

Pharmacy Infection Control: Pharmacoepidemiology and infection control surveillance

Dr. Yousef Ahmed Alomi*, 

BSc. Pharm, MSc. Clin Pharm, BCPS, BCNSP, DiBA, CDE

Critical Care Clinical Pharmacists, TPN Clinical Pharmacist, Freelancer Business Planner, Content Editor, and Data Analyst, Riyadh, SAUDI ARABIA.

Anhar Alyousef, Pharm D

Innova healthcare company, Riyadh, SAUDI ARABIA.

Mohammed Mominul Islam, 

MBBS, MPH, MSc,

Deputy Director, Department of Infection Prevention and Control (IPC), King Fahad Specialist Hospital, Tabuk, SAUDI ARABIA.

Nahed Rashid Alyami, BSc, MPHil, BCPS, BCCCP, CPHQ

Head of Clinical Pharmacy Unit, ID and ICU Senior Clinical Pharmacist, Jubail General Hospital, Jubail, SAUDI ARABIA.

Maha Hussein Almadany, Bsc. Pharm

Health Care Quality Management Professional Diploma (HCQM), Pharmacy Quality Department, King Salman bin Abdulaziz Medical City, Al Madina Al Monwarah, SAUDI ARABIA.

Fatimah Abdaziz Almana, BSc, MSc, MSHA

King Fahad Specialist Hospital, Dammam, SAUDI ARABIA.

Correspondence:

Dr. Yousef Ahmed Alomi, BSc. Pharm, MSc. Clin Pharm, BCPS, BCNSP, DiBA, CDE, Critical Care Clinical Pharmacists, TPN Clinical Pharmacist, Freelancer Business Planner, Content Editor and Data Analyst, Riyadh 11392, Riyadh, SAUDI ARABIA.

Phone no: +966504417712

E-mail: yalomi@gmail.com

Received: 22-12-2021 ;

Accepted: 27-02-2022.

Copyright: © the author(s), publisher and licensee Pharmacology, Toxicology and Biomedical Reports. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License

Access this article online



www.ptbreports.org

DOI:
10.5530/PTB.2022.8.10

ABSTRACT

Objectives: Pharmacoepidemiology and infection control surveillance is an initiative that provides insights into pharmacy infection control. It involves various guidelines and policies that must be followed to ensure the pharmacy environment and workplace are secured from infections. Different approaches have been considered for the measures to be effective. Documentation of pharmacy practices in every area of the pharmacy department is vital in controlling the pharmacy infections. This study aimed to explore the pharmacoepidemiology and infection control surveillance policy in pharmacy practice as a new initiative in Saudi Arabia. **Methods:** It is a narrative review of pharmacoepidemiology and infection control surveillance pharmacy practice. Litterateur searched. A literature search was performed using various databases, including PubMed, Medline, and Google Scholar, about specific pharmacy practice infection control policies and procedures. The search period was from the 1960s until October 2021. The terms were in English and included narrative review, systemic review, meta-analysis, and guidelines across all hospitals and community pharmacy services. Moreover, the national and international guidelines of were searched that relates to the study objectives. The committee of pharmacy research formulated and consisted of various experts, including clinical pharmacists, drug information pharmacists, and infection control specialists. Some authors drafted the policy guidelines, and others reviewed and corrected them. The additional author, an infection control specialist, revised the final document. The study emphasizes the pharmacoepidemiology and infection control surveillance of the Pharmacy infection control policy. **Results:** The Pharmacoepidemiology and infection control surveillance policy consisted of pharmacoepidemiology and infection control surveillance steps in pharmacy practice. The pharmacoepidemiology and infection control surveillance contained multiple performances: infected prepared medications, type of bugs, and sensitivity patterns to medications. In addition to the number of spillage cleaning and needle-stick injuries, the number of cross-tarnsmission of infections. Besides, the search also included adherence to infection control guidelines. **Conclusion:** Pharmacoepidemiology and infection control surveillance policy is a new pharmacy infection prevention and control initiative. The pharmacoepidemiology and infection control surveillance policy enhances the infection control documentation system. Additionally, it encourages pharmacists to follow infection prevention and control regulations in various locations throughout the public and healthcare systems. Therefore, pharmacoepidemiology and infection control surveillance policies strongly recommend Saudi Arabian pharmacy practices.

Keywords: Pharmacy, Infection, Control, Pharmacoepidemiology, Surveillance.

