Unit 3. Research Types

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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.

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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).

- 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.

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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 cūrṇa**; 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 **Gudūcī**; omics profiling
T1	First-in-human / proof of concept	Phase I/II safety and early efficacy of standardized extract
T2	Clinical efficacy/effectiveness	RCTs; validation of outcomes including *Agni*/*Bala* scales
T3	Implementation	Integrate a whole-system **Ayurvedic OA package** 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.

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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).

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, χ^2), 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 qual + quant 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.

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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	**Agni** 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 **drug-induced hepatotoxicity**
Cohort (prospective/retrospective)	Incidence; prognosis; effects	Risk ratio, hazard ratio	Confounding by indication	Outcomes after **Basti** vs none in routine records
Ecological	Population-level correlations	Correlation coefficients	Ecological fallacy	District-level *ṛtucaryā* 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.

Design	Features	Strengths	Cautions	Example
RCT (explanatory)	Strict criteria, fixed protocol, intense follow-up	High internal validity	Limited generalisability	Capsule **Gudūcī** 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 **OA** regimens with shared control
Non-randomized interventional	Allocation by program/logistics	Feasible when randomisation impractical	Confounding risk	Step-wedge rollout of **Nasya** training

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

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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

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	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

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)

1. **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.

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.