The art (and joy!) of scientific writing

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Hurdles to overcome in the dissemination of your study results

TRIAGE

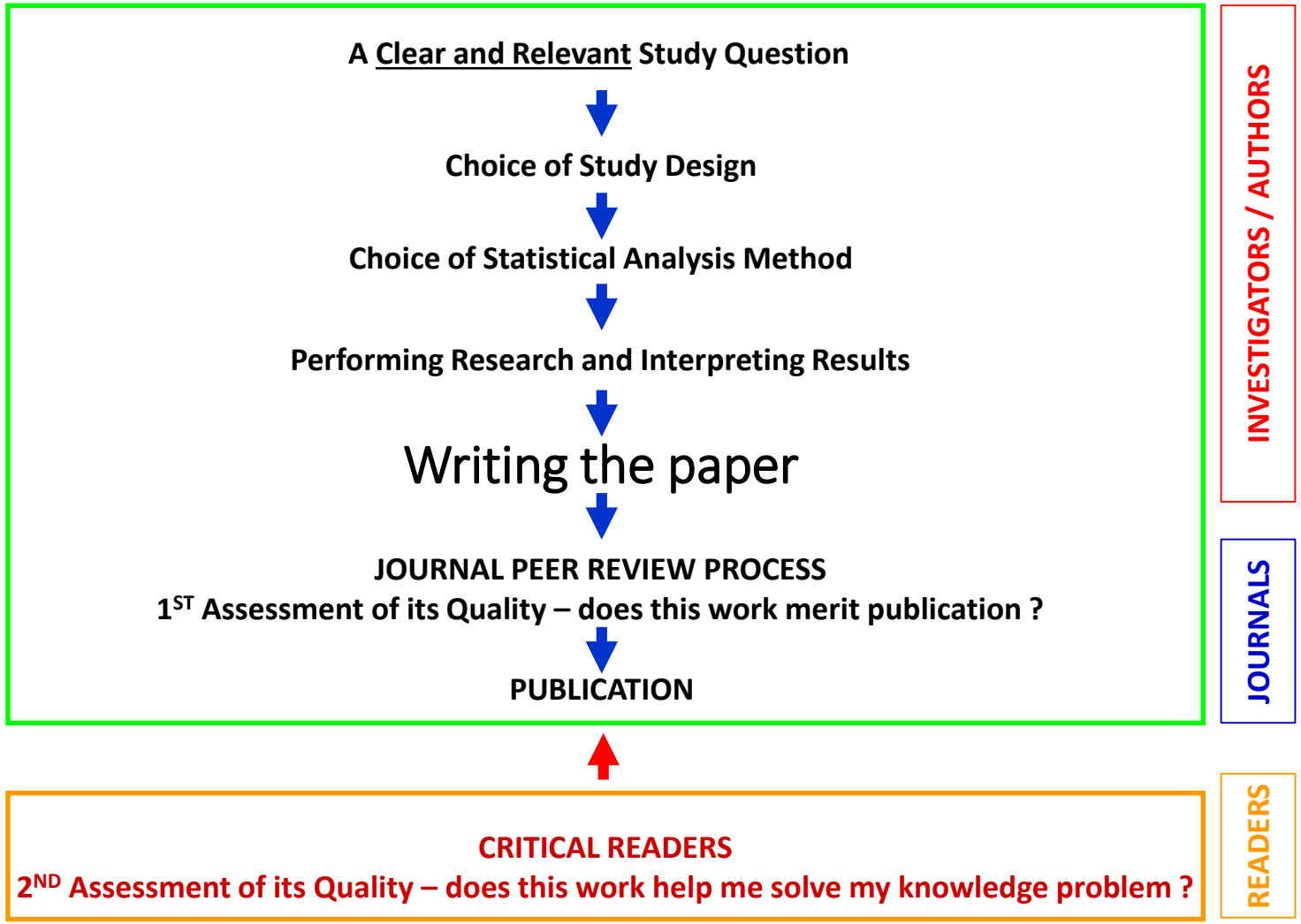
“I receive about 15 articles per day. Most of them I reject within 3 minutes. The main reason for rejecting them is that I do not see the point of the research.”

