


# Pharmacy Infection Control: Basic Hygiene for Pharmacy Staff

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## ABSTRACT

**Objectives:** This study aims at declaring the Hand Hygiene (HH) and Personal Protective Equipment (PPE) policy and procedures as a new initiative for Infection Prevention and Control (IPC) for the pharmacy services in Saudi Arabia. **Methods:** This is a narrative review of pharmacy infection control. A literature search was performed using various databases, including PubMed, Medline, and Google Scholar, about specific topics related to infection control in pharmacy practice. The search period was from the 1960s to October 2021. The terms searched were in English and included narrative review, systemic review, meta-analysis, and guidelines. terms Policies and procedures for the last 10 years across all hospitals or community pharmacy services were included in the search terms. The research team of the pharmacy infection control consist of various expert members including clinical pharmacists, community pharmacists, and infection control specialists. One member drafted the policy. Some member reviewed the draft policy and corrected it. The other member, who is an infection control specialist, revised last draft. The topic emphasizes on the adoption and practices of the policies and procedures on hand hygiene (HH) and personal protective equipment (PPE) for the pharmacy infection prevention and control. **Results:** The hand hygiene and personal protective equipment policy of pharmacy infection prevention control consist of various items, including steps of hand hygiene and proper donning and doffing sequences of the PPE during pharmacy performances. **Conclusion:** The policies and procedures related to hand hygiene and personal protective equipment are the foundations of pharmacy infection control and control. Implementation and practices of HH and PPE aims at the prevention and control Healthcare with ephazaized on pharmacy staff related Infections, which in lieu, improve patient safety Therefore, hand hygiene and personal protective equipment policy is recommended for all pharmacy settings in the Kingdom of Saudi Arabia.

**Keywords:** Pharmacy, Infection control, Hand hygiene, Personal protective equipment, Saudi Arabia.

## INTRODUCTION

Patients and Healthcare Workers (HCWs) are vulnerable to healthcare-associated infections. Healthcare-associated Infection (HAI) "... is an infection that occurs in a patient as a result of care at a health care facility that was not present at the time of admission to the facility. To be considered an HAI, the infection must begin on or after the third day of admission (the day of admission is day 1)".<sup>1</sup> Infections can be transmitted from the healthcare workers (HCW) to patients and vice versa, and/or from the surrounding environment.<sup>2-3</sup> Hands of healthcare workers can be responsible for the transmission of pathogens from patient-to-patient. Furthermore, HAI may occur due to pharmacists daily activities, like preparation, distribution, and dispensing of medications via the hands or by the automatic machines.<sup>4-7</sup> Clinical pharmacists perform the physical assessment of the patients and as such are in direct contact with the patients to collect their medical and medication history. Infections might be transferred to the patients through direct contact with them during patient counselling sessions for their the medications procedures.<sup>4-6</sup> The distributive pharmacists prepare multiple parenteral drugs, ophthalmic injections, and solutions<sup>8-9</sup> for regular intravenous administration, chemotherapy, and total parenteral nutrition.<sup>9-10</sup> Parenteral medications should be prepared under clear areas and sterile conditions because of which the pharmacists should take care to prevent the transmission of

any diseases and improve patient safety.<sup>8-11</sup> The pharmacy staff should follow hand hygiene and wear personal protective equipment (PPE) like gloves, goggles, masks, gowns, shoe cover and caps as a barrier to avoid any transmission of viruses and bacteria.<sup>9</sup> Any breach in HH and PPE protocol, would lead to spread of the HAI, compromising the patient safety. The resulting HAI would increase hospital stay, increasing the morbidity and mortality rates.<sup>1-2,11,13</sup> Previous studies have discussed hand hygiene procedures and usage of PPE.<sup>3,9,13,15-24</sup> These preventive measures are for all healthcare workers. However, very few studies have focused their research on the usage of hand hygiene and PPE kits in pharmacy practice especially during the COVID-19 pandemic.<sup>25-28</sup> Most of the studies have discussed about the hand hygiene of healthcare professionals.<sup>9,29-38</sup> Therefore, this review aims to discuss and adopt the basic principles of hand hygiene and the use of PPE for the purpose of IPC practices in pharmacy services.

## MATERIALS AND METHODS

This is a narrative review of pharmacy infection control. We performed literature search from various databases, including PubMed, Medline, and Google Scholar, about specific topics related to infection control in pharmacy practice. The search period was from the 1960s until October 2021. The search terms were in English

