How to Write a Research Manuscript ?

Writing a Paper: Getting Started

"The only way to learn to write is to write" --Peggy Teeters

- No single best way
- Varies from paper to paper
- Background reading--Literature search!

Parts of a Manuscript – Structure

Write in What Order?

Title
Abstract
Introduction
Methods
Results
Discussion
References

"Writing is a lot easier if you have something to say"
--Sholem Asch

Methods

- Editors judge the study on whether your methods are adequate to answer your specific aim or hypothesis
  - Rationale for choosing procedures/tests
  - The pivotal point to judge whether the results are valid
- Don't suggest a method you have no expertise with
  - Your peer reviewer may uncover this
  - Use consultants for methods you have no experience with, stating this in paper
- Methods usually the weakest section
  - Often deficient in detail, not providing enough information to replicate the study
  - Statistical shortcomings

Methods

- Study design, setting & period of study
- Study subjects consent and IRB approval
- Details of sample (sample size, selection methods of study subjects, how organized)
- Interventions, outcome measures, statistical analyses
- Include the locations and times that data were collected
- Give enough information to replicate the study; don't assume only the specialist in your field will read it

Results

- The heart of your paper
- Write after figures and tables are constructed
  - Consider your data critically
  - Construct tables, figures
  - Write the results
  - Use subheadings
- Results determine
  - Whether you've answered your original question(s)
  - Your direction for future studies
  - Both of which belong in the discussion

Results

- State ALL the findings
  - Whether significant or not
  - Without bias or interpretation
  - Do not include weaknesses, strengths of study, ie don't discuss results
- List experiments in order listed in methods
- Use logical headings and group your findings
  - Characteristics of study subjects
  - Findings in order listed in methods
  - General to specific
- Use past tense
- Results confirm or reject your hypothesis: they do not prove anything.

Results

- Short and to the point—Main or most important findings first
- Present only data directly relevant to the study—focus
- Don't repeat methods but you may remind the reader briefly how you measured something.
- Allow the data to speak for itself—use tables/figures – construct them first and use as a basis for writing
- In Tables and Figures, be descriptive, specific. Do not repeat the obvious:
  - NO: Results of the kidney lead analysis are shown in Table 1.
  - YES: Kidney lead concentrations increased in group 1 over the first 10 study weeks (Table 1).
- Present absolute numbers and percentages so reviewers can judge the significance of the findings.
- Statistical significance ≠ clinical significance

Results or Data?

Results

Mean translational movements in the X (left to right), Y (back to front) and Z (bottom to top) head directions were 0.10 ± 0.11 mm, 0.16 ± 0.03 mm, and 0.65 ± 0.58 mm, respectively. Mean rotational movements about the three axes were 0.44 ± 0.42 degrees, 0.24 ± 0.26 degrees, and 0.18 ± 0.17 degrees, respectively. Movement was not significantly correlated with age for translation in the X (r = -0.09; p = 0.69), Y (r = 0.21; p = 0.35) or Z (r = -1.02; p = 0.64) directions. Movement was not significantly correlated with age for rotation in the X (r = 0.15; p = 0.51), Y (r = -0.20; p = 0.35) or Z (r = 0.02; p = 0.94) directions.

Results!

VARIABLE	CONTROL	ASD	t(22)	P*
Demographics				
Age, Y	13.1 ± 2.5, range 9-17	14.4 ± 3.3, range 10-18	-1.532	0.34
N	10	7 HFA, 7 AD		
FSIQ	116 ± 10.5	112 ± 15.9	-1.42	0.123
VIQ	114 ± 14.2	104 ± 20.3	-1.53	0.112
PIQ	114 ± 6.3	118 ±13.6	-1.23	0.112
Neuropsychological Results				
EM Accuracy, %	90 ± 11	76 ± 25	-1.625	0.118
EL Accuracy, %	85 ± 12	69 ± 27	-1.768	0.095
EM Response Time, s	2047 ± 272	2531 ±393	3.33	**0.003**
EL Response Time, s	1960 ± 300	2141 ± 363	0.623	0.539
Region of Interest Analysis—Activation				
Amygdala, Vox	9342	2342	3.44	**0.006**
Fusiform Gyrus, Vox	7898	1239	3.58	**0.002**
Prefrontal Cortex, Vox	9098	1122	3.65	**0.003**

