Scientific Data Visualization

The Good, the Bad, the Ugly

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EDS EPIDEMIOLOGY & DATA SCIENCE

Amsterdam UMC
Universitair Medische Centra

Disclosures & Disclaimer

I have a small company (Epiconsult BV) that offers consultation and training on scientific data visualisation, presentation and publication

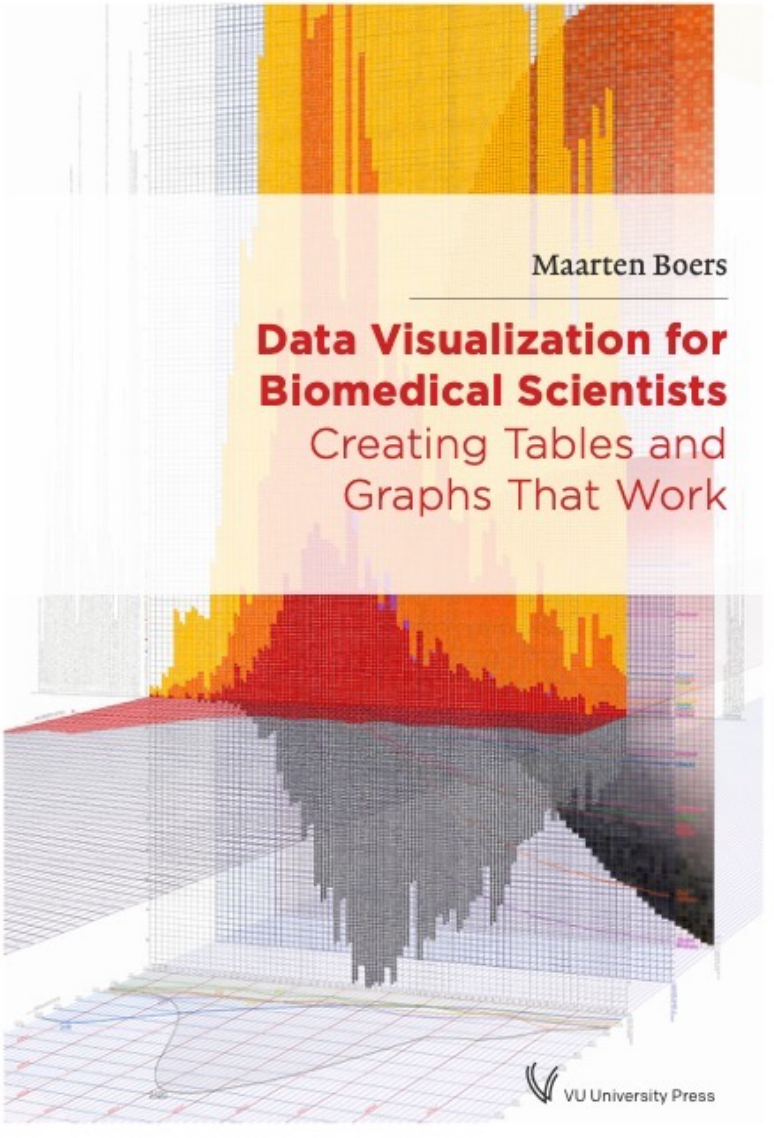
…and yes, I'm open for business… 😎

This lecture is not about: imaging of bodies, organs, cells

Essential reading!

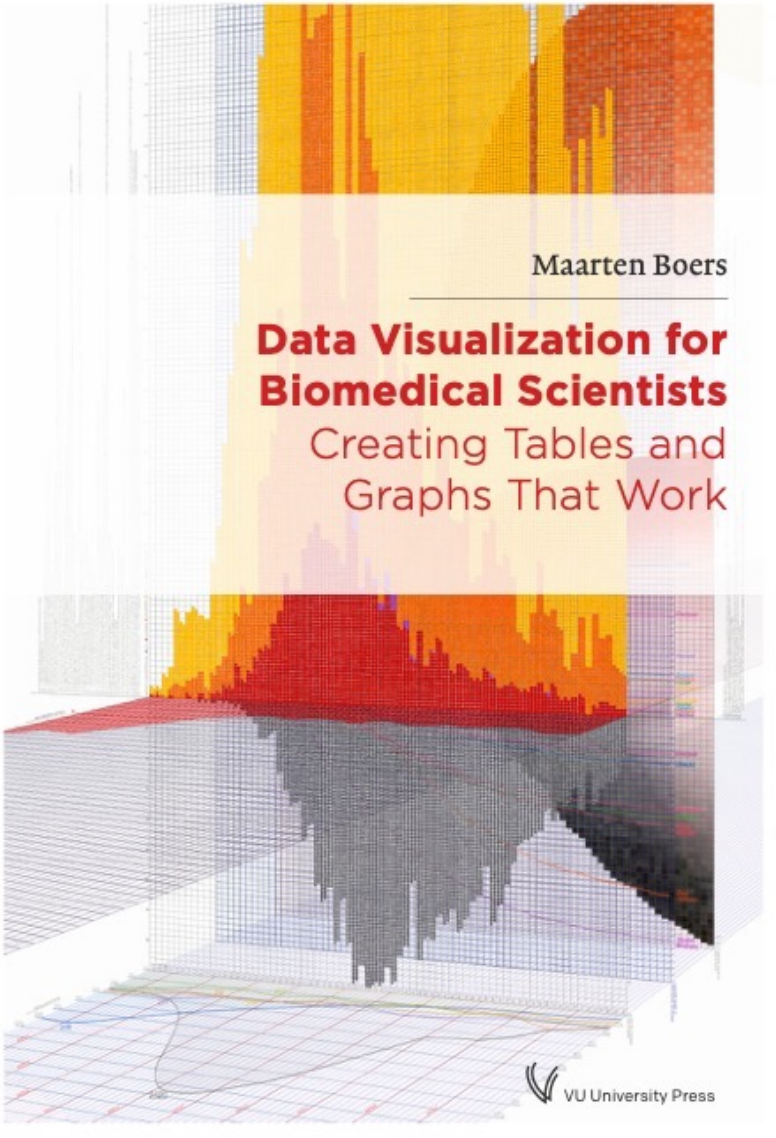
contents
1. intro
2. tables
3. graphs
4. matrix graphs
5. publishing and presenting

Now also as e-book!



How to order

cost: € 48,50, but 20% off today with code 'Boers22Workshop' at www.vuuniversitypress.com/product/data-visualization-for-biomedical-scientists/

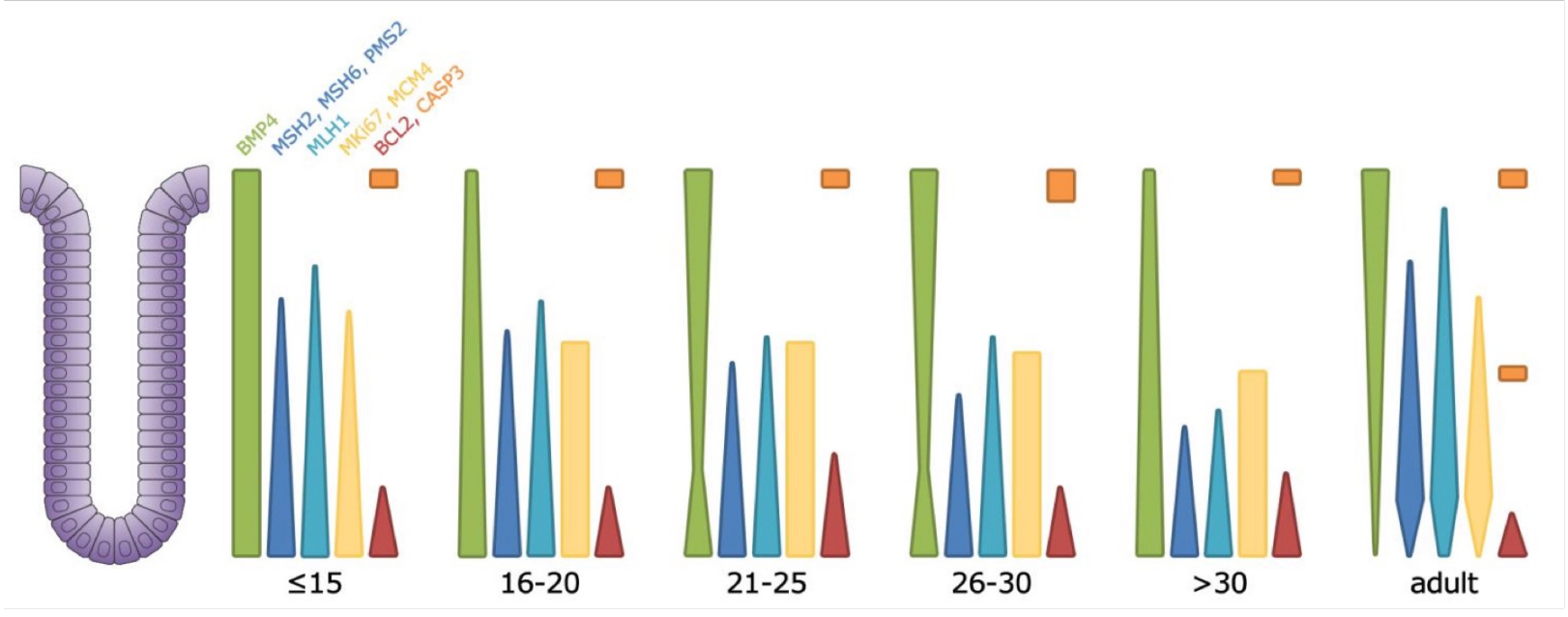


Essential course!

New course at EpidM (epidm.nl):
hands-on skills for Tables (Word)
and Graphs (Prism)
4 hours of prep time on your own,
and 4 hours of interactive teaching
personalized feedback
on your own material
book required, cost € 195,
in Amsterdam, June 14, 2023

reserve your slot at :
https://www.epidm.nl/en/course/scientific-data-visualization-tables-and-graphs-that-work/

Protein expression along the crypt axis in the developing and adult human colon



thanks to Wing Ho Man
5th-y medical student
VUmc Honours Programme laureate 2009

quiz: exploring a popular graph

Is the number of infections
(reported cases, positive covid tests)
decreasing or increasing?

