Comment construire et écrire une méta-analyse ?

David GASQ *

Cours optionnel de DES MPR – Généralités en méthodologie pour la MPR

28 juin 2022 - 20 minutes + 10 min de discussion

**MCU-PH, Université Toulouse 3, CHU de Toulouse; ToNIC, Toulouse NeuroImaging Center, Université de Toulouse, Inserm, UPS*

Revue systématique et méta-analyse

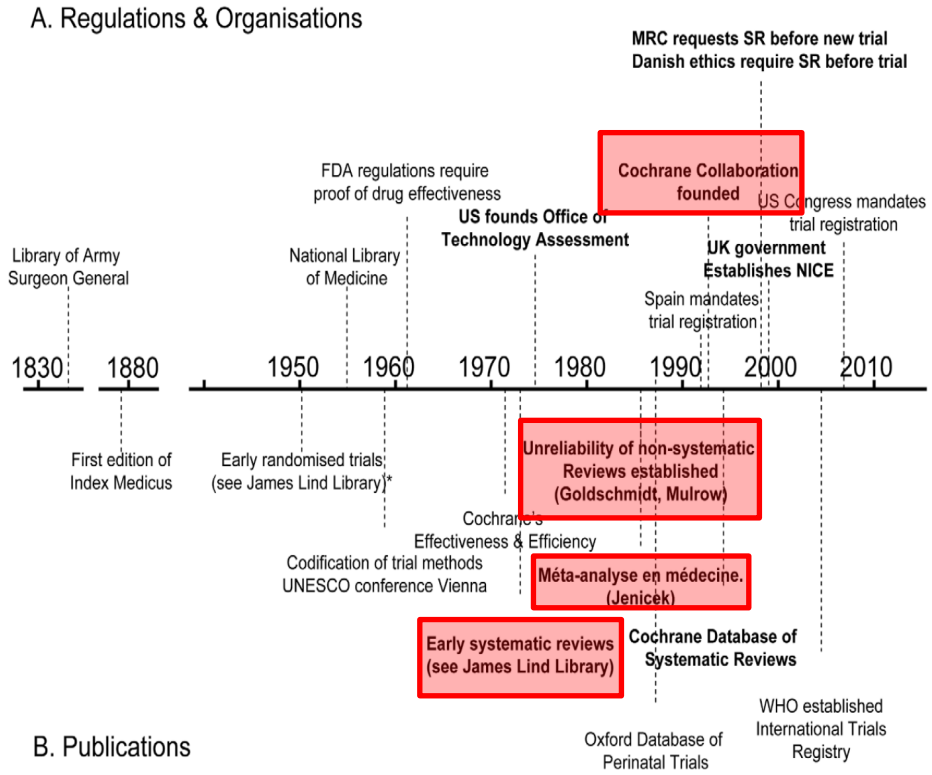


Figure 1. Policy and academic milestones in the development of trials and the science of reviewing trials.
doi:10.1371/journal.pmed.1000326.g001

Seventy-Five Trials and Eleven Systematic Reviews a Day: How Will We Ever Keep Up? *2010*

Hilda Bastian[1]*, Paul Glasziou[2], Iain Chalmers[3]

1 German Institute for Quality and Efficiency in Health Care (IQWiG), Cologne, Germany, 2 Centre for Research in Evidence-Based Practice, Faculty of Health Sciences, Bond University, Gold Coast, Australia, 3 James Lind Library, James Lind Initiative, Oxford, United Kingdom

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

PLoS Medicine | www.plosmedicine.org 0696 August 2005 | Volume 2 | Issue 8 | e124

The New Statistics: Why and How

Psychological Science XXXX 1–23 © The Author(s) 2013 Reprints and permissions: sagepub.com/journalsPermissions.nav DOI: 10.1177/0956797613504966 pss.sagepub.com SAGE

Geoff Cumming
La Trobe University

VIEWPOINT

The Proposal to Lower *P* Value Thresholds to .005

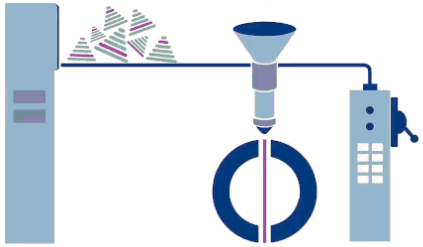
John P.A. Ioannidis JAMA April 10, 2018 Volume 319, Number 14

David GASQ
DES MPR
27/06/2022

Revue systématique de littérature

Première étape = RSL *(cf. exposé C. Villepinte)*

1. Formuler une question
2. Critères de sélection ⇔ niveau de preuve
3. Recherche des publications ➔ données à analyser
4. Sélectionner les essais ⇔ qualité des études & niveaux de biais
5. Synthétiser les caractéristiques des essais
   - Hétérogénéité des études ?



Synthèse, qualités et biais des études

Table 1
Characteristics of participants, type of intervention and modalities of rehabilitation.