Edwin Gale (Former Chief Editor of Diabetologia)

“There is no form of prose more difficult to understand and more tedious to read than the average scientific paper.”

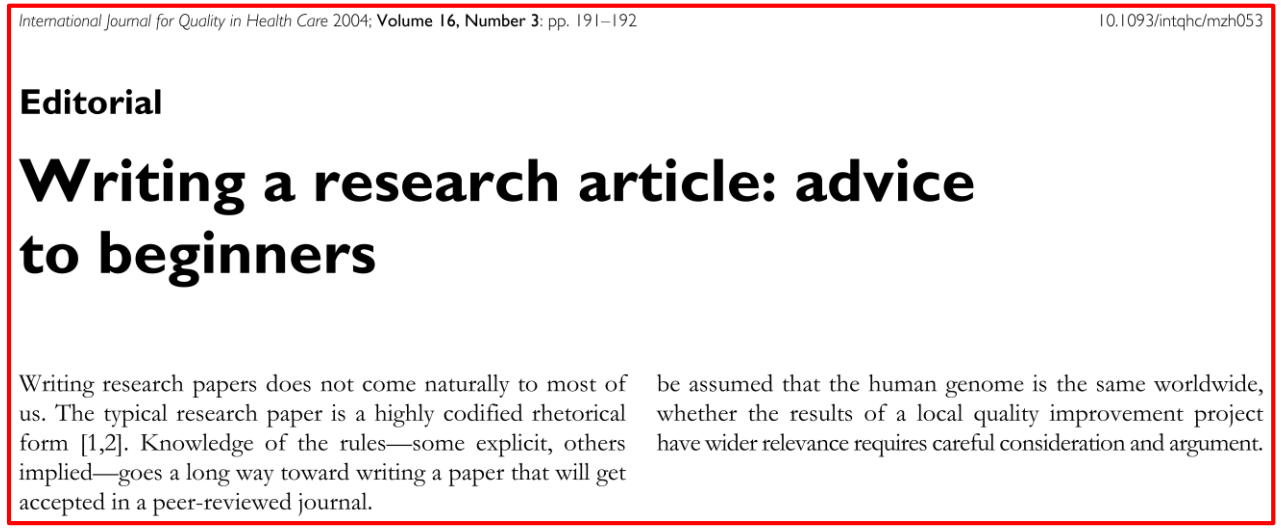
Frances Crick (scientist, reviewer and reader)

Research and Scientific Literature advance Medicine



Author skills

- Quality of oral presentations will partly depend on your natural talent as a speaker
- Scientific writing can be learned by applying relatively simple principles



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Editorial

Writing a research article: advice to beginners

Writing research papers does not come naturally to most of us. The typical research paper is a highly codified rhetorical form [1,2]. Knowledge of the rules—some explicit, others implied—goes a long way toward writing a paper that will get accepted in a peer-reviewed journal.

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- Practice makes perfect!

Phrasing a Research Question

- A good paper addresses **one** specific research question
  - expressing precisely what the study covers
  - everything is organized around that question

- PICO format
  - **P** Population
  - **I** Intervention
  - **C** Comparison
  - **O** Outcome

Example
In critically ill adults with severe acute kidney injury (P)
Does *delayed* kidney replacement therapy initiation (I)
Versus *early* kidney replacement therapy initiation (C)
Increase 28-day survival (O)?

Phrasing a research question

While phrasing a research question, you may think already about the possible study conclusion – in which you may use the PICO elements again.

Research question
In critically ill adults with severe acute kidney injury (P) does delayed (I) versus early (C) kidney replacement therapy initiation increase 28-day survival (O)?

(Hypothetical) Conclusion
Critically ill adults with severe acute kidney injury (P) starting kidney replacement therapy later (I) had a better 28-day survival (O) compared with those starting kidney replacement therapy early (C).