"reported cases:
week total compared with
previous week (growth rate)"

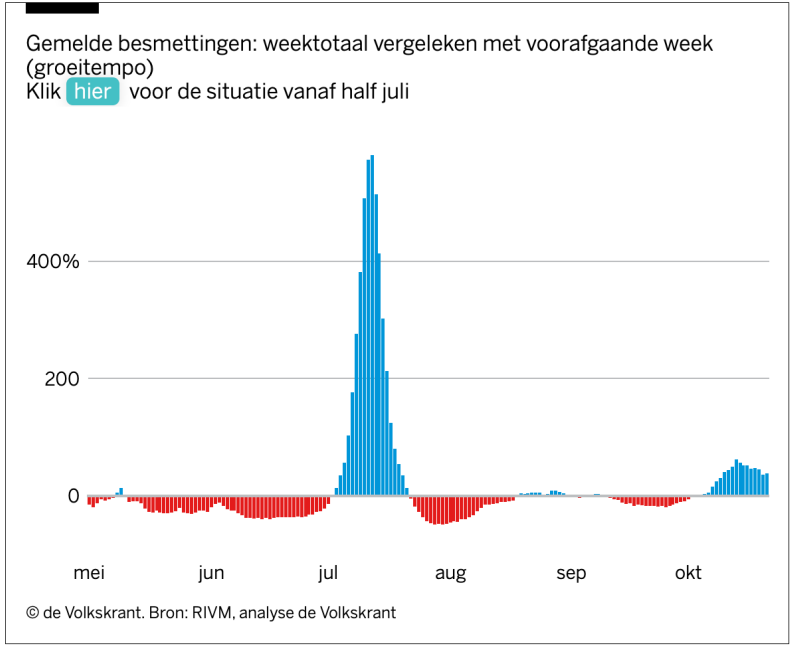
change in number of cases

expressed as % (blue/red)

current cases this week
as % of cases last week

daily bars: running calculation

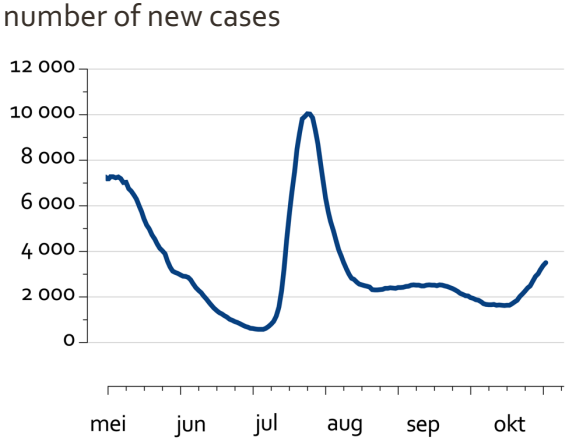
Daalt of stijgt het aantal gemelde besmettingen?
De dagcijfers kunnen flink schommelen, de procentuele verandering op weekbasis geeft meer inzicht in de toe- of afname van het aantal gemelde besmettingen.



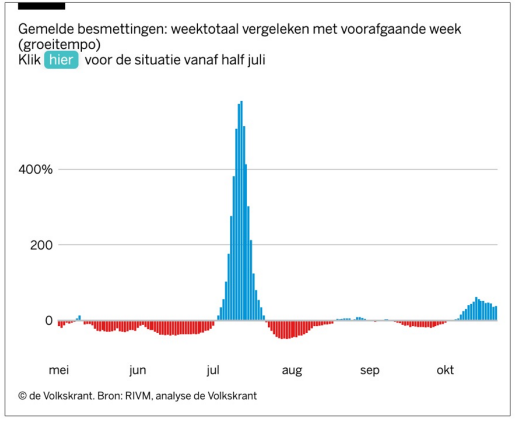
quiz: what is a better scale for the y-axis?

A. absolute number of new cases
B. change on a linear scale
C. change on a log scale…

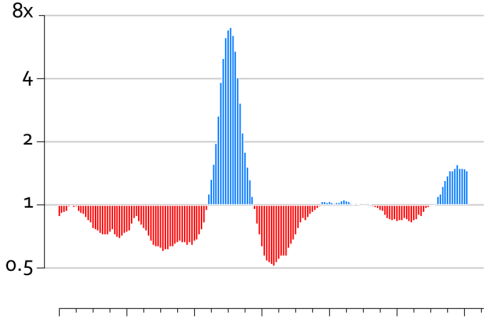
A



B



C



Overview

- effective imaging/data visualization
- message
- audience
- creation

effective imaging

clear vision:

- good graphs, images, tables; effective and minimal text

clear understanding:

- focus on a single message
- tells a story through a well-ordered and obvious sequence

Quantitative information

Body text:

good for concepts, discussion;
can show only limited amount of data

Table:

good to show lots of data with precision;
relationships between data need to be relatively simple

Graph:

good to show lots of data with complex relationships:
pattern recognition!
less precision

message

- what is it?
  - for the parts, for the whole
- make it obvious
  - in clear text, titles, conclusion
  - choices in tables, graphs
  - ordering of information
- delete anything that doesn't reinforce your message
  - (I don't mean selective reporting!!)

audience

- 3 types of audiences and 3 types of meetings
  - specialist (your field): little effort necessary if your findings are of interest
  - general (related fields): need context and don't understand jargon
  - very general (unrelated, lay public):
    need explanation on both the problem and the solution

- If you want to serve all, you must:
  - provide context, big picture, why the problem is important
  - introduce your message
  - avoid jargon, severely limit abbreviations
  - interpret the results in the context of the problem

- For all: tell a story!

dataviz creation: general strategy

- Clear vision
  - Highlight the data, make it stand out:
  - data ink (enhance)
  - vs
  - non-data ink (reduce)

- Clear understanding
  - Tell a story

- Iterative process

dataviz creation: tools

- For tables, Word, Powerpoint and Excel do nicely
- For graphs, Excel and Powerpoint make them, but:
  - templates are mostly wrong
  - orientation towards business (sales over time)
  - orientation towards 'fluff'
  - formatting can be maddening
- SPSS can make complex graphs, but:
  - templates are not for publication
  - formatting is tedious
- R has extensive possibilities, but:
  - steep learning curve
  - templates not very good

dataviz creation: tools

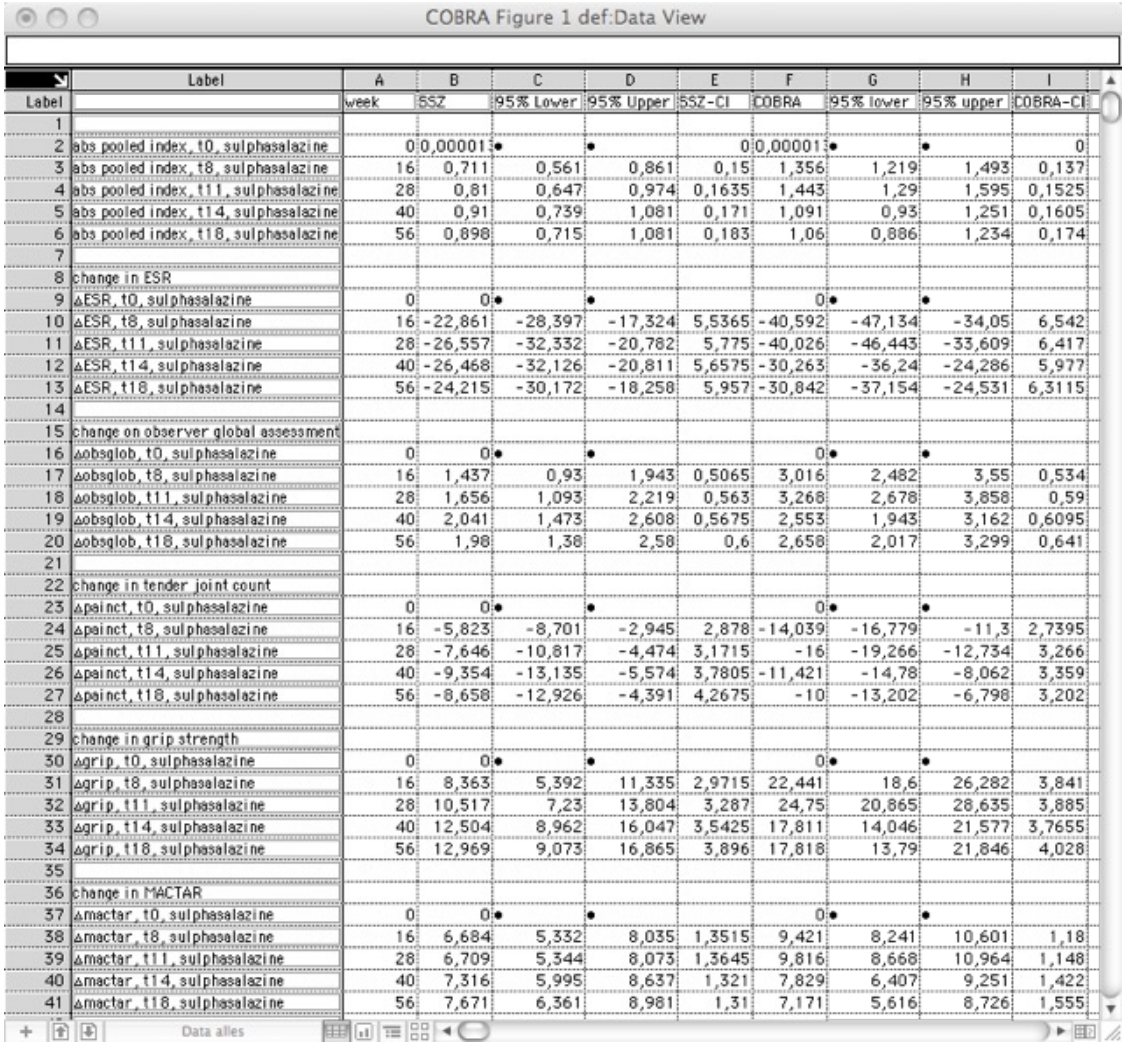
- In most dedicated programs, 'everything is possible'
- many programs offer freely downloadable demos
- google: "scientific graphing software"
- My current favorite: GraphPad Prism
  - get it 'for free'
  - in Amsterdam UMC,
  - thanks to me!

- Formatting templates usually better, and easier to change, but:
  - cost (€50-500)
  - learning curve
  - cross platform?