INTRODUCTION

The documentation of pharmaceutical care performance is a critical issue in contemporary healthcare. The healthcare practice needs a better pharmaceutical care performance documentation system.¹ The documentation system includes all pharmacist's activities, such as medication errors and safety. It also captures drug consumption and utilization and the pharmacist's intervention and improvement practices.²⁻⁶ The pharmacist can review previous documentation to assess the pharmacy's quality management activities and plan future pharmacy service improvements.⁷ Additionally, Using the right documentation system eradicates mistakes in performance and unnecessary costs and prevents infection-related issues to patients and pharmaceutical products while implementing pharmacy infection control aspects. Additionally, it is significant if infection epidemiology, prevention, and control are accomplished through data analysis and corrective actions.⁸⁻¹⁹ Previously, a survey of infection occurrence involved growing bugs that were

used to document problems before they occurred or before expanding and making significant changes. Thus, pharmacoepidemiology and infection control surveillance was considered a pharmacy infection prevention and control measure. Different rules and regulations discussed infection control surveillance.²⁰⁻²⁸ However, it is uncommon to find pharmacy infection control research as a routine activity in pharmacy practice.²⁹⁻³⁰ The majority of studies addressed infection-related problems while performing pharmacy duties.⁸⁻¹⁹ Few publications about pharmacoepidemiology and infection control surveillance policy and procedures have been made. The authors are unaware of any publications about pharmacoepidemiology or infection control surveillance policies and procedures. Therefore, this project aims at declaring pharmacy infection prevention and control surveillance and pharmacoepidemiology policy and procedures at healthcare facilities.

MATERIALS AND METHODS

A narrative review of pharmacoepidemiology and infection control surveillance on pharmacy practices was done using both secondary data sources. It involved researching 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 terms were in English and included narrative review, systemic review, meta-analysis, and guidelines. For the last 10 years, policies and procedures terms were searched across all hospitals or community pharmacies. The pharmacy services in the search included inpatient, outpatient, and ambulatory care pharmacy, satellite pharmacy, extemporaneous preparation unit, repackaging unit, pharmacy store, drug information center, and clinical pharmacy services. Furthermore, the national and international guidelines for infection control in pharmacy and hospital practice guide the current review.³¹⁻³² That has included the Centers for Disease Control and Prevention (CDC) of the United States of America, the Saudi Center for Diseases Control (SCDC), the American Society of Health-System Pharmacist (ASHP), and the World Health Organization (WHO), and the United States Pharmacopeia (USP) guidelines and regulations.^{20-24,33-39} The committee of pharmacy infection control consists of various members, including clinical pharmacists, community pharmacists, and infection control specialists. Some authors drafted the policy guidelines, and others reviewed and corrected them. The additional author, who is an infection control specialist, revised it. The policy included topics such as environmental and workplace, staff immunization and occupational safety, pharmacy basic hygiene, quality of pharmacy infection control, pharmacy infection control competency, and pharmacy infection control education and training. Besides pharmacy infection prevention and control surveillance and Pharmacoepidemiology, The international Appraisal of Guidelines, Research, and Evaluation (AGREE) standard guided the reporting of the results of this study.⁴⁰

Search: **pharmacy infection control**[Title/Abstract] Filters: **Full text, Humans, English**

((“pharmacie”[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy s”[All Fields]) AND “infection control”[Title/Abstract]) AND ((ft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmacy: «pharmacie»[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy’s”[All Fields]

Search: **infection control pharmacy**[Title/Abstract] Filters: **Full text, Humans, English**

((“infect”[All Fields] OR “infectability”[All Fields] OR “infectable”[All Fields] OR “infectant”[All Fields] OR “infectants”[All Fields] OR “infected”[All Fields] OR “infecteds”[All Fields] OR “infectibility”[All Fields] OR “infectible”[All Fields] OR “infecting”[All Fields] OR “infection s”[All Fields] OR “infections”[MeSH Terms] OR “infections”[All Fields] OR “infection”[All Fields] OR “infective”[All Fields] OR “infectiveness”[All Fields] OR “infectives”[All Fields] OR “infectivities”[All Fields] OR “infects”[All Fields] OR “pathogenicity”[MeSH Subheading] OR “pathogenicity”[All Fields] OR “infectivity”[All Fields]) AND “control pharmacy”[Title/Abstract]) AND ((ft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection: «infect»[All Fields] OR «infectability»[All Fields] OR «infectable»[All Fields] OR «infectant»[All Fields] OR «infectants»[All Fields] OR «infected»[All Fields] OR «infecteds»[All Fields] OR “infectibility”[All

Fields] OR “infectible”[All Fields] OR “infecting”[All Fields] OR “infections”[All Fields] OR “infections”[MeSH Terms] OR “infections”[All Fields] OR “infection”[All Fields] OR “infective”[All Fields] OR “infectiveness”[All Fields] OR “infectives”[All Fields] OR “infectivities”[All Fields] OR “infects”[All Fields] OR “pathogenicity”[Subheading] OR “pathogenicity”[All Fields] OR “infectivity”[All Fields]