Study (year)	Type of intervention	N	Age, years, mean (SD)	Time post-stroke, months, mean (SD)	Baseline FMA-UE score (/66) mean (SD)	Rehabilitation modalities	
						Duration and frequency	Setting (number of centres)
Michaelsen (2006)	TRT	15	68.9 (10.7)	16.7 (9.1)	47.9 (8.5)	1 h, 3 days/week, 5 weeks	Home
Lin, Wu, Wei (2007)	CIMT	17	57.1 (18.3)	16.3 (N/A)	N/A	2 h, 5 days/week, 3 weeks	Rehab (4)
Wu, Chen, Tang (2007)	CIMT	24	53.9 (11.2)	12.5 (9.6)	46.8 (11.6)	2 h, 5 days/week, 3 weeks	Rehab (2)
Wu, Lin, Chen (2007)	CIMT	15	54.7 (8.6)	18.5 (6.9)	N/A	2 h, 5 days/week, 3 weeks	Rehab (2)
Thielman (2008)	TRT	5	62.4 (8.9)	13.6 (11.0)	29.8 (2.5)	45 min, 3 days/week, 12 sessions	Rehab (1)
Woodbury (2009)	CIMT + TRT	6	60.0 (8.6)	36.3 (35.3)	38 (10.3)	6 h, 5 days/week, 2 weeks	Rehab (1)
	CIMT	5	64.8 (2.7)	32.4 (33.7)	42.0 (6.8)	6 h, 5 days/week, 2 weeks	
Lin (2010)	BAT	16	52.1 (9.6)	13.9 (12.7)	48.0 (12.4)	2 h, 5 days/week, 3 weeks	Rehab (3)
Wu (2011)	CIMT	22	51.9 (11.9)	14.9 (12.0)	N/A	2 h, 5 days/week, 3 weeks	Rehab (4)
	BAT	22	52.2 (10.7)	15.9 (13.7)	N/A	2 h, 5 days/week, 3 weeks	
Wu, Chen, Chen (2012)	CIMT + TRT	15	52.3 (11.3)	14.9 (13.6)	46.9 (5.9)	2 h, 5 days/week, 3 weeks	Rehab (4)
	CIMT	15	54.9 (10.2)	15.0 (10.2)	46.6 (9.0)	2 h, 5 days/week, 3 weeks	
Wu, Chen, Lin (2012)	CIMT + TRT	20	54.0 (9.7)	15.7 (13.5)	43.0 (9.6)	2 h, 5 days/week, 3 weeks	Rehab (4)
	CIMT	19	56.3 (12.2)	13.7 (7.3)	39.1 (11.3)	2 h, 5 days/week, 3 weeks	
Lima (2014)	CIMT + TRT	10	61.6 (9.5)	86.0 (64.3)	46.9 (10.1)	3 h, 5 days/week, 2 weeks	Home
	CIMT	11	56.7 (7.2)	75.6 (29.4)	48.6 (5.7)	3 h, 5 days/week, 2 weeks	
de Oliveira Cacho (2015)	TRT	10	47.4 (11.5)	51.84 (48.36)	32.8 (18.6)	45 min, 2/week, 20 sessions	Rehab (1)

BAT: bilateral arm therapy; CIMT: constraint induced movement therapy; CIMT + TRT: constraint induced movement therapy associated with trunk restraint therapy; FMA-UE: Fugl-Meyer Assessment for upper extremity; Home, home-based rehabilitation; N/A: not available; Rehab, rehabilitation units; TRT: trunk restraint therapy.

Table 2
Technical aspects of the kinematic evaluation.

Study (year)	Movement capture system	Sampling frequency (LPF), Hz	No. of markers	Position analysed	Distance of object	Movement velocity	No. of trials	Task analysed	Onset/offset of movement
Michaelsen (2006)	IRED, Optotrack	120	8	Seated, trunk unrestrained	80% AL	SV	10	Palmar grasp (cylinder)	> 5% PV/< 5% PV
Lin, Wu, Wei (2007)	IMAS, Vicon	60 (5)	4	Seated, trunk restrained	AL	SV	5	Reaching to grasp a can	Pressure sensor/ Movement of can
Wu, Chen, Tang (2007)	IMAS, Vicon	60 (5)	1	Seated, trunk restrained	AL	SV	5	Reaching to press a bell	Hand pressure sensor/ Desk bell pressure sensor
Wu, Lin, Chen (2007)	IMAS, Vicon	60 (5)	1	Seated, trunk restrained	AL	SV	3	Reaching to press a bell	Hand pressure sensor/ Desk bell pressure sensor
Thielman (2008)	IMAS, Motion Analysis System	60 (6)	5	Seated, trunk unrestrained	75% AL	SV	5	Reaching to touch a target	Wrist velocity > 0.06 m/s/< 0.06 m/s
Woodbury (2009)	IMAS, Vicon	100 (12)	12	Seated, trunk unrestrained	80% AL	SV	3	Reaching to touch a target	> 10% PV/< 10% PV
Lin (2010)	IMAS, Vicon	120 (5)	1	Seated, trunk restrained	AL	MV	3	Reaching to press a bell with index	> 5% PV/Desk bell pressure sensor
Wu (2011)	IMAS, Vicon	120	1	Seated, trunk restrained	AL	MV	3	Reaching to press a bell with index	> 5% PV/Desk bell pressure sensor
Wu, Chen, Chen (2012)	IMAS, Vicon	120 (5)	12	Seated, trunk unrestrained	90% AL	SV	3	Reaching to grasp a can	> 5% PV/< 5% PV
Wu, Chen, Lin (2012)	IMAS, Vicon	120 (5)	12	Seated, trunk unrestrained	90% AL	MV	3	Reaching to press a bell with index	> 5% PV/Desk bell pressure sensor
Lima (2014)	IMAS, Qualisys	120 (7)	27	Seated, trunk unrestrained	90% AL	SV	N/A	Reaching to grasp a can	N/A/N/A
de Oliveira Cacho (2015)	IMAS, Qualisys	240 (6)	5	Seated, trunk restrained	AL	N/A	3	Reaching a target	> 5% PV/< 5% PV

AL: arm length; Hz: Hertz; IMAS: infrared motion analysis system (passive markers); IRED: infrared-emitting diodes; LPF: low pass filter; MV: maximal velocity; N/A: not available; SV: spontaneous velocity; PV: peak velocity.

Annals of Physical and Rehabilitation Medicine 64 (2021) 101366
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Review

Responsiveness of kinematic and clinical measures of upper-limb motor function after stroke: A systematic review and meta-analysis

Claire Villepinte [a,b,c,*], Arpana Verma [d], Chloe Dimeglio [e,f], Xavier De Boissezon [a,g], David Gasq [a,c]

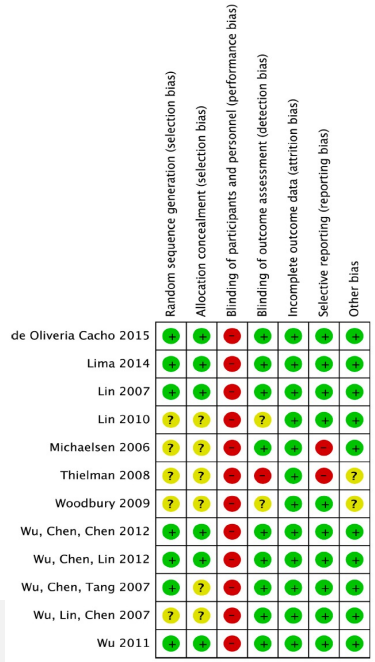

Fig. 2. Risk of bias of studies assessed with the Cochrane Collaboration Risk of Bias tool.