Clear vision: high signal-to-noise ratio

Clear vision: low signal-to-noise ratio

Clear vision


COBRA Figure 1 def:Data View

	Label	A	B	C	D	E	F	G	H	I
Label		week	SSZ	95% Lower	95% Upper	SSZ-CI	COBRA	95% lower	95% upper	COBRA-CI
1										
2	abs pooled index, t0, sulphasalazine	0	0,00001			0	0,00001			0
3	abs pooled index, t8, sulphasalazine	16	0,711	0,561	0,861	0,15	1,356	1,219	1,493	0,137
4	abs pooled index, t11, sulphasalazine	28	0,81	0,647	0,974	0,1635	1,443	1,29	1,595	0,1525
5	abs pooled index, t14, sulphasalazine	40	0,91	0,739	1,081	0,171	1,091	0,93	1,251	0,1605
6	abs pooled index, t18, sulphasalazine	56	0,898	0,715	1,081	0,183	1,06	0,886	1,234	0,174
7										
8	change in ESR									
9	ΔESR, t0, sulphasalazine	0	0				0			
10	ΔESR, t8, sulphasalazine	16	-22,861	-28,397	-17,324	5,5365	-40,592	-47,134	-34,05	6,542
11	ΔESR, t11, sulphasalazine	28	-26,557	-32,332	-20,782	5,775	-40,026	-46,443	-33,609	6,417
12	ΔESR, t14, sulphasalazine	40	-26,468	-32,126	-20,811	5,6575	-30,263	-36,24	-24,286	5,977
13	ΔESR, t18, sulphasalazine	56	-24,215	-30,172	-18,258	5,957	-30,842	-37,154	-24,531	6,3115
14										
15	change on observer global assessment									
16	Δobsglob, t0, sulphasalazine	0	0				0			
17	Δobsglob, t8, sulphasalazine	16	1,437	0,93	1,943	0,5065	3,016	2,482	3,55	0,534
18	Δobsglob, t11, sulphasalazine	28	1,656	1,093	2,219	0,563	3,268	2,678	3,858	0,59
19	Δobsglob, t14, sulphasalazine	40	2,041	1,473	2,608	0,5675	2,553	1,943	3,162	0,6095
20	Δobsglob, t18, sulphasalazine	56	1,98	1,38	2,58	0,6	2,658	2,017	3,299	0,641
21										
22	change in tender joint count									
23	Δpainct, t0, sulphasalazine	0	0				0			
24	Δpainct, t8, sulphasalazine	16	-5,823	-8,701	-2,945	2,878	-14,039	-16,779	-11,3	2,7395
25	Δpainct, t11, sulphasalazine	28	-7,646	-10,817	-4,474	3,1715	-16	-19,266	-12,734	3,266
26	Δpainct, t14, sulphasalazine	40	-9,354	-13,135	-5,574	3,7805	-11,421	-14,78	-8,062	3,359
27	Δpainct, t18, sulphasalazine	56	-8,658	-12,926	-4,391	4,2675	-10	-13,202	-6,798	3,202
28										
29	change in grip strength									
30	Δgrip, t0, sulphasalazine	0	0				0			
31	Δgrip, t8, sulphasalazine	16	8,363	5,392	11,335	2,9715	22,441	18,6	26,282	3,841
32	Δgrip, t11, sulphasalazine	28	10,517	7,23	13,804	3,287	24,75	20,865	28,635	3,885
33	Δgrip, t14, sulphasalazine	40	12,504	8,962	16,047	3,5425	17,811	14,046	21,577	3,7655
34	Δgrip, t18, sulphasalazine	56	12,969	9,073	16,865	3,896	17,818	13,79	21,846	4,028
35										
36	change in MACTAR									
37	Δmactar, t0, sulphasalazine	0	0				0			
38	Δmactar, t8, sulphasalazine	16	6,684	5,332	8,035	1,3515	9,421	8,241	10,601	1,18
39	Δmactar, t11, sulphasalazine	28	6,709	5,344	8,073	1,3645	9,816	8,668	10,964	1,148
40	Δmactar, t14, sulphasalazine	40	7,316	5,995	8,637	1,321	7,829	6,407	9,251	1,422
41	Δmactar, t18, sulphasalazine	56	7,671	6,361	8,981	1,31	7,171	5,616	8,726	1,555

Data alles

		week							
		16		28		40		56	
pooled index*	SSZ	0,71	(0,15)	0,81	(0,16)	0,91	(0,17)	0,90	(0,18)
	COBRA	1,36	(0,14)	1,44	(0,15)	1,09	(0,16)	1,06	(0,17)
change in: **…ESR**	SSZ	–23	(6)	–27	(6)	–26	(6)	–24	(6)
	COBRA	–41	(7)	–40	(6)	–30	(6)	–31	(6)
…observer global assessment	SSZ	–1,4	(0,5)	–1,7	(0,6)	–2,0	(0,6)	–2,0	(0,6)
	COBRA	–3,0	(0,5)	–3,3	(0,6)	–2,6	(0,6)	–2,7	(0,6)
…tender joint count	SSZ	–5,8	(2,9)	–7,6	(3,2)	–9,4	(3,8)	–8,7	(4,3)
	COBRA	–14,0	(2,7)	–16,0	(3,3)	–11,4	(3,4)	–10,0	(3,2)
…grip strength	SSZ	8,4	(3,0)	10,5	(3,3)	12,5	(3,5)	13,0	(3,9)
	COBRA	22,4	(3,8)	24,8	(3,9)	17,8	(3,8)	17,8	(4,0)
…MACTAR	SSZ	6,7	(1,4)	6,7	(1,4)	7,3	(1,3)	7,7	(1,3)
	COBRA	9,4	(1,2)	9,8	(1,1)	7,8	(1,4)	7,2	(1,6)

*mean (one half 95% CI)

What about ‘text tables’ ?

Often used in qualitative research

PubMed search strategy

((((("Receptors, Tumor Necrosis Factor"[nm] OR TNFR:Fc OR "TNFR-Fc fusion protein"[Supplementary Concept] OR "TNFR-Fc fusion protein"[All Fields] OR "etanercept"[All Fields] OR "enbrel"[All Fields]) OR ("infliximab"[Supplementary Concept] OR "infliximab"[All Fields] OR "remicade"[All Fields] OR "mab ca2"[All Fields] OR "monoclonal antibody ca2"[All Fields]) OR ("adalimumab"[Supplementary Concept] OR "adalimumab"[All Fields] OR "humira"[All Fields]) OR ("interleukin 1 receptor antagonist protein"[MeSH Terms] OR "interleukin 1 receptor antagonist protein"[All Fields] OR "anakinra"[All Fields] OR "kineret"[All Fields] OR "antril"[All Fields]) OR ("abatacept"[Supplementary Concept] OR "abatacept"[All Fields]) OR CTLA4Ig[All Fields] OR "orencia"[All Fields]) OR ("rituximab"[Supplementary Concept] OR "rituximab"[All Fields] OR "rituxan"[All Fields] OR "idec c2b8"[All Fields]) OR ("golimumab"[All Fields] OR "golimumab"[Supplementary Concept] OR "simponi"[All Fields] OR "cnto-148"[All Fields] OR ("cnto"[All Fields] AND "148"[All Fields])) OR ("tocilizumab"[All Fields] OR "tocilizumab"[Supplementary Concept] OR "atlizumab"[All Fields] OR "actemra"[All Fields]) OR ("certolizumab"[All Fields] OR "certolizumab pegol"[Supplementary Concept] OR "CDP870"[All Fields] OR ("cdp"[All Fields] AND "870"[All Fields]) OR "cimzia"[All Fields]) OR ("tofacitinib"[Supplementary Concept] OR "tofacitinib"[All Fields]) OR ("Antibodies, Monoclonal"[Mesh] OR "Monokines"[Mesh] OR "Receptors, Interleukin-1"[Mesh] OR "Receptors, Interleukin-6"[Mesh])) AND ("Randomized Controlled Trial"[ptyp] OR "Controlled Clinical Trial"[ptyp] OR "Multicenter Study"[ptyp] OR "randomized"[tiab] OR "randomised"[tiab] OR "placebo"[tiab] OR "randomly"[tiab] OR "trial"[tiab] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh]) AND ("Arthritis, Rheumatoid"[MeSH Terms] OR (Rheumatoid[text word] AND arthriti*[text word]))) NOT (animals[mh] NOT human[mh])

PubMed search strategy

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book, p. 73,74

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TNF and inhibition (OR)
"Receptors, Tumor Necrosis Factor"[nm]
TNFR:Fc
"TNFR-Fc fusion protein"[Supplementary Concept]
"TNFR-Fc fusion protein"[All Fields]
"etanercept"[All Fields]
"enbrel"[All Fields])
"infliximab"[Supplementary Concept]
"infliximab"[All Fields]
"remicade"[All Fields]
"mab ca2"[All Fields]
"monoclonal antibody ca2"[All Fields])
"adalimumab"[Supplementary Concept]
"adalimumab"[All Fields]
"humira"[All Fields]
"golimumab"[All Fields]
"golimumab"[Supplementary Concept]
"simponi"[All Fields]
"cnto-148"[All Fields]
"cnto"[All Fields] AND "148"[All Fields]
certolizumab"[All Fields]
"certolizumab pegol"[Supplementary Concept]
"CDP870"[All Fields]
("cdp"[All Fields] AND "870"[All Fields])
"cimzia"[All Fields]

IL-1 and inhibition (OR)
("interleukin 1 receptor antagonist protein"[MeSH Terms]
"interleukin 1 receptor antagonist protein"[All Fields]
"anakinra"[All Fields] OR "kineret"[All Fields]
"antril"[All Fields])
"Receptors, Interleukin-1"[Mesh]

Abatacept (OR)
"abatacept"[Supplementary Concept]
"abatacept"[All Fields])
CTLA4Ig[All Fields]
"orencia"[All Fields]

Rituximab (OR)
"rituximab"[Supplementary Concept]
"rituximab"[All Fields]
"rituxan"[All Fields]
"idec c2b8"[All Fields]

Tocilizumab (OR)
"tocilizumab"[All Fields]
"tocilizumab"[Supplementary Concept]
"atlizumab"[All Fields]
"actemra"[All Fields])
"Receptors, Interleukin-6"[Mesh]

Tofactinib (OR)
("tofacitinib"[Supplementary Concept]
"tofacitinib"[All Fields]

Monoclonal Antibodies (OR)
"Antibodies, Monoclonal"[Mesh]
"Monokines"[Mesh]

AND

Randomized Clinical Trial (OR)
"Randomized Controlled Trial"[ptyp]
"Controlled Clinical Trial"[ptyp]
"Multicenter Study"[ptyp]
"randomized"[tiab]
"randomised"[tiab]
"placebo"[tiab]
"randomly"[tiab]
"trial"[tiab]
randomized controlled trials[mh]
random allocation[mh]
double-blind method[mh]
single-blind method[mh])

AND

Rheumatoid Arthritis (OR)
"Arthritis, Rheumatoid"[MeSH Terms]
Rheumatoid[text word] AND arthriti*[text word]

NOT

Animal studies
NOT (animals[mh] NOT human[mh])

