# Improving Forest/Caterpillar Plots

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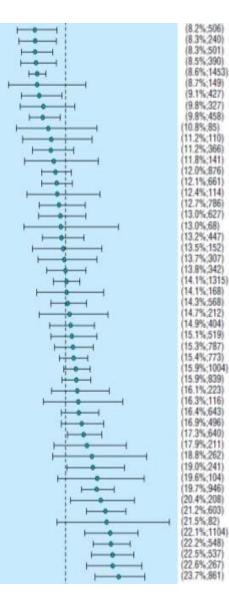
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#### **Example Caterpillar Plot**

w.icnarc.org

Manchester Fertility Services **Fazakerley Hospital** Ninewells Hospital Hull IVF Unit King's College Hospital **BMI Chiltern Hospital Cromwell IVF Centre ARU Aberdeen University** Walsgrave Hospital Hartlepool General Hospital **BUPA Hospital, Leicester** University College Hospital Wirral Fertility Centre Glasgow Royal Infirmary Sheffield Fertility Centre Leicester Royal Infirmary London Fertility Centre St Mary's Hospital Newham General Hospital Edinburgh ACU **BMI Portland Hospital** Washington Hospital **Royal Victoria Infirmary Bourne Hall Clinic** University Hospital Wales **Bridge Fertility Centre** Esperance Hospital, Eastbourne Wessex Fertility Services **Churchill Clinic Midland Fertility Services** University of Bristol Wolfson Family Clinic **Royal Masonic Hospital** Northampton Fertility Service North Staffordshire Hospital London Women's Clinic Guy's and St Thomas's Hospitals **BMI Park Hospital BUPA Roding Hospital** Holly House Fertility Unit **BMI Priory Hospital** South Cleveland Hospital Leeds General Infirmary **BMI Cheisfield Park Hospital** Oxford IVF Unit Southmead General Lister Hospital Royal Maternity Hospital, Belfast St James's Hospital Birmingham Women's Hospital NURTURE, Nottingham



# **Typical Uses and Interpretations**

- Display data from "league tables" that rank institutions
- Display data from meta-analysis
- Interpretations
  - Accuracy of each mean or other estimate
  - Comparison of two means based on overlap
- Note: one is correct, the other not

### Outline of Method

$$V_{diff} = V_1 + V_2 = 2V$$
$$SE_{diff} = \sqrt{2SE} \gg 1.4SE$$

- Means would have to differ by
  2 SE<sub>diff</sub> = 2(1.4) SE to be significant
- Thus we need intervals based on 1.4 SE, not 2 (or 1.96) SE
- For a normal distribution, this is an 84% interval

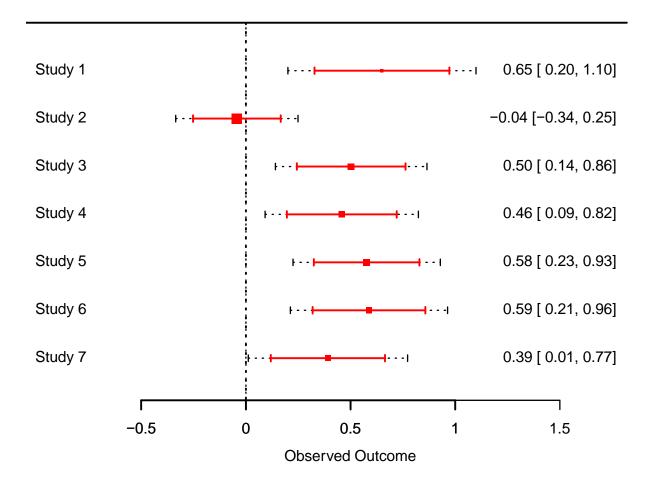
## **Ref and Procedure**

- Goldstein H, Healy MJR. (1995). The graphical presentation of a collection of means. *Journal of the Royal Statistical Society A*, 158, 175–177.
- Ideally: display both 84% and 95% intervals
- Method 1: Modify plot function forest() in R package metafor (Viechtbauer)
- Method 2: Use built-in metafor functions
- https://www.metaforproject.org/doku.php/plots:forest\_plot\_with\_multiple\_cis

### Small example Usual forest plot

Study 1				0.65 [ 0.20, 1.10]		
Study 2	+-	••••••		-0.04 [-0.34, 0.25]		
Study 3			}·····	0.50 [ 0.14, 0.86]		
Study 4			<b>⊦</b>	0.46 [ 0.09, 0.82]		
Study 5			}·····-	0.58 [ 0.23, 0.93]		
Study 6			}······	0.59 [ 0.21, 0.96]		
Study 7		+	·····	0.39 [ 0.01, 0.77]		
		t				
	-0.5	0	0.5 1	1.5		
Observed Outcome						

### New Forest Plot (Method 1)



### New Forest Plot (built-in functions)

Study

Estimate [95% CI]

	•	
Study 1	<b>_</b>	0.65 [ 0.20, 1.10]
Study 2		-0.04 [-0.34, 0.25]
Study 3	- <b></b> =	0.50 [ 0.14, 0.86]
Study 4	=	0.46 [ 0.09, 0.82]
Study 5	=	0.58 [ 0.23, 0.93]
Study 6	=	0.59 [ 0.21, 0.96]
Study 7		0.39 [ 0.01, 0.77]
	-0.5 0 0.5 1 1.5	
	Observed Outcome	

#### Non meta-analysis example: Surgical complications

Study		Estimate [95% CI]
Bariatrics	-	0.04 [0.04, 0.05]
Cholecystectomy	-	0.05 [0.04, 0.06]
Hernia	-	0.02 [0.01, 0.03]
Colectomy		0.11 [0.10, 0.13]
Appendectomy	-	0.02 [0.01, 0.02]
Hiatal.hernia	-	0.04 [0.03, 0.05]
Ventral.HerniaComponent	-	0.05 [0.03, 0.06]
Ileostomy.Closure	=	0.12 [0.07, 0.16]
Pancreatectomy	<b>-</b>	- 0.23 [0.16, 0.31]
Hepatic	- <b></b>	0.07 [0.03, 0.12]
	•	

## Conclusions

- With only 95% intervals, we can be misled by overlap/nonoverlap
- With only 84% intervals, we won't have intervals we want for individual studies
- With both in one combined plot, we get everything we need
- Easy to do with *metafor* package, using suggested options or choose Ity, Iwd, col

## Limitations

- Assumption of equal variances/standard errors
- Goldstein and Healy have more nuanced technique for unequal variance case
- Nothing is perfect for unequal variance case (always approximate)
- Approximate (but conservative) post hoc multiple comparisons are possible