Méta-analyse quantitative

1. Approche quantitative et systématique
2. Combinaison de données ➔ synthèse chiffrée
   - Augmente la puissance statistique
   - Augmente la précision de l'estimation et améliore sa généralisation
   - Explication de la variabilité entre études
     - *Manque de données valides ?*
3. Aboutit à de nouveaux résultats

Indicateurs méta-analysables

- Le principe = méta-analyser un indicateur extrait ou calculé à partir des études

- Pour être méta-analysable, l'indicateur doit être:
  - Comparable
  - Calculable ⇔ erreur standard connue
  - Interprétable

- Indicateur = **taille d'effet (*effect size*)**
  - Donnée reflétant la magnitude et la direction d'une relation
    - Ex. = effet d'un traitement A versus B
  - ES = différence de moyenne standardisée
    - ***d de Cohen*** *(Hedges' g, Glass, …)*

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s}$$

Effect size	***d***
Very small	0.01
Small	0.20
Medium	0.50
Large	0.80
Very large	1.20
Huge	2.0

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    - Ex. = effet d'un traitement A versus B
  - ES = différence de moyenne standardisée
    - ***d de Cohen*** *(Hedges' g, Glass, …)*
  - Calcul à partir de la tendance centrale et **dispersion**

Standard deviation (SD)

$$\sigma = \sqrt{V} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}x_i^2 - \bar{x}^2}.$$

Standard error (SE)

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

Z-score

$$z = \frac{x - \mu}{\sigma}$$

Confidence interval (CI)

$$\text{Upper 95\% limit} = \bar{x} + (\text{SE} \times 1.96)$$

$$\text{Lower 95\% limit} = \bar{x} - (\text{SE} \times 1.96)$$

Le recueil des données

- Recueil méthodique de l'indicateur ciblé = tendance centrale + dispersion
- Vérification = procédure en binôme

Type	KinCom	NumStudy	Study	Subgroup	n	PreM	PreSD	PostM	PostSD
CLIO	FMA-UE	3	Wu, Chen, Tang 2007	CIMT	24	39,5	13,5	45,8	11,6
CLIO	FMA-UE	5	Thielman 2008	TRT	5	29,8	2,5	36,2	2,4
CLIO	FMA-UE	6	Woodbury 2009	CIMT	5	42,0	6,8	46,0	4,6
CLIO	FMA-UE	7	Woodbury 2009	CIMT+TRT	6	38,0	10,3	49,0	9,7
CLIO	FMA-UE	8	Lin 2010	BAT	16	48,0	12,4	57,6	1,3
CLIO	FMA-UE	11	Wu, Chen, Chen 2012	CIMT	15	46,6	9,0	50,9	7,8
CLIO	FMA-UE	12	Wu, Chen, Chen 2012	CIMT+TRT	15	46,9	5,9	54,0	5,4
CLIO	FMA-UE	17	de Oliveira Cacho 2015	TRT	10	32,8	18,6	35,7	20,1
CLIO	MAL AOU	2	Lin, Wu, Wei 2007	CIMT	17	0,64	0,71	2,04	1,04
CLIO	MAL AOU	3	Wu, Chen, Tang 2007	CIMT	24	0,64	0,86	1,85	1,24
CLIO	MAL AOU	4	Wu, Lin, Chen 2007	CIMT	15	0,95	0,89	2,32	1,45
CLIO	MAL AOU	6	Woodbury 2009	CIMT	5	1,61	1,00	3,14	1,32
CLIO	MAL AOU	7	Woodbury 2009	CIMT+TRT	6	1,43	0,68	2,27	0,79
CLIO	MAL AOU	8	Lin 2010	BAT	16	1,06	0,83	1,25	0,92
CLIO	MAL AOU	9	Wu 2011	BAT	22	0,90	0,77	1,41	1,06
CLIO	MAL AOU	10	Wu 2011	CIMT	22	1,02	0,82	2,11	1,05
CLIO	MAL AOU	11	Wu, Chen, Chen 2012	CIMT	15	1,11	0,74	2,06	0,92
CLIO	MAL AOU	12	Wu, Chen, Chen 2012	CIMT+TRT	15	0,97	0,61	1,99	0,85
CLIO	MAL AOU	13	Wu, Chen, Lin 2012	CIMT	19	0,60	0,60	1,50	0,80
CLIO	MAL AOU	14	Wu, Chen, Lin 2012	CIMT+TRT	20	0,80	0,70	1,50	0,80
CLIO	MAL AOU	15	Lima 2014	CIMT	11	0,70	0,70	2,60	0,70
CLIO	MAL AOU	16	Lima 2014	CIMT+TRT	10	1,30	0,60	3,10	1,00

Excel

Logiciels dédiés

Indicateurs méta-analysables

- Études descriptives (1 seul groupe)
  - Moyenne
  - Incidence, proportion, prévalence, sensibilité, spécificité, VPP, VPN
  - Corrélation
- Études comparatives (2 groupes, pré-post)
  - Différence moyenne (mean différence ou MD)
  - Différence moyenne standardisée (standardized mean difference ou SMD)
  - Risque relatif, odds ratio, NNT, hazard ratio, …
- Méta-analyser = ?
  - Calculer la taille d'effet poolée = effect size (ES)
  - Calculer l'intervalle de confiance à 95% de l'estimation de l'ES
  - Réaliser un test statistique de la différence par rapport à zéro (Z-score, p-value)