((((("Receptors, Tumor Necrosis Factor"[nm] OR TNFR:Fc OR "TNFR-Fc fusion protein"[Supplementary Concept] OR "TNFR-Fc fusion protein"[All Fields] OR "etanercept"[All Fields] OR "enbrel"[All Fields]) OR ("infliximab"[Supplementary Concept] OR "infliximab"[All Fields] OR "remicade"[All Fields] OR "mab ca2"[All Fields] OR "monoclonal antibody ca2"[All Fields]) OR ("adalimumab"[Supplementary Concept] OR "adalimumab"[All Fields] OR "humira"[All Fields]) OR ("interleukin 1 receptor antagonist protein"[MeSH Terms] OR "interleukin 1 receptor antagonist protein"[All Fields] OR "anakinra"[All Fields] OR "kineret"[All Fields] OR "antril"[All Fields]) OR ("abatacept"[Supplementary Concept] OR "abatacept"[All Fields]) OR CTLA4Ig[All Fields] OR "orencia"[All Fields]) OR ("rituximab"[Supplementary Concept] OR "rituximab"[All Fields] OR "rituxan"[All Fields] OR "idec c2b8"[All Fields]) OR ("golimumab"[All Fields] OR "golimumab"[Supplementary Concept] OR "simponi"[All Fields] OR "cnto-148"[All Fields] OR ("cnto"[All Fields] AND "148"[All Fields])) OR ("tocilizumab"[All Fields] OR "tocilizumab"[Supplementary Concept] OR "atlizumab"[All Fields] OR "actemra"[All Fields]) OR ("certolizumab"[All Fields] OR "certolizumab pegol"[Supplementary Concept] OR "CDP870"[All Fields] OR ("cdp"[All Fields] AND "870"[All Fields]) OR "cimzia"[All Fields]) OR ("tofacitinib"[Supplementary Concept] OR "tofacitinib"[All Fields]) OR ("Antibodies, Monoclonal"[Mesh] OR "Monokines"[Mesh] OR "Receptors, Interleukin-1"[Mesh] OR "Receptors, Interleukin-6"[Mesh])) AND ("Randomized Controlled Trial"[ptyp] OR "Controlled Clinical Trial"[ptyp] OR "Multicenter Study"[ptyp] OR "randomized"[tiab] OR "randomised"[tiab] OR "placebo"[tiab] OR "randomly"[tiab] OR "trial"[tiab] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh]) AND ("Arthritis, Rheumatoid"[MeSH Terms] OR (Rheumatoid[text word] AND arthriti*[text word]))) NOT (animals[mh] NOT human[mh])

book, p. 73,74

((((("Receptors, Tumor Necrosis Factor"[nm] OR TNFR:Fc OR "TNFR-Fc fusion protein"[Supplementary Concept] OR "TNFR-Fc fusion protein"[All Fields] OR "etanercept"[All Fields] OR "enbrel"[All Fields]) OR ("infliximab"[Supplementary Concept] OR "infliximab"[All Fields] OR "remicade"[All Fields] OR "mab ca2"[All Fields] OR "monoclonal antibody ca2"[All Fields]) OR ("adalimumab"[Supplementary Concept] OR "adalimumab"[All Fields] OR "humira"[All Fields]) OR ("interleukin 1 receptor antagonist protein"[MeSH Terms] OR "interleukin 1 receptor antagonist protein"[All Fields] OR "anakinra"[All Fields] OR "kineret"[All Fields] OR "antril"[All Fields]) OR ("abatacept"[Supplementary Concept] OR "abatacept"[All Fields]) OR CTLA4Ig[All Fields] OR "orencia"[All Fields]) OR ("rituximab"[Supplementary Concept] OR "rituximab"[All Fields] OR "rituxan"[All Fields] OR "idec c2b8"[All Fields]) OR ("golimumab"[All Fields] OR "golimumab"[Supplementary Concept] OR "simponi"[All Fields] OR "cnto-148"[All Fields] OR ("cnto"[All Fields] AND "148"[All Fields])) OR ("tocilizumab"[All Fields] OR "tocilizumab"[Supplementary Concept] OR "atlizumab"[All Fields] OR "actemra"[All Fields]) OR ("certolizumab"[All Fields] OR "certolizumab pegol"[Supplementary Concept] OR "CDP870"[All Fields] OR ("cdp"[All Fields] AND "870"[All Fields]) OR "cimzia"[All Fields]) OR ("tofacitinib"[Supplementary Concept] OR "tofacitinib"[All Fields]) OR ("Antibodies, Monoclonal"[Mesh] OR "Monokines"[Mesh] OR "Receptors, Interleukin-1"[Mesh] OR "Receptors, Interleukin-6"[Mesh])) AND ("Randomized Controlled Trial"[ptyp] OR "Controlled Clinical Trial"[ptyp] OR "Multicenter Study"[ptyp] OR "randomized"[tiab] OR "randomised"[tiab] OR "placebo"[tiab] OR "randomly"[tiab] OR "trial"[tiab] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh]) AND ("Arthritis, Rheumatoid"[MeSH Terms] OR (Rheumatoid[text word] AND arthriti*[text word]))) NOT (animals[mh] NOT human[mh])

TNF and inhibition (OR)
"Receptors, Tumor Necrosis Factor"[nm]
TNFR:Fc
"TNFR-Fc fusion protein"[Supplementary Concept]
"TNFR-Fc fusion protein"[All Fields]
"etanercept"[All Fields]
"enbrel"[All Fields])
"infliximab"[Supplementary Concept]
"infliximab"[All Fields]
"remicade"[All Fields]
"mab ca2"[All Fields]
"monoclonal antibody ca2"[All Fields])
"adalimumab"[Supplementary Concept]
"adalimumab"[All Fields]
"humira"[All Fields]
"golimumab"[All Fields]
"golimumab"[Supplementary Concept]
"simponi"[All Fields]
"cnto-148"[All Fields]
"cnto"[All Fields] AND "148"[All Fields]
certolizumab"[All Fields]
"certolizumab pegol"[Supplementary Concept]
"CDP870"[All Fields]
("cdp"[All Fields] AND "870"[All Fields])
"cimzia"[All Fields]

IL-1 and inhibition (OR)
("interleukin 1 receptor antagonist protein"[MeSH Terms]
"interleukin 1 receptor antagonist protein"[All Fields]
"anakinra"[All Fields] OR "kineret"[All Fields]
"antril"[All Fields])
"Receptors, Interleukin-1"[Mesh]

Abatacept (OR)
"abatacept"[Supplementary Concept]
"abatacept"[All Fields])
CTLA4Ig[All Fields]
"orencia"[All Fields]

Rituximab (OR)
"rituximab"[Supplementary Concept]
"rituximab"[All Fields]
"rituxan"[All Fields]
"idec c2b8"[All Fields]

Tocilizumab (OR)
"tocilizumab"[All Fields]
"tocilizumab"[Supplementary Concept]
"atlizumab"[All Fields]
"actemra"[All Fields])
"Receptors, Interleukin-6"[Mesh]

Tofactinib (OR)
("tofacitinib"[Supplementary Concept]
"tofacitinib"[All Fields]

Monoclonal Antibodies (OR)
"Antibodies, Monoclonal"[Mesh]
"Monokines"[Mesh]

AND

Randomized Clinical Trial (OR)
"Randomized Controlled Trial"[ptyp]
"Controlled Clinical Trial"[ptyp]
"Multicenter Study"[ptyp]
"randomized"[tiab]
"randomised"[tiab]
"placebo"[tiab]
"randomly"[tiab]
"trial"[tiab]
randomized controlled trials[mh]
random allocation[mh]
double-blind method[mh]
single-blind method[mh])

AND

Rheumatoid Arthritis (OR)
"Arthritis, Rheumatoid"[MeSH Terms]
Rheumatoid[text word] AND arthriti*[text word]

NOT

Animal studies
NOT (animals[mh] NOT human[mh])

TNF and inhibition (OR)

"Receptors, Tumor Necrosis Factor"[nm]
TNFR:Fc
"TNFR-Fc fusion protein"[Supplementary Concept]
"TNFR-Fc fusion protein"[All Fields]
"etanercept"[All Fields]
"enbrel"[All Fields])
"infliximab"[Supplementary Concept]
"infliximab"[All Fields]
"remicade"[All Fields]
"mab ca2"[All Fields]
"monoclonal antibody ca2"[All Fields])
"adalimumab"[Supplementary Concept]
"adalimumab"[All Fields]
"humira"[All Fields]
"golimumab"[All Fields]
"golimumab"[Supplementary Concept]
"simponi"[All Fields]
"cnto-148"[All Fields]
"cnto"[All Fields] AND "148"[All Fields]
certolizumab"[All Fields]
"certolizumab pegol"[Supplementary Concept]
"CDP870"[All Fields]

Tocilizumab (OR)

"tocilizumab"[All Fields]
"tocilizumab"[Supplementary Concept]
"atlizumab"[All Fields]
"actemra"[All Fields])
“Receptors, Interleukin-6"[Mesh]

Tofactinib (OR)

("tofacitinib"[Supplementary Concept]
"tofacitinib"[All Fields]

Monoclonal Antibodies (OR)

"Antibodies, Monoclonal"[Mesh]
"Monokines"[Mesh]

AND

Randomized Clinical Trial (OR)

"Randomized Controlled Trial"[ptyp]
"Controlled Clinical Trial"[ptyp]
"Multicenter Study"[ptyp]
"randomized"[tiab]

what about clinical trial and DSMB reports?

especially for DSMB, the purpose is
to detect weak but potentially important safety signals

so we want an optimum signal to noise ratio

but what do we get:

typically, hundreds and hundreds of pages with poorly formatted text, tables and primitive figures (often raw, unformatted SAS outputs)

as DSMB chair I challenged the lead statistician. His response:

'We don't have time to make pretty tables.'

book p. 63-66

Table 10.1.3.1
Demographic and Baseline Characteristics (Double-Blind Period)
All Patients Randomized Set

	Number of Subjects (%)		
	Placebo (N=15)	20 mg (N=22)	40 mg (N=18)
Body Mass Index (kg/m^2) (d)			
N	15	22	18
Mean (SD)	28.79(5.358)	33.57(10.209)	27.91(5.947)
Median	28.00	29.70	28.50
Minimum, Maximum	20.0,37.3	20.0,60.1	17.1,43.5
BMI Categories (N[%])			
< 30 kg/m^2	9(60.0)	12(54.5)	13(72.2)
>= 30 kg/m^2	6(40.0)	10(45.5)	5(27.8)
Smoking Classification (N[%])			
Subject has never smoked	5(33.3)	12(54.5)	8(44.4)
Subject is a current smoker	7(46.7)	7(31.8)	4(22.2)
Subject is an ex-smoker	3(20.0)	3(13.6)	6(33.3)
Female Reproductive Status (N[%])			
Postmenopausal	1(6.7)	0	0
Surgically Sterile	2(13.3)	3(13.6)	0
Female of Childbearing Potential	4(26.7)	7(31.8)	4(22.2)
N/A (Subject is Male)	8(53.3)	12(54.5)	14(77.8)

(a) Age at the date of Informed consent.
(b) Subject checked more than one race option on case report form.
(c) Weight measured prior to the first dose of double-blind study drug.
(d) BMI is calculated from the weight taken prior to the first dose of study drug and height taken as Screening.