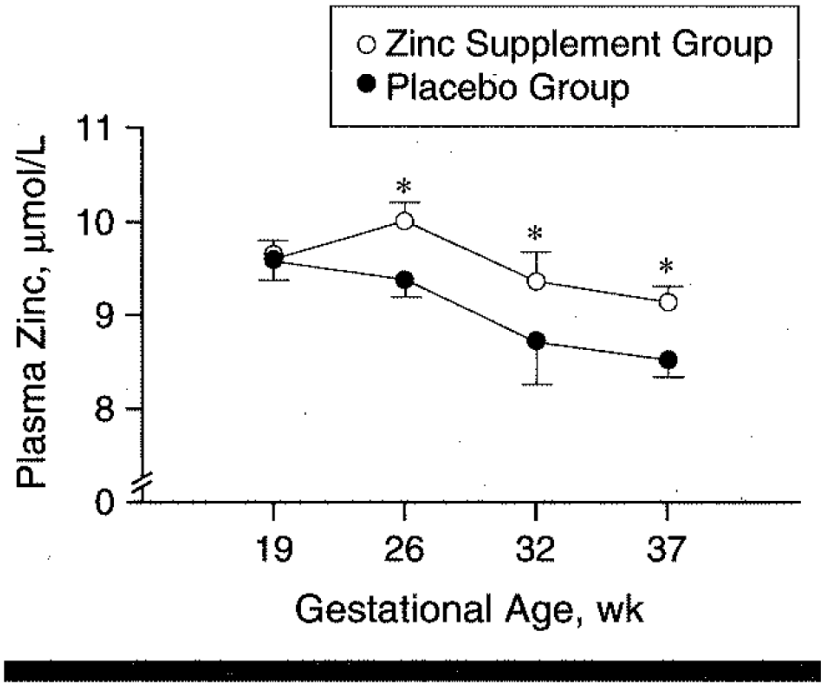
*$p<0.05$ was considered significant

Results—Don't Regurgitate Data

- As shown in Table 1, the mean age of participants was 20.4 ± 2 years, and 80% of patients were Caucasian. Treatment group contained 40 patients, whereas control group contained 45 patients. Table 2 shows the demographics of women in these groups. There were 24 women in the control group, and 33 women in the treatment group...

- There were no significant differences in treatment and control patient intake demographics (Table 1), although a significantly greater number of patients in the treatment group dropped from the study for a variety of reasons, mostly relating to adverse reactions. However, analysis of patients in this group later revealed that those dropped patients had significant disease at intake (Table 2). In comparing the two treatment groups (Figure 1), we found that...

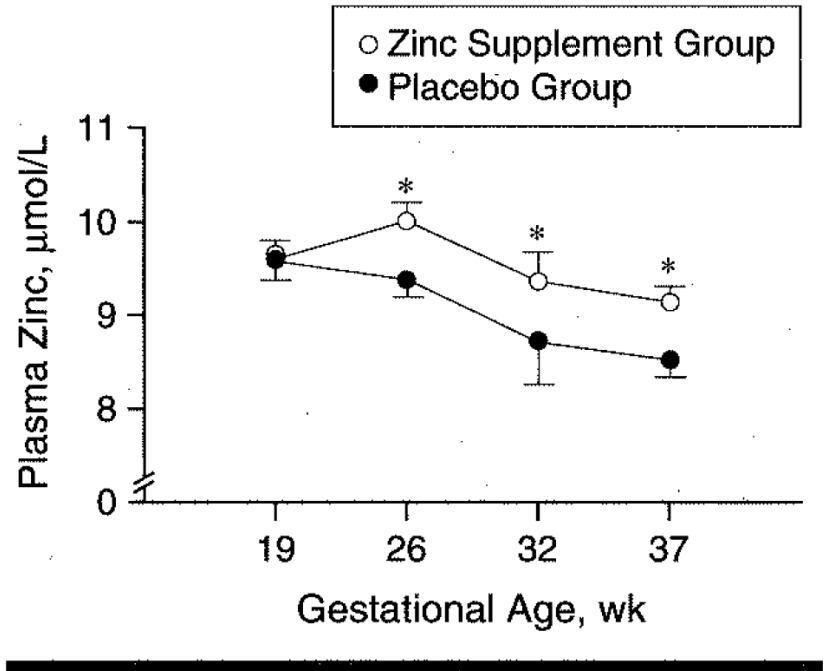
Don’t State the Obvious



Changes in plasma zinc concentrations. Asterisk indicates significant difference between the values of the zinc supplement and placebo groups ($P \leq .05$). Vertical bars indicate SEMs.