Forest plot

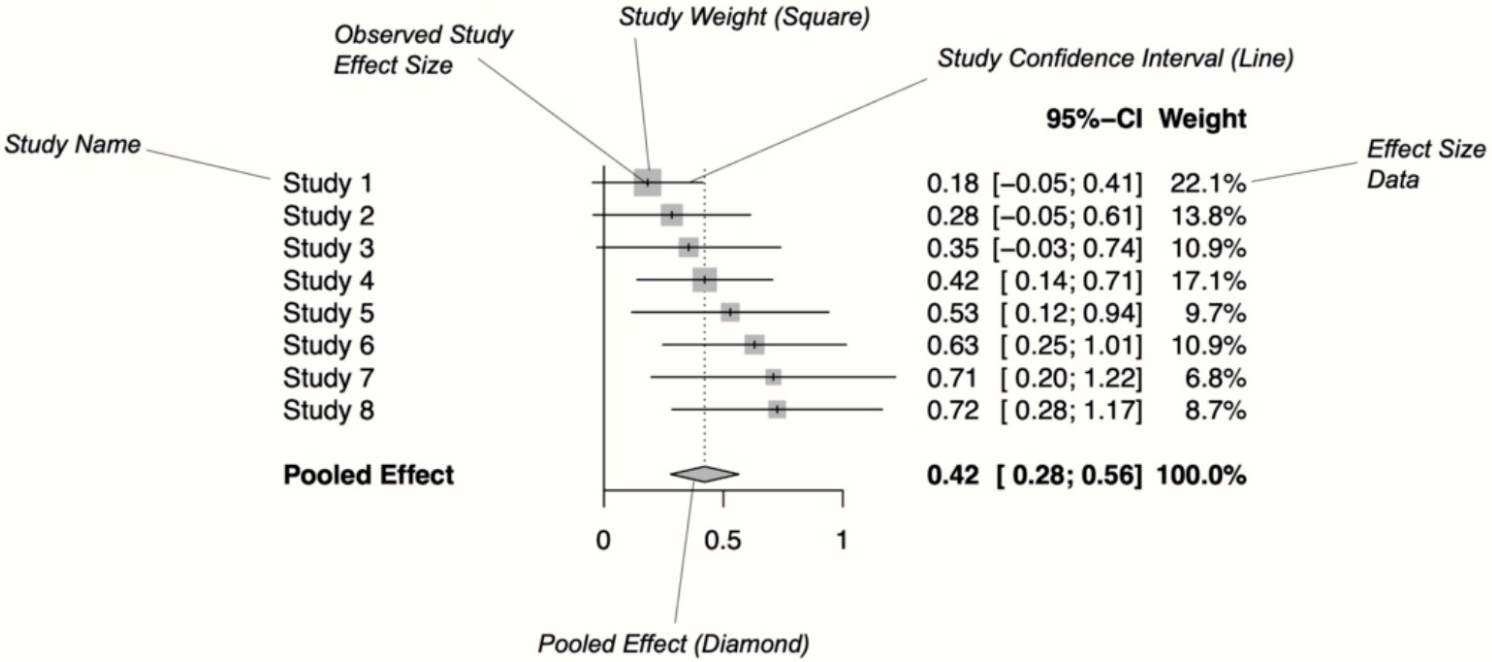


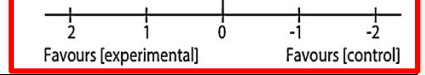
Figure 6.1: Key elements of a forest plot.

Doing Meta-Analysis in R: A Hands-on Guide.

Forest plot

Annals of Physical and Rehabilitation Medicine 59 (2016) 114–124
Available online at ScienceDirect www.sciencedirect.com
Elsevier Masson France EM|consulte www.em-consulte.com
Original article
Muscle strengthening for hemiparesis after stroke: A meta-analysis
Sophie Wist *, Julie Clivaz, Martin Sattelmayer
School of Health Sciences, University of Applied Sciences and Arts Western Switzerland Valais (HES-SO Valais-Wallis), Leukerbad, Switzerland

Study or Subgroup	Experimental Total	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
6MWT end of intervention				
PRT				
Subtotal (95% CI)	75	69	58.6%	0.28 [-0.20, 0.75]
Test for overall effect: Z = 1.14 (P = 0.25)				
Aerobic exercise				
Subtotal (95% CI)	68	65	35.4%	0.09 [-0.25, 0.43]
Test for overall effect: Z = 0.50 (P = 0.62)				
FES				
Subtotal (95% CI)	6	6	6.0%	-0.19 [-1.32, 0.95]
Test for overall effect: Z = 0.32 (P = 0.75)				
Total 6MWT end of intervention (95% CI)	149	140	100.0%	0.17 [-0.12, 0.46]
Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 6.63$, df = 5 (P = 0.25); $I^2 = 25\%$				
Test for overall effect: Z = 1.15 (P = 0.25)				
6MWT follow up (4 years)				
PRT				
Total 6MWT follow up (95% CI)	11	7	100.0%	0.36 [-0.59, 1.32]
Test for overall effect: Z = 0.75 (P = 0.46)				
10MWT end of intervention				
PRT				
Total 10MWT end of intervention (95% CI)	60	54	100.0%	0.09 [-0.28, 0.46]
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.10$, df = 2 (P = 0.95); $I^2 = 0\%$				
Test for overall effect: Z = 0.50 (P = 0.62)				
10MWT follow up (4 years)				
PRT				
Total (95% CI)	11	7	100.0%	0.43 [-0.53, 1.39]
Test for overall effect: Z = 0.88 (P = 0.38)				