Table 10.1.3.1
Demographic and Baseline Characteristics (Double-Blind Period)
All Patients Randomized Set

	Number of Subjects (%)		
	80 mg (N=15)	160 mg (N=13)	Total (N=83)
Body Mass Index (kg/m^2) (d)			
N	15	13	83
Mean (SD)	31.90(11.613)	26.82(5.086)	30.12(8.523)
Median	28.40	25.80	28.50
Minimum, Maximum	19.6,61.0	19.0,37.6	17.1,61.0
BMI Categories (N[%])			
< 30 kg/m^2	9(60.0)	10(76.9)	53(63.9)
>= 30 kg/m^2	6(40.0)	3(23.1)	30(36.1)
Smoking Classification (N[%])			
Subject has never smoked	5(33.3)	5(38.5)	35(42.2)
Subject is a current smoker	4(26.7)	6(46.2)	28(33.7)
Subject is an ex-smoker	6(40.0)	2(15.4)	20(24.1)
Female Reproductive Status (N[%])			
Postmenopausal	0	0	1(1.2)
Surgically Sterile	1(6.7)	0	6(7.2)
Female of Childbearing Potential	2(13.3)	4(30.8)	21(25.3)
N/A (Subject is Male)	12(80.0)	9(69.2)	55(66.3)

(a) Age at the date of Informed consent.
(b) Subject checked more than one race option on case report form.
(c) Weight measured prior to the first dose of double-blind study drug.
(d) BMI is calculated from the weight taken prior to the first dose of study drug and height taken as Screening.

Improvements

- Change to proportional font
- ‘Number of subjects’ header removed
- Reduced precision

precision

by tradition:

mean: 1 decimal more precise than source data;

SD: 2 decimals more precise

	Placebo (N=15)
Body Mass Index (kg/m^2) (d)	
N	15
Mean (SD)	28.79(5.358)
Median	28.00
Minimum, Maximum	20.0,37.3

precision

by tradition:

mean: 1 decimal more precise than source data;

SD: 2 decimals more precise

however: I (your consumer) have no interest in your traditions, but only in clinically relevant signals

so for me, BMI by integers is good enough

	Placebo (N=15)
Body Mass Index (kg/m^2) (d)	
N	15
Mean (SD)	28.79(5.358)
Median	28.00
Minimum, Maximum	20.0,37.3

	placebo (N=15)
Body Mass Index (kg/m²)[d]	
mean (SD)	29 (5)
median (min, max)	28 (20, 37)

Improvements

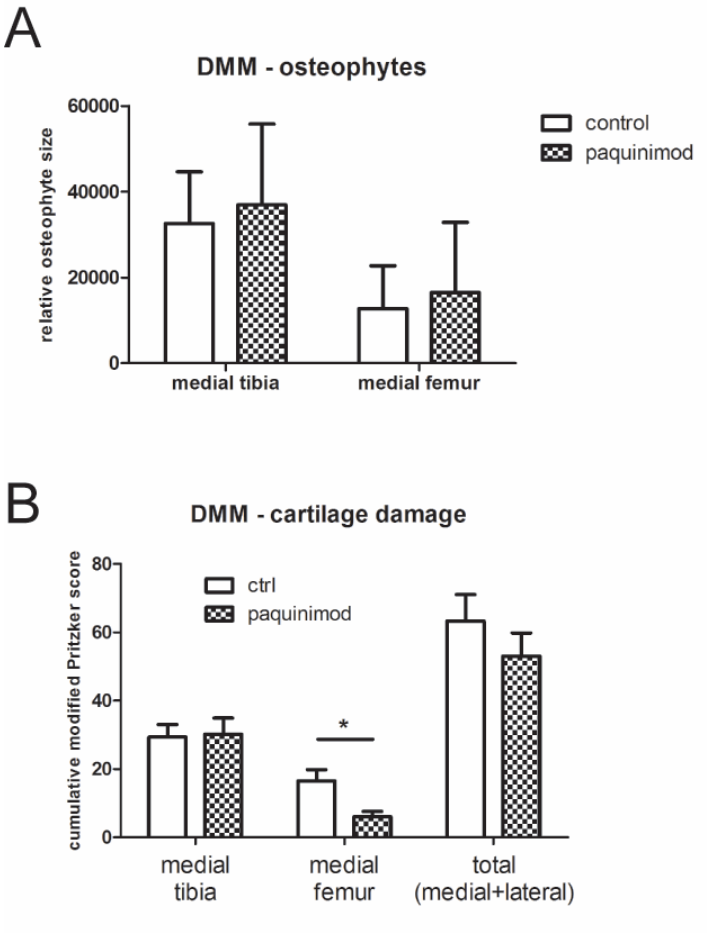
- Change to proportional font
- 'Number of subjects' header removed
- Reduced precision
- Reduced column width allows all columns on one page:
  surface reduction by 66%!
  - Light vertical background stripe
    to better distinguish the treatment groups in columns
- Proper alignment in columns
- 'Min, max' placed in parentheses after median
  - Boldface for main category headers, grouped BMI categories
    under Body Mass Index
- Abbreviated variable labels
- Only the single relevant footnote '(d)' retained

Table 10.1.3.1 (cont'd)
Demographic and Baseline Characteristics (Double-Blind Period)
All Patients Randomized Set

	placebo (N=15)	20 mg (N=22)	40 mg (N=18)	80 mg (N=15)	160 mg (N=13)	total (N=83)
Body Mass Index (kg/m^2)[d]						
mean (SD)	29 (5)	34 (10)	28 (6)	32 (12)	27 (5)	30 (9)
median (min, max)	28 (20, 37)	30 (20, 60)	29 (17, 44)	28 (20, 61)	26 (19, 38)	29 (17, 61)
BMI Categories (kg/ m^2; N,%)						
< 30	9 (60)	12 (55)	13 (72)	9 (60)	10 (77)	53 (64)
≥ 30	6 (40)	10 (45)	5 (28)	6 (40)	3 (23)	30 (36)
Smoking status (N,%)						
never	5 (33)	12 (55)	8 (44)	5 (33)	5 (39)	35 (42)
current	7 (47)	7 (32)	4 (22)	4 (27)	6 (26)	28 (34)
ex	3 (20)	3 (14)	6 (33)	6 (40)	2 (15)	20 (24)
Female Reproductive Status (N,%)						
postmenopausal	1 (7)	0	0	0	0	1 (1)
surgically sterile	2 (13)	3 (14)	0	1 (7)	0	6 (7)
female of childbearing potential	4 (27)	7 (32)	4 (22)	2 (13)	4 (31)	21 (25)
n/a (male)	8 (53)	12 (55)	14 (78)	12 (80)	9 (69)	55 (66)

d. BMI is calculated from the weight taken prior to the first dose of study drug and height taken as Screening.

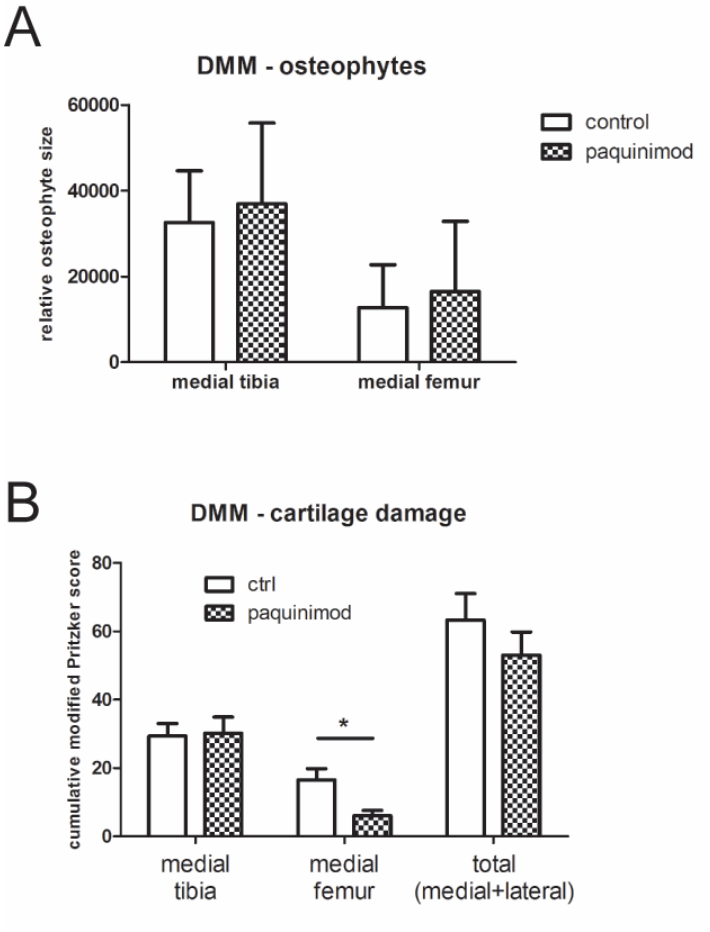
Clear vision: the ‘dynamite plunger’



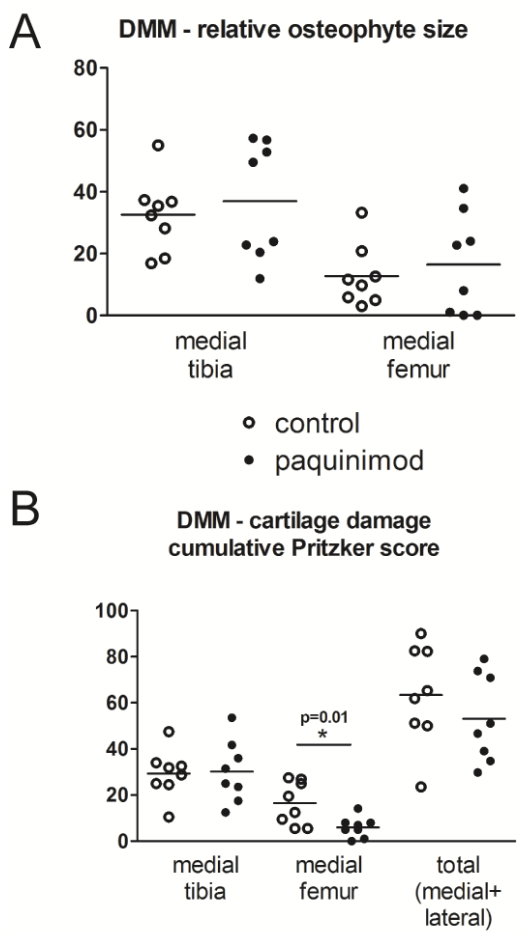
distributions of observations
summarized as mean + error
depicted as bar graphs with error bars

confess:
Have you made graphs like this?