Figure 1 is a graph illustrating the plasma zinc levels (µmoL/L) over the 37 weeks versus gestational age in both the zinc supplement group and placebo group. The placebo and the zinc group both decreased over the 37 weeks of the study, but the differences were significant for the zinc group.

State What's Important



Changes in plasma zinc concentrations. Asterisk indicates significant difference between the values of the zinc supplement and placebo groups ($P \leq .05$). Vertical bars indicate SEMs.

We measured mothers' plasma zinc levels before randomization (week 19) and at 26, 32, and 37 weeks' gestational age (Fig 1).

Beginning as early as 26 weeks and at each timepoint, differences in plasma zinc levels between placebo and zinc supplement groups were statistically significant ($P \leq 0.05$) after randomization.

Discussion Construction

- Summarize major findings—1st paragraph
- Explain how your findings relate to those of others—what do they mean?
- Clinical relevance of the findings?
- Limitations and how this influenced your study?
  - How will you overcome these in the next studies?
- Explain the implications of findings
- What future direction(s) will you take?

Discussion: Getting Carried Away

- Few authors:
  - Attempt to overly state or the importance of their findings
  - Come to erroneous or unsupported conclusions
  - Uncritically accept statistical results
- This all distracts from work's importance and signals to the reviewer, about the problems with the research
- Also results in excessive length, a common problem
- Authors should let the data speak for themselves

Discussion—Common Mistakes

1. Unwarranted speculations
2. Injecting divergent issues
3. Conclusions not supported by the data
4. Not suggesting future directions for research

Introduction

- Why did you carry out this research? State the specific purpose or rationale for the study.

- What is the existing state of knowledge of this topic? Synthesize information tracing the development of the problem and summarize its current state…ie, the background. You ask (with citations):
  - What's known?
  - What's unknown?
  - What are the gaps in knowledge this study will fill?

- What are you going to do and what do you expect to find?
  State your hypothesis or question clearly (Objectives, Aims)

- Give only strictly pertinent references.

Introduction

- This is a vital part of your paper—it convinces (or not) the reader whether your study:
  - Has merit and asks important research questions
  - Is focused and supported by relevant recent citations
  - Is ultimately important to human health and human disease

- Reviewers and editors will judge the paper's importance in the introduction.

- You will better focus your introduction AFTER you construct your findings (results) and consider them (discussion).

- Your research question is the most important part—in your discussion, you will address whether the question or hypothesis was answered based on your data.

Introduction Structure

1. What is the general problem or current situation?

   Zinc plays a critical role in many biochemical functions, including nucleic acid metabolism and is critical in early development.

2. What is the specific problem or controversy? Its significance?

   Zinc deficiency is associated with increase metabolic problems in fetuses. Studies evaluating relationship between zinc intake and pregnancy outcomes have produced conflicting results for many reasons…

3. What are our hypotheses/questions, and how will we answer them?

   To clarify the relationship between zinc levels in the mother's diet and pregnancy outcomes, we undertook a randomized placebo-controlled trial of zinc supplementation.

   Our objective was to determine if zinc supplementation was associated with higher birth weight.

   Our findings will help to provide continuing nutritional guidelines in pregnancy.

The Abstract

- 1st Impression to journal editor and the reader!
- Follow the Journal's Guidelines
- Most abstracts are often too long: ≤250 words
- Structure it (outline it)

"*The abstract is the single most important part of a manuscript, yet the most often poorly written*" -JAMA Editor

The Abstract

- First looked at by editors/sometimes only thing read by readers
- Sometimes only part available electronically—KEY words!
- Summarizes the main points succinctly:
  - Background/Significance
  - Objective
  - Study design, methods
  - Primary results
  - Principal conclusions, implications
- Do NOT be vague—be substantive and brief

Abstract

- Emphasize methods, main results, and conclusion
- Introduction/purpose: 2 sentences
- Put objective as imperative style:
  - Objective: To evaluate whether zinc supplementation during pregnancy affects infant birth measures.
- Methods, Results: 2-4 sentences each
- Conclusion: 1-2 sentences

Structured Abstract

Context—Summarize the study rationale and provide clinical (or other) reason for the study question.