Search: **infection control pharmacist**[Title/Abstract] Filters: **Full text, Humans, English**

((“infect”[All Fields] OR “infectability”[All Fields] OR “infectable”[All Fields] OR “infectant”[All Fields] OR “infectants”[All Fields] OR “infected”[All Fields] OR “infecteds”[All Fields] OR “infectibility”[All Fields] OR “infectible”[All Fields] OR “infecting”[All Fields] OR “infection s”[All Fields] OR “infections”[MeSH Terms] OR “infections”[All Fields] OR “infection”[All Fields] OR “infective”[All Fields] OR “infectiveness”[All Fields] OR “infectives”[All Fields] OR “infectivities”[All Fields] OR “infects”[All Fields] OR “pathogenicity”[MeSH Subheading] OR “pathogenicity”[All Fields] OR “infectivity”[All Fields]) AND “control pharmacist”[Title/Abstract]) AND ((ft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection: «infect»[All Fields] OR «infectability»[All Fields] OR «infectable»[All Fields] OR «infectant»[All Fields] OR «infectants»[All Fields] OR «infected»[All Fields] OR «infecteds”[All Fields] OR “infectibility”[All Fields] OR “infectible”[All Fields] OR “infecting”[All Fields] OR “infections”[All Fields] OR “infections”[MeSH Terms] OR “infections”[All Fields] OR “infection”[All Fields] OR “infective”[All Fields] OR “infectiveness”[All Fields] OR “infectives”[All Fields] OR “infectivities”[All Fields] OR “infects”[All Fields] OR “pathogenicity”[Subheading] OR “pathogenicity”[All Fields] OR “infectivity”[All Fields]

Search: **infection control pharmaceutical care**[Title/Abstract] Filters: **Full text, Humans, English**

((“infection control”[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]) AND “pharmaceutical care”[Title/Abstract]) AND ((ft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection control: «infection control»[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]

Search: **pharmacy infection prevention**[Title/Abstract] Filters: **Full text, Humans, English**

((“pharmacie”[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy s”[All Fields]) AND “infection prevention”[Title/Abstract]) AND ((ft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmacy: «pharmacie”[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy’s”[All Fields]

Search: **pharmaceutical care infection control**[Title/Abstract] Filters: **Full text, Humans, English**

((“biopharmaceutics”[MeSH Terms] OR “biopharmaceutics”[All Fields] OR “pharmaceutic”[All Fields] OR “pharmaceutics”[All Fields] OR “pharmaceutical preparations”[MeSH Terms] OR (“pharmaceutical”[All Fields] AND “preparations”[All Fields]) OR “pharmaceutical preparations”[All Fields] OR “pharmaceutical”[All Fields] OR “pharmaceutics”[All Fields] OR “pharmaceutical s”[All Fields] OR “pharmaceutically”[All Fields]) AND “care infection control”[Title/Abstract]) AND ((ft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmaceutical: «biopharmaceutics»[MeSH Terms] OR “biopharmaceutics”[AllFields] OR “pharmaceutic”[AllFields] OR “pharmaceutics”[AllFields] OR “pharmaceutical preparations”[MeSH Terms] OR (“pharmaceutical”[All Fields] AND “preparations”[All Fields]) OR “pharmaceutical preparations”[All Fields] OR “pharmaceutic”[All Fields] OR “pharmaceutics”[All Fields] OR “pharmaceutical’s”[All Fields] OR “pharmaceutically”[All Fields]

Search: **pharmaceutical care infection prevention**[Title/Abstract] Filters: **Full text, Humans, English**

((“biopharmaceutics”[MeSH Terms] OR “biopharmaceutics”[All Fields] OR “pharmaceutic”[All Fields] OR “pharmaceutics”[All Fields] OR “pharmaceutical preparations”[MeSH Terms] OR (“pharmaceutical”[All Fields] AND “preparations”[All Fields]) OR “pharmaceutical preparations”[All Fields] OR “pharmaceutic”[All Fields] OR “pharmaceutics”[All Fields] OR “pharmaceutical s”[All Fields] OR “pharmaceutically”[All Fields]) AND “careinfectionprevention”[Title/Abstract]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmaceutical: «biopharmaceutics»[MeSH Terms] OR “biopharmaceutics”[AllFields] OR “pharmaceutic”[AllFields] OR “pharmaceutics”[AllFields] OR “pharmaceutical preparations”[MeSH Terms] OR (“pharmaceutic”[All Fields] AND “preparations”[All Fields]) OR “pharmaceutical preparations”[All Fields] OR “pharmaceutic”[All Fields] OR “pharmaceutics”[All Fields] OR “pharmaceutical’s”[All Fields] OR “pharmaceutically”[All Fields]