submitted



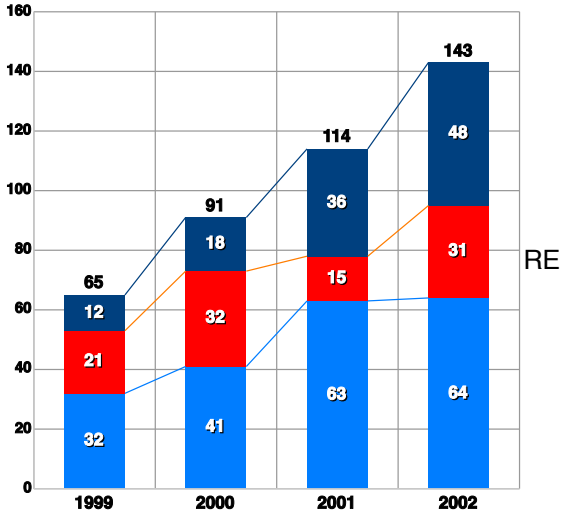
published

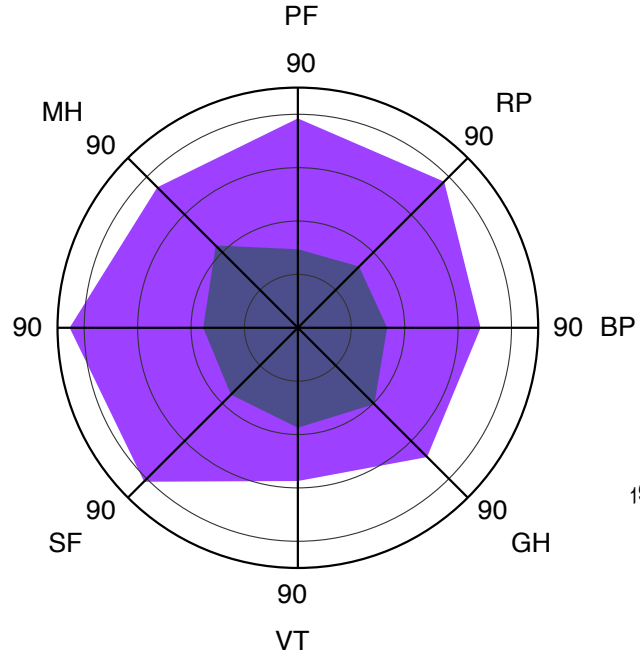


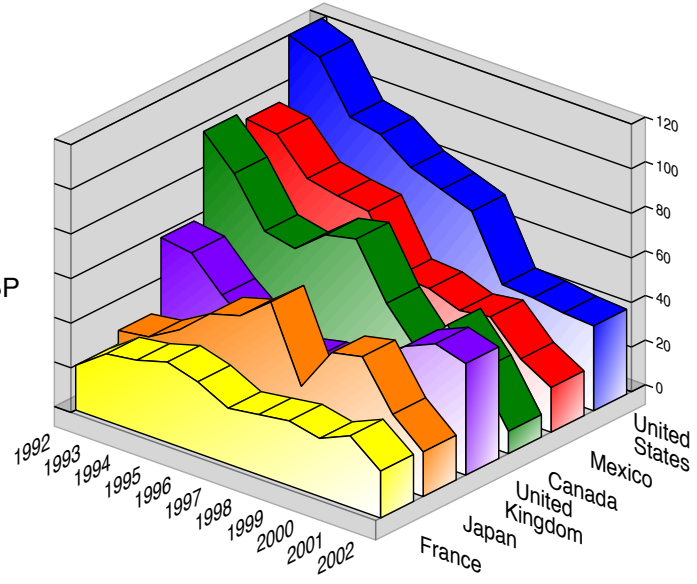
Schelbergen RF, et al.
Ann Rheum Dis 2015;74:2254.

Clear vision: graph types to avoid

stack bar area 3D and...

