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# **Unit 3. Research Types**

# **Unit 3: Research Types**

# **Learning Goals**

By the end of this unit, you will be able to:

- Distinguish **primary** from **secondary** research and select appropriate use-cases.
- Differentiate basic, applied, and translational research and map work across the T0-T4 continuum.
- Compare qualitative, quantitative, and mixed-methods approaches, including sampling and analysis basics.
- Contrast **observational** and **interventional** designs with common subtypes and typical biases.
- Separate descriptive from analytical studies and identify suitable measures and statistics.

# 1) Primary and Secondary Research

# 1.1 Primary Research

**Definition:** Investigator collects **original data** to answer a specific question.

**Typical designs:** cross-sectional surveys, case-control, cohort, randomized controlled trials (RCTs), laboratory experiments, implementation trials, N-of-1 trials.

### **Strengths**

- Tailored variables and outcomes.
- · Control over quality, timing, and follow-up.
- Clear linkage to the research question.

# Limitations

- Costly and time-consuming.
- Ethics, approvals, logistics.
- Recruitment and data loss challenges.

# Ayurveda-relevant examples

- Measuring WOMAC pain change after a standardized Abhyanga-Svedana package (pragmatic RCT).
- Lab characterization of **Punarnavā** extract (preclinical experiment).

# 1.2 Secondary Research

**Definition:** Uses **existing data** or studies to derive new insights.

# Forms

- Systematic reviews (with or without meta-analysis).
- Guideline synthesis and evidence summaries.
- Secondary data analyses of hospital records, claims, registries, EHRs.
- Umbrella reviews (review of reviews).

# Strengths

- Rapid, cost-effective; broad perspective.
- Higher power (pooled estimates).

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• Reduces duplication of small primary studies.

#### Limitations

- Dependent on quality and heterogeneity of underlying studies.
- Missing variables; confounding in routine data.
- Risk of publication/selection bias (mitigated by registries and comprehensive searches).

### Ayurveda-relevant examples

- Meta-analysis of Virechana in chronic constipation vs usual care.
- State-wide EHR analysis of **Rasāyana counselling** uptake and outcomes.

# 2) Basic, Applied, and Translational Research

# 2.1 Basic Research (Fundamental)

Goal: Generate mechanistic knowledge without immediate clinical application.

Methods: pharmacognosy, chemistry, receptor assays, animal models, analytical standardization.

**Example:** Identify active fractions and quality markers for **Navāyasa cūrņa**; establish stability parameters.

# 2.2 Applied Research

**Goal:** Solve **practical problems**—diagnostics, therapeutics, prevention, delivery.

Methods: prototype development, feasibility/pilot trials, comparative effectiveness, health economics.

**Example:** Develop and pilot a **dosage algorithm** for *Takra-basti* in IBS-D based on tolerance and symptom response.

### 2.3 Translational Research

Goal: Bridge bench → bedside → community → policy. Often described as T0-T4:

Stage	Focus	Illustrative Activities (Ayurveda context)
T0	Discovery	Identify bioactive leads from <b>Gudūcī</b> ; omics profiling
T1	First-in-human / proof of concept	t Phase I/II safety and early efficacy of standardized extract
T2	Clinical efficacy/effectiveness	RCTs; validation of outcomes including Agni/Bala scales
Т3	Implementation	Integrate a whole-system <b>Ayurvedic OA package</b> into district hospitals; fidelity and cost
T4	Population impact	Scale-up, monitoring, and policy adoption across states

**Key point:** Translational work requires **multi-disciplinary teams**, robust **quality assurance**, and **reporting standards** so steps are reproducible.

# 3) Qualitative, Quantitative, and Mixed-Methods

# 3.1 Qualitative Research

Purpose: Understand meanings, experiences, contexts, and processes.

**Common designs:** phenomenology, grounded theory, ethnography, case study; **methods:** in-depth interviews (IDIs), focus group discussions (FGDs), observations, document analysis.

Sampling: purposive, theoretical, maximum variation; sample size guided by saturation (not power).

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**Analysis:** thematic analysis, constant comparative method, coding frameworks; strategies to enhance trustworthiness—triangulation, member checking, audit trail, reflexivity.

### **Use-cases in Ayurveda**

- Barriers and facilitators to **Pathya-Apathya** adherence after **Virechana**.
- Patient perspectives on **integrative oncology** clinics.

### 3.2 Quantitative Research

**Purpose:** Measure **frequency**, **effect**, **association**, and test hypotheses. **Data types:** numeric (continuous, discrete), categorical (nominal, ordinal).

Sampling: probability-based (simple random, stratified, cluster) or non-probability (consecutive).

**Analysis:** estimates (means, proportions), comparisons (t-test, ANOVA, χ²), association/effect (OR, RR, HR), regression models, confidence intervals, p-values, power and sample-size calculations.