Search: **infection control Saudi Arabia**[Title] Filters: **Full text, Humans, English**

((“infection control”[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]) AND “saudi arabia”[Title]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection control: «infection control»[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]

Search: **infection control surveillance policy**[Title/Abstract] Filters: **Full text, Humans, English**

((“infection control”[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]) AND “surveillance policy”[Title/Abstract]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection control: «infection control»[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]

Search: **infection control surveillance policy**[MeSH Terms] Filters: **Full text, Humans, English**

((“infection control”[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]) AND “legal epidemiology”[MeSH Terms]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection control: «infection control»[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]

Search: **infection control surveillance procedure**[Title/Abstract] Filters: **Full text, Humans, English**

((“infection control”[MeSH Terms] OR (“infection”[All Fields] AND “control”[AllFields])OR“infectioncontrol”[AllFields])AND“surveillance

procedure”[Title/Abstract]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection control: «infection control»[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]

Search: **infection control epidemiology policy**[Title/Abstract] Filters: **Full text, Humans, English**

((“infection control”[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]) AND “epidemiology policy”[Title/Abstract]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

infection control: «infection control»[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]

Search: **pharmacy infection control surveillance**[Title/Abstract] Filters: **Full text, Humans, English**

((“pharmacie”[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy s”[All Fields]) AND “infection control surveillance”[Title/Abstract]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmacy: «pharmacie”[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy’s”[All Fields]

Search: **pharmacy infection control surveillance**[MeSH Terms] Filters: **Full text, Humans, English**

((“pharmacie”[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy s”[All Fields]) AND (“infection control”[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields])) AND “epidemiology”[MeSH Terms]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmacy: «pharmacie”[All Fields] OR “pharmacies”[MeSH Terms] OR “pharmacies”[All Fields] OR “pharmacy”[MeSH Terms] OR “pharmacy”[All Fields] OR “pharmacy’s”[All Fields]

infection control: «infection control»[MeSH Terms] OR (“infection”[All Fields] AND “control”[All Fields]) OR “infection control”[All Fields]

Search: **pharmacoepidemiology infection control**[Title/Abstract] Filters: **Full text, Humans, English**

((“pharmacoepidemiology”[MeSH Terms] OR “pharmacoepidemiology”[All Fields] AND “infection control”[Title/Abstract]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmacoepidemiology: «pharmacoepidemiology»[MeSH Terms] OR “pharmacoepidemiology”[All Fields]

Search: **pharmacoepidemiology infection control**[MeSH Terms] Filters: **Full text, Humans, English**

((“pharmacoepidemiology”[MeSH Terms] OR “pharmacoepidemiology”[All Fields] AND “infection control”[MeSH Terms]) AND ((fft[Filter]) AND (humans[Filter]) AND (english[Filter]))

Translations

pharmacoepidemiology: «pharmacoepidemiology»[MeSH Terms] OR “pharmacoepidemiology”[All Fields]

Table 1: Exploration of the Surveillance Key Performance Indicators.

1.	Take a random sample of cultures for all clean and sterile <i>places</i> in the pharmacy departments monthly. For instance, <ol style="list-style-type: none"> 1) All areas for sterile preparation ISO 6,7 and 8 2) all horizontal and vertical laminar flow 3) hoods 4) All repackaged areas 5) All extemporaneous area 6) All unit dose distribution area 7) All sink water at a place in the pharmacy units 8) All air conditioning and flow in the pharmacy units
2.	Take a random sample of cultures monthly for sterile preparation. For instance, TPN, regular parenteral medications, sterile parenteral oncology medications, and eye drops preparation.
3.	Follow up any infected pharmaceutical preparation had been distributed accidentally.
4.	Record any transmitted diseases among pharmacy worker
5.	Follow up monthly drug resistance reports by arrangements with microbiology laboratories.
6.	Take a random sample for pharmacy staff for hand hygiene and PPE compliance.
7.	Follow up cleaning the pharmacy environment and workplace with disinfectant daily with a recording sheet.
8.	Review the hand sanitizer and disinfectant used in the pharmacy departments and healthcare departments that wish to add to the healthcare organizations formulary
9.	Document any sharp or needle stick or infected material and follow up with immunization policy
10.	Follow up and Document the spill cleaning at any locations in the pharmacy services.
11.	Follow up with any new staff for immunization policy and procedures.
12.	Document any diseases transmissions during pandemic or epidemic situations for the pharmacy workers
13.	Report monthly the Pharmacoepidemiology and infection control surveillance report to the pharmacy director and copy to infection control departments

infection control[MeSH Terms]: «infection control»[MeSH Terms]