Forest plot

Annals of Physical and Rehabilitation Medicine 63 (2020) 518–534
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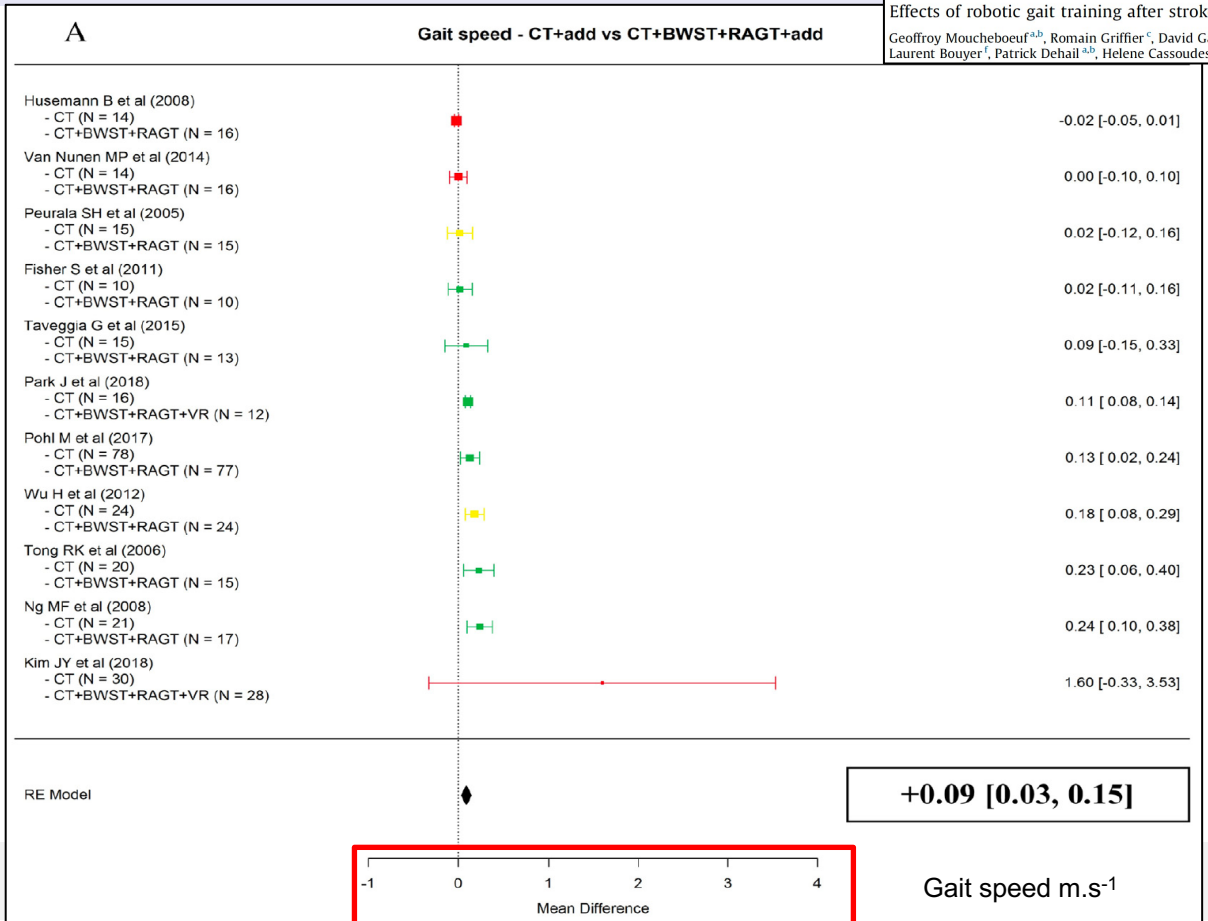
Review

Effects of robotic gait training after stroke: A meta-analysis☆

Geoffroy Moucheboeuf[a,b], Romain Griffier[c], David Gasq[d,e], Bertrand Glize[a,b], Laurent Bouyer[f], Patrick Dehail[a,b], Helene Cassoudesalle[a,b,*]



Forest plot

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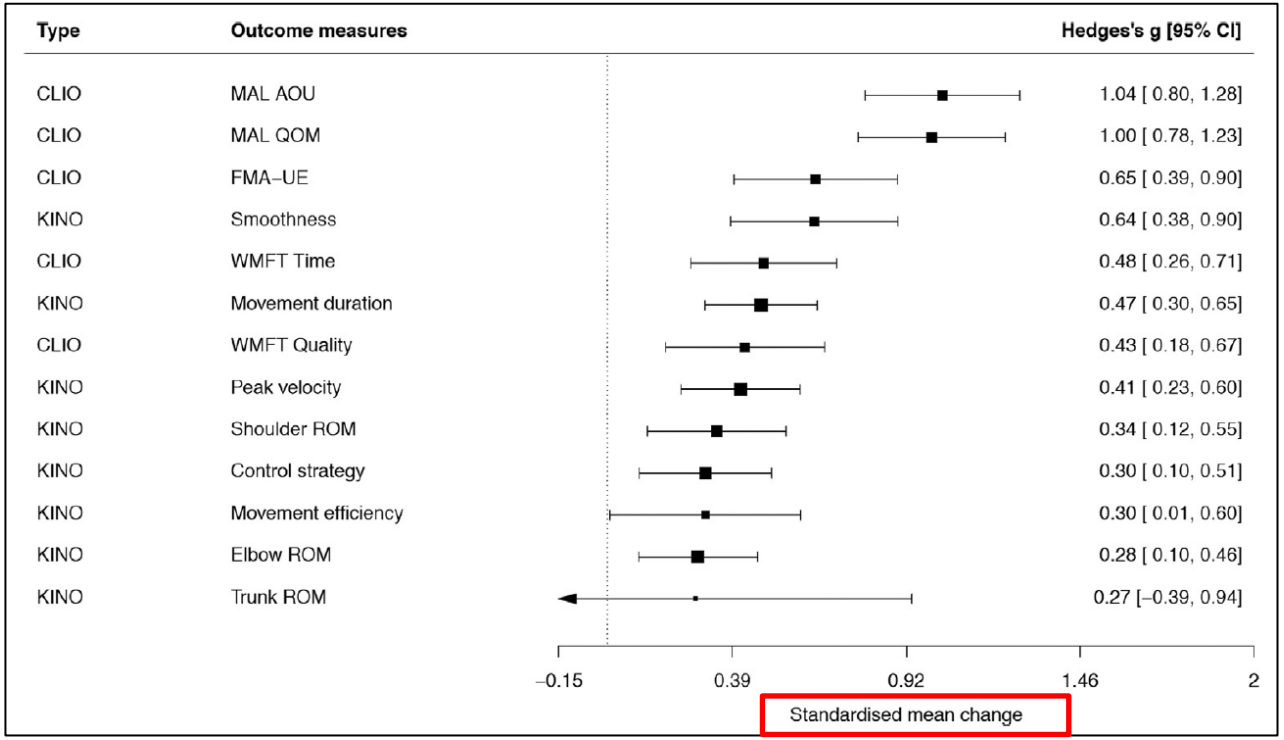
Review

Responsiveness of kinematic and clinical measures of upper-limb motor function after stroke: A systematic review and meta-analysis

Claire Villepinte [a,b,c,*], Arpana Verma [d], Chloe Dimeglio [e,f], Xavier De Boissezon [a,g], David Gasq [a,c]