and included narrative review, systemic review, meta-analysis, and guidelines. The date of policies and procedures terms were limited to the last 10 years only. All hospitals and community pharmacies were included in the search term. The pharmacy services included inpatient pharmacy, outpatient or ambulatory care pharmacy, satellite pharmacy, extemporaneous preparation, repackaging units, pharmacy store, drug information center, and clinical pharmacy services. The national and international guidelines of infection control in hospital practice,<sup>39-40</sup> which included the Centers for Disease Control and Prevention (CDC) of the United States of America, the Saudi Center of Diseases Control (SCDC), American Society of Health-System Pharmacists (ASHP), and World Health Organization (WHO), and the United States Pharmacopeia (USP) were referred as project guidelines.<sup>9-10,14-15,20-22,41-45</sup> The team formed for writing the pharmacy infection control policies and procedures included expert members such as, clinical pharmacists, community pharmacists, and infection control specialists. Some authors drafted the policy guidelines, whereas the other authors corrected the draft, and the additional members revised it. The policy consisted of various topics, such as environment and workplace related, staff immunization and occupational safety, basic hygiene and personal protective equipment at pharmacy, quality of pharmacy infection control, competency of pharmacy staffs on infection control, and education and training for them. The Appraisal of Guidelines, Research, and Evaluation (AGREE) guided the reporting of the results of this review.<sup>46</sup>

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## RESULTS

**Pharmacist Clothes: All pharmacies should implement the following types of clothes in the pharmacy department.**<sup>3,9,14-22,24</sup>

- White coats
  - Keep two or more coats.
  - Hooks should be available to facilitate the removal of white coats before contact with patients in areas close to patient rooms.
- Personal Protective Equipment:
  - Use of PPE according to transmission-based precautions indicated.
- Footwear:
  - Covered toes with small heels and nonskid soles.

- Personal items:
  - All personal items (jewelry, watches, cell phones, and pagers) should be removed during the daily work, as they may harbor microorganisms. for distributive pharmacist
  - The need for disinfected of contaminated person items like, jewelry, watches, cell phones and pagers are not recommended.
- Laundering:
  - Daily wear must be washed daily or at least once a week.
  - May be washed at on-site facilities or at home (hot water and bleach should be used).

**Transmission-based precautions: The pharmacy to implement the following types of infection control measures**<sup>1,3,9,14-22,24,47-52</sup>

Transmission-based precautions: These precautions are additional protection methods adopted when required, depending on the mode of transmission of diseases. They are categorized as contact, droplet and airborne precautions.<sup>47</sup>

- Contact precautions-healthcare workers to apply the following steps and methods as explored in Figure 1:
  - Educating patients and visitors.
  - Single room is indicated.
  - Door signage for patient’s room-
    - signage used for contact precautions should have colour code (green),
    - it should come with two languages, both Arabic and English.
    - It should also contain image of the type of PPE to be used (aiding staffs who cannot read Arabic or English).<sup>1</sup>
  - Before entry to the patient’s room-
    - Perform hand hygiene, then
    - wear disposable gown and gloves,
  - Before leaving patient’s room-
    - To discard all PPE, in the waste bin provided, as per the medical waste management policy of the facility.
  - Precaution to be taken when patient requires to be transported to other department, such as for CT scanning or MRI:
    - To carry the contact precaution card during transport of the patient.
    - Notify the receiving department of the type of precaution to be taken.
    - Prepare the patient: put dressing over any oozing wound,
    - Give patient a new gown, and
    - Cover the patient with a new sheet.
  - Healthcare worker transporting the patient should perform hand hygiene and wear disposable gown and gloves.
  - Diseases under contact isolation precautions are- all multidrug-resistant organisms (MDRO) like MRSA VRSA, VRE, CRE, ESBL, gastroenteritis (shigella, salmonella), hepatitis-A and hepatitis-B virus infection.
  - Use disposable equipment.
  - Minimum stocking inside patient’s room.
  - Hand hygiene: soap and water or, an alcohol-based hand rub (ABHR).
  - Limit the transport of the patient.
  - Clean the room regularly by focusing on hi-touch surfaces.
  - To clean the room with an EPA-approved disinfectant, followed by disinfecting with a 1:10 bleach solution especially frequently touched surfaces, and use disposable equipment.
- Droplet precautions-healthcare workers to apply the following steps and methods as explored in Figure 2:

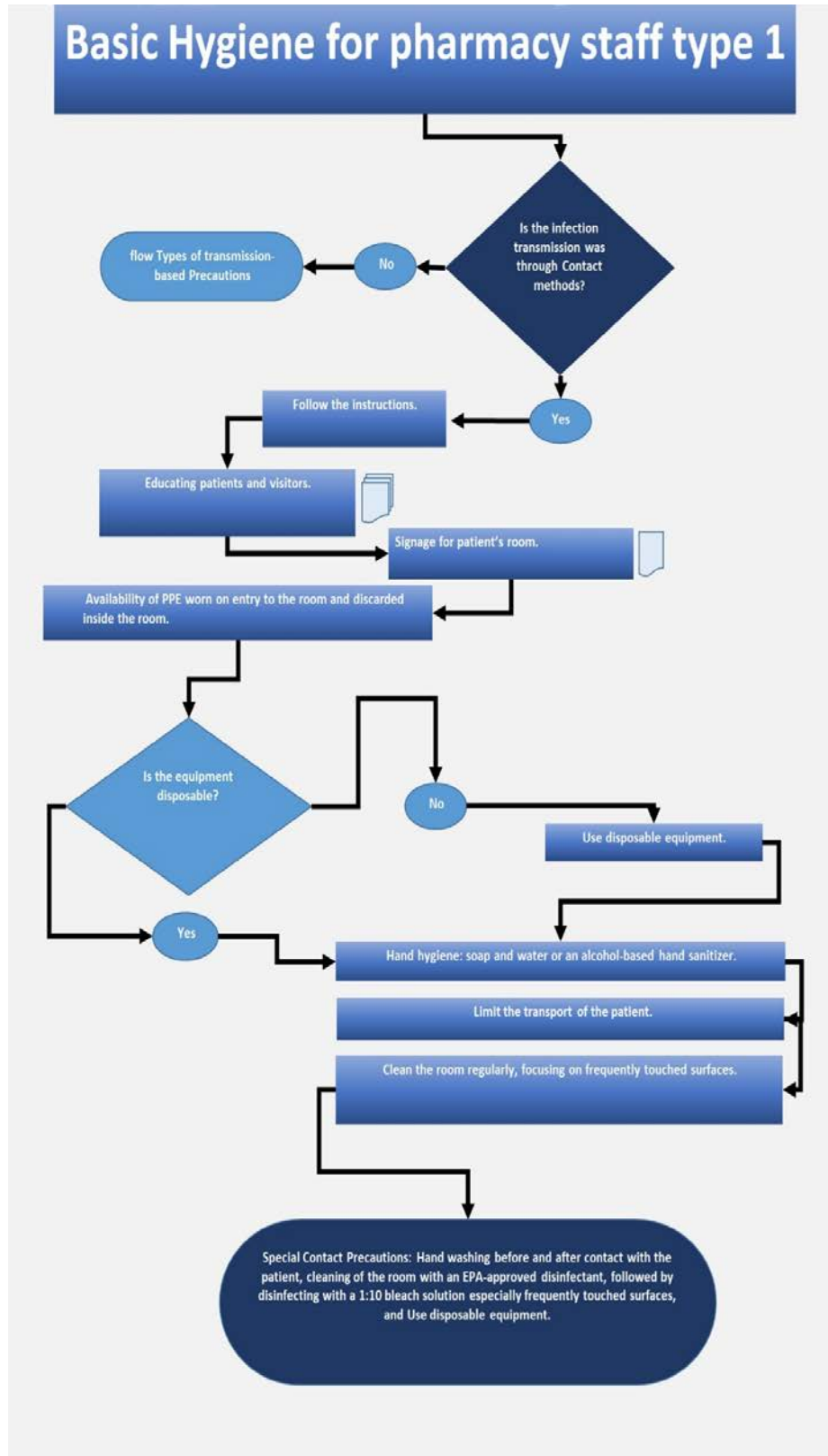
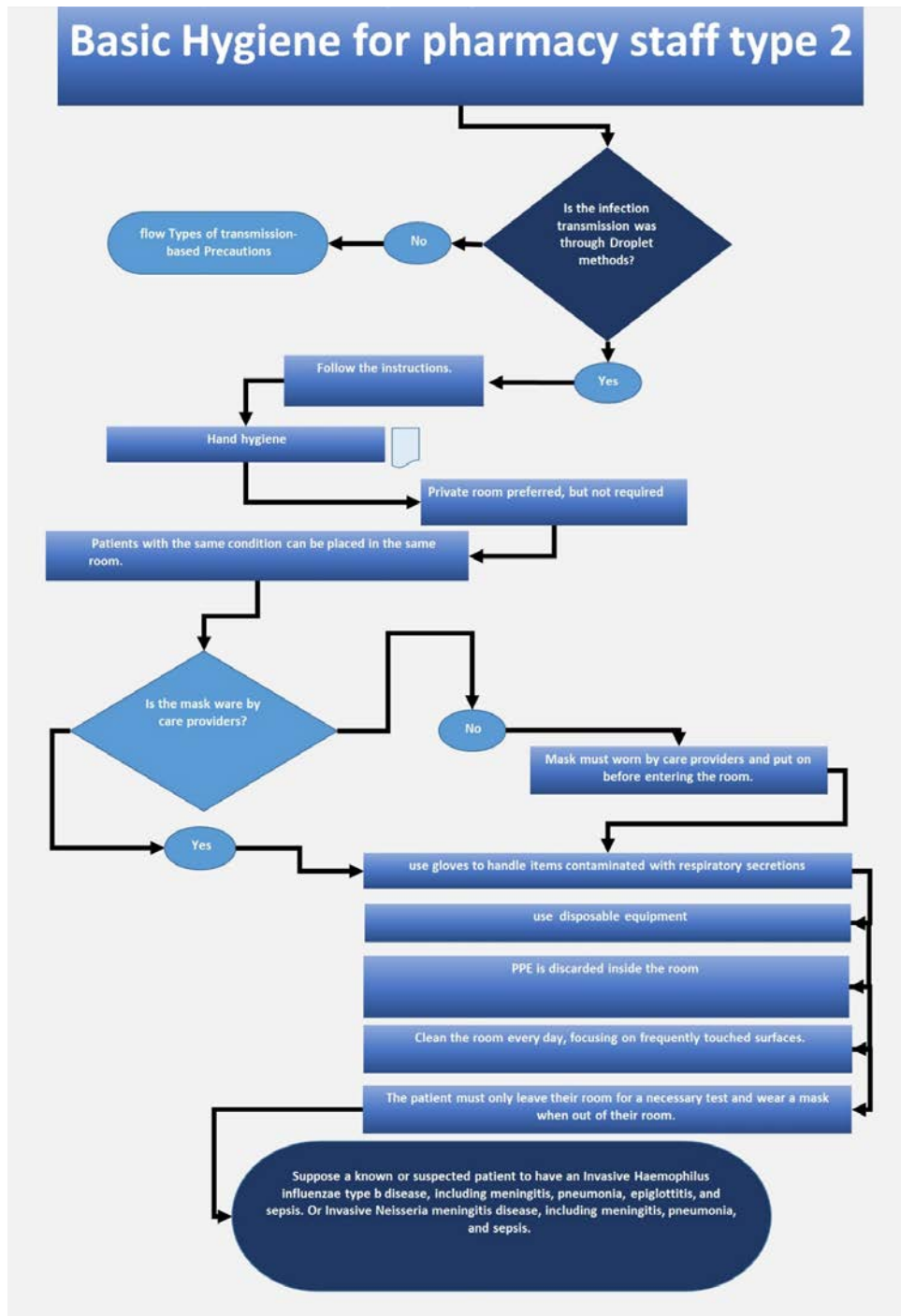