### 3.3 Mixed-Methods Research

Why: Many health questions need both numbers and narratives. Core designs

- Convergent parallel: collect gual + guant simultaneously; merge in interpretation.
- Explanatory sequential: start quantitative → explain findings qualitatively.
- Exploratory sequential: start qualitative → build measure/intervention → test quantitatively.

**Example:** Pragmatic RCT of a whole-system package (quant outcomes) + interviews of patients and therapists (qual) to interpret adherence, acceptability, and context.

# 4) Observational and Interventional Studies

# 4.1 Observational Designs

No investigator-assigned intervention; exposures observed as they occur.

Design	Question Type	Measure	Typical Biases	Example
Cross-sectional	Prevalence; associations at one time	Prevalence ratio, odds ratio	Temporal ambiguity	<b>Agni</b> impairment prevalence among OPD attendees
Case series/report	Signals; early harms or benefits	Descriptive	Selection, no comparator	Unusual herb-drug interaction
Case-control	Risk factors for rare outcomes	Odds ratio	Recall, selection	Risk factors for <b>drug-</b> <b>induced hepatotoxicity</b>
Cohort (prospective/retrospective)	Incidence; prognosis; effects	Risk ratio, hazard ratio	Confounding by indication	Outcomes after <b>Basti</b> vs none in routine records
Ecological	Population-level correlations	Correlation coefficients	Ecological fallacy	District-level <i>ṛtucaryā</i> program vs NCD trends

**Validity tips:** define exposure/outcome precisely; address confounding (restriction, matching, multivariable adjustment, propensity scores); ensure follow-up completeness.

### 4.2 Interventional Designs

**Investigator assigns** an intervention.

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Design	Features	Strengths	Cautions	Example
RCT (explanatory)	Strict criteria, fixed protocol, intense follow- up	High internal validity	Limited generalisability	Capsule <b>Gudūcī</b> vs placebo in carefully selected patients
RCT (pragmatic)	Broad criteria, flexible delivery, routine settings	Real-world relevance	Requires large sample, cluster effects	Whole-system Ayurveda + usual care vs usual care
Cluster RCT	Randomise clinics/districts	Minimises contamination	Needs ICC-adjusted sample size	PHCs allocated to Rasāyana counselling
Adaptive/Platform trials	Modify arms by interim data	Efficient learning	Complex stats/oversight	Multiple <b>OA</b> regimens with shared control
Non-randomized interventional	Allocation by program/logistics	Feasible when randomisation	Confounding risk	Step-wedge rollout of <b>Nasya</b> training

**Core safeguards:** allocation concealment, blinding (where feasible), pre-registration, intention-to-treat analysis, DSMB for safety.

# 5) Descriptive and Analytical Studies

### 5.1 Descriptive

Purpose: Describe who, what, when, where—distributions of person, place, time.

# **Outputs**

- Frequencies, proportions, rates (prevalence, incidence).
- Summary statistics (mean, median, SD, IQR).
- Maps and time trends.

### **Examples**

- Monthly count of **Asrugdāra** (AUB) cases by age group at a teaching hospital.
- Nutritional profile (BMI categories) among **Prakṛti** strata.

# 5.2 Analytical

Purpose: Test hypotheses about associations or effects; estimate magnitude and uncertainty.

### **Effect measures**

- Risk Ratio (RR): cohort or trial (incidence).
- Odds Ratio (OR): case-control; logistic regression.
- Hazard Ratio (HR): time-to-event (Cox model).
- Mean Difference / Standardized Mean Difference: continuous outcomes.
- Prevalence Ratio/OR: cross-sectional associations.

### **Examples**

- Does adding **Takra** to diet reduce recurrence of dyspepsia vs no Takra? (RR/ARR/NNT).
- Is high Vyāyāma-śakti associated with better post-Virechana recovery? (adjusted OR).

# Descriptive vs Analytical—At a glance

Feature	Descriptive	Analytical

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Feature	Descriptive	Analytical
Aim	Summarise	Test association/causation
Comparator	None	Present (explicit or implicit)
Measures	Prevalence, mean, SD	OR, RR/ARR, HR, MD/SMD

Causality Not inferred Investigated with design + control of bias

# Choosing the Right Type: A Quick Decision Path

- 1. Clarify your question. Frequency? Association? Effect? Experience/context? Implementation?
- 2. Ethics & feasibility. Can you assign interventions? If not, choose observational.
- 3. Need depth of meaning? Use qualitative or mixed-methods.
- 4. Generalise to routine care? Consider pragmatic or cluster RCTs.
- 5. Time/resources limited? Start with secondary research to map evidence and refine PICO.