RESULTS AND DISCUSSION

The infection control pharmacist should perform infection control surveillance in pharmacy practice as follows, as explored in Figure 1.^{1,21-25,30}

1. The infection control pharmacist should create an annual plan for the pharmacy practice's surveillance program based on risk assessment.
2. Segregate the surveillance-based area of interest and critical pharmacy department sites. The areas selected were determined by
 - a) A higher risk of administering pharmaceutical preparation to patients
 - b) The pharmaceutical preparation's dosage. That's included intravenous, oral, or topical administration.
 - c) The method of preparation that is required is sterile, clean, or regular
 - d) The daily volume of preparation
 - e) The cost of medications
 - f) The expected clinical severity of infected pharmaceuticals preparation
 - g) Use appropriate resources such as patient's cultural and

financial information, medical, human resources, and medication consumption records.

- h) Assess the risk of pharmaceutical preparation products.
3. All surveillance key performance indicators (KPI) in every area of the pharmacy departments are explored, as shown in Table 1. The exploration includes;
 - a) Formulating the definition of KPI.
 - b) Exploring the calculation method of KPI.
 - c) Setting up a maximum target in the KPI.
 - d) Declaring potential action to prevent the infection.
4. Establish the surveillance requirements for each area of the pharmacy departments. For example, personal, laboratory material, surveillance training, and infection rate calculation. In addition, other support resources, such as computers, statistical analysis, and pharmacy director assistance, should be included. Use of the following step-by-step methods of surveillance tools;
 - a) Setting up of data collection form.
 - b) Use of computer data analysis software.
 - c) Using multiple data collection.
 - d) Setting up terms such as ratio, incidence, prevalence, and rare.
 - e) Making analysis using parametric and non-parametric biostatistics tools.
 - f) Making correlation and regression analyses for future predictions.
 - g) Using validation and reliability tools in data analysis.
 - h) Comparing results with previous results or previous literature.
 - i) Making a report of surveillance.
 - j) Making the surveillance more frequently and regularly.
6. Annual evaluation of all surveillance reports and services, surveillance outcomes assessment in pharmacy practice

CONCLUSION

The policy is a new pharmacy infection prevention and control initiative that improves the infection control documentation system. It also encourages pharmacists to adhere to infection prevention and control regulations in places such as the public and healthcare organizations. Its components include drug-resistant surveillance, incidents of contaminated pharmaceutical preparations, and pharmacy workers' occupational safety. Furthermore, the monitoring of infection control standards compliance manipulates suggestions and regulations. Therefore, Pharmacoepidemiology and infection control surveillance are especially advised to be implemented in pharmacy infection and prevention operations in Saudi Arabia.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