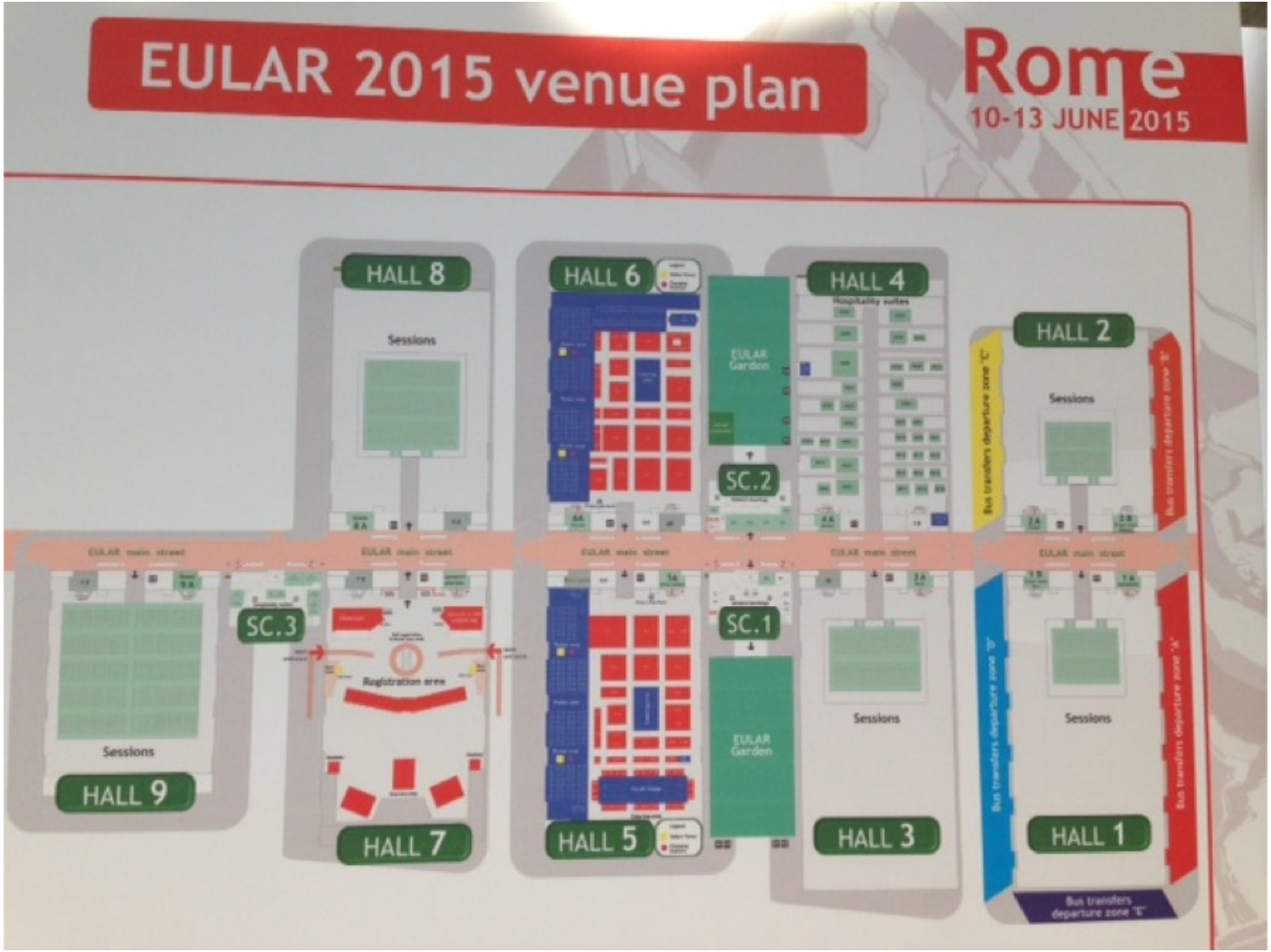


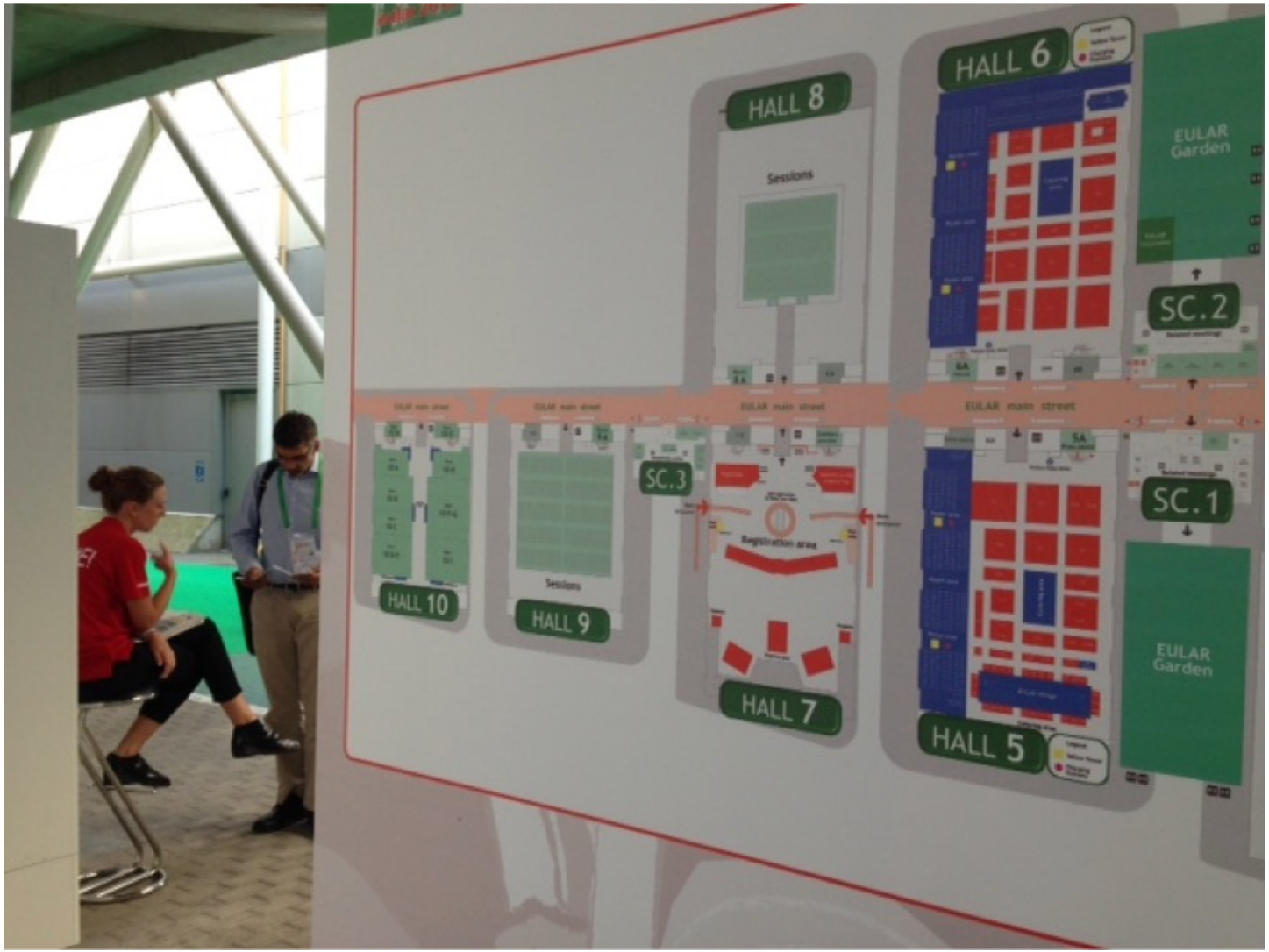




Clear understanding

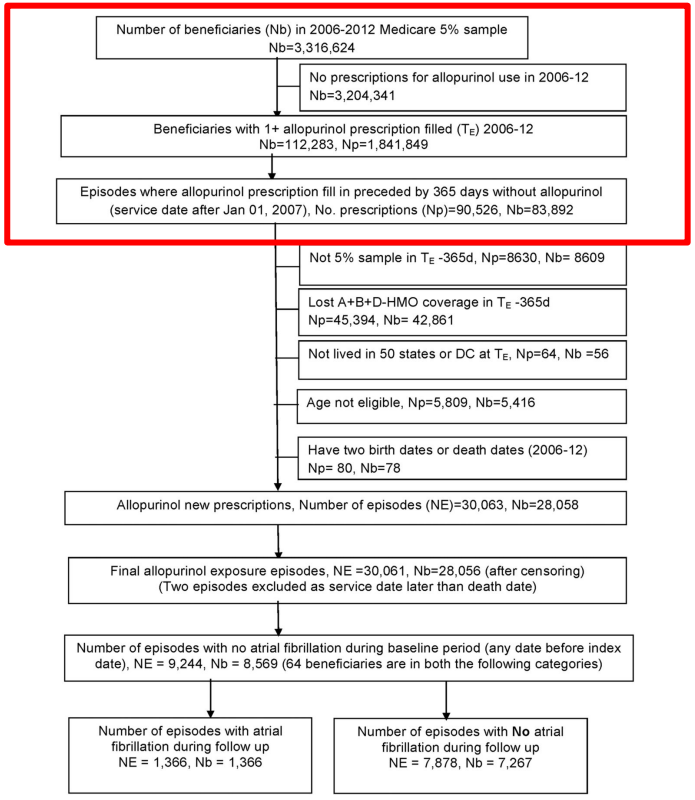

EULAR 2015 venue plan
Rome
HALL 8
HALL 6
HALL 4
HALL 2
SC.2
SC.3
SC.1
HALL 10
HALL 9
HALL 7
HALL 5
HALL 3
HALL 1
EULAR official shuttle departure zones
Rome
ZONE A
ZONE B
ZONE C
ZONE D
ZONE E
Ask Me


EULAR 2015 venue plan
Rome
10-13 JUNE 2015
HALL 8
Sessions
HALL 6
EULAR Garden
HALL 4
Hospitality suites
HALL 2
Sessions
SC.2
SC.3
SC.1
Registration area
Sessions
HALL 9
HALL 7
HALL 5
EULAR Garden
HALL 3
Sessions
HALL 1
Bus transfers departure zone 'C'
Bus transfers departure zone 'B'
Bus transfers departure zone 'A'
Bus transfers departure zone 'E'


HALL 8
Sessions
HALL 6
EULAR Garden
SC.2
EULAR main street
SC.3
SC.1
Registration area
HALL 10
Sessions
HALL 9
HALL 7
HALL 5
EULAR Garden

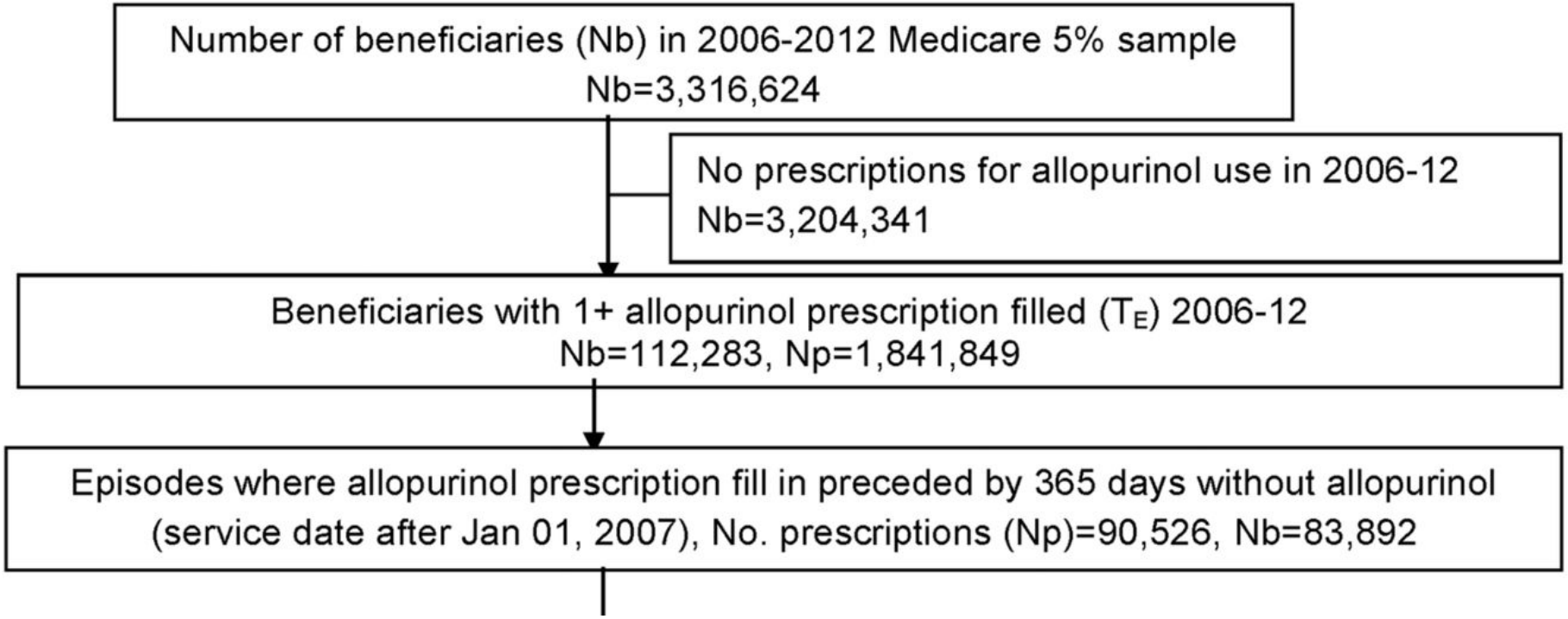
Clear understanding

Flow chart of study cohort of incident allopurinol users from 2006 to 2012 excluding allopurinol use at baseline (baseline was longest possible and at least 365 days).



Singh JA, et al.
Ann Rheum Dis
2017;76:72-8.

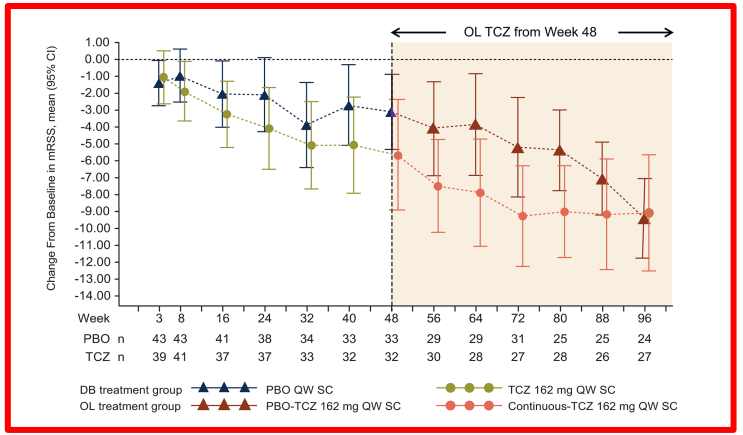
Clear understanding



category	beneficiaries	allopurinol prescriptions
2006-12 Medicare 5% sample	3,320,000	
at least 1 prescription	112,000	1,840,000
new prescription	83,900	90,500
analysis set	28,100	30,100
no AF during baseline	8,570	9,240
AF during follow up: yes	1,340	1,370
AF during follow up: no	7,270	7,880

category	beneficiaries	allopurinol prescriptions
no prescription	3,200,000	
not 5% sample	8,610	8,630
lost coverage	42,900	45,400
age exclusion	5,420	5,810
other	144	134

Clear understanding



	PBO		TCZ	
Wk	Mean (SD) [95% CI] change from BL	Mean (SD) [95% CI] observed score	Mean (SD) [95% CI] change from BL	Mean (SD) [95% CI] observed score
24	-2.1 (6.7) [-4.3, 0.1]	23.2 (9.3) [20.2, 26.3]	-4.1 (7.3) [-6.5, -1.7]	21.8 (9.9) [18.5, 25.1]
48	-3.1 (6.3) [-5.4, -0.9]	22.3 (8.1) [19.4, 25.1]	-5.6 (9.1) [-8.9, -2.4]	19.6 (10.1) [15.9, 23.2]
72	-5.2 (7.9) [-8.1, -2.3]	19.8 (8.0) [16.9, 22.7]	-9.3 (7.5) [-12.2, -6.3]	16.0 (9.1) [12.4, 19.7]
96	-9.4 (5.6) [-11.8, -7.0]	15.3 (7.6) [12.1, 18.6]	-9.1 (8.7) [-12.5, -5.6]	16.2 (9.8) [12.3, 20.1]

Figure 2 Mean change (95% CI) in mRSS from baseline to week 96 (intent-to-treat population; observed data). Negative values denote improvement. Patients randomly assigned to PBO 162 mg QW SC received OL TCZ 162 mg QW SC from week 48. BL, baseline; DB, double-blind; mRSS, modified Rodnan Skin Score; OL, open-label; PBO, placebo; %pFVC, per cent predicted forced vital capacity; QW, every week; SC, subcutaneously; TCZ, tocilizumab.