Forest plot

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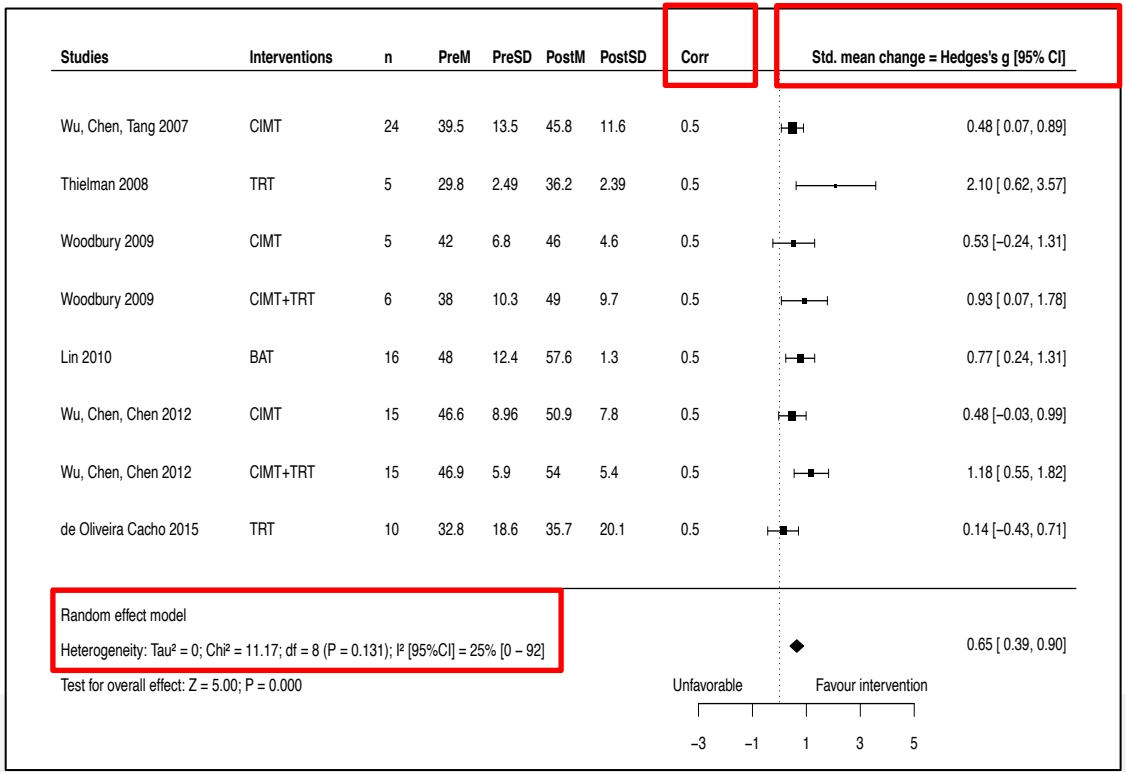
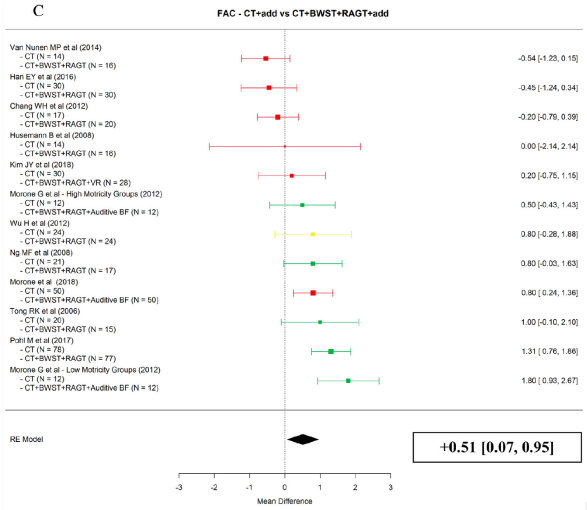
- Mesurer l'hétérogénéité: test Q de Cochran, I^2 statistic, …
- Modèle à **effet aléatoire >> fixe**