Funding

None

Consent for Publications

Informed consent was obtained from all the participants

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>

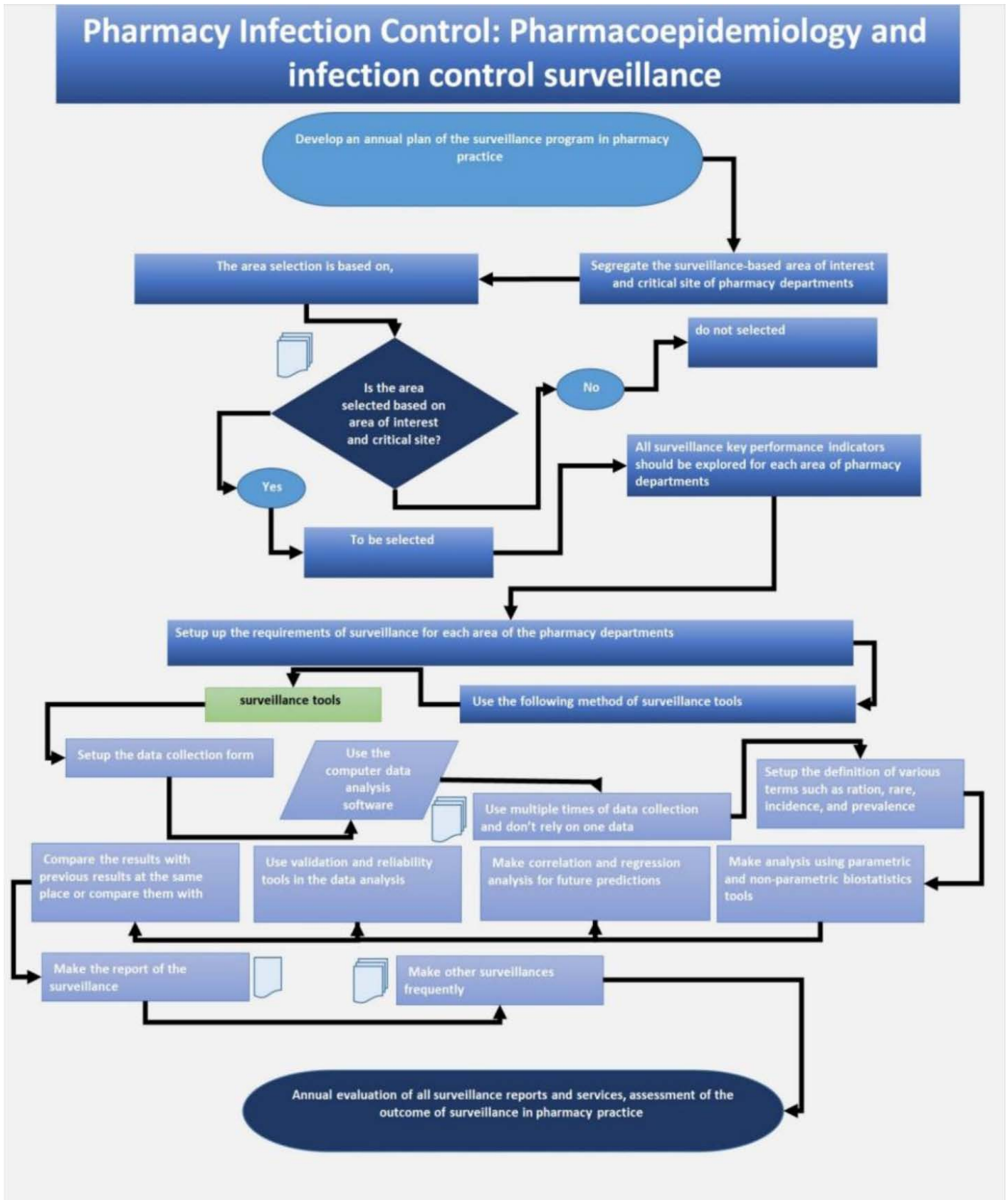




Figure 1: Pharmacoepidemiology and infection control surveillances steps flow chart.

ABBREVIATIONS

CBAHI: Saudi Central Board for Accreditation of Healthcare Institutions; **CDC:** Centers for Disease Control and Prevention of the United States of America, **SCDC:** Saudi Center for Diseases Control; **ASHP:** American Society of Health-System Pharmacists; **WHO:** World Health Organization; **UPS:** United States Pharmacopeia; **AGREE:** Appraisal of Guidelines, Research, and Evaluation; **KPI:** Key Performance Indicators; **ISO:** International Organization for Standardization.