Phrasing a Research Question

- Some secondary related (sub)questions are allowed

- Key attributes of research questions
  - Specific
  - Original / novel
  - Generally relevant to broad scientific community
  - Precise
  - Sometimes expressed in terms of possible association between X and Y in population Z
  - Should extend previous knowledge and be of interest to colleagues in the same area

Important points in scientific writing

- Lay-out
- Structure
- Content
- Language
- Length

Some papers are difficult to read…

The more difficult to read the lower the chances of acceptance by a journal …

Writing a research article: advice to beginners

Writing research papers does not come naturally to most of us. The typical research paper is a highly codified rhetorical form [1,2]. Knowledge of the rules—some explicit, others implied—goes a long way toward writing a paper that will get accepted in a peer-reviewed journal. Primacy of the research question A good research paper addresses a specific research question. The research question—or study objective or main research hypothesis—is the central organizing principle of the paper. Whatever relates to the research question belongs in the paper; the rest doesn't. This is perhaps obvious when the paper reports on a well planned research project. However, in applied domains such as quality improvement, some papers are written based on projects that were undertaken for operational reasons, and not with the primary aim of producing new knowledge. In such cases, authors should define the main research question a posteriori and design the paper around it. Generally, only one main research question should be addressed in a paper (secondary but related questions are allowed). If a project allows you to explore several distinct research questions, write several papers. For instance, if you measured the impact of obtaining written consent on patient satisfaction at a specialized clinic using a newly developed questionnaire, you may want to write one paper on the questionnaire development and validation, and another on the impact of the intervention. The idea is not to split results into 'least publishable units', a practice that is rightly decried, but rather into 'optimally publishable units'. What is a good research question? The key attributes are: (i) specificity; (ii) originality or novelty; and (iii) general relevance to a broad scientific community. The research question should be precise and not merely identify a general area of inquiry. It can often (but not always) be expressed in terms of a possible association between X and Y in a population Z, for example 'we examined whether providing patients about to be discharged from the hospital with written information about their medications would improve their compliance with the treatment 1 month later'. A study does not necessarily have to break completely new ground, but it should extend previous knowledge in a useful way, or alternatively refute existing knowledge. Finally, the question should be of interest to others who work in the same scientific area. The latter requirement is more challenging for those who work in applied science than for basic scientists. While it may safely be assumed that the human genome is the same worldwide, whether the results of a local quality improvement project have wider relevance requires careful consideration and argument. Structure of the paper Once the research question is clearly defined, writing the paper becomes considerably easier. The paper will ask the question, then answer it. The key to successful scientific writing is getting the structure of the paper right. The basic structure of a typical research paper is the sequence of Introduction, Methods, Results, and Discussion (sometimes abbreviated as IMRAD). Each section addresses a different objective. The authors state: (i) the problem they intend to address—in other terms, the research question—in the Introduction; (ii) what they did to answer the question in the Methods section; (iii) what they observed in

Lay-out

No structure

No paragraphs

Structure of a paper

IMRAD

Introduction	***describes the problem*** *the authors intend to address and what* ***research question*** *they would like to answer*
Methods	*what the authors* ***did*** *to answer that question*
Results	*what they* ***observed***
and	
Discussion	*what they* ***think*** *the results mean*

Note: Abstract usually follows the same structure

A clear structure is needed in the entire text, in each section and in each paragraph

Each paragraph should deal with only one topic and have a specific purpose

Introduction

Should have a clear line of reasoning!

State the **problem** you would like to address and why it is important

State the **gap of knowledge**: what question is still unanswered and what should thus be investigated

State the **objectives** of your study **or the research question**

Simple kidney epidemiology example

CKD is global health problem
High medical / cost burden
Numbers of patients on KRT worldwide reported by renal registries

From countries/regions X and Y such numbers have been reported
But at a global level for some countries they are lacking

Paper aims to investigate the incidence, prevalence and survival of patients treated by KRT for ESKD in country Z

Methods

Should provide sufficient detail for others to reproduce the study

Specific, concrete, technical and fairly detailed:

- Context, setting and study design
- Population
  - Patients, doctors, hospitals
  - Sampling strategy (inclusion & exclusion criteria; time of inclusion)
- Ethical committee approval for the study and information about informed consent
- Intervention (if applicable)
- Main study variables: demographics, clinical & lab data (any definitions / classifications)
- Data collection instruments and procedures
- Analysis methods and strategies (e.g. descriptive and analytical)