Objective—State the purpose or question asked. If more than one objective, state primary objective and key secondary objectives.

Design—Describe basic design, including relevant details.

Setting—General community, primary care, hospital, etc.

Patient or other **population**—describe demographics, disorders, inclusion/exclusion criteria, etc.

Interventions—name, dose, dosage

Main outcome **measure(s)**

Results

Conclusions

Tables & Figures

Tables and Figures

- **Critical** to a paper—Editors and readers look at these before reading the paper!
- Editors judge your paper on how well these are constructed
- Stand alone and tell a complete story
- Unambiguous—immediately clear
- Eliminate numerical data and long explanations in text
- Figures display important trends, procedures, simplify detailed data, and show basic methodologies.

Tables

During the encoding task, significant activation clusters were detected in the left middle frontal gyrus (MFG) extending into the inferior frontal gyrus (IFG) (BA 9/45/47; Talaraich coordinates: −40, 14, 28), left MFG (BA 8; −40, 22, 50), left superior frontal gyrus (BA 6; −24, −8, 64), right IFG (BA 47; 28, 28, −2), left LTL (BA 22; −62, −22, 2), right cerebellum (30, −70, −16) together with right fusiform/lingual gyrus (BA 18; 18, −88, −14), left cerebellum/vermis (−6, −60, −16) (Fig. 1, top row) as well as the left (−30, −12, −18) and right hippocampus (34, −12, −16) (Fig. 2, left panel). During the retrieval task, when performance was not considered, significant activation clusters were detected in the left IFG (BA 47; −28, 24, −4), left MFG/IFG extending into the anterior cingulate cortex (BA 9/44/24; −36, 12, 28), right IFG (BA 44; 56, 16, 24 and BA 47; 36, 20, −10), left supramarginal gyrus (BA 40; −34, −46, 42), right putamen and caudate (16, 10, 2), right cerebellum (36, −74, −18) together with right fusiform/lingual gyrus (BA 18; 28, −90, −6) and vermis (−2, −62, −40) (Fig. 1, middle row) as well as the right hippocampus (26, −4, 22) (Fig. 2, right panel). During retrieval, brain activation related to accurate memory performance was observed in the left LTL (Fig. 1, bottom row), with peak activation in the middle temporal gyrus (BA 21 and 22; −50, −38, −4) extending into the superior and inferior temporal gyri. No activation clusters were detected in the prefrontal cortex, hippocampus, or other MTL structures. No brain regions showed negative correlations with behavioral performance.

This requires a table!

Tables

This result does NOT require a table!

Table 1. Effect of aeration on growth of *Streptomyces coelicolor*

Temp (°C)	No. of expt	Aeration of growth medium	Growth[a]
24	5	+[b]	78
24	5	–	0

[a] As determined by optical density (Klett units).
[b] Symbols: +, 500-ml Erlenmeyer flasks were aerated by having a graduate student blow into the bottles for 15 min out of each hour; –, identical test conditions, except that the aeration was provided by an elderly professor.

Growth medium aeration was essential for the growth of S. coelicolor. At room temperature (24°C), no growth was measurable in stationary cultures, whereas in aerated cultures, we measured substantial growth (78 Klett units).

Tables & Result

Table 2.—Selected Pregnancy Outcomes and Neonatal Measurements in the Zinc Supplement and Placebo Subgroups by Body Mass Index (BMI) Categories

