



Comparison of Epidemiologic Study Designs

	<i>Cross-sectional</i>	<i>Ecological</i>	<i>Experimental</i>	<i>Retrospective Cohort</i>	<i>Prospective Cohort</i>	<i>Case-control</i>
Study population	Sample of population; exposure and outcome measured at same point in time	Groups	Voluntary participants at risk for developing the outcome of interest at baseline	Sample of population at risk for developing the outcome of interest at baseline	Sample of population at risk for developing the outcome of interest at baseline	Sample of population; cases and controls from the same source population
Persons of interest	Exposed persons or Prevalent cases	Exposed <u>groups</u>	Persons assigned to a treatment or other exposure	Exposed persons	Exposed persons	Persons with disease (cases)
Comparison group	Non-exposed persons or Persons without disease	Non-exposed <u>groups</u>	Persons assigned to not receive treatment being investigated (control / placebo group)	Non-exposed persons	Non-exposed persons	Persons without disease (controls)
Measures of occurrence	<ul style="list-style-type: none"> • Prevalence • Prevalence odds 	<ul style="list-style-type: none"> • Group-level prevalence • Group-level prevalence odds • Group-level risk • Group-level rate • Group-level odds • Average or trend in: risk, rate, prevalence, or odds 	<ul style="list-style-type: none"> • Risk • Rate • Odds • Hazard 	<ul style="list-style-type: none"> • Risk • Rate • Odds • Hazard 	<ul style="list-style-type: none"> • Risk • Rate • Odds • Hazard 	<ul style="list-style-type: none"> • Odds of exposure
Measures of association	<ul style="list-style-type: none"> • Prevalence odds ratio • Prevalence ratio • Prevalence difference 	<ul style="list-style-type: none"> • Prevalence ratio • Prevalence difference • Prevalence odds ratio • Risk ratio • Risk difference • Rate ratio • Rate difference • Correlation coefficients • Regression coefficients 	<ul style="list-style-type: none"> • Risk ratio • Risk difference • Rate ratio • Rate difference • Odds ratio • Odds ratio • Hazard ratio • Survival curves • Efficacy 	<ul style="list-style-type: none"> • Risk ratio • Risk difference • Rate ratio • Rate difference • Odds ratio • Hazard ratio • Survival curves 	<ul style="list-style-type: none"> • Risk ratio • Risk difference • Rate ratio • Rate difference • Odds ratio • Hazard ratio • Survival curves 	Odds ratio Which, depending on sampling, can approximate: <ul style="list-style-type: none"> • Risk ratio • Rate ratio • Hazard ratio
Temporal relationship	Can be hard to establish	Can be hard to establish	Easy to establish	Sometimes hard to establish	Easy to establish	Sometimes hard to establish
Multiple associations	Can assess several exposures and outcomes	Can assess several exposures and outcomes	Multiple interventions on single outcome or effect of single intervention on more than one outcome	Often one exposure with multiple outcomes, though there are exceptions	Often one exposure with multiple outcomes, though there are exceptions	One outcome with multiple exposures
Time required for study	Relatively short	Relatively short	Usually short, depends on disease progression	Moderate, depends on obtaining follow-up data	Long, depends on length of follow-up	Relatively short, unless real-time case acquisition





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	<i>Experimental</i>	<i>Cross-sectional</i>	<i>Ecological</i>	<i>Retrospective Cohort</i>	<i>Prospective Cohort</i>	<i>Case-control</i>
Cost of study	Very expensive	Generally inexpensive	Generally inexpensive	Generally less expensive than prospective cohort study	Expensive	Relatively inexpensive
Population size needed	Relatively small	Can be large or small	Usually large since entire populations are studied	Relatively large	Relatively large	Much smaller than other similarly-powered studies (i.e. cohort)
Potential biases	<ul style="list-style-type: none"> • Assessment of outcome • Information bias • Loss to follow-up 	<ul style="list-style-type: none"> • Survival bias • Reverse causation • Confounding • Information bias 	<ul style="list-style-type: none"> • Ecological fallacy • Reverse causation • Confounding 	<ul style="list-style-type: none"> • Assessment of outcome • Selection bias • Confounding • Information bias 	<ul style="list-style-type: none"> • Assessment of outcome • Selection bias • Confounding • Information bias • Loss to follow-up 	<ul style="list-style-type: none"> • Assessment of exposure • Selection bias • Confounding • Information bias
Best when	<ul style="list-style-type: none"> • Evaluating treatment options (drug, counseling) • Vaccine trials 	<ul style="list-style-type: none"> • Onset of disease is prolonged • Rapid-response settings • Measuring descriptive information 	<ul style="list-style-type: none"> • Individual level information is unavailable • Studying a community-level exposure 	Exposure is rare	Exposure is rare	Outcome is rare
Advantages	Provides clearest evidence of causality	<ul style="list-style-type: none"> • Inexpensive • Fast • Can often be done using publically-available data • Usually good generalizability 	<ul style="list-style-type: none"> • Inexpensive • Fast • Can often be done using publically-available data • Can draw conclusions about group-level characteristics 	<ul style="list-style-type: none"> • Can directly estimate risks and rates of disease • Usually good generalizability 	<ul style="list-style-type: none"> • Can directly estimate risks and rates of disease • Fewer problems establishing temporality • Usually good generalizability 	<ul style="list-style-type: none"> • Relatively inexpensive • Fast • Can estimate risks and rates of disease (under specific sampling parameters) • Needs fewer participants than cohort
Challenges	<ul style="list-style-type: none"> • Ethical problems (equipoise): very few exposures can be assigned • Low generalizability • Very expensive 	<ul style="list-style-type: none"> • Sometimes temporality cannot be established • Cannot measure incidence of disease • Prevalence varies with duration of disease 	<ul style="list-style-type: none"> • Inappropriate conclusions may be drawn regarding relationships at the individual level based on ecological data (ecological fallacy) 	<ul style="list-style-type: none"> • Selection of non-exposed comparison group often difficult. • Changes over time in disease diagnosis / treatment criteria and research methods • Loss to follow-up 	<ul style="list-style-type: none"> • Selection of non-exposed comparison group often difficult. • Changes over time in disease diagnosis / treatment criteria and research methods • Loss to follow-up 	<ul style="list-style-type: none"> • Selection of appropriate controls often difficult • Incomplete information on exposure