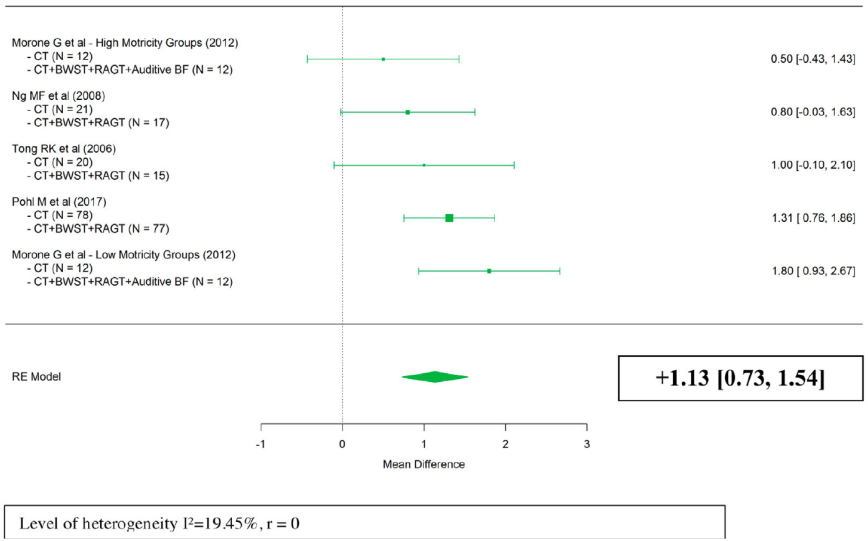
Explorer l'hétérogénéité ++



Analyse en sous-groupes et méta-régression

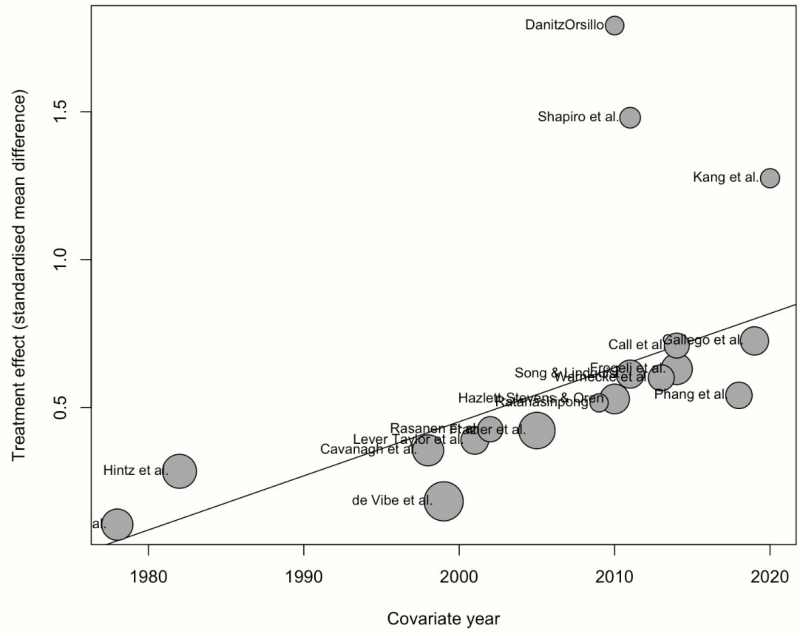
- Exploration de l'hétérogénéité entre études
  - Facteurs potentiels d'hétérogénéité connus à priori
- Analyses en sous-groupes
- Méta-régression
  - Procédure statistique





Analyse en sous-groupes et méta-régression

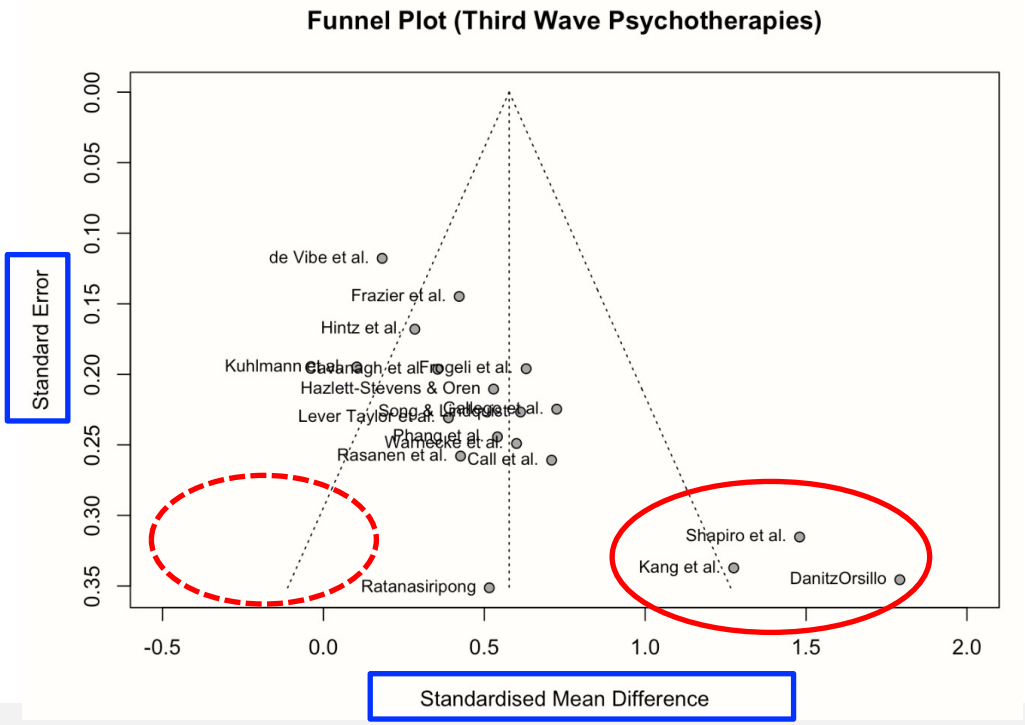
- Exploration de l'hétérogénéité entre études
  - Facteurs potentiels d'hétérogénéité connus à priori
- Analyses en sous-groupes
- Méta-régression
  - Procédure statistique & **Bubble plot**



Doing Meta-Analysis in R: A Hands-on Guide.

Funnel plot = évaluation du biais de publication

- Test de Egger = asymétrie du funnel plot ?



Doing Meta-Analysis in R: A Hands-on Guide.

Analyse de sensibilité

Annals of Physical and Rehabilitation Medicine 64 (2021) 101366

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Review

Responsiveness of kinematic and clinical measures of upper-limb motor function after stroke: A systematic review and meta-analysis

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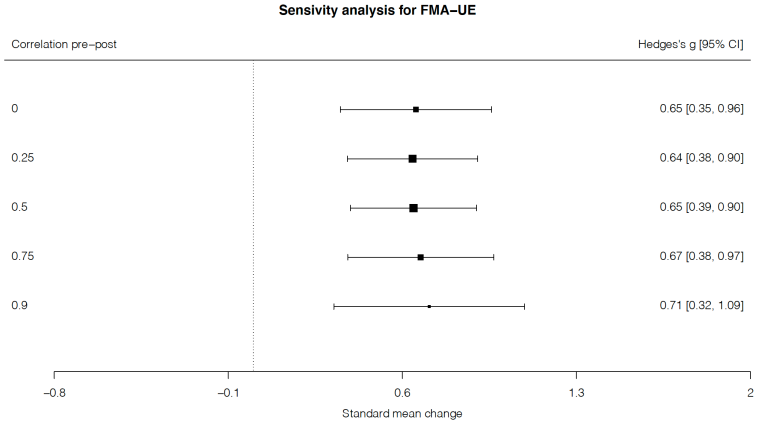
- Évaluation de l'impact d'un choix sur les résultats
  - Ex. = valeur de la corrélation pré-post
  - Impact d'études biaisées, cut-off, etc …



Supplemental results – Sensitivity analysis

Table A1. Sensitivity analysis for different correlation values used for computing the pre–post summative effect size (a statistically signifi
difference for an outcome would correspond to a lack of overlap of confidence intervals [CIs] obtained with different values of r).

