposed by Office of Public Health: A MRSA colonized or infected resident should get a private room if possible; If necessary, a MRSA resident can share a room with another same SCC colonized or infected resident, or at least, share a room with another resident who has intact skin and no “tubes” (low MRSA risk); A resident with MRSA colonization or infection shouldn’t be placed with another resident who has another antibiotic resistant organism, for instance, another SCC MRSA or ESBL. (Office of Public Health 2008.)

4.2 Standard Precaution

Standard precaution is a strategy comprised with a series of infection prevention measures. The strategy combines the main points of universal precautions and body substance isolation. It is based on the opinion that, patients’ blood, body fluids, secretions and excretions (except sweat) are all contagious, and need to be isolated, regardless if there is significant blood contamination, or if there will be contact with patients’ broken skin or mucous membranes. (APIC 2009.)

Standard precaution aims to prevent infection transmission in facility, it benefits all participators, all employees, residents, and visitors.

“Standard Precaution protects residents by ensuring that contaminated hands and equipment are cleaned and/or disinfected prior to use”, in other words, standard precaution protects residents from medical treatment/nursing. On the other hand, “Standard Precaution protects facility staff by ensuring that personal protective equipment (PPE) is always available when contact with blood or body fluids is anticipated”, in other words, standard precaution protects staff from source of infection. (APIC 2009.)

Standard precaution must be performed with all residents, when staff is at risk of exposing to residents’ blood, all body fluid (secretion, sputum, urine,

excrement; sweat is not included), broken skin, mucous membranes (APIC 2009).

Standard precaution includes hand hygiene, personal protective equipment, management of contaminated equipment and environment, and safe injection practice (APIC 2009).

Appropriate hand hygiene and management of contaminated equipment and environment will be stressed in following sections. Personal protective equipment (PPE) includes gloves, masks, gowns, and eyewear. PPE should be removed before leaving resident's room. A manner of appropriately remove / put on PPE (Image 1) should be trained, to prevent the potential possibility of causing unnecessary contamination. Hand hygiene should be performed after PPE removing. (WHO 2008, APIC 2009.)

Hands: Hands disinfection has two options. A waterless hand disinfection should be performed between resident contacts, disinfectant need to contain at least 60% alcohol. A soap and running water based hand washing should be performed if hands are visibly soiled, or after dealing with body fluid exposed jobs. (Office of Public Health 2008.)

Gloves: Disposable gloves must be used in dealing with body fluid or broken skin or mucous membranes. The selection of sterile or non-sterile gloves depends on the task requirements. Attention should be paid to limit touching items to reduce unnecessary contaminations. Gloved hands should be kept away from own face. Broken gloves should be discarded. (Office of Public Health 2008, APIC 2009.)

Masks, Eye protection, or Face shields: These are to be used when expose to potential splashing body fluids or blood (Office of Public Health 2008).

