MASTERING
THE SYSTEMATIC REVIEW
DAY-4

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UNDERSTANDING DATA, CRITICAL APPRAISAL & DATA EXTRACTION

1) UNDERSTANDING DATA IN RESEARCH

Types of Data, Identify Useful Data, Statistical Parameters

2) CRITICAL APPRAISAL

Appraisal Tools by Study Type

3) DATA EXTRACTION

4) COMMON ISSUES FACED

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BY THE END OF TODAY, YOU WILL BE ABLE TO:

- UNDERSTAND WHAT DATA IS, TYPES OF DATA, AND HOW IT'S USED IN RESEARCH.
- EXTRACT RELEVANT AND STATISTICALLY MEANINGFUL DATA FROM STUDIES.
- APPRAISE THE QUALITY OF STUDIES USING STANDARD TOOLS.
- ORGANIZE YOUR FINDINGS IN PREPARATION FOR SYNTHESIS AND WRITING.

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DATA IN RESEARCH

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UNDERSTANDING DATA IN RESEARCH

DATA REFERS TO THE **FACTS**, **FIGURES**, AND **OUTCOMES** REPORTED IN A RESEARCH STUDY — INCLUDING **QUANTITATIVE RESULTS** (E.G., CHOLESTEROL LEVELS) AND **QUALITATIVE INSIGHTS** (E.G., THEMATIC ANALYSES).

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TYPES OF DATA IN RESEARCH STUDIES

GENERAL DATA

THESE ARE MOSTLY USED IN DEMOGRAPHICS, BASELINE CHARACTERISTICS, OR DESCRIPTIVE SUMMARIES IN A STUDY.

OUTCOME DATA

THESE ARE CRITICAL DURING THE DATA EXTRACTION PHASE, AS THEY DETERMINE HOW THE DATA WILL BE INTERPRETED STATISTICALLY.

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GENERAL DATA

THESE ARE MOSTLY USED IN DEMOGRAPHICS, BASELINE CHARACTERISTICS, OR DESCRIPTIVE SUMMARIES IN A STUDY.

THESE ARE THE BROAD CATEGORIES INTO WHICH ALL DATA CAN BE CLASSIFIED — REGARDLESS OF THE RESEARCH DOMAIN. UNDERSTANDING THESE IS ESSENTIAL BEFORE INTERPRETING OUTCOME MEASURES.

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LIST OF GENERAL DATA TYPES

NOMINAL

Categorical, no order

Example: - Smoking status: smoker/non-smoker

ORDINAL

Ordered categories

Example: - Disease stage: mild/moderate/severe

INTERVAL

Numeric, no true zero

Example: - Temperature in °C

RATIO

Numeric, true zero

Example: - LDL level, BMI, weight

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OUTCOME DATA

THESE ARE CRITICAL DURING THE DATA EXTRACTION PHASE, AS THEY DETERMINE HOW THE DATA WILL BE INTERPRETED STATISTICALLY.

THESE REFER TO HOW THE **PRIMARY** OR **SECONDARY** OUTCOMES OF INTEREST IN A STUDY ARE MEASURED AND ANALYZED. THIS IS PARTICULARLY CRITICAL DURING DATA EXTRACTION AND SYNTHESIS.

LIST OF OUTCOME DATA TYPES

CONTINUES DATA

Example

LDL levels, BMI, HbA1c, Blood pressure

BINARY DATA

Example

Quit vs not quit smoking, Event vs No event

CATEGORICAL DATA

Example

Response Level (e.g., none, partial, complete)

TIME-TO-EVENT DATA

Example

Time to relapse, Time to recovery

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LIST OF OUTCOME DATA TYPES

1) CONTINUES DATA

→ NUMERICAL VALUES MEASURED ON A SCALE, CAPABLE OF HAVING INFINITE GRADATIONS

COMMON METRICS

MEAN- Average value of Data.

SD- Indicates variability.

MD- Main Difference

SMD- Standardized Mean Difference

CI- Confidence Interval

P-VALUE- Confidence Interval

LIST OF OUTCOME DATA TYPES

COMMON METRICS

MEAN- Average value of Data

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The average value of a data set **(sum of all values ÷ number of values)**

Measures how spread out the values are around the mean – **indicates variability**.

The **difference between the average outcome** in two groups (e.g., treatment vs control).

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LIST OF OUTCOME DATA TYPES

COMMON METRICS

MEAN- Average value of Data

SD- Indicates variability

MD- Main Difference

SMD- Standardized Mean Difference

CI- Confidence Interval

P-VALUE- Confidence Interval

A **mean difference** adjusted for differences in measurement scales across studies.

A **range** that likely contains the true effect; **usually reported as a 95% certainty range**.

Shows the **probability** that the observed results happened by chance; lower means more statistically significant **(commonly < 0.05)**.