≥60% and change in mRSS equal to or greater than the MCID of 4.7 units in the continuous-tocilizumab group (table 2).

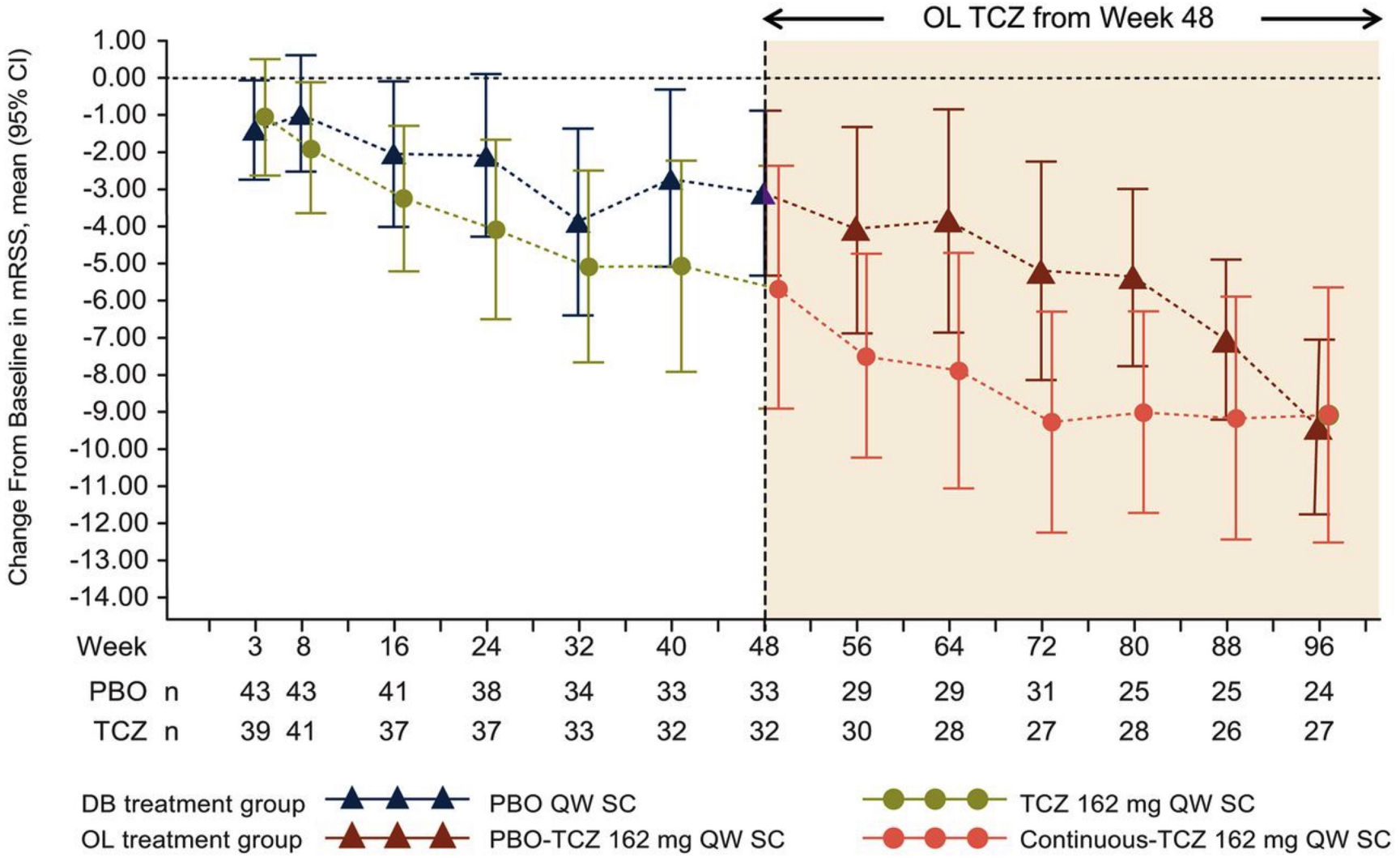
Improvements in Clinician Global VAS and patient-reported outcomes, as indicated by negative change in HAQ-DI, Clinician Global VAS, and Patient Global VAS and positive change in FACIT-Fatigue Score, observed at week 48 in the tocilizumab group were maintained through the open-label period in the continuous-tocilizumab group (table 2). Furthermore, greater improvements in patient-reported outcomes were observed in placebo-tocilizumab patients after they switched to tocilizumab during the open-label period than during the double-blind placebo period. Patients in the placebo group experienced mean (95%CI) changes from baseline in HAQ-DI of 0.17 (0.05 to 0.30) after 48 weeks of double-blind placebo treatment and –0.29 (–0.46 to –0.13) at week 96 after 48 weeks of open-label tocilizumab treatment (placebo-tocilizumab). Changes from baseline in Clinician Global VAS were –7.69 (–15.06 to –0.32) and –20.61 (–29.52 to –11.7), respectively, changes in Patient Global VAS were –4.03 (–12.42 to 4.36) and –23.75 (–38.95 to –3.46), respectively, and changes in FACIT-Fatigue Scores were 1.37 (–1.37 to 4.11) and 11.26 (5.72 to 16.81), respectively.

Among patients who completed the study to week 96 (completers analysis), similar proportions in both treatment groups experienced worsening in %pFVC (figure 3); 42% of patients in the placebo-to-cilizumab group and 46% of patients in the continuous-tocilizumab group had absolute decreases (>0) in %pFVC during the open-label period from weeks 48 to 96 compared with 83% of patients receiving placebo and 54% of patients receiving tocilizumab during the double-blind period from weeks 0 to 48. During the open-label period, no patients in either treatment group who completed week 96 or withdrew experienced >10%absolute decline in %pFVC after receiving tocilizumab, in contrast to three in the placebo group and one in the tocilizumab group during the double-blind period.

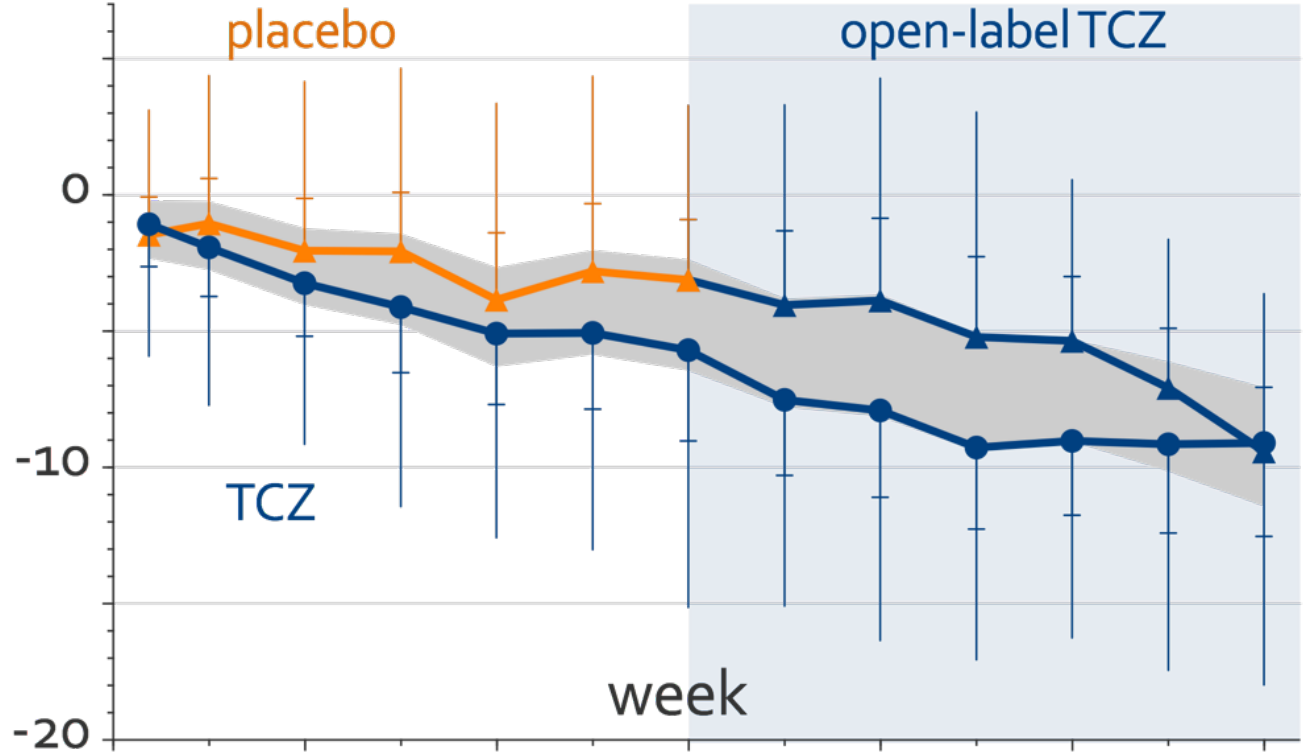
Safety

SAE rates (95% CIs) were 76.1 (50.6–110.0) in the placebo group and 66.7 (42.3–100.1) in the tocilizumab group by week

Khanna D. Ann Rheum Dis 2018;77:212


OL TCZ from Week 48
Change From Baseline in mRSS, mean (95% CI)
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00
-9.00
-10.00
-11.00
-12.00
-13.00
-14.00
Week 3 8 16 24 32 40 48 56 64 72 80 88 96
PBO n 43 43 41 38 34 33 33 29 29 31 25 25 24
TCZ n 39 41 37 37 33 32 32 30 28 27 28 26 27
DB treatment group
OL treatment group
PBO QW SC
PBO-TCZ 162 mg QW SC
TCZ 162 mg QW SC
Continuous-TCZ 162 mg QW SC

change in modified Rodnan skin score (mean)



placebo n	43	41	34	33	29	25	24
TCZ n	43	37	33	32	28	28	27

dataviz creation: summing up

- general strategy: clear vision, clear understanding

- message/audience/context
  - different for article, poster, oral

- tools
  - dedicated graph program
  - tables usually in word processor
  - posters usually in slide program

- time

effective imaging: the bottom line

- clear vision:
  - good graphs, images, tables; effective and minimal text
- clear understanding:
  - focus on a single message
  - tells a story through a well-ordered and obvious sequence

it’s not rocket science…

… but like everything else

it requires **effort**
and **dedication**