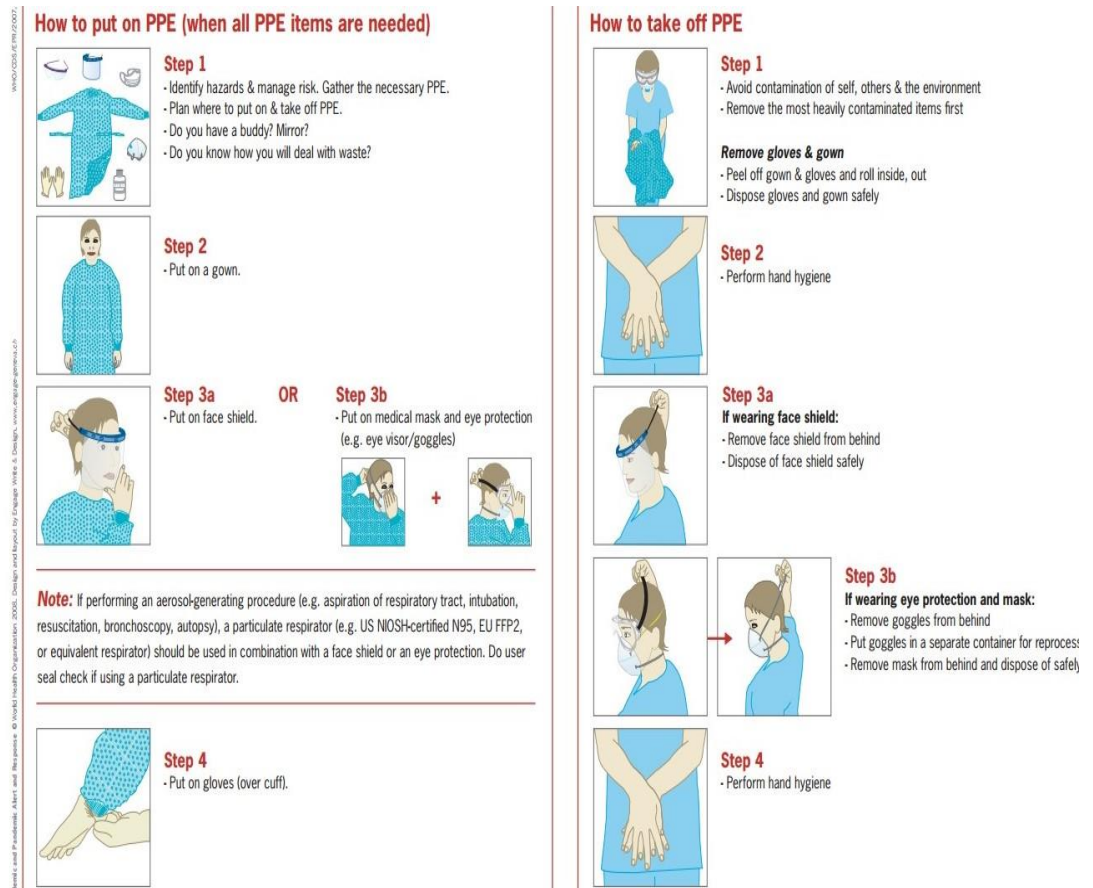


IMAGE 1 How to Put On and Remove PPE (WHO 2008)

Gowns: Gowns are to be used to protect staff's clothes from being contaminated, for example, during bathing or for contact isolation. Gown should be removed and discarded before leaving resident's room. (Office of Public Health 2008, APIC 2009.)

Disinfection of contained equipment and environmental surfaces will be introduced at section 4.4 and 4.5.

Linen: Linens can be handled separately, all the linens in the facility need to be treated as were potentially infectious. If the linen is wet (by water, urine, or faces), should be collected into a plastic bag. The former concept "isolation linen", which means collected and handled separately on the

basis of resident's diagnosis, was no longer performed. (Office of Public Health 2008.)

Respiratory etiquette: this is a new point which be adopted into "2007 guideline for isolation precaution", to cover the mouth and nose while coughing or sneezing with a tissue, to control respiratory secretions. Perform hand hygiene after contact with secretions. (APIC 2009.)

4.3 Contact Isolation

Contact borne spread is the main method of MRSA spreading. As we mentioned earlier, contact borne spread includes direct transmission and indirect transmission. Direct transmission is that kinds of infection caused by direct contact with contaminated skin or body fluids. Indirect transmission caused by contact with contaminated objects or environment, for instance, care givers' hands. Contact isolation is an important supplementary measure when there is MRSA reservoirs in facility. (APIC 2009.)

Data showed that, the numbers of MRSA infection and colonization are increasing in non-acute healthcare settings, nursing home included. The patient management in these settings is different from in hospitals, in these settings, the risk of invasive infection is lower, but environment and activities are more complicate. (Kolendi 2010, National clinical effectiveness committee 2013.).

As mentioned, MRSA spreads mainly by direct or indirect contact, airborne transmission seldom but actually happened due to droplets. "When a MRSA-infected or colonized resident has a respiratory infection, droplets expelled during coughing, sneezing, or talking may contain MRSA", "respiratory drops can expose individuals and environmental surfaces within three feet of the coughing person to an infectious agent in the droplets". Thus, employees should wear a mask when working within three

feet from a MRSA infected resident who has respiratory infections. (APIC 2009.)

LCT facilities should develop MRSA management policies on the basis of following factors, facility's MRSA risk assessment and surveillance, evidence-based practice guidance, and state regulations. (APIC 2009.)

Gloves: Non-sterile disposal gloves should be worn before contact a MRSA resident. Gloves should be discarded if soiled, or before leaving the resident's room, or before touching a clean object. After gloves removing and hand hygiene, make sure that hands do not touch any potentially contaminated items. (Office of Public Health 2008.)