# **Key Terms and Measures (Pocket Table)**

Term	Meaning (simple)	Typical Use
Prevalence	Proportion with condition at a time	Cross-sectional description
Incidence	New cases over time	Cohorts, trials
ARR / RRR / NNT	Absolute/relative risk reduction; number needed to treat	t Trials, decision-making
Confounding	A third factor distorts exposure-outcome link	Address by design/analysis
Selection bias	Systematic difference in who enters study	All designs; robust sampling
Information bias	Measurement error (misclassification)	All designs; blinding, validation
Effect modification	True difference in effect by a third variable	Report stratum-specific effects
Saturation	No new themes in qualitative data	Qualitative sampling adequacy

### Assessment

# A. Multiple-Choice Questions (MCQs)

- 1. A study using hospital EHR to evaluate outcomes of patients who received **Basti** vs those who did not, without assigning treatment, is:
  - A) RCT
  - B) Cohort (observational)
  - C) Case-control
  - D) Cross-sectional

# **Answer:** B

- 2. A systematic review with meta-analysis that pools RCTs comparing Abhyanga vs usual care is:
  - A) Primary research
  - B) Secondary research
  - C) Mixed-methods research
  - D) Implementation research

# Answer: B

- 3. Which is **not** a translational stage activity?
  - A) Identifying a bioactive fraction (lab bench)
  - B) Phase III pragmatic trial in district hospitals
  - C) State-wide policy roll-out monitoring
  - D) Retrospective billing audit for staff punctuality

Answer: D

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- 4. Grounded theory and thematic analysis are methods of:
  - A) Qualitative research
  - B) Quantitative research
  - C) Adaptive trial design
  - D) Health economics modelling

#### Answer: A

- 5. The **best measure** of association in a case-control study is typically:
  - A) Risk ratio
  - B) Odds ratio
  - C) Hazard ratio
  - D) Mean difference

#### Answer: B

- 6. A **cluster RCT** is most appropriate when:
  - A) Individual randomisation risks contamination between participants
  - B) The disease is extremely rare
  - C) Only lab animals are available
  - D) You want only mechanistic insight

#### Answer: A

- 7. A **descriptive** study mainly provides:
  - A) Causal attribution
  - B) Hypothesis testing with adjusted OR
  - C) Summary of prevalence by age and sex
  - D) Hazard ratios over time

#### Answer: C

- 8. Explanatory RCTs are primarily intended to maximise:
  - A) External validity
  - B) Internal validity
  - C) Qualitative insights
  - D) Cost-minimisation

### Answer: B

- 9. In mixed-methods, an **explanatory sequential** design means:
  - A) Qualitative then quantitative
  - B) Quantitative then qualitative
  - C) Both together and merged
  - D) Only qualitative

### Answer: B

- 10. **Confounding by indication** is a typical risk in:
  - A) Randomized trials
  - B) Non-randomized comparative studies using routine care data
  - C) Phenomenological interviews
  - D) Case reports

### Answer: B

# **B. Short-Answer Questions (SAQs)**

- 1. Define **primary** and **secondary** research with one Ayurveda-relevant example each.
- 2. Distinguish basic, applied, and translational research; place one of your current ideas on the T0-T4 ladder.
- 3. List three strategies to improve **trustworthiness** in qualitative research.
- 4. Explain allocation concealment and intention-to-treat in interventional studies.
- 5. Differentiate descriptive and analytical studies using the outcome of a Panchakarma program as context.

# C. Long-Answer Questions (LAQs)

 Design choice essay: A district hospital wants to evaluate an integrative osteoarthritis pathway combining whole-system Ayurveda with physiotherapy. Compare pragmatic RCT, cluster RCT, and prospective cohort, discussing validity, feasibility, contamination, and ethics.

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2. **Mixed-methods plan:** Outline a convergent-parallel mixed-methods study to evaluate **Pathya adherence** after Virechana—include sampling, instruments, primary outcomes, analysis, and how you will integrate findings.

# D. Case Vignette (Applied Classification)

A teaching hospital launches an **Abhyanga-Svedana** package for chronic low back pain. They first analyse three years of OPD records to estimate baseline pain scores and service use; then they run a pragmatic RCT; finally, they interview patients and therapists about acceptability and barriers.

### Tasks:

- a) Label each phase as primary/secondary; observational/interventional; qualitative/quantitative.
- b) For the RCT phase, state the **primary effect measure** and **two ways** to minimise bias.

# **Quick Recap (for revision)**

- **Primary vs Secondary:** New data vs existing data/studies.
- Basic-Applied-Translational: Mechanism → solution → movement into real care and policy.
- Qual-Quant-Mixed: Meanings and context; numbers and tests; both for depth and breadth.
- Observational vs Interventional: See vs assign; each has classic subtypes and biases.
- **Descriptive vs Analytical:** Summarise vs test; pick measures accordingly.

End of Unit 3.

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