Results

Logical order - straightforward – only FACTS

Usually you have more data than you can publish – try to be selective

- Describe
  - Data collection and recruitment (how many did you include - response rates etc)
  - Population – details in table 1 (demographics, clinical condition (numbers and percentages))
  - Key findings with respect to central study question - table / figure
  - Secondary findings (secondary outcomes, subgroup analyses (preferably only those planned)) - table / figure
  - Sensitivity analyses - text
- Every table/figure should be referred to in text
- In that text don't fully repeat all data from the tables/figures, but only the most striking features – the text should be clear on its own without tables/figures
- Avoid too many tables/figures and non-essential results – check the guidelines for authors
- **<u>No</u> opinions, <u>no</u> interpretations, <u>no</u> conclusions!**

Tables

Table 1. Demographic and disease-related characteristics of respondents per GDP tertile

	All respondents $n = 7820$	Lower GDP tertile[a] $n = 3399$	Middle GDP tertile[a] $n = 2060$	Higher GDP tertile[a] $n = 2361$	P-value[b]
Male sex (%)	55.7	53.8	56.7	57.7	0.009
Age, mean (SD), years	59.2 (14.0)	58.7 (14.3)	58.0 (13.6)	60.9 (13.8)	<0.001
Marital status, % married	60.7	62.1	58.2	60.8	0.018
Educational level, % with vocational or higher education	59.2	52.7	57.2	70.0	<0.001

- Clear and concise title
- Table with title should be clear without reading the text
- Numbers as well as percentages
- No need to present two categories when categories are mutually exclusive

	rhIL-11 (n=20)	Placebo (n=20)
Sex		
Men	15 (75%)	15 (75%)
Women	5 (25%)	5 (25%)

Tables

- Use footnotes where necessary

[a]For the categorization of countries per GDP category, see Supplementary data, Figure S2.
[b]P-values calculated with Chi-square tests and Kruskall–Wallis tests to compare GDP tertiles on categorical and continuous outcomes.
LTX, living donor kidney transplantation; DTX, deceased donor kidney transplantation.