Figure 1: Contact precautions- healthcare workers steps flow chart

1. Single room, with neutral pressure 1
2. Door signage for patient's room-
  - It should come with two languages, both Arabic and English.
  - It should also contain image of the type of PPE to be used (aiding staffs who cannot read Arabic or English).<sup>1</sup>





**Figure 2:** Droplet precautions- healthcare workers steps flow-chart.

3. Before entry to the patient's room-
  - Perform hand hygiene, then
  - Wear surgical mask and face shield or, goggle (to reduce the exposure of infectious microorganism to the eyes, nose and mouth while in close proximity of the patient),<sup>1,48</sup>
4. After leaving patient's room-
  - To discard PPE, the surgical mask, in the waste bin provided, as per the medical waste management policy of the facility.
  - To perform hand hygiene.
5. Precaution to be taken when patient requires to be transported to other department, such as for CT scanning or MRI:
  - To carry the droplet precaution card during transport of the patient.
  - To allow patient to wear a surgical mask (if tolerated).
  - To train the patient regarding respiratory hygiene and cough etiquettes.<sup>52</sup>
  - Patient to cover their mouth and/or nose during coughing and sneezing.
  - To use available waste bin to dispose their tissue or paper

- towel.
- To wash hand or to perform hand rub, that which is available.
  - Notify the receiving department of the type of precaution to be taken.
- To limit movement of the patient outside the room.
  - Applies to microorganisms with droplet  $>5\mu$  in size.<sup>49</sup>
  - Droplet are produced during talking, coughing and sneezing of the patient.
  - Equipment-
    - To use dedicated patient care equipment or the disposable ones.
  - To re-use medical equipment for the next patient, cleaning and disinfection is require.<sup>49</sup>
  - Clean the rooms every day by focusing on frequently touched surfaces.
  - The patient must leave room only for a necessary test and wear a mask when out of their room.
- Use PPE If the patients are known or is suspected to have infection such as invasive *Hemophilus influenzae* type b disease, including meningitis, pneumonia, epiglottitis, and sepsis; or invasive *Neisseria meningitis* disease, including meningitis, pneumonia, and sepsis. Other serious bacterial respiratory infections including Diphtheria (pharyngeal), *Mycoplasma pneumonia*, Pertussis, Pneumonic plague, Streptococcal (group A) pharyngitis, pneumonia, or scarlet fever in infants and young children, Serious viral infections, including Adenovirus, Influenza, Mumps Parvovirus B19, MERS COV and Rubella.<sup>49</sup>
- Airborne precautions-healthcare workers to apply the following steps and methods as explored in Figure 3<sup>49</sup>
    - Door signage for patient's room-
      - signage used for contact precautions should have colour code (blue),
      - It should come with two languages, both Arabic and English.
      - It should also contain image of the type of PPE to be used