	BMI ≥26			BMI <26		
	Zinc Supplement (n=155)	Placebo (n=145)	*P*	Zinc Supplement (n=134)	Placebo (n=134)	*P*
Maternal Characteristics						
Age, y	24.8	24.2	.32	22.9	21.2	.01
BMI, kg/m²	33.4	33.0	.64	22.3	22.2	.57
Current smoker, %	7.7	5.5	.44	3.0	3.0	.98
Pregnancy Outcome						
Birth weight, g	3240	3241	.99	3190	2942	.005
Gestational age, wk	39.0	38.7	.47	38.6	37.9	.08
Preterm birth <32 wk, %	3.2	5.5	.33	3.0	6.8	.15
Birth weight <1500 g, %	3.9	3.5	.84	2.3	6.0	.12
Anthropometric Measurements						
Crown-heel length, cm	50.2	49.8	.41	50.3	49.7	.20
Head circumference, cm	34.3	34.0	.50	34.1	33.4	.005
Abdominal circumference, cm	33.3	33.1	.64	32.8	32.6	.58
Arm length, cm	9.9	9.7	.27	9.9	9.6	.03
Subscapular skinfold, mm	4.2	3.9	.05	3.9	3.6	.06
Neonatal Outcome						
Neonatal hospital stay, d	3.9	4.5	.47	3.1	4.9	.10
Neonatal sepsis, %	0.7	1.4	.52	0	2.2	.08

In women with BMI <26 kg/m^2, zinc supplementation was associated with a significant increase in birth weight of 248 g *(P=0.005), an increase in head circumference of 0.7 cm (P=0.005), and increase in arm length of 0.3 cm (P=0.03). The other outcome measures all favored the zinc supplement group but the differences were not statistically significant (Table 2).*

Table & Result

Table 3.—The Effect of Maternal Zinc Supplementation on Birth Weight by Body Mass Index (BMI) Categories

BMI Category, kg/m²	Zinc Supplement Group		Placebo Group		Difference	
	No.	Birth Weight, g	No.	Birth Weight, g	Birth Weight, g	*P*
<19.8	20	2997	23	2572	425	.11
19.8-26.0	116	3224	109	3038	186	.04
26.1-29.0	46	3279	37	3227	52	.74
>29.0	108	3223	108	3267	−44	.60

Table 3 shows the mean birth weight by the BMI categories recommended by the NIH Institute of Medicine. The lower the BMI, the greater the effect of zinc supplementation on birth weight.

The Title

- First reviewed by Journal Editors before abstract
- Short
- Specific, Relevant, Descriptive
- Write last—your findings and conclusions may alter your title

Title: Ask Yourself

- What is the single most important point of this study?
- How would I tell my colleague, in one short descriptive sentence:

  what's this study about?

- A descriptive, specific title perfectly framing your study will be apparent only after you've written the paper and abstract.
  - Start with a short descriptive *working* title

Writing Style
Accuracy & Clarity

- Proper words in proper places make the true definition of style. --Jonathan Swift
- Have something to say and say it as clearly as you can… the essence of style. --Matthew Arnold
- If writing is unclear, readers and reviewers won't understand
- Avoid vague language
- Multiple mistakes in spelling and syntax, suggests similar sloppiness in the project
- Check and double check data

Writing Style
Accuracy & Clarity

- Use active voice whenever possible

Active voice: the subject is performing the verb

Passive voice: the subject receives the action expressed in the verb

Passive (more wordy) Active (more concise)

For eg.,

- ***There are*** **treatment guidelines for carcinoma *that were* reported by Khalid, et al.**
- *Correction:* **Treatment guidelines for carcinoma were reported by Khalid, et al.**

- *Better:* **Khalid, et al. reported treatment guidelines for carcinoma.** ***(Active voice)***