- Clean lay-out – **no copy paste** from output statistical software

Figures

Breakdowns from numbers screened to numbers of patients analysed are useful

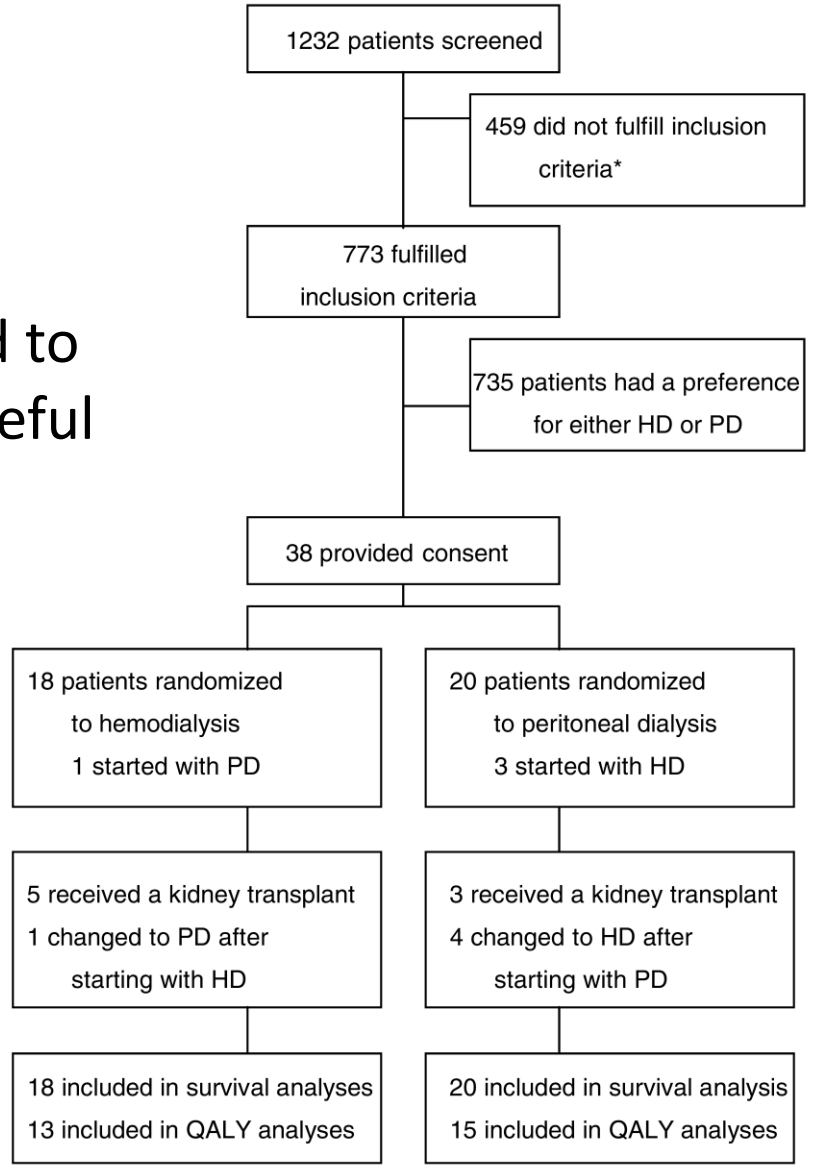
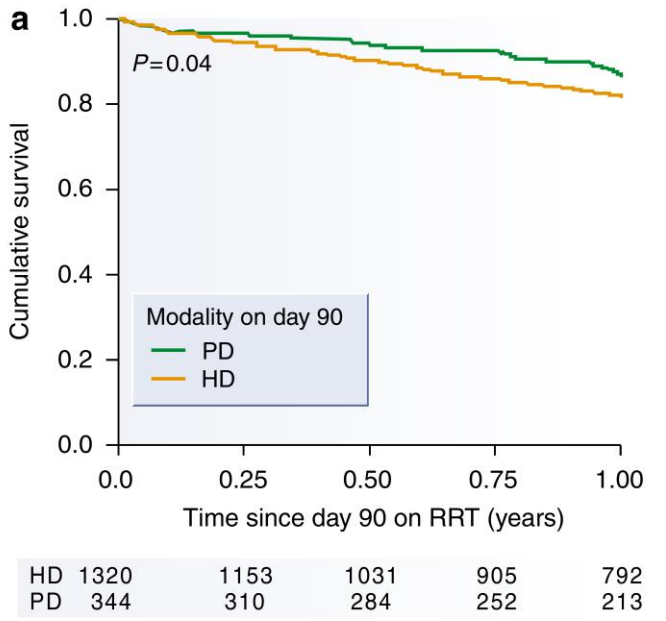
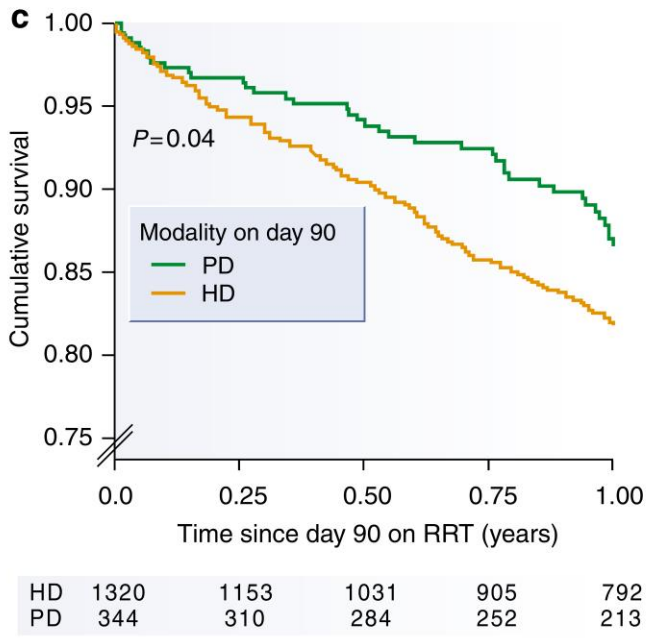


Fig. 1. Trial profile. Abbreviations are: HD, hemodialysis; PD, peritoneal dialysis; QALY, quality-adjusted life years. *These patients had a medical, social, or logistic objection against either hemodialysis or peritoneal dialysis.