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LIST OF OUTCOME DATA TYPES

2) BINARY DATA

→ OUTCOMES THAT FALL INTO ONE OF TWO MUTUALLY EXCLUSIVE CATEGORIES

COMMON METRICS

(RR)- Risk Ratio

(OR)- Odds Ratio

RISK DIFFERENCE

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COMMON METRICS

(RR)- Risk Ratio

(OR)- Odds Ratio

RISK DIFFERENCE

The ratio of the probability of an event in the intervention group to the control group. **RR = 1 means no difference**.

The ratio of the odds of an event occurring in one group to the odds in another group; often used in **case-control studies**.

The absolute difference in event rates between two groups (e.g., **30% - 10% = 20% reduction**).

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LIST OF OUTCOME DATA TYPES

3) CATEGORICAL DATA

→ (SOMETIMES USED INTERCHANGEABLY WITH NOMINAL/ORDINAL IN OUTCOMES)

COMMON METRICS

FREQUENCIES

CHI-SQUARE TESTS

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COMMON METRICS

FREQUENCIES

CHI-SQUARE TESTS

The number of times a particular category or value appears in the data set. **Often shown in tables or counts**.

A **statistical test** used to assess whether there is a significant **association between two categorical variables**.

LIST OF OUTCOME DATA TYPES

4) TIME-TO-EVENT DATA

→ OUTCOMES MEASURED BY THE TIME UNTIL AN EVENT OCCURS

COMMON METRICS

HR- Hazard Ratio

KAPLAN-MEIER SURVIVAL CURVES

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LIST OF OUTCOME DATA TYPES

COMMON METRICS

HR- Hazard Ratio

KAPLAN-MEIER SURVIVAL CURVES

Compares the rate at which an event (e.g., death, relapse) happens over time in two groups. **HR = 1** means no difference; **HR < 1** favors treatment.

A **graphical method** to estimate the probability of surviving (or avoiding an event) over time, allowing comparison between groups.

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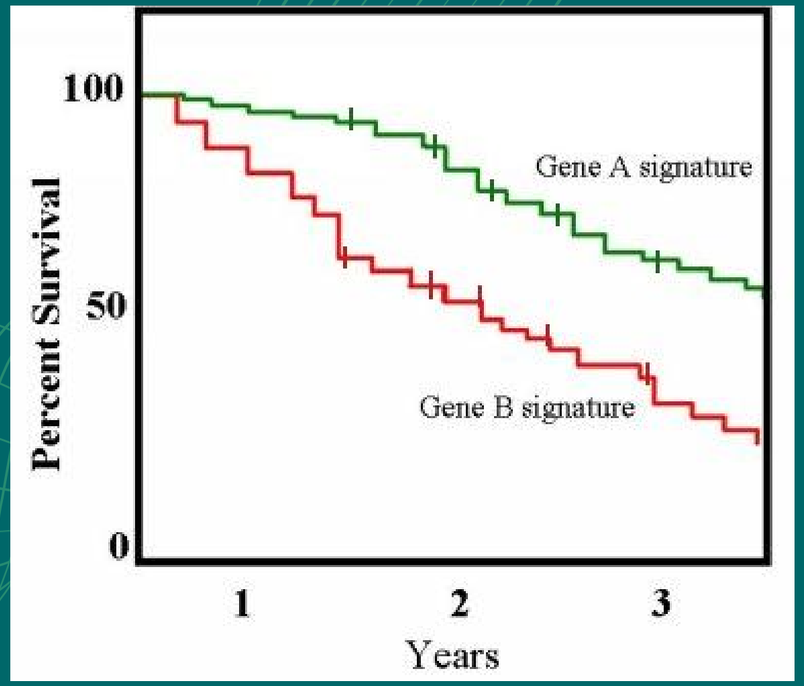
LIST OF OUTCOME DATA TYPES

COMMON METRICS

HR- Hazard Ratio

KAPLAN-MEIER SURVIVAL CURVES

A **graphical method** to estimate the probability of surviving (or avoiding an event) over time, allowing comparison between groups.



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HOW TO EXTRACT CONTINUOUS VS BINARY DATA

WHAT TO EXTRACT	CONTINUOUS	BINARY
OUTCOME	Measurement (e.g., LDL, BMI, BP)	Event status (e.g., quit smoking = yes/no)
RESULT FORMAT	Mean ± Standard Deviation (SD)	Number of events / total (e.g., 40/100)
EFFECT SIZE	Mean Difference, Standardized Mean Difference (SMD) (SD)	Risk Ratio (RR), Odds Ratio (OR), Risk Difference
CONFIDENCE INTERVAL	Typically reported as 95% CI	Typically reported as 95% CI
P- VALUE	Included for testing significance	Same – used to determine statistical significance

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HOW IS DATA COLLECTED IN RESEARCH

QUANTITATIVE STUDIES

CLINICAL MEASUREMENTS, LAB RESULTS, SURVEYS.