Hand Washing and Hand Disinfection: As mentioned, hand washing needs to perform on the basis of soap and running water, hand disinfection should perform with disinfectant which contains at least 60% alcohol. Attention should be paid not to touch environmental surfaces before leaving the room. (Office of Public Health 2008.)

Gowns: Disposable gowns should be used in case of physical contact with MRSA residents, for example, during bathing, or morning washing, or changing diapers, or changing wound dressing, etc. Gown should be applied before or immediately entry a MRSA-infected resident's room, and be removed and discarded before leaving resident's room. (Office of Public Health 2008.)

Masks: Mask should be worn to prevent the possibility of expose to splashing body fluid, for example, uncontrolled cough. Mask and face protection can be safely removed if touch only ties and straps. Mask should be applied when doing work within three feet of a MRSA infected resident who has respiratory infections. (Office of Public Health 2008, APIC 2009.)

Equipment and Devices: "Where possible, dedicate the use of personal, noncritical medical equipment, such as thermometers and blood pressure apparatus, to the resident with MRSA", according to the 2008 guideline for

LTCF. "If use of common equipment is unavoidable, these items must be disinfected between residents with a facility approved product". (Office of Public Health 2008, APIC 2009.)

Environment Cleaning and Disinfecting: Contaminated environment of MRSA residents should be cleaned and disinfected regularly and frequently, at least daily. Contaminated environment include close environment (bed rail, over-bed tables, bed-tables, etc.), frequently touched objects (door knobs, toilet, walker, etc.), and so on. (Office of Public Health 2008, APIC 2009.)

Before Leaving Own Room: If a MRSA infected resident has problems with control secretions, for example uncontrolled coughing, make sure that movement and transport should be limited, nevertheless, try to reduce opportunities of leaving room. When a MRSA infected resident needs to leave his/her room, make sure that: perform hand hygiene, change clean clothes, cover wounds safely. If a MRSA infected resident needs transport, for example, to another department, or to go to see doctor, except hand hygiene, clean clothes, safely covered wounds, attention should also be paid to avoid contact potential contaminated surfaces, and apply appropriate PPE. (APIC 2009.)

Activities: Nursing home residents should be treated and respected as being at home. Participation in social activities shouldn't be forbidden. A resistant with MRSA colonization or infection can also take part in activities, as long as all colonized or infected body sites (except nares) can be securely covered, and behaving good hygiene and hand washing. It is not necessary for a MRSA nasal colonized resident to wear a mask to go outside or to attend activities, as long as he/she can cover nose and mouth when coughing or sneezing. Residents with MRSA colonization in sputum, don't need to wear masks if they can cover their mouth and nares with a tissue when coughing or sneezing. But if they are also suffering from uncontrolled coughing, for example, pneumonia or bronchitis, then they need to wear mask if they attend to go outside. Regular hand

washing is extremely important for those residents, especially after coughing or sneezing. If the residents don't have enough awareness or ability to perform good hand washing or hand hygiene, it is the nurses' responsibility to educate or help them. (Office of Public Health 2008.)

4.4 Environmental and Equipment Cleaning and Disinfection

The prevalence and risk factors of MRSA in nursing home is still not quantified neither proved. However, according to hospital-based studies, MRSA was proved to be able to survive 1-56 days at common hospital materials, plastic patient chart, laminated table top, and cloth curtain included. (APIC 2009.)

The MRSA risk factors still haven't been proved in nursing homes, but following factors may make environmental factors play more important role in MRSA transmission: Residents live longer in nursing homes than in hospitals, lengths of stay in nursing homes are measured by months or years, while in hospitals are measured by days or weeks; Seldom private room (not proved); Residents move freely in the department; Contamination opportunities are various and difficult to measure and control. (APIC 2009.)

There was a study got strong evidence to show that patient can acquire MRSA from contaminated environment (3/26 in ICU). In the same study, it was revealed MRSA was isolated in every environmental sample. In another study, MRSA was isolated from 73% of MRSA infected residents' rooms and 69% of MRSA colonized residents' rooms. Both of the studies suggested that, the close environment of MRSA infected or colonized residents would be contaminated and become a source of transmission. (APIC 2009.)

Thus, an appropriate environmental cleaning and disinfection plan is an essential element during process of infection prevention. Most healthcare facilities assign the cleaning of residents care areas to trained

environmental staff. If trained environmental staff is not available, specific care staff should be clearly assigned. (APIC 2009.)