Figures

- Put labels on each axis
- In survival plots present numbers at risk at regular timepoints
- Present the **full** scale for proportion of survival – always start at zero; axes with higher cut-offs will exaggerate any differences
- Extend plots only through a maximum period of follow-up that is achieved by a reasonable proportion (10–20%) of participants





Jager KJ et al. Kidney Int 2008;74:560-5

Discussion

- Commonly used structure
  - State the main findings of your study
  - Analyse the study's strengths and limitations (random error, bias, confounding)
  - Discuss main results with reference to previous research (novelty vs 'confirmation')
  - Interpretation of the findings / mechanism
  - Discuss clinical relevance and practice and policy implications
  - Conclusion & implication (& sometimes including directions for future research)
- In paragraphs use
  - First sentence to indicate what it is about;
  - Last sentence to give its message
  - Preferably to form bridge to next paragraph
- Avoid bold statements & avoid being overcautious
- Try to limit to 4 pages maximum; double spaced

The other parts ….

Title

- Easy-to-understand and as short as possible
- Should report the subject of the research – not the results - and should raise an interest
- Follow the style preference of the target journal

Authorship

- Avoid gift authorships!

International Committee of Medical Journal Editors (ICMJE) criteria for authorship

- Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
- Drafting the work or revising it critically for important intellectual content; AND
- Final approval of the version to be published; AND
- Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

The other parts ….

Acknowledgements

- Enable colleagues to be thanked for work done if they don’t qualify for authorship

References

- Different systems for lay-out – check journal guidelines for authors which one is required
- Where readers can find more/relevant information
- Check journal guidelines for conference proceedings/abstracts/personal communications
- Never cite a paper you have not read yourself – may lead to awkward mistakes ☺

Non-native English speakers

- Do not rewrite for ever
  - Final version may be worse than the third
  - Put the before-last draft away for some days and then look at it with fresh eyes

- Don’t write in your native language (unless English of course ☺)
  - At some point you will discover the advantages of using English right away

- Show the draft to colleagues and consult a native English speaker, if possible

Common mistakes (1)

- Introduction is an extensive review of the literature
- Research question is not (sufficiently) specified
- Stated aim of the paper is:
  - tautological (e.g. ‘The aim of this paper is to describe what we did’) or
  - vague (e.g. ‘We explored issues related to X’)
- Methods, interventions and instruments are not described in sufficient detail
- Results are reported selectively (e.g. % without frequencies, *P*-values without measures of effect)
- Text repeats (almost) all results presented in a table
- Detailed tables are provided for results that do not relate to the main research question

Common mistakes (2)

- Discussion overstates the implications of the results and does not acknowledge the limitations of the study
- Discussion does not provide an answer to the research question
- In Introduction and Discussion, key arguments are not backed up by appropriate references
- Structure of the paper is chaotic (e.g. methods are described in the Results section)
- References are out of date or cannot be accessed by most readers
- Manuscript does not follow the journal's instructions for authors
- Paper much exceeds the maximum number of words allowed
- Paper is written in poor English

Different strategies for the writing process

Steps	Strategy 1	Strategy 2	Strategy 3	Strategy 4
	MAKE SURE BEFOREHAND THAT YOUR RESEARCH QUESTION IS CRYSTAL CLEAR AND COVERING A GAP OF KNOWLEDGE			
1	Start making an outline	Search a matching article that you consider well written as an example	Start preparing tables and discuss these in depth with your supervisors	In case of writer's block simply start writing what it is you would like to say. No punctuation and including typos
2	Look for references	Perhaps from the same journal	Write the methods section while doing the analyses	Split the thinking from the writing
3	Write each paragraph one by one		Introduction	Bring in the structure (one message per paragraph) and nice sentences only later on
4	Discuss early stages with colleagues / supervisor		Discussion	

Some final remarks

- Check if journal requires the use of reporting standards (STROBE, CONSORT etc)
- Avoid plagiarism – always rephrase and always provide references

References

Papers on scientific writing

- Perneger TV and Hudelson PM. Writing a research article: advice to beginners. International Journal for Quality in Health Care 2004;16:191–192
- Sharp D. Kipling's guide to writing a scientific paper. CMJ 2002;43:262-267

THANK YOU FOR YOUR ATTENTION