QUALITATIVE STUDIES

INTERVIEWS, FOCUS GROUPS, OPEN-ENDED QUESTIONNAIRES.

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WHAT'S YOUR JOB AS A REVIEWER?
WHEN YOU COLLECT THE DATA IN RESEARCH STUDIES...

EXTRACT

ORGANIZE

WHAT ORIGINAL AUTHORS
HAVE ALREADY COLLECTED
& REPORTED

HOW TO IDENTIFY USEFUL DATA (FROM INCLUDED STUDIES)

FOCUS ONLY ON:

- PICO ELEMENTS
- STUDY CHARACTERISTICS
- RESULTS

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DRAWING FINAL OUTCOMES FROM MULTIPLE STUDIES

- COMPARE RESULTS ACROSS STUDIES WITH SIMILAR POPULATIONS AND INTERVENTIONS
- LOOK FOR CONSISTENCY IN DIRECTION AND MAGNITUDE OF EFFECTS
- USE EXTRACTED STATISTICS TO EVALUATE WHETHER A MEANINGFUL PATTERN EMERGES
- HIGHLIGHT DISCREPANCIES AND HYPOTHESIZE REASONS (STUDY DESIGN, SAMPLE SIZE, QUALITY)

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WHAT IS CRITICAL APPRAISAL?

CRITICAL APPRAISAL IS THE PROCESS OF EVALUATING WHETHER A STUDY IS TRUSTWORTHY, VALID, AND METHODOLOGICALLY SOUND ENOUGH TO INCLUDE IN YOUR SYNTHESIS.

WHAT TO LOOK FOR?

- IS THE **STUDY DESIGN APPROPRIATE** FOR THE QUESTION?
- ARE **METHODS CLEARLY DESCRIBED**?
- ARE THERE **RISKS OF BIAS** (E.G., SELECTION, PERFORMANCE, ATTRITION)?
- ARE THE **RESULTS CREDIBLE** AND TRANSPARENTLY REPORTED?

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WHAT IS DATA EXTRACTION?

DATA EXTRACTION MEANS PULLING OUT THE KEY INFORMATION FROM EACH STUDY AND ORGANIZING IT IN A STRUCTURED TABLE.

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KEY FIELDS TO INCLUDE IN YOUR TABLE

STUDY NAME	EXAMPLE
study name	Smith et al., 2020
Population	Adults aged 30-60, n = 200
Intervention	Aerobic exercise
Comparison	No exercise
Outcome	LDL cholesterol
Study Design	RCT
Results	LDL ↓ 15% over 12 weeks
Quality Score	Low Risk of Bias

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🚨 COMMON ISSUES & HOW TO SUPPORT PARTICIPANTS

ARTICLE TOO COMPLEX??

START WITH ABSTRACT, THEN METHODS/RESULTS

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🚨 COMMON ISSUES & HOW TO SUPPORT PARTICIPANTS

CAN'T DECIDE IF STUDY IS GOOD OR BAD??

↓

USE CHECKLIST AND ASK A MENTOR

COMMON ISSUES & HOW TO SUPPORT PARTICIPANTS

FORGOT TO SAVE FULL TEXTS??

EMPHASIZE USE OF ZOTERO/ RAYYAN.AI

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COMMON ISSUES & HOW TO SUPPORT PARTICIPANTS

CONFUSED BY RESULT TERMINOLOGY??

FOCUS ON EFFECT DIRECTION AND SIZE

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🔍 LET’S DIVE INTO FULL-TEXT SCREENING: THE FINAL FILTER FOR QUALITY EVIDENCE

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STEPS FOR LEARNING FULL TEXT SCREENING

1. START WITH THE TITLE & ABSTRACT

2. SKIM THE INTRODUCTION

3.DIVE INTO THE METHODS

4. ANALYZE THE RESULTS

5. CRITICALLY READ THE DISCUSSION

6. CHECK REFERENCES

7. PRACTICAL TIPS FOR BEGINNERS

1. START WITH THE TITLE & ABSTRACT

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GOAL: DECIDE IF THE PAPER IS WORTH YOUR TIME.

WHAT TO LOOK FOR:

PICO MATCH: DOES IT ALIGN WITH YOUR RESEARCH QUESTION (POPULATION, INTERVENTION, OUTCOME)?

STUDY DESIGN: IS IT AN RCT, COHORT STUDY, META-ANALYSIS, ETC.?

KEY FINDINGS: WHAT ARE THE MAIN RESULTS?

PRO TIP-

USE THE CRAAP TEST (CURRENCY, RELEVANCE, AUTHORITY, ACCURACY, PURPOSE) TO FILTER LOW-QUALITY PAPERS.

2. SKIM THE INTRODUCTION

GOAL: UNDERSTAND THE CONTEXT AND RESEARCH GAP.