Writing Style
Accuracy & Clarity

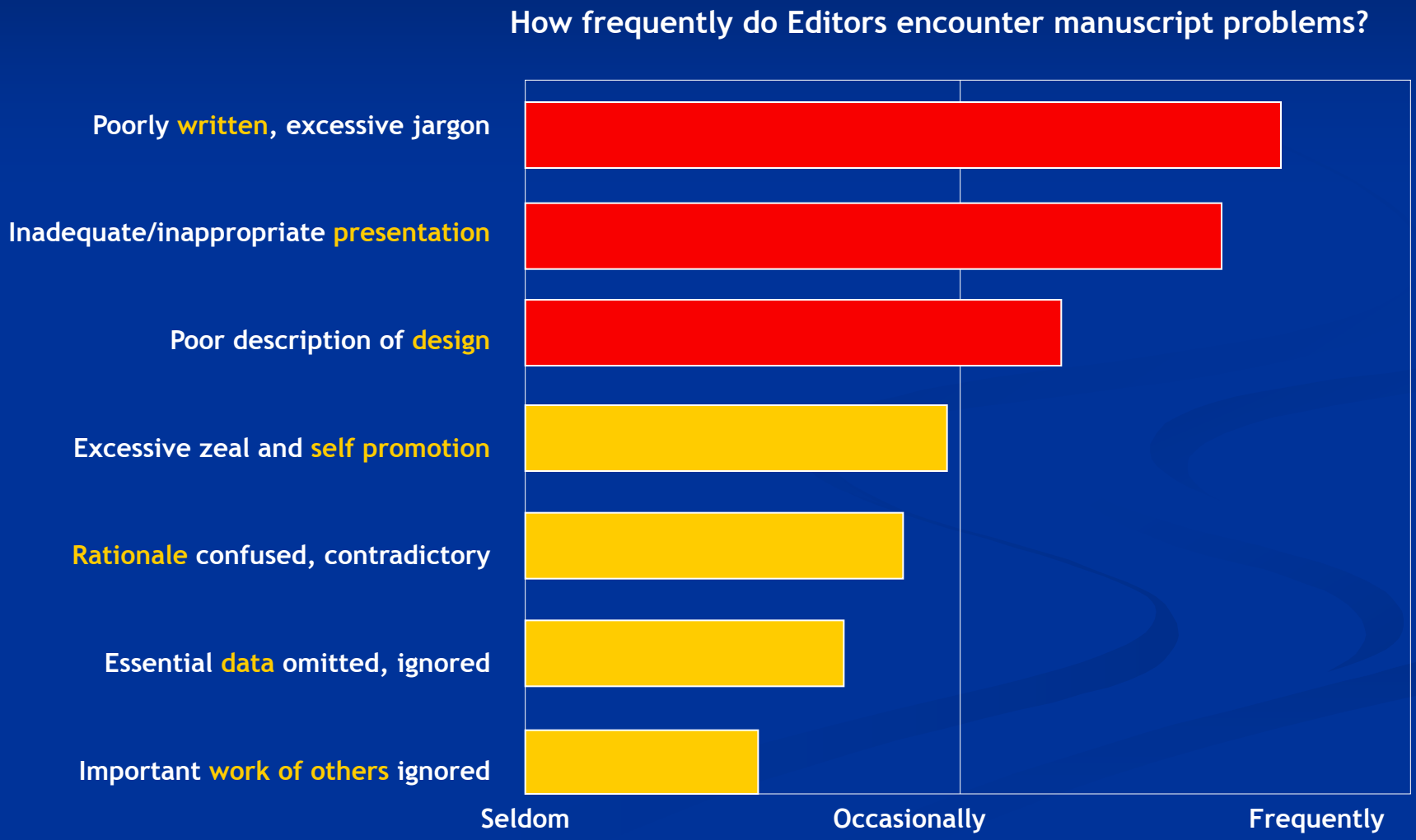
- All first drafts have too many words
- Next drafts: prune vigorously, avoid repetition, wordiness, long sentences, excessive adverbs/adjectives
- Strip every sentence
- Writing improves in proportion to deletion of unnecessary words
- When you have the choice of two words, use the simpler one
- The most valuable of all talents is that of never using two words when one will do. -- Thomas Jefferson

Simplify

- a majority of = most
- a considerable amount of = much
- a number of = several/some
- on account of = because
- referred to as = called
- has the capacity to = can
- it is clear that = clearly
- at the present time = now
- give rise to = cause
- is defined as = is
- subsequent to = after

"Those who have the most to say usually say it with the fewest words"

Problems of Manuscript



Byrne DW, Publishing Medical Research Papers, Williams and Wilkins, 1998

Top 10 Avoidable Reasons Manuscripts Rejected

1. Wrong journal, format, preparation
2. Disorganized study design
3. Defective tables, figures
4. Poor organization throughout, writing, spelling
5. No hypothesis or problem statement
6. No or insufficient conclusion
7. Overinterpretation of results
8. Article unfocused, too verbose and long
9. Inappropriate statistical methods; methods not sufficient to repeat study
10. Poorly written abstract/title

