Section C: The Infection Preventionist

After completing this section, learners will be able to:

- Describe the literature review process
- Differentiate among research study designs (e.g., peer reviewed, experimental vs. non-experimental, qualitative vs. quantitative)
- Understand basic statistics for use in research analysis (e.g., *p* value, confidence interval, appropriateness of test)
- Comprehend adult learning principles (e.g., communication techniques, just-in-time training, in-services)
- Perform HCP competency assessments (e.g., return demonstration, post tests, auditing).
- Differentiate leadership styles and understand related principles
- Know the value of continuing professional development (e.g., seek knowledge, certifications, continuing education courses)

In this section we cover the infection preventionist roles of research, analysis, education, and training. For research and analysis, we describe different types of research study design, analysis of published research including systematic literature reviews, and analysis of statistics. We highlight the IP's role in providing IPC education and training, including objectives, adhering to adult learning principles, and using sound teaching practices and techniques. Also addressed are HCP competencies and assessment of training course effectiveness.

Topic 1: Infection Prevention Research and Analysis

Here we discuss different types of research study design, analysis of published research including systematic literature reviews, and analysis of statistics.

Research Study Design

The critical evaluation of published research, including the type of study design used, is necessary to appropriately assign value to the conclusions of the authors of a paper. Understanding the advantages and disadvantages of each study design should prepare the infection preventionist to critically evaluate published research studies so as to appropriately assign value to the findings.

Infection prevention professionals need to be alert to changing recommendations and requirements as well as new scientific literature and guidelines. Based on their findings, IPs can modify the IPC program as needed.

Exhibit 4-1 is an overview of types of epidemiology study designs.

Exhibit 4-1: Epidemiology Study Designs

Type	Basic Design	Advantages	Disadvantages
Descriptive (e.g., case report, case series)	• A case report describes one or a small number of cases by person, place, and time. • A case series does the same for a defined number of cases.	• Case reports are quick, easy, and may be useful to formulate hypotheses and identify potentially important populations. • Case series does the same, except rates may be estimated.	A case report or case series has no controls for comparison, and risk factors cannot be estimated.
Analytical: cross-sectional (e.g., prevalence, correlational, or survey)	Outcome and potential risk factors are assessed in a population group at one point in time.	• Analytical cross-sectional studies are quicker, easier, and cheaper than cohort studies. • They help describe extent exposures in a population. • Serial cross-sectional studies can investigate changes in prevalence.	• Incidence cannot be determined. • Temporal sequence of cause and effect for risk factors and outcome cannot be determined. • Risk of selection bias exists.
Analytical: Case-control (e.g., case referent, comparison)	Population of individuals with and without the outcome are identified, then compared for exposures to one or more potential risk factors.	• Case-control studies are quicker, easier, and cheaper than cohort study, especially if outcome is rare or has long latency period. • They are useful in studying multiple possible risk factors for an outcome. • If outcome is rare, a smaller study size is needed than for a cohort study.	• Measures exposure rate, not exposure-specific incidence. • Risk exposure may be unavailable or difficult to assess, subject to recall bias or inaccuracy, or biased by knowledge of outcome. • Selection of proper controls may be difficult; temporal sequence of cause and effect for risk factors and outcome cannot be determined with certainty.