Kinematic and clinical outcome measures	No. participants/ rehab groups/studies	Pooled effect estimates of standardised mean difference calculated by Hedges' g (95 imputing different correlation values				
		r = 0.0	r = 0.25	r = 0.5	r = 0.75	r = 0.90
MAL AOU	217/3/9	1.00 (0.75; 1.25)	1.02 (0.77; 1.26)	1.04 (0.80; 1.28)	1.04 (0.80; 1.28)	0.98 (0.74; 1.23)
MAL QOM	217/3/9	0.96 (0.72; 1.20)	0.98 (0.75; 1.21)	1.00 (0.78; 1.23)	1.02 (0.79; 1.25)	0.98 (0.75; 1.22)
Smoothness	121/4/8	0.69 (0.37; 1.01)	0.68 (0.38; 0.97)	0.64 (0.38; 0.97)	0.57 (0.37; 0.77)	0.48 (0.31; 0.66)
FMA-UE	96/4/6	0.65 (0.35; 0.96)	0.64 (0.38; 0.90)	0.65 (0.39; 0.90)	0.67 (0.38; 0.97)	0.71 (0.32; 1.09)
WMFT Time	75/3/3	0.53 (0.21; 0.85)	0.51 (0.23; 0.79)	0.48 (0.26; 0.71)	0.42 (0.27; 0.58)	0.33 (0.23; 0.43)
Movement duration	131/3/7	0.51 (0.26; 0.76)	0.50 (0.28; 0.71)	0.47 (0.30; 0.65)	0.42 (0.28; 0.56)	0.33 (0.22; 0.45)
WMFT Quality	64/3/2	0.43 (0.08; 0.78)	0.43 (0.13; 0.73)	0.43 (0.18; 0.67)	0.41 (0.17; 0.65)	0.39 (0.15; 0.63)
Peak velocity	114/4/3	0.43 (0.16; 0.69)	0.42 (0.19; 0.65)	0.41 (0.23; 0.60)	0.40 (0.24; 0.56)	0.38 (0.19; 0.57)
Shoulder ROM	96/3/5	0.34 (0.06; 0.62)	0.34 (0.10; 0.58)	0.34 (0.12; 0.55)	0.33 (0.14; 0.53)	0.31 (0.13; 0.48)
Movement efficiency	112/4/7	0.33 (0.05; 0.62)	0.32 (0.03; 0.61)	0.30 (0.01; 0.60)	0.27 (-0.01; 0.55)	0.22 (0.01; 0.43)
Control strategy	128/4/7	0.31 (0.07; 0.55)	0.31 (0.09; 0.52)	0.30 (0.10; 0.51)	0.30 (0.10; 0.49)	0.27 (0.10; 0.45)
Elbow ROM	107/3/6	0.28 (0.02; 0.54)	0.28 (0.05; 0.51)	0.28 (0.10; 0.46)	0.30 (0.10; 0.50)	0.26 (0.10; 0.42)
Trunk ROM	68/3/5	0.23 (-0.06; 0.58)	0.24 (-0.10; 0.58)	0.27 (-0.39; 0.94)	0.24 (-0.59; 1.07)	0.19 (-0.71, 1.08)

FMA-UE, Fugl-Meyer Motor Assessment of Upper Extremity; MAL AOU, Motor Activity Log amount of use; MAL QOM, Motor Activity Log

quality of movement; ROM, range of motion; r, coefficient of correlation between pre- and post-test paired data; WMFT, Wolf Motor Function

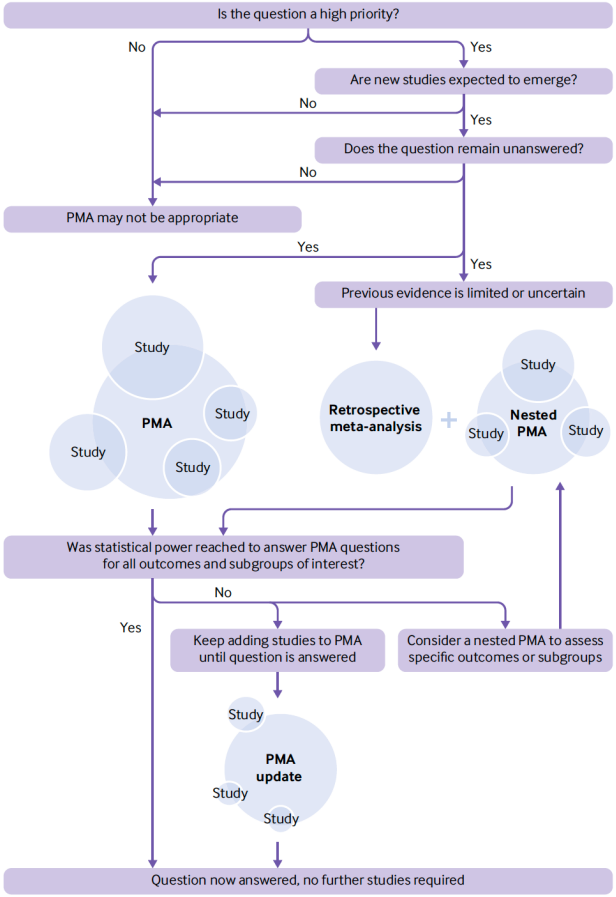
Faire encore mieux ➔ méta-analyse prospective

Limiter les biais des RSL et méta-analyses rétrospectives

RESEARCH METHODS AND REPORTING

A guide to prospective meta-analysis

Anna Lene Seidler,[1] Kylie E Hunter,[1] Saskia Cheyne,[1] Davina Ghersi,[1,2] Jesse A Berlin,[3] Lisa Askie[1]



Sources d'informations

David GASQ
DES MPR
27/06/2022

PLOS | COMPUTATIONAL BIOLOGY

EDITORIAL

Ten simple rules for carrying out and writing meta-analyses

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OPEN ACCESS

Citation: Forero DA, Lopez-Leon S, González-Giraldo Y, Bagos PG (2019) Ten simple rules for carrying out and writing meta-analyses. PLoS Comput Biol 15(5): e1006922. https://doi.org/10.1371/journal.pcbi.1006922

Editor: Scott Markel, Dassault Systemes BIOVIA, UNITED STATES

Published: May 16, 2019

Funding: YG-G is supported by a PhD fellowship from Centro de Estudios Interdisciplinarios Básicos y Aplicados