ORCID ID

Yousef Ahmed Alomi  <https://orcid.org/0000-0003-1381-628X>

Mohammed Mominul Islam  <https://orcid.org/0000-0003-4858-9697>

REFERENCES

- Zierler-Brown S, Brown TR, Chen D, Blackburn RW. Clinical documentation for patient care: Models, concepts, and liability considerations for pharmacists. *Am J Health Syst Pharm.* 2007;64(17):1851-8. doi: 10.2146/ajhp060682, PMID 17724368.
- Rector KB, Veverka A, Evans SK. Improving pharmacist documentation of clinical interventions through focused education. *Am J Health Syst Pharm.* 2014;71(15):1303-10. doi: 10.2146/ajhp130670, PMID 25027538.
- Maes KA, Studer H, Berger J, Hersberger KE, Lampert ML. Documentation of pharmaceutical care: Validation of an intervention oriented classification system. *J Eval Clin Pract.* 2017;23(6):1425-32. doi: 10.1111/jep.12817, PMID 28960678.
- Fox BI, Felkey BG, Berger BA, Krueger KP, Rainer RK. Use of personal digital assistants for documentation of pharmacists' interventions: A literature review. *Am J Health Syst Pharm.* 2007;64(14):1516-25. doi: 10.2146/ajhp060152, PMID 17617503.
- Alomi YA, Alghamdi SJ, Alattyh RA. National pharmacist intervention documentation system at the Ministry of Health in Saudi Arabia. *PTB Reports.* 2019;4(3):31-3. doi: 10.5530/PTB.2018.4.11.
- Kim Y, Schepers G. Pharmacist intervention documentation in US health care systems. *Hosp Pharm.* 2003;38(12):1141-7. doi: 10.1177/001857870303801211.
- Alomi YA, Alghamdi SJ, Alattyh RA, Elshenawy RA. The evaluation of pharmacy strategic plan in past. *Community Med.* 2013-2016 and Forecasting of New Vision 2030 at Ministry of Health in Saudi Arabia. *J Pharm Pract;*2018(Jun 10);4(2):93-101.
- Souza Dias MB, Cavassin LGT, Stempliuk V, Xavier LS, Lobo RD, Sampaio JLM, et al. Multi-institutional outbreak of *Burkholderia cepacia* complex associated with contaminated mannitol solution prepared in compounding pharmacy. *Am J Infect Control.* 2013 Nov;41(11):1038-42. doi: 10.1016/j.ajic.2013.01.033, PMID 23663863.
- Staes C, Jacobs J, Mayer J, Allen J. Description of outbreaks of health-care-associated infections related to compounding pharmacies, 2000-12. *Am J Health Syst Pharm.* 2013 Aug 1;70(15):1301-12. doi: 10.2146/ajhp130049, PMID 23867487.
- Held MR, Begier EM, Beardsley DS, Browne FA, Martinello RA, Baltimore RS, et al. Life-threatening sepsis caused by *Burkholderia cepacia* from contaminated intravenous flush solutions prepared by a compounding pharmacy in another state. *Pediatrics.* 2006 Jul;118(1):e212-5. doi: 10.1542/peds.2005-2617, PMID 16785290.
- Mattner F, Gastmeier P. Bacterial contamination of multiple-dose vials: A prevalence study. *Am J Infect Control.* 2004;32(1):12-6. doi: 10.1016/j.ajic.2003.06.004, PMID 14755229.
- Stucki C, Sautter AM, Favet J, Bonnabry P. Microbial contamination of syringes during preparation: the direct influence of environmental cleanliness and risk manipulations on end-product quality. *Am J Health Syst Pharm.* 2009 Nov 15;66(22):2032-6. doi: 10.2146/ajhp070681, PMID 19890087.
- Centers for Disease Control and Prevention (CDC). CDC grand rounds: Preventing unsafe injection practices in the U.S. Health-care system. *M.M.W.R Morb Mortal Wkly Rep.* 2013;62(21):423-5. PMID 23718950.
- Centers for Disease Control and Prevention (CDC). Multistate outbreak of fungal infection associated with injection of methylprednisolone acetate solution from a single compounding pharmacy – United States, 2012. *M.M.W.R Morb Mortal Wkly Rep.* 2012;61(41):839-42. PMID 23076093.
- Kainer MA, Reagan DR, Nguyen DB, Wiese AD, Wise ME, Ward J, et al. Fungal infections associated with contaminated methylprednisolone in Tennessee. *N Engl J Med.* 2012 Dec 6;367(23):2194-203. doi: 10.1056/NEJMoa1212972, PMID 23131029.
- Yablon BR, Dantes R, Tsai V, Lim R, Moulton-Meissner H, Arduino M, et al. Outbreak of *Pantoea agglomerans* bloodstream infections at an oncology clinic-Illinois, 2012-2013. *Infect Control Hosp Epidemiol.* 2017;38(3):314-9. doi: 10.1017/ice.2016.265, PMID 27919308.
- Selenic D, Dodson DR, Jensen B, Arduino MJ, Panlilio A, Archibald LK. Enterobacter cloacae bloodstream infections in pediatric patients traced to a hospital pharmacy. *Am J Health Syst Pharm.* 2003;60(14):1440-6. doi: 10.1093/ajhp/60.14.1440. PMID 12892028.
- Shehab N, Brown MN, Kallen AJ, Perz JF. U.S. Compounding Pharmacy-Related Outbreaks, 2001-2013: Public Health and Patient Safety Lessons Learned. *J Patient Saf.* 2018;14(3):164-73. doi: 10.1097/PTS.000000000000188. PMID 26001553.
- Gershman MD, Kennedy DJ, Noble-Wang J, Kim C, Gullion J, Kacica M, et al. Multistate outbreak of *Pseudomonas fluorescens* bloodstream infection after exposure to contaminated heparinized saline flush prepared by a compounding pharmacy. *Clin Infect Dis.* 2008 Dec;47(11):1372-9. doi: 10.1086/592968, PMID 18937575.