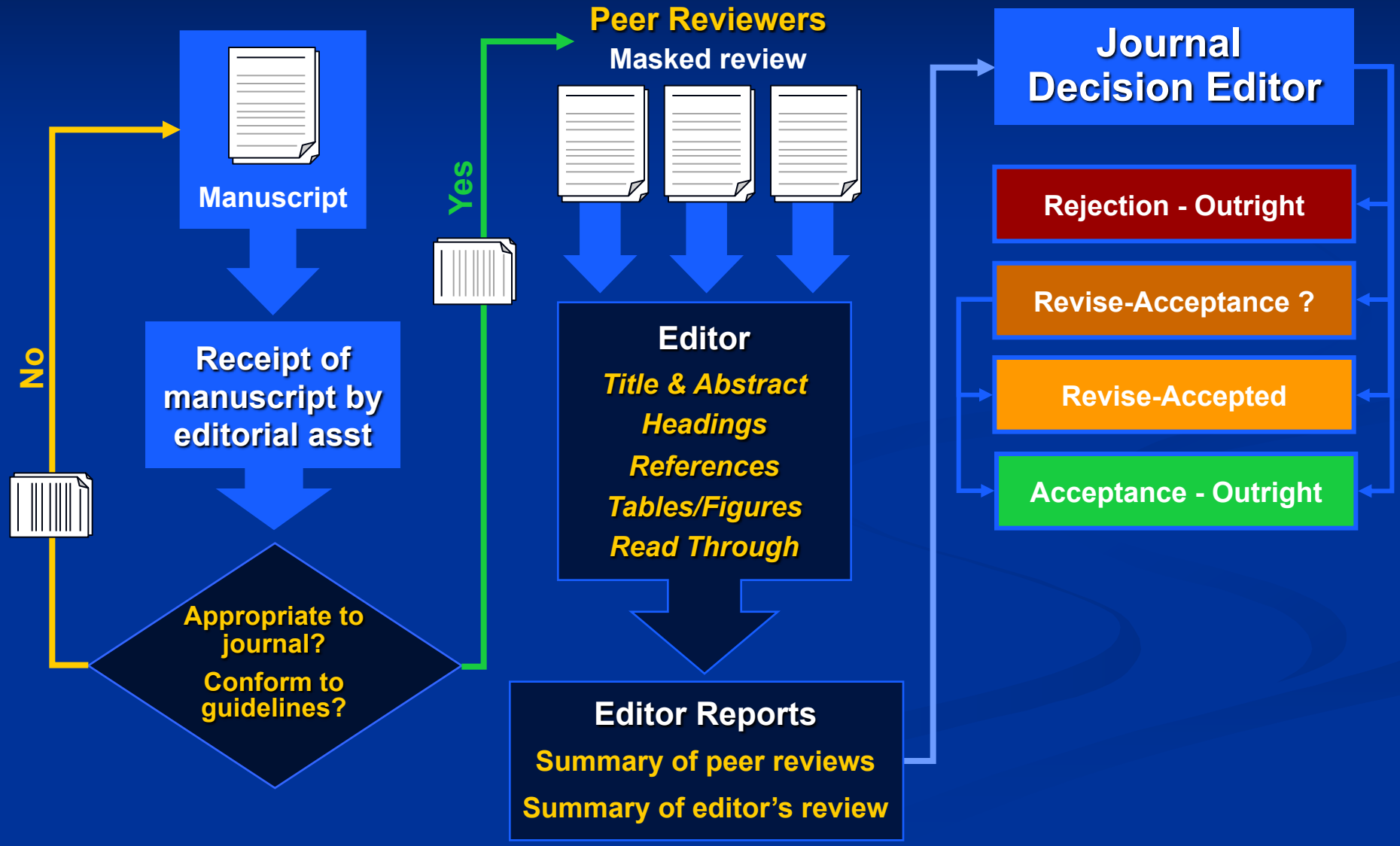
Pierson DJ, Respiratory Care 49(10), 2004

Byrne DW, Publishing Medical Research Papers, Williams and Wilkins, 1998

The Research article

- Writing and editing the article is the last step in the research process
- The article tells the story from study inception, through data collection, statistical analysis, findings and discussion
- The process of writing the article should be analogous to the research process—it requires attention to detail, time, and revision

Manuscript Reviews




Thank You!