WHAT TO LOOK FOR:

RESEARCH GAP: WHY WAS THIS STUDY DONE?

HYPOTHESIS: WHAT IS THE AUTHORS' MAIN CLAIM?

OBJECTIVE: WHAT SPECIFIC QUESTION DOES THE PAPER ANSWER?

RED FLAGS:

VAGUE OBJECTIVES (E.G., "TO EXPLORE..." WITHOUT CLEAR HYPOTHESES).

NO MENTION OF PRIOR SYSTEMATIC REVIEWS ON THE TOPIC.

3.DIVE INTO THE METHODS

GOAL: ASSESS STUDY QUALITY AND RISK OF BIAS

KEY SECTIONS:

WHAT TO CHECK FOR?

- **STUDY DESIGN** - RCT? OBSERVATIONAL? QUALITATIVE?
- **PARTICIPANTS**- INCLUSION/EXCLUSION CRITERIA (MATCHES YOUR PICO?)
- **INTERVENTION**- DOSAGE, DURATION, CONTROL GROUP DETAILS
- **OUTCOMES**- PRIMARY VS. SECONDARY OUTCOMES
- **STATISTICAL ANALYSIS**- SAMPLE SIZE CALCULATION, TESTS USED (T-TEST, ANOVA)

PRO TIP:

USE CHECKLISTS LIKE ROB 2 (FOR RCTS) OR NEWCASTLE-OTTAWA SCALE (FOR OBSERVATIONAL STUDIES) TO ASSESS BIAS.

4. ANALYZE THE RESULTS

GOAL: EXTRACT USABLE DATA FOR YOUR REVIEW.

WHAT TO LOOK FOR?

KEY NUMBERS:

- MEAN, SD, P-VALUES, CONFIDENCE INTERVALS (CI), EFFECT SIZES.
- **TABLES/FIGURES:** FOREST PLOTS, SURVIVAL CURVES, REGRESSION MODELS.
- **SUBGROUP ANALYSES:** DID THEY TEST DIFFERENT POPULATIONS OR DOSES?

EXAMPLE:

"THE INTERVENTION GROUP HAD A 15% REDUCTION IN LDL (95% CI: −20 TO −10; P=0.01)."

RED FLAG:

MISSING SDS OR UNCLEAR STATISTICAL METHODS.

OVEREMPHASIS ON STATISTICALLY INSIGNIFICANT RESULTS.

5. CRITICALLY READ THE DISCUSSION

GOAL: EVALUATE HOW THE AUTHORS INTERPRET THEIR FINDINGS.

WHAT TO LOOK FOR?

- **INTERPRETATION**: DO THE RESULTS SUPPORT THE HYPOTHESIS?
- **LIMITATIONS**: DID THEY ACKNOWLEDGE BIASES (E.G., SMALL SAMPLE SIZE)?
- **GENERALIZABILITY**: CAN THE FINDINGS APPLY TO YOUR POPULATION?

PRO TIP:

COMPARE THE DISCUSSION TO THE RESULTS—DO THEY OVERHYPE CONCLUSIONS?

6. CHECK REFERENCES

GOAL: FIND ADDITIONAL RELEVANT PAPERS.

WHAT TO LOOK FOR?

- **SEMINAL PAPERS**: KEY STUDIES CITED REPEATEDLY.
- **CONTRADICTORY EVIDENCE**: REFERENCES THAT DISAGREE WITH THE AUTHORS' CLAIMS.

7. PRACTICAL TIPS FOR BEGINNERS

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A. SKIM VS. DEEP READ

- SKIM: ABSTRACT, FIGURES, AND CONCLUSIONS FIRST.
- DEEP READ: ONLY IF THE PAPER IS RELEVANT AND HIGH-QUALITY.

B. TAKE NOTES

USE A TEMPLATE LIKE THIS:

- **FIELD NOTES**
- **PICO MATCH** : ✓ (ADULTS WITH DIABETES, METFORMIN VS. PLACEBO)
- **RISK OF BIAS** : HIGH (NO BLINDING, SMALL SAMPLE)
- **KEY RESULTS** : LDL ↓ 12% (P=0.03)

C. USE TOOLS

- ZOTERO: HIGHLIGHT AND ANNOTATE PDFS.
- ELICIT.AI: SUMMARIZE COMPLEX SECTIONS.

FINAL CHECKLIST

BEFORE INCLUDING A PAPER IN YOUR REVIEW, ASK:

- DOES IT MATCH MY PICO?
- IS THE STUDY DESIGN APPROPRIATE?
- ARE THE RESULTS STATISTICALLY SIGNIFICANT AND CLINICALLY MEANINGFUL?
- IS THE RISK OF BIAS ACCEPTABLE?

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Thank you for having you guys!!!

SEE YOU AT WORKSHOP!!!