Frequent cleaning and disinfection should be performed if a resident is on contact isolation. “Areas requiring more frequent, effective cleaning and disinfection include, but not limited to, bed rails, light switches, over-bed tables, bedside commodes, bathroom fixtures in the resident’s room, doorknobs, any equipment in the immediate area of the resident, and any equipment that is multi-use between residents”. (APIC 2009.)

An appropriate monitor would be helpful during the assessment of environmental control quality. A standardized environmental cleaning checklist can be a tool of quality assessment, at same time, a guide for new staff. (APIC 2009.)

4.5 Terminal Cleaning and Disinfection

The concept of terminal cleaning was specified as: “The room, or cubicle, and bedside equipment of patients on Transmission-based Precautions are cleaned using the same procedures used for patients on Standard Precautions, unless the infecting microorganism(s) and the amount of environmental contamination indicates special cleaning. In addition to thorough cleaning, adequate disinfection of bedside equipment and environmental surfaces (i.e., bedrails, bedside tables, carts, commodes, doorknobs, faucet handles) is indicated for certain pathogens, especially Enterococci, which can survive in the inanimate environment for prolonged periods of time”. (APIC 2009.)

Besides, even though haven’t been clearly specified or proved, curtains, especially privacy curtains, which around MRSA resident’s bed, would likely to be contaminated and become a source of infection, which should be taken care carefully. (APIC 2009.)

5 HAND HYGIENE

Hand hygiene is the most simple and most effective measure in infection prevention.

5.1 Standard Hand Hygiene

The most authoritative hand hygiene guideline is published by the World Health Organization (WHO) and the Centres For Disease Control And Prevention (CDC) (APIC 2009).

On the basis of guideline published by WHO, the 5 moments of hand hygiene are: before touching a patient/resident, before a procedure, after a procedure or body fluids exposure risk, after patient contact, after contact with patient surroundings (Image 2). The 7 important parts of hand hygiene are: palm to palm, between fingers, back of hands, base of thumbs, back of fingers, fingernails, wrists. There are 2 options for daily nursing, waterless hand disinfection, and hand washing with soap and running water. Waterless hand hygiene with alcohol / hand rub, disinfectant need to contain at least 60% alcohol, should be performed between resident contacts (Image 3). Hand washing with soap and running water should be performed when hands are visibly soiled, after dealing with body fluid exposed jobs, and after using the restroom (Image 4). (Office of Public Health 2008, APIC 2009, WHO 2009)

**YOUR 5 MOMENTS
FOR HAND HYGIENE***

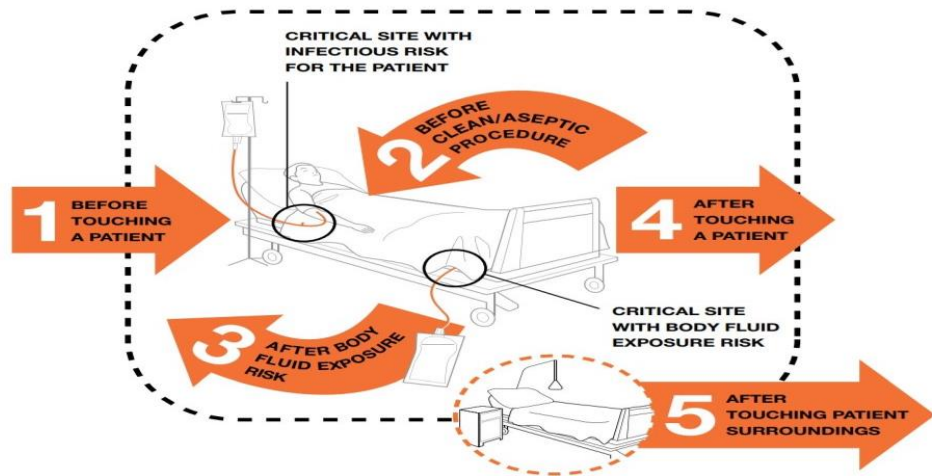


IMAGE 2 Five Moments for Hand Hygiene (WHO 2009)

RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

⌚ Duration of the entire procedure: 20-30 seconds

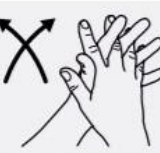



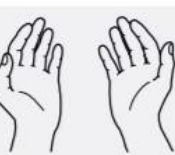
<p>1a</p>	<p>1b</p>	<p>2</p>
<p>3</p>	<p>4</p>	<p>5</p>
<p>6</p>	<p>7</p>	<p>8</p>
<p>Apply a palmful of the product in a cupped hand, covering all surfaces;</p>		
<p>Rub hands palm to palm;</p>		
<p>Right palm over left dorsum with interlaced fingers and vice versa;</p>		
<p>Palm to palm with fingers interlaced;</p>		
<p>Backs of fingers to opposing palms with fingers interlocked;</p>		
<p>Rotational rubbing of left thumb clasped in right palm and vice versa;</p>		
<p>Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;</p>		
<p>Once dry, your hands are safe.</p>		

IMAGE 3 Steps of Hand Disinfection / Handrub (WHO 2009)

HOW TO HANDWASH?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

🕒 Duration of the entire procedure: 40-60 seconds

<p>0</p> 	<p>1</p> 	<p>2</p> 
<p>3</p> 	<p>4</p> 	<p>5</p> 
<p>6</p> 	<p>7</p> 	<p>8</p> 
<p>9</p> 	<p>10</p> 	<p>11</p> 

Wet hands with water;

Apply enough soap to cover all hand surfaces;

Rub hands palm to palm;

Right palm over left dorsum with interlaced fingers and vice versa;

Palm to palm with fingers interlaced;

Backs of fingers to opposing palms with fingers interlocked;

Rotational rubbing of left thumb clasped in right palm and vice versa;

Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;

Rinse hands with water;

Dry hands thoroughly with a single use towel;

Use towel to turn off faucet;

Your hands are now safe.

IMAGE 4 Steps of Hand Washing (WHO 2009)

5.2 The Importance of Hand Hygiene

“Hand hygiene is the corn stone of any infection control program and plays an integral role in reducing the transmission and occurrence of infection” (APIC 2009).

On the basis of “CDC guideline for hand hygiene in Healthcare Settings, 2002”, it is staff’s responsibility to maintain the implementation of appropriate hand hygiene: All levels healthcare associated workers included; Ask visitors to perform hand hygiene before entering and leaving resident’s or patient’s room; Apply proper PPE when at risk of exposing to blood and body fluids; Remove gloves after a procedure, when moving from a dirty site to cleaner ones, and before care another patient/resident; Perform hand hygiene after removing gloves, before and after contact with a patient/resident, before and contact with patient’s surroundings. (APIC 2009.)

It has been proved that, good resident compliance with hand hygiene can reduce MRSA transmission in a significant level. Resident hand hygiene should be encouraged when resident’s hands are contaminated by other residents or their environment. (APIC 2009.)

Visitors may lack the necessary knowledge and awareness on hand hygiene. In departments should have sufficient, obvious and simple educational signs and illustrations on hand hygiene. (APIC 2009.)

5.3 Hand Hygiene Compliance in Nursing Home

A qualified systematic review, which is published at 2015, reviewed 56 studies on the topic of hand hygiene in nursing home, pointed that, in nursing homes, the effectiveness of hand hygiene is still haven’t been well documented, hand hygiene compliance is still low. The same article also inferred the fact that, even though the quantity and quality of the studies is increasing, only 25% of randomized studies got positive conclusion of

hand hygiene intervention, and more evidence is still needed. (Hocine 2015.)

Another observational practice study, which published at 2018 and titled as “the impact of isolation on healthcare worker contact and compliance with infection control practices in nursing homes”, trained researchers observe healthcare workers in nursing homes, to evaluate the staff compliance of PPE and hand hygiene during care of residents who is at contact isolation. The study lasted 15 months, 999h and 4325 visits were observed in total. As a result, “for residents in isolation, compliance was 34% for gowns and 58% for gloves, health care workers hand hygiene compliance was 45% versus 44% on entry and 66% versus 55% on exit for isolation and non-isolation rooms”. Concluded as, the compliance of gowns and gloves are limited, same with compliance of hand hygiene. (Pineles 2018.)

More study and report was not found on topic of hand hygiene compliance in nursing homes. Current reports indicated that the compliance of hand hygiene in nursing home is less than optimal. Most LTC lack hand hygiene monitors and intervention feedback.