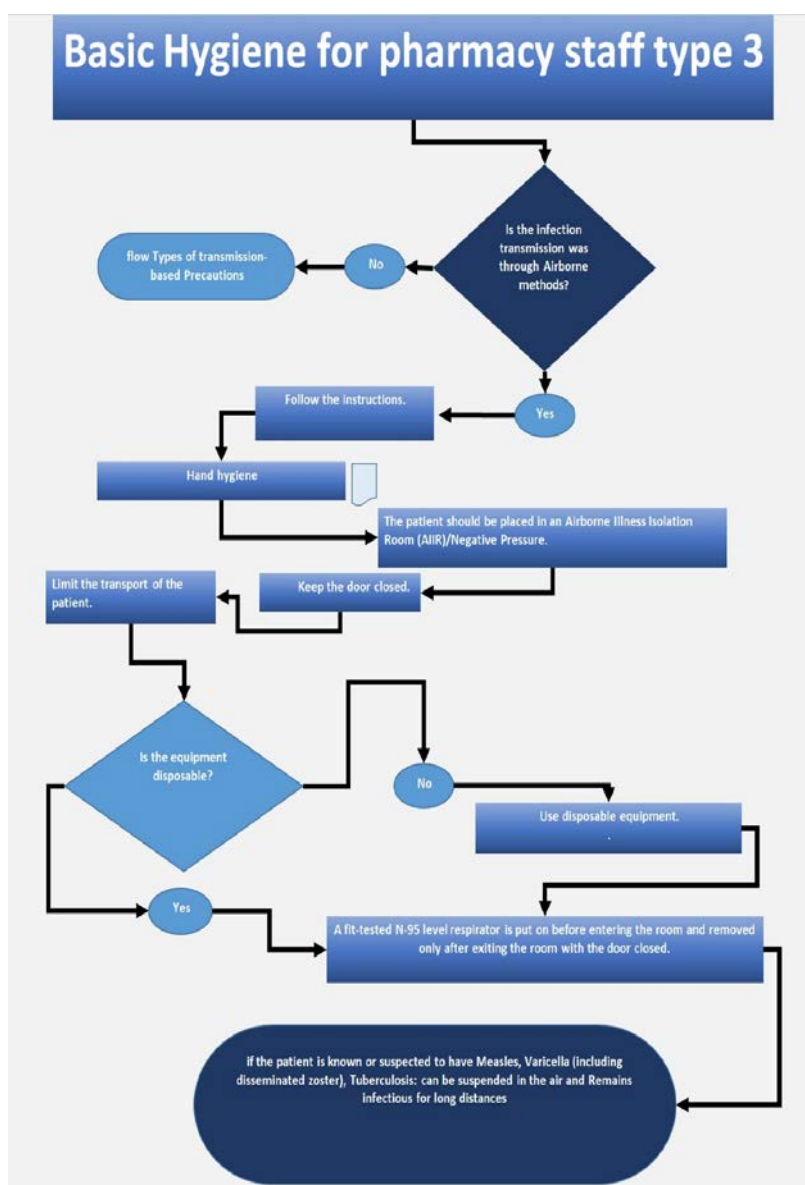


Figure 3: Airborne precautions- healthcare workers steps flow chart.

- (aiding staffs who cannot read Arabic or English).<sup>47</sup>
2. Before entry to the patient's room-
    - perform hand hygiene, then
    - to don fit-tested N-95 respirator,
    - to use Powered Air Purifying Respirator (PAPR)- for N-95 respirator non-fit or bearded healthcare workers.<sup>1,51</sup>
  3. After leaving patient's room-
    - To doff the N-95 respirator after coming out of the patient's room and when the room is completely closed.
  4. Precaution to be taken when patient requires to be transported to other department, such as for CT scanning or MRI:
    - To carry the airborne precaution card during transport of the patient.
    - To allow patient to wear a surgical mask (if tolerated).
    - Never to use N-95 respirator for the patient (N-95 respirator to be used only for the healthcare workers).
    - Notify the receiving department of the type of precaution to be taken.
  5. Use disposable equipment.
  6. Airborne isolation precautions are applied for the following diseases-
    - Measles
    - pulmonary or laryngeal tuberculosis,
    - disseminated zoster,
    - Chicken pox (where additional contact precautions are required).
    - any microorganisms that are less than  $<5\mu$  in size in diameter (as they remain suspended in air).<sup>48</sup>

**Standard Precautions: The pharmacist must follow the general standards of pharmacy infection control in the hand hygiene and PPE as follows<sup>3,9,14-22,24,50</sup>**

**Standard Precautions**

- a) These are the "...minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where health care is delivered" (50) . Its components are as follows-
  - i. Hand hygiene (hand wash or, hand rub),

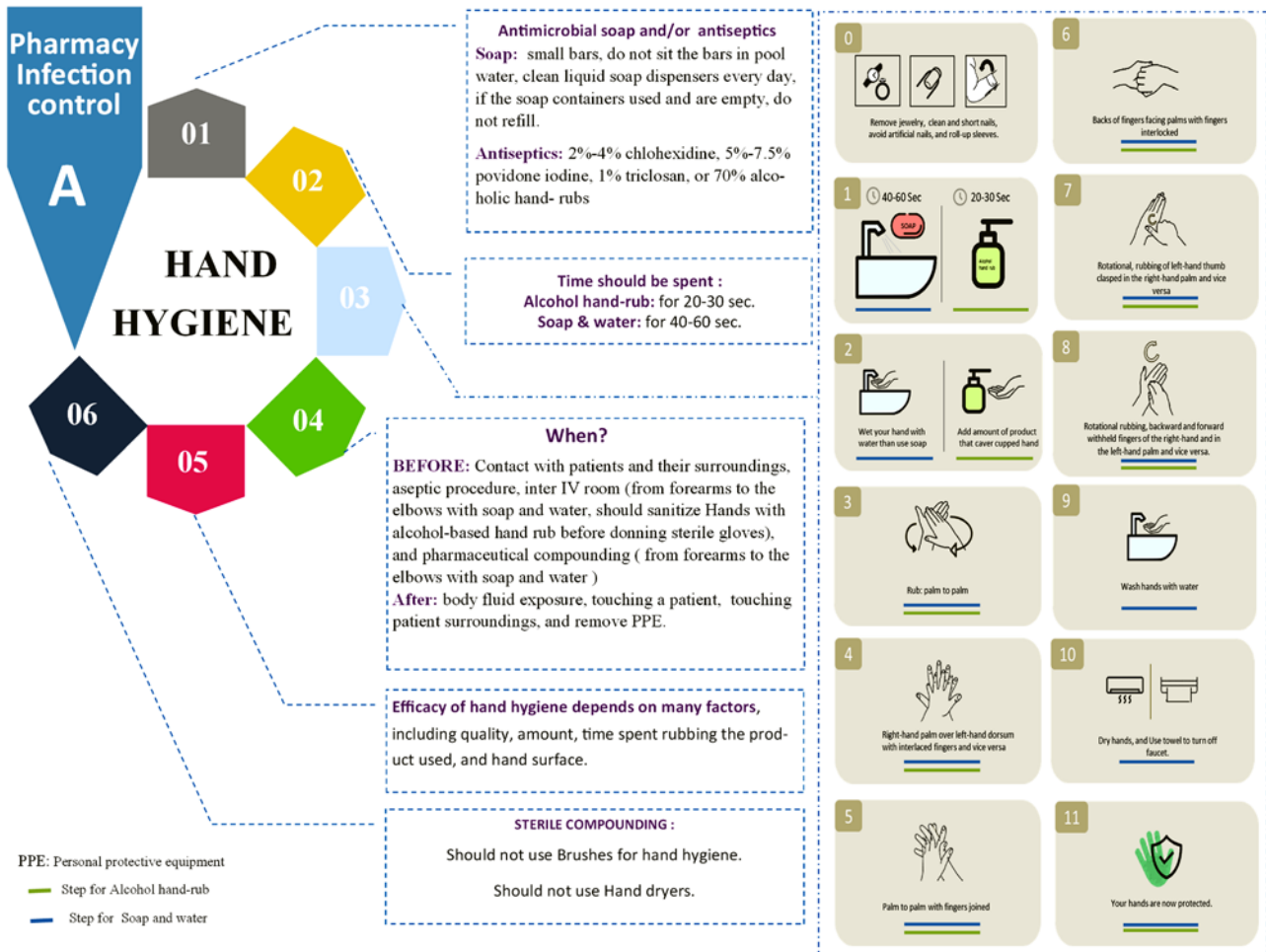
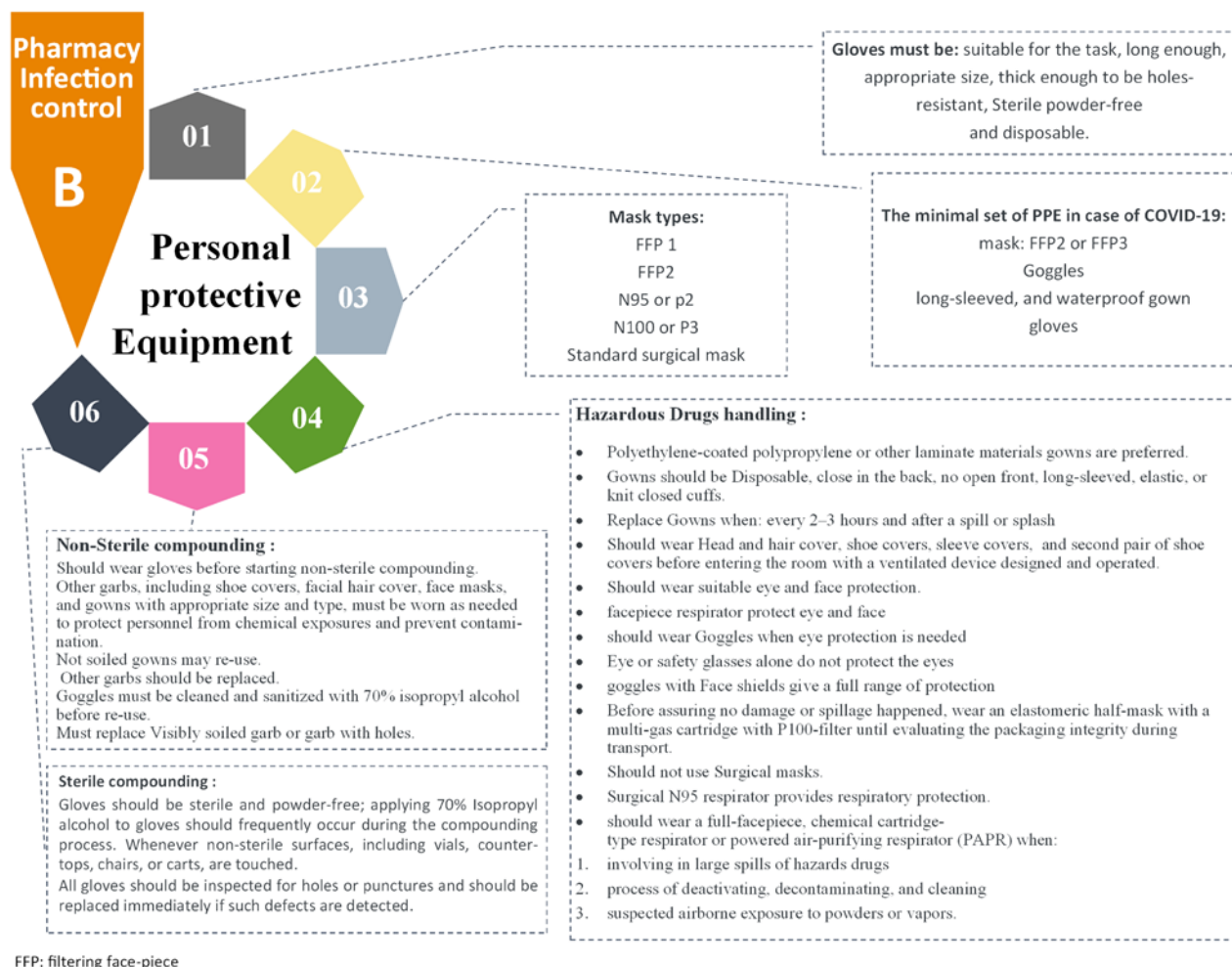


Figure 4: Principle of Hand Hygiene techniques.



**Figure 5:** Principle of Personal Protective Equipment (PPE) Procedures.

- ii. PPE usage (viz. gloves, masks, eyewear).
- iii. Respiratory hygiene / cough etiquette.
- iv. Sharps safety through engineering along with control of work practice.
- v. Safe injection practices (i.e., applying aseptic technique for parenteral medications).
- vi. Use of sterile instruments and devices.
- vii. Environmental surfaces-cleaning and disinfection.<sup>50</sup>

### Hand hygiene

1. Each pharmacy staff should perform daily checks about the availability soap and alcohol-based hand rub in their work area and rest room.
2. Decontaminate hands with alcohol-based hand rub (preferentially) or soap and water (especially, when visibly soiled with blood and body fluid) in the following situations-
3. Before and after handling medications equipment,
4. Before and after direct patient contact,
5. Before and after handling the medication,
6. Before and after of clean and sterile procedures,
7. Before donning sterile gloves or after removing the gloves,
8. Before and after handling medical devices. For instance, respiratory

9. devices, and intravascular catheters (palpating, replacing, accessing, repairing, or dressing)
9. Before eating and after using a restroom,
10. After contact with blood, body fluids, mucous membranes, non-intact skin, and wound dressings (here hand washing is indicated),
11. After contact with inanimate objects in the patients' immediate environment,
12. If moving from a contaminated body site to a clean body site.

### Hand Hygiene techniques

1. Each section of pharmacy department should contain a hand wash station and hand rub dispenser, such as a hand sanitizer (Isopropyl Alcohol 75%).
2. The pharmacists should wash before starting any work and after finishing based on above situations.
3. The pharmacist should be the hand according to procedures (Figure 4) by soap and water.
4. Use the water and soap before beginning the work or each activity as mentioned above and at any location of the pharmaceutical sections such as an outpatient pharmacy, inpatient pharmacy, community pharmacy, repackage area, drug information section,





**Figure 6:** Principle of Personal Protective Equipment on and off techniques.

clinical pharmacy section, medications safety officer, pharmacy infection unit, and pharmacy research section.

- Use water and soap plus hand sanitizer for any pharmaceutical compounding (sterile or non-sterile).

### Skin care

- The pharmacy workers might use the hand lotions or creams to reduce the irritant effect of hand sanitizer and antiseptics.
- Follow the manufacture recommendations about the lotions or creams and related effects on soaps that is being used at healthcare organization.

### Personal Protective Equipment (PPE)

- There are several types of equipment the pharmacist should use in practice, Gown mask or respirator, glass or face shield, and gloves (Figure 5).
- The pharmacist should don the PPE in proper sequence after hand hygiene with soap and water or alcohol-based hand rub.
- All personal items and jewelries like watches, rings, bracelets, should be removed.
- The pharmacist should finish drinking or eating food and toilet

before using PPE

- The pharmacist should check all PPE material for manufacturing defect.
- To wear the gown with the seal in the back first below the head and middle of the back .
- The surgical mask or respirator should wear as secondary with a seal in the top back of the head and back crown of the head.
- The glasses or face shield should wear.
- The gloves should wear the right hand then left hand.
- Once the pharmacist finish work, all PPE should remove at the same place before going to another site (Figure 6).
- First, the pharmacist should remove gloves of the left hand, then the right hand without touching the gloves after removing.
- The Gown should be removed by opening the two sealed and pending the Gown. Use gowns without touching the inside or opposite face of Gown. Throw the disposable Gown was used in the waste bin. Otherwise, Gown should keep the unique basket and send it to Lennon for cleaning and sterilization
- The glasses face mask should remove at the third one and disposable in the wastage back .
- The face mask or respirator should be removed by one side and another side without touching it and thrown in the basket

## Other hand hygiene requirements

1. Do not wear artificial fingernails or extenders when preparing the medication or have direct contact with high-risk patients such as in intensive care patients or those with chronic diseases such as diabetes mellitus.
2. Keep tips of natural nails as small as possible.
3. Do not wear the same pair of gloves if you go out from preparation area, and do not wash gloves between uses with different pharmacy preparation areas or patients.
4. Change gloves during pharmaceutical products if moving from a contaminated pharmacy site to a clean site.
5. Monitor pharmacy workers compliance with recommended hand-hygiene practices.
6. Provide pharmacy workers education and training about the hand hygiene and PPE and related activities for each type of patient to prevent transmission of microorganisms.
7. Provide hand-hygiene material for all pharmacy staff.
8. Investigate the outcome of following hand hygiene on pharmaceutical products and patients.

## Hand-hygiene agents

1. Choose the most appropriate formulations for hand-hygiene products in pharmacy practice.
2. Evaluate the safety and efficacy of infection control products and materials.
3. Assess the advantages and disadvantages of hand sanitizer and antiseptics.
4. Choose a suitable device to encourage the usage and optimal application of hand-hygiene agents.
5. Choose the suitable hand lotions or creams to minimize the potential irritation associated with hand-hygiene agents.

## Pharmacoepidemiologic and surveillances research and development

1. Design the experimental models for the study of cross-contamination from pharmacy staff to pharmaceutical preparations then to the patient and from environment to pharmaceutical preparations.
2. Design new follow-up protocols for assessing the *in vivo* efficacy of infection control agents, in term of volume and applications and actual use in pharmacy department.
3. Provide cost-effectiveness evaluation of infection control materials.

## CONCLUSION

The strategies for hand hygiene and use of PPE are necessary for the pharmacy infection control. This improves protection of patients against infection in any healthcare organization. All healthcare professionals including the pharmacists should revise and follow the infection control technique, typically following new the international and national guidelines and global recommendations of contamination control. The governance of hand hygiene and personal protective requirements tools is particularly encouraged to keep away from contamination-associated issues and monetary burden on the healthcare system.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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## Consent For Publications

It is not applicable in this review

## Ethical Approval


This research is exempted from research and ethical committee or an institutional review board (IRB) approval.


<https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html>

## ABBREVIATIONS

**ABHR:** alcohol-based hand rub; **AGREE:** Appraisal of Guidelines for Research and Evaluation; **ASHP:** American Society of Health-System Pharmacists; **CDC:** Centers for Disease Control and Prevention; **ESBL:** Extended Spectrum Beta-Lactamase (producing organism); **CT:** computerized tomography; **CRE:** Carbapenem-resistant Enterobacteriaceae; **COVID-19:** Coronavirus Disease 2019; **HAI:** Healthcare-associated Infections; **HH:** Hand Hygiene; **HCWs:** Healthcare Workers; **H1N1:** influenza A; **IPC:** Infection Prevention and Control; **IV:** Intravenous; **KSA:** Kingdom of Saudi Arabia; **MDRO:** multidrug-resistant organism; **MERS-CoV:** Middle East respiratory syndrome coronavirus; **MOH:** Ministry of Health; **MRI:** Magnetic resonance imaging; **PAPR:** Powered Air Purifying Respirator; **MRSA:** (methicillin-resistant *Staphylococcus aureus*); **PPE:** personal protective equipment; **SARS:** Severe Acute Respiratory Syndrome; **SCDC:** Saudi Center of Diseases Control; **SWOT:** Strengths, Weaknesses, Opportunities, and Threats; **USP:** United States Pharmacopeia; **VRE:** Vancomycin-resistant Enterococci; **VRSA:** Vancomycin-resistant *Staphylococcus aureus*; **WHO:** World Health Organization.

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