How common is it, and why?
(how can we best find out?)

Daniele Fanelli
How common is it? Where? Why? Is it growing? How can we prevent it?

We still don’t know!

Here, quickly overview current and potential data and tools for RRI

• The perfect ones that we largely don’t have
• The ones we mostly have: survey data
• What we might have in the future
• Considerations
The perfect experiment: data audit

• Select researchers at random, find out
  – Avoid most biases/problems
  – Help to prevent misconduct
  – Limited only by our ability to detect
  – In practice, difficult and ethically questionable

• **US FDA Bioresearch Monitoring program!**
  – 1977-1990: 10-20% questionable research, 2% researchers barred from grants (Glick 1993)
  – (more recent?)

• Perfect, but only one field, only detectable RM
Over the years, many surveys have asked scientists directly...

...different things, in different ways!

<table>
<thead>
<tr>
<th>Question</th>
<th>Form of misconduct</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Since entering medical school have you...?”</td>
<td>“Fabricated data”</td>
<td>Yes  No</td>
</tr>
<tr>
<td>“Have you participated in research involving [...] during the last 10 years?”</td>
<td>“Modified research or experimental results to improve the outcome”</td>
<td>Never  Sometimes  Frequently</td>
</tr>
<tr>
<td>“Indicate the number of [...] members you have observed/experienced exhibiting [...] within the last 5 years”</td>
<td>“Failing to present data that contradict one's own previous research”</td>
<td>0  1-5  &gt;5</td>
</tr>
<tr>
<td></td>
<td>“Seriously misleading interpretation of results”</td>
<td></td>
</tr>
</tbody>
</table>

Results appeared inconclusive and difficult to compare
“Tricks” in my meta-analysis  
(Fanelli 2009)

- How many committed or observed X at least once
- Only questions on fabrication, falsification, alteration and QRP that distort scientific knowledge. No plagiarism, professional misconduct etc…

- All surveys conducted between 1986-2005
  - USA (15), UK (3), multinational (2), and Australia (1)
  - Medical/clinical (8), biomedical (6), multidisciplinary (6), economy (1)

- In total 85 questions:
  - about fabrication, falsification, alteration, modification (meta-analysis)
  - Questionable research practices (systematic review only)
Scientists who admit fabrication, falsification, or alteration of results

1.97% (N=7, 95% CI: 0.86-4.45)

Scientists who know a colleague who fabricated, falsified, or altered results

14.12% (N=12, 95% CI: 9.91-19.72)
Questionable Research Practices

e.g. “failing to publish data that contradicts one’s previous research”
“dropping data points based on a gut feeling”

![Box plot showing admission rates in various research contexts](chart.png)
## “Repairing misconduct”?

<table>
<thead>
<tr>
<th>ID</th>
<th>N cases</th>
<th>Action taken</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangney, 1987</td>
<td>78</td>
<td>Took some action to verify their suspicions of fraud or to remedy the situation</td>
<td>46</td>
</tr>
<tr>
<td>Rankin, 1997</td>
<td>31 (incl. Plag.)</td>
<td>In alleged cases of scientific misconduct a disciplinary action was taken by the dean</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some authority was involved in a disciplinary action</td>
<td>20.5</td>
</tr>
<tr>
<td>Ranstam, 2000</td>
<td>49</td>
<td>I interfered to prevent it from happening</td>
<td>28.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I reported it to a relevant person or organization</td>
<td>22.4</td>
</tr>
<tr>
<td>Kattenbraker, 2007</td>
<td>33</td>
<td>Reported to supervisor</td>
<td>36.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reported to Institutional Review Board</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discussed with colleagues</td>
<td>36.4</td>
</tr>
<tr>
<td>Titus, 2008</td>
<td>115 (incl. Plag.)</td>
<td>The suspected misconduct was reported by the survey respondent</td>
<td>24.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The suspected misconduct was reported by someone else</td>
<td>33.3</td>
</tr>
</tbody>
</table>

Around half of recalled cases had no action whatsoever taken against them.
What influences admission rates?

Inverse variance-weighted regression

<table>
<thead>
<tr>
<th>Factor</th>
<th>B</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking about self vs colleagues:</td>
<td>-4.53</td>
<td>0.81</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Using “fabrication” or “falsification” vs “alteration” or “modification”:</td>
<td>-1.02</td>
<td>0.39</td>
<td>0.0086</td>
</tr>
<tr>
<td>Handed-out surveys vs mailed:</td>
<td>1.17</td>
<td>0.4</td>
<td>0.0032</td>
</tr>
</tbody>
</table>

Controlling for these factors, tested for differences between:

- Year
- USA / other *
- Researcher / other
- Biomedical / other
- Social Sc. / other

n.s. Medical / other B = 0.85 0.28

P = 0.0022

82% of variance explained (N=15)
Summary of key findings

• Overall, survey data is coherent:
  – Data fabrication, falsification and alteration was
    • admitted on average by around 2% (1% - 4%)
    • directly observed by 14% (10% - 20%)
  – Questionable Research Practices were
    • admitted on average by up to 34%
    • directly observed by up to 72%
  – Around 50% discovered but not dealt with

• admissions => probably conservative
• Higher in some disciplines (e.g. medical/clinical research)

Limitations:
- Methodology of survey had the greatest influence
- Just what people think/say
Future: studying bias/misconduct in the literature

• In biomedical and increasingly in other fields, correct meta-analyses for “publication bias”
• Excess of “positive” results in most fields
  – Simplistically, “file-drawer”
  – In practice combination of biases
• Meta-analyses detected “funding effect” and others

• Ideally, try to do that without meta-analysis
A simple proxy of bias

• Take papers that declare in the abstract to have “tested a hypothesis”
• Read them and determine the authors’ conclusions:
  – “positive” (full or partial support)
  – “negative” (null or negative support)

• Verify if non-scientific factors affect the likelihood of reporting a positive
• Not a direct measure of bias, but a proxy: logically connected to bias but needs interpretation
• (More refined methods to come…)
Does bias vary by discipline/methodology? (Fanelli 2010a)

Searched all 10,837 journals in the 22 disciplines of the Essential Sciences Indicators database.
Over 2,500 papers, 150 per discipline, (2000-2007), at random.

Certain kinds of research (e.g. “soft” disc., behavioural) are more likely to report positive results.
Do pressures to publish increase bias?
A support with NSF data on US states

Researchers report more positive results in states where they publish more papers with same/less funding!
Conclusions for RRI

• Research on RI usually identified with surveys (i.e. to compare EU-US)
  – Little scope for doing more, unless we standardize methodology
  – Funding should encourage the development of a standard survey tool.

• A promising approach: analyses of the literature (meta- or not)
  – Independent, precise data on various kinds of biases
  – Potential tool for monitoring of research

• Have data audits a role too?