6 OWN EXPERIENCE ABOUT PRACTICAL PROBLEMS

Nursing home belongs to long term health care facility, plays an important role in elderly and disability nursing. Patients who is living in a nursing home usually be called “resident”, which means they are living at their own place, need to be treated as living at “own home”.

There are a few points observed by author, from information searching and discussion with colleagues at work place.

6.1 Blank of MRSA Screening and Risk Assessment

According to author’s working experience and information from register nurses in nursing homes, the “MRSA residents” are those ones who got MRSA infected and being diagnosed in hospitals.

MRSA screening is seldom performed in nursing home, even in high-risk groups. The reason is still unknown.

In practice, nursing homes lack a proper MRSA risk assessment.

6.2 Conflict between Nursing Principle and Environment

Nursing homes are special care facilities, there residents live as in their own homes, nurses meant to provide necessary assistance during daily care, at the same time, to maintain residents “live in a normal life” as much as possible. Residents can decide their own lifestyles and activities, so it’s impossible for nurses to take care residents in an order of “from healthy to infect”. For severe Alzheimer resident, it may be impossible to try to keep her/his away from a MRSA resident. For a poor appetite resident, it is difficult to try to keep his/her in good nutrition.

6.3 The Importance and Lack of Continue Education

Large number of practical nurses lack the necessary theoretical knowledge of MRSA, for instance, risk assessment, MRSA resident

placement, appropriate PPE removal method, poor compliance with hand hygiene, lack of ability/awareness to identify new infections, etc.

The situation may related to: lack of concern, overload of working, lack of permanent workers (a serious problem, exist in most private or/and public nursing homes), being temporary workers (free regular continue-education are only opened to permanent workers).

7 THE GUIDE PRODUCTION

This guide process began at spring of 2017. The original reason for this guide is the needs of being a new worker in a nursing home with MRSA residents. Author has 3 years of ICU work experience in hospital, thus knowing the MRSA prevention measures in hospital, but nursing home is a completely different facility, which means the prevent measures are different with previous experiences. The interest arose from the differences thence the topic was chosen.

7.1 Executing of the Guide

The information search began from the beginning of March in 2017, since the new work needs. As more information got, more article read, more differences were noticed and interest were aroused.

At the beginning of April, the guide enrolment was applied and passed. At the same time, the main points were settled after personal discussion with register nurses and practical nurses in working unit. April was mainly spent to search information about the choosing points.

The original interest of this guide was totally personal improvement, as the increasing of information, and the revelation of problems, the importance and lack of a reliable guideline was realized.

7.2 Information Retrieval

During information retrieval, the mainly used search engines are: the school library masto-finna, PubMed, Medic, ScienceDirect. At first, information retrieval was mainly through these widely accepted, qualified, reliable search engines, to maintain the correctness of theoretical knowledge about MRSA.

Later on, more information are searched through websites: European Centre for Disease Prevention and Control, Euro surveillance, the journal

of hospital infection, Nice clinical guideline centre, WHO, and THL. Part of these websites are referred from earlier literature references, some of them are suggested by colleagues and tutors. This part aims to searching for latest information to maintain the timeliness of the guideline.

The searching keywords were originally set as “MRSA” and other combined words, such as: prevention, guideline, nursing home, hand hygiene, contact isolation. Anyway, the advanced searching with keywords “MRSA” & “nursing home” got few topic-related results, thus, the new keyword “long term healthcare facilities” was added.

7.3 Evaluation of the Guide

During the information searching, a lack of professional, qualified, reliable articles/studies in the topic (MRSA in nursing home) was noticed.

Most of current MRSA prevention guidelines and qualified studies are based on hospitals, only a few of guidelines and researches are for long term healthcare facilities, and no qualified, reliable, practical guideline was found for nursing home.

The guide describes necessary theoretical knowledge of MRSA, in a simple and comprehensive way, including MRSA definition, emergence, classification, risk factors, transmission Mechanism, colonization and infection, and commonly used treatment. The theoretical part are based on published books, to maintain the guide’ correctness, reliability and comprehensiveness.

Apart from MRSA theoretical knowledge, the guide emphasized MRSA infection control and prevention. Since the lack of reliable guideline and studies for nursing home, the guide references the most popular and reliable guidelines for long term care facilities (published by WHO, CDC), combined with nursing home practice and latest nursing home articles/studies, proposes a nursing program for nursing homes with

MRSA residents, in a routine of admission→risk assessment→resident placement→standard precaution→contact isolation→activities.

