The trouble with research writing and what we can do about it

Valerie Matarese

www.uptoit.org
Research publishing landscape

Research article – important scholarly genre
  Status, career and funding decisions
  Intellectual responsibility
  Long-lasting public record

Research output
  3 million articles in ~40,000 journals
  +3% annually (recently +6%)
  ~7-9 million researchers and growing

Publishers’ responses
  A “crush of manuscripts” to be processed
  More journals
  Bigger journals

Source: STM Report 2018
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Source: STM Report 2018
Internationalization of the researcher—author

Globalization encourages
Researcher mobility for training
International collaborations for better research

Research teams are multicultural, multilingual
50% of US postdocs are foreign born

Global output of science and engineering papers
Anglophone countries <30% (USA 17.8%)
China 18.6% (+8% annually)

Research is now predominantly done and reported by scholars who use English as an additional language

Sources: STM Report 2018; National Science Board S&E Indicators 2018
Internationalization of academic English

Minority of research articles written by native English speakers
Decline in standard academic English

Writing
Influenced by other languages, writing cultures
--> Linguistic interference
Modeled on published texts → self-perpetuating problem

Journal editors, reviewers also use English as an additional language
Tolerance of linguistic variation if “intelligible”
Standard academic English no longer required

a new English is emerging
Internationalization of academic English

English for research publication purposes

- Convergence of writing by native and non-native speakers
- Standardized style within broad disciplines
- Awkward, no longer wrong
- Lower readability, risk of ambiguity
- May defy comprehension, undermine reproducibility
English “for research” examples

Non-standard paragraphing
  Too short (1-2 sentences)
  Too long (entire section)
  Confusion of topic sentence and headings

Capitalization
  Too much: generic scientific terminology
    Rituximab, Bromopyruvate, Pharmacovigilance
  Too little: proper names
    swedish, english, Department of public health
English “for research” examples

Evolution in meaning

proliferate (grow)
  “resting and proliferating cells”

post (after)
  patient had fever and rash at 24 h post injection (p.i.)
  NSAIDs are used to relieve joint pain during and post-exercise
  Biopsies were collected before, during and post intervention
Evolution in meaning

risk (harm)

"The potential risk of radiation exposure from CT cannot be reasonably estimated." (PLoS One)

fold change (ratio)

If A changes to B, fold change = (B-A)/A
In bioinformatics, fold change = B/A
English “for research”
examples

Comparisons

Between A and B
A is greater than B
A is greater when compared with B
A is greater as compared to B
A is increased as compared to B

"The response in cases was increased as compared to controls."

No comparison intended
A is high
A is greater

"Pulmonary mycetoma is more frequent in AIDS patients."
English “for research” examples

Shortenings of multiword expressions

cancer-related genes
hormone receptor-positive breast cancer
contrast medium administration
5% non-fat dry milk
nicotinic acetylcholine receptor

X-ray attenuation depends on a tissue’s effective atomic number (Z).
Scholarly writing is inherently difficult

Learned skill acquired via training (mentoring, courses)

Researchers not all fortunate to have training
- Learn by doing, mimic articles in target journals
- Spectrum of writing skills, irrespective of scientific ability

Novice writers
- Produce text that reflects their thinking
- Do not satisfy readers’ needs for information
  --> Called “writer-based writing”

Skilled writers
- First draft may be writer-based
- Successive drafts take into account readers’ needs
  --> Produce “reader-friendly writing”
Difficulties with academic rhetoric

Research article has persuasive elements (arguments)

Rhetorical argument

Set of premises that lead to a conclusion
Based on ancient Greek philosophy
Ingrained in Western society
Less familiar to Eastern cultures

Radiation can cause cancer.
Whole-body CT delivers a 15 mSv dose of radiation.
Therefore, whole-body CT can cause cancer.
Difficulties with academic rhetoric

Rhetorical statements are claims about knowledge
- Appropriate strength of verbs, e.g. indicate vs. suggest
- Correct modal verb, e.g. *can, may, will cause cancer*
- Difficult for non-native English speakers

Rhetorical errors (fallacies)
- Due to poor writing, e.g. non-sequitur (missing premise)

- **All proteins denature upon heating.**
- Therefore, **hemoglobin will denature upon heating.**

Due to poor reasoning:
- Circular reasoning
- False dichotomy
- Faulty generalization
Deficits adhering to the research article genre

Adhering to genre = organizing text according to expectations

Research article genre

Four sections (IMRaD), subsections with headings
Study aim, ethical research practices, display elements . . .
Citation, detail in methods, numerical precision . . .

Researchers learn genre by

Mentoring, coauthoring
*Good* example articles, journals’ instructions to authors
Reporting guidelines

*But!* Disciplinary variations, sometimes conflicting advice, not all articles are good examples
Superficial methods

Greater complexity of research --> minimal Methods sections

End of article (IRD - M)
Small font
Only online

Superficial methods hinder reproducibility

Journals are implementing change
Researchers resist detailed methods
Paradoxical adherence to genre = inadequate scientific reporting
Borrowing knowledge and citing sources

Research articles integrate new data into the knowledge base
   --> Synthesize new knowledge

Skills needed:
   Search for literature, critical appraisal
   Select authoritative sources
   Paraphrase borrowed knowledge
      Know when and how to use direct quotation
   Attribute borrowed information to the source by citation
   Write text to accompany citations
      --> Inform readers of purpose
Borrowing knowledge and citing sources