Type	Basic Design	Advantages	Disadvantages
Analytical: Cohort (e.g., prospective, longitudinal)	A **cohort** is a group sharing a common experience such as central lines. Population of individuals with and without exposure to potential risk factors are identified and followed to compare the incidence of the outcome in each group. For example, a study is undertaken to follow a population of residents with and without exposure to invasive devices to determine the association of invasive device exposure and development of HAIs.	• Exposure-specific incidence of outcome can be measured directly. • Usually there is less bias in patient selection and determining exposure information than in case-control study. • Cohort studies are useful in studying outcomes with short latency period and multiple possible outcomes from exposure to a potential risk factor. • They provide stronger evidence for a direct causal association than do cross-sectional or case-control studies.	• Longer, more expensive to conduct, especially if outcome has a long latency period following exposure. • If outcome event is rare, a large study size is needed. • Outcome determination may be biased, and individuals may be lost to follow-up.
Experimental clinical trials (e.g., controlled trial, randomized clinical trial (RCT))	• Investigator assigns interventions to an experimental (or treated) group and to a control (or placebo or standard care) group (randomized allocation is the best method). • Experimental and control groups should be treated similarly in all respects, except for the intervention, and are followed to compare the incidence of the outcome in each group.	• Randomization minimizes bias. • Double-blinding minimizes bias in determining outcomes. • RCT provides better evidence for a direct causal association than do other study designs and is the best design to use to establish efficacy of treatment or intervention.	• These trials are artificial and more expensive and difficult to conduct than other studies. • Only a subgroup of individuals are included, limiting generalization to other groups. • Randomization does not guarantee similar comparison groups. • If historical controls are used, they are subject to selection bias, and findings must be interpreted with extreme caution.

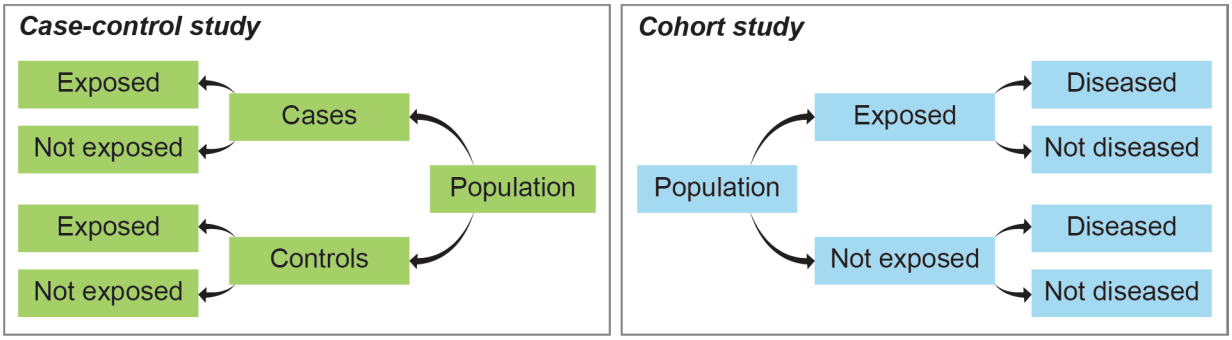
Note that analytical studies include cross-sectional, case-control, and cohort studies. All of these types compare individuals with and without an outcome by the presence of one or more hypothesized risk factors.

Some important differences between cohort and discussed more next, followed by a discussion of how different studies represent different levels of evidence.

Case-Control Versus Cohort Studies

Exhibit 4-2 shows how case-control studies start with knowledge of who does and does not have the outcome of interest while cohort studies start with the population and follow it.

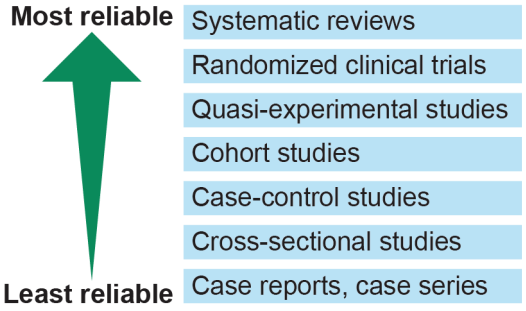
Exhibit 4-2: Case-Control Study Versus Cohort Study Design



Levels of Evidence

The decision to choose a particular study design is dependent on a number of factors, such as feasibility, study question, and outcome of interest. However, it is important to consider the relative strengths and weaknesses of each study design when interpreting research findings because not all are equally useful when making decisions related to resident care. Therefore, studies are frequently weighted according to the different levels of evidence they provide, as shown in Exhibit 4-3.

Exhibit 4-3: Levels of Evidence



The levels of evidence lists study types that provide the weakest evidence at the bottom and higher levels correspond to studies that provide evidence of increasing quality, reliability, and validity, with the best evidence for clinical decision making at the top.

- High quality systematic reviews of multiple studies (addressed later in this topic) provide better evidence than any single study.