- US Department of Health and Human Services, Centers for Disease Control and Prevention. Infection control in healthcare personnel: Infrastructure and routine practices for occupational infection prevention and control services recommendations only. p. 1-8; 2019. Available from: <https://www.cdc.gov/infectioncontrol/pdf/guidelines/infection-control-HCP-recommendations-only-H.pdf> [cited 28/6/2022].
- WHO. Infection Prevention And Control Assessment Framework at the Facility Level Introduction and user instructions [internet]. Vol. 2016; 2018. Available from: <http://www.who.int/infection-prevention/publications/core-com-> [cited 28/6/2022].
- Ontario Agency for Health Protection, Promotion, Provincial Infectious Diseases Advisory Committee. Best practices for infection prevention and control programs in all health care settings. *Public health Ontario;* 2012. 87 p.
- Beattie M. A guide to infection control in the hospital. *Aust Infect Control.* 2001. 102 p;6(3). doi: 10.1071/HI01102.
- Al Knawy B, Khoja T, Balkhy H, Pittet D. *GCC Infection control manual;* 2013. p. 1-324.
- Lee TB, Montgomery OG, Marx J, Olmsted RN, Scheckler WE, Association for Professionals in Infection Control and Epidemiology. Recommended practices for surveillance: Association for Professionals in Infection Control and Epidemiology (APIC), Inc. *Am J Infect Control.* 2007;35(7):427-40. doi: 10.1016/j.ajic.2007.07.002, PMID 17765554.
- Society T, epidemiology H. Cambridge University Press, The Society for Healthcare Epidemiology of America; 2016;26(12):916-22.
- Masterton RG. Surveillance studies: How can they help the management of infection? *J Antimicrob Chemother.* 2000;46(TOPIC T2):53-8.
- Scheckler WE, Brimhall D, Buck AS, Farr BM, Friedman C, Garibaldi RA, et al. Requirements for infrastructure and essential activities of infection control and epidemiology in hospitals: A consensus panel report. *Society for Healthcare Epidemiology of America. Infect Control Hosp Epidemiol.* 1998;19(2):114-24. doi: 10.1086/647779, PMID 9510112.
- Hennessy S. Use of health care databases in pharmacoepidemiology. *Basic Clin Pharmacol Toxicol.* 2006;98(3):311-3. doi: 10.1111/j.1742-7843.2006.pto_368.x, PMID 16611207.
- Montastruc JL, Benevent J, Montastruc F, Bagheri H, Despas F, Lapeyre-Mestre M, et al. What is pharmacoepidemiology? Definition, methods, interest and clinical applications. *Therapie.* 2019;74(2):169-74. doi: 10.1016/j.therap.2018.08.001, PMID 30389102.
- Alomi YA, Alyousef AM. Infection control pharmacist: A New Initiative Project in The Kingdom of Saudi Arabia. *PTB Reports.* 2021;7(2):40-3. doi: 10.5530/PTB.2021.78.
- Alomi YA, Abdullah Hakami LE, Yahya Khayat NA, Bamagaus YA, Rafuden Bakhsh TM, Adnan Khayat N, et al. Mass gathering (hajj) pharmacy infection control: new initiative in Saudi Arabia. *IJPCS.* 2020;9(1):5-9. doi: 10.5530/ijpcs.2020.9.2.
- Kastango ES, American Society of Health-System Pharmacists (ASHP). Blueprint for implementing USP chapter 797 for compounding sterile preparations. *Am J Health Syst Pharm.* 2005;62(12):1271-88. doi: 10.1093/ajhp/62.12.1271, PMID 15947127.
- United States Pharmacopeia, General Chapter USP <800> Hazardous Drugs-Handling in Healthcare Settings. *The United States pharmacopeial convention.* 2017. p. 1-20.
- USP, General Chapter USP <795> Pharmaceutical Compounding – Nonsterile Preparations. USP 42-NF [internet]. p. 1-13; 2019. Available from: <http://www.usp.org/compounding/general-chapter-795> [cited 28/6/2022]. In:.
- Ontario: Provincial Infectious Diseases Advisory Committee. Public health Ontario. Best practices for cleaning, disinfection, and sterilization of medical equipment/devices in all health care settings. 110 p.
- Rutala WA, Weber DJ, Weinstein RA, Pearson ML. Guideline for disinfection and sterilization in healthcare facilities. *Centers for Disease Control and Prevention (CDC).* p. 2019; 2008. Miscellaneous inactivating agents [internet]. Available from: http://www.cdc.gov/hicpac/Disinfection_Sterilization/10_0MiscAgents.html [cited 28/6/2022].

38. Update L. Manag Health Care Workers Who Had Contacts Patients COVID. 2020;19 infection.
39. World Health Organization (WHO). Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages [internet]. World Health Organization. Vol. 2019; 2020. Available from: https://apps.who.int/iris/bitstream/handle/10665/331695/WHO-2019-nCov-IPC_PPE_use-2020.3-eng.pdf [cited 28/6/2022].
40. Brouwers MC, Kerkvliet K, Spithoff K, AGREE Next Steps Consortium. The AGREE reporting checklist: A tool to improve reporting of clinical practice guidelines. *BMJ*. 2016;352:i1152. doi: 10.1136/bmj.i1152, PMID 26957104.