Many published articles have deficits

Common errors

  Unsubstantiated claims: statements of fact without citations
  Inadequate references:
    Lack expected evidence
    Secondary sources of evidence (cumulative error)
  References when none expected or for unclear reasons
  Borrowed claims are copied, not paraphrased (microplagiarism)
Confounding factors of current times

Difficulty getting collegiate feedback on manuscripts
  Hyperspecialization of science
    -- Few colleagues can give feedback
  Mentors lack time, may lack skills to help collaborators of different cultural linguistic backgrounds
  Hence feedback may only be from peer reviewers

Less support from most journals and publishers
  Journal editors not interested, skilled in language issues
  Reviewers score writing acceptability "yes" or "no"
  Publishers have eliminated copyediting
  Hence manuscripts with errors are published
    -- Serve as bad models
Bad textual mentors: a vicious circle

1. Internationalization of researchers has led to:
   English “for research” – awkward, ambiguous

2. Research writing is difficult:
   Inherently (rhetoric, genre, citation)
   Increasingly (complexity, multiculturalism, guidelines)

3. Researchers struggle to make **reader-friendly** writing

4. Journals tolerate non-standard English if “intelligible”
   Publish articles with infelicities and errors

5. Abundance of awkward articles
   Model for other authors who mimic them
   “Bad textual mentors”
Researchers

Research

Writing

Reviewing

Reading

Replicating

Research reports

Manuscripts

peer review

Published articles
Research

- Writing
- Reviewing
- Reading
- Replicating
- Teaching
- Mentoring
- Caring for patients...

Research reports

- Manuscripts (awkward)
- Published articles

Lost time

Less time
Researchers

Research
Writing
Reviewing
Reading
Replicating
Teaching
Mentoring
Caring for patients ...

Research reports

Manuscripts (awkward)
Published articles (mediocre)

R&R

Policy (science & health)
Public trust in science

Lost time
Less time
Waste
Harm
“Uniform Requirements for Manuscripts Submitted to Biomedical Journals”

International Committee of Medical Journal Editors
Formatting an IMRaD research article
First issued 1979
Regularly revised and expanded
Now: “Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals”

Since 1990s, efforts to standardize the reporting of different types of studies: “reporting guidelines”
Solutions from academia, 2

First reporting guideline, 1996
  Consolidated Standards for Reporting Trials (CONSORT statement)
  Randomized controlled trials
  Checklist of items to include in different parts of article
  Positive impact on quality of reporting

Hundreds of reporting guidelines available today
  Clinical research: diagnostic, observational, case reports ...
  Systematic reviews and meta-analyses
  Preclinical animal research
  etc.

But! Not so effective, unfamiliar to authors, not required
Solutions from academia, 3

NIH joint workshop with Science and Nature journal groups
No word limit on methods sections
Authors submit checklist on key items for reproducibility

Resource Identification Initiative (https://scicrunch.org/resources)
Research Resource Identifier (RRID) for antibodies, model organisms, cell lines, plasmids, software, etc.
RRID Portal: access to repositories with information

Protocols.io
Open access repository of methods: post, edit, share
Digital object identifier (DOI) for citation
Examples

“The following antibodies were used: anti-Tbr1 (1:100; Abcam, catalog #ab31940 RRID:AB_2200219)...”

“sgRNAs were generated by HiScribe (NEB E2050S) T7 in vitro transcription using PCR-generated DNA as a template (dx.doi.org/10.17504/protocols.io.dm749m).”
Grassroots solution
An authors’ editor in every scientific research institute

Research institutes should provide skilled editorial support

Authors’ editor works with authors

Language editing: grammar, style, text efficiency ...

Substantive editing:
  Correct some errors
  Prompt author revision of errors, lacunae

Keep researchers up-to-date: reporting guidelines, initiatives for reproducibility, ethics

Individualized training: manuscript conferences, didactic editing

Screen for misconduct, e.g. plagiarism, data manipulation
Grassroots solution
An authors’ editor in every scientific research institute

First in-house editors, US medical research, 1960s...

Features of institutional editing service
- Disciplinary specialization
- Workload (hours, manuscripts...)
- Teleworking with occasional site visits ideal
- Editor’s skills (depends on researchers’ needs)

Positive effects on
- Researchers: saved time, individualized instruction, good publishing practices, better manuscripts
- Institutes: researcher training, protect reputation, contribute to advancement of science
Researchers

Research Writing

Reviewing

Reading Replicating

Teaching Mentoring Caring for patients ...

Authors' editor

Better Manuscripts

Easier

Published articles More usable
Researchers

- Research Writing
- Reviewing
- Reading Replicating
- Teaching Mentoring Caring for patients...

Authors’ editor

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Published articles More usable

More time
Open science movement: opportunity for change

Open science
- Accessibility to research outputs for all members of society
- Maximize benefits of research
- Reduce barriers to access

Open science and editorial support
- Methodology - accurate protocols
- Peer review - fair, diplomatic reviews
- Access - careful choice of journals

In-house authors’ editors can help research institutes transition to open science
Conclusions

Non-standard English and laxity in scientific reporting:
  --> mediocre research reports
  --> bad textual mentors

Reporting guidelines and web-based tools:
  --> important for quality reporting

Scientific research institutes with authors' editors:
  --> efficient use of time and resources
  --> contribute responsibly to knowledge production
  --> support open science
The trouble with research writing and what we can do about it

Valerie Matarese

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