In addition to those, the guide underlines hand hygiene in a separate section, emphasized the standard hand hygiene (hand wash, antiseptic hand rubbing included, surgical hand antisepsis not included) and the importance of hand hygiene.

Furthermore, the guide proposes a few practical problems on the basis of facts of nursing homes, and assumes possible reasons.

8 CONCLUSIONS

As mentioned, most guideline for MRSA control and prevention are based on hospitals. Recent years, MRSA guidelines for long term care facilities are increasing. However, a reliable MRSA guideline for nursing home is currently unavailable,

Nursing homes have more complicate environment than hospitals. In hospital, the first important purpose is to treat disease. However, in nursing homes, assistances are offered to maintain the quality of life at the same time of “being alive”. Thus, there are much more social activities than hospitals. Human rights, especially autonomy, are respected and protected in a higher level.

On the other hand, nursing homes are non-strictly divided for elderly or disabilities. The residents in nursing homes have different underlying diseases, most of them are suffering mental diseases or symptoms at the same time of physical diseases. All these factors impede the developing of MRSA control in nursing homes.

Besides, the lack of MRSA studies in nursing home is still unbelievably huge, especially in the implementation of MRSA risk assessment, environment management and supervision of workers’ hand hygiene compliance. All these factors created difficulties on MRSA preventing.

This guide indicated in detail that, MRSA residents have the right to be participate in social activities, as long as she/he have the ability to behave good hygiene. On the other side, this guide stressed the importance of hand hygiene and applying PPE, to guarantee the employee’s work right and safety.

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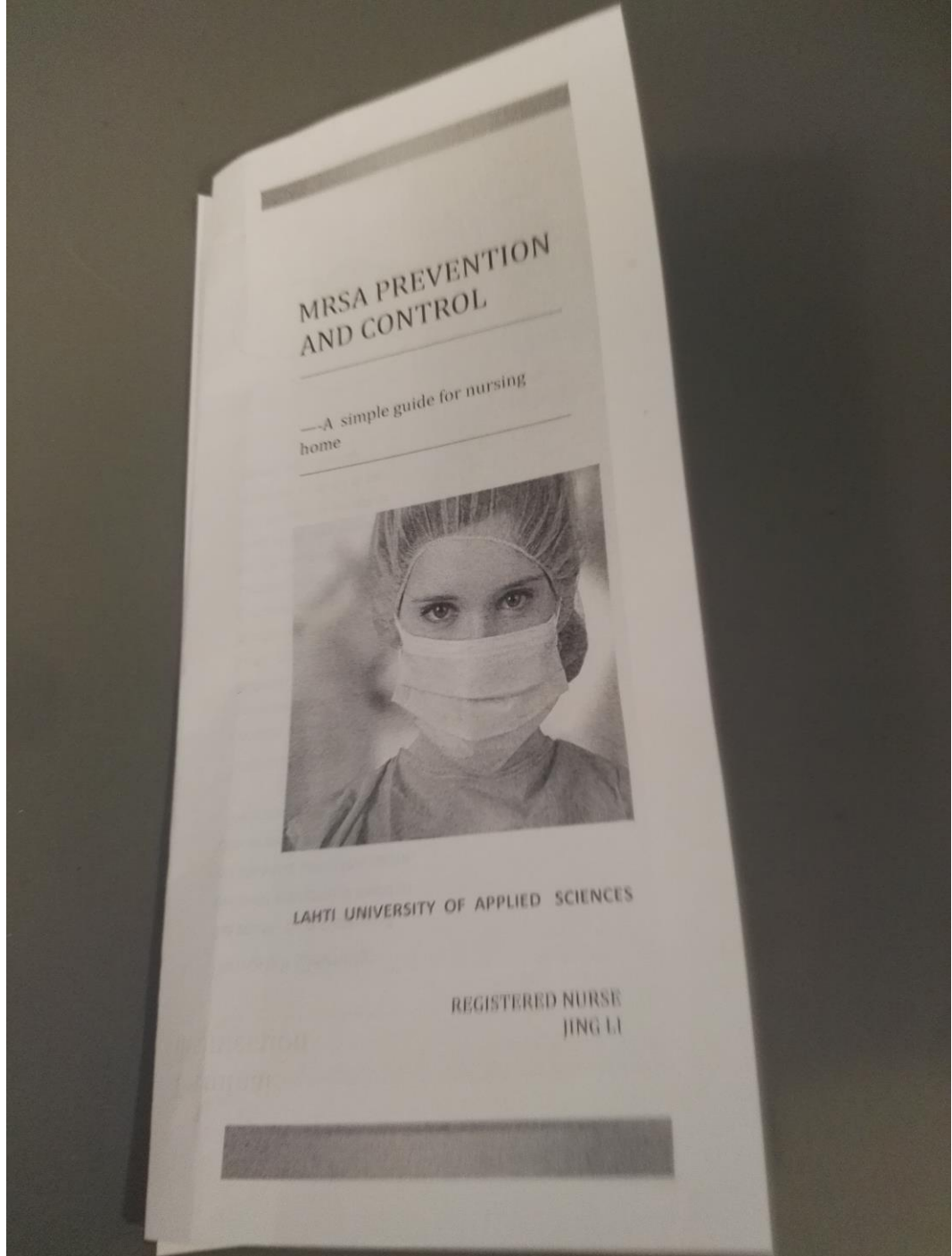
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APPENDICES

Brochure: MRSA Prevention and Control—A guide for nursing home



Admission to nursing home

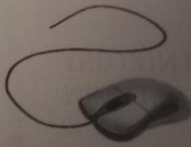
- MRSA risk assessment:**
severity of illness; aging; underlying diseases (diabetes, renal diseases, vascular diseases, immune system diseases, dialysis); previous systemic antibiotic treatment; previous experiences of hospital or clinic; IV treatment or drug use; broken skin (pressure ulcers, postoperative wounds); permanent indwelling catheter or percutaneous device; previous MRSA colonization or infected history.
- Room Arrangement:**
A MRSA colonized or infected resident should get a private room if possible. If necessary, a MRSA resident can share a room with another same SCC colonized or infected resident, or at least, share a room with another resident who has intact skin and no "tubes" (low MRSA risk). A resident with MRSA colonization or infection shouldn't be placed with another resident who has another antibiotic resistant organism, for instance, another SCC MRSA or ESBL.

Stay in nursing home

- Standard Precaution:** Standard precaution must be performed with all residents, when staff is at risk of exposing to residents' blood, all body fluid (secretion, sputum, urine, excrement; sweat is not included), broken skin, mucous membranes.
- Contact Isolation:** contact borne spread is the main method of MRSA spreading, especially from care givers' hands. Plus, employees should wear a mask when working within three feet from a MRSA infected resident who has respiratory infections.
- Activities:** A resistant with MRSA colonization or infection can also take part in activities, as long as all colonized or infected body sites (except nares) can be securely covered, and behaving good hygiene and hand washing.
- Hand Hygiene:**
2 options, 5 moments, 7 steps
- Environment Control:** in nursing homes, environmental factors plays a more important role in MRSA transmission. frequent cleaning and disinfection should be performed if a

Terminal disinfection

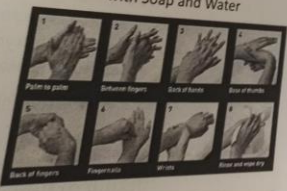
- Thorough Cleaning:** the room, or cubicle, and bedside equipment need to be cleaned using the same procedures as Standard Precautions
- Adequate Disinfection:** bedside equipment and environmental surfaces (i.e., bedrails, bedside tables, carts, commodes, doorknobs, faucet handles). Curtains, especially privacy curtains, which around MRSA resident's bed, would likely to be contaminated and become a source of infection, so need to be taken care carefully.



Hand Hygiene

- 2 options:
Waterless hand hygiene with alcohol $\geq 60\%$.
Hand washing with soap and running water
- 5 moments
before touching a patient/resident, before a procedure, after a procedure or body fluids exposure risk, after patient contact, after contact with patient surroundings.
- 7 steps
palm to palm, between fingers, back of hands, base of thumbs.


7 Steps of Handwashing with Soap and Water



How to take off PPE


How to take off

- 1 Peel off gown & gloves and roll inside. Dispose gloves and gown safely.
- 2 Perform hand hygiene.
- 3 Remove face shield from behind. Dispose face shield safely.
- 4 Perform hand hygiene.



MRSA PREVENTION AND CONTROL

—A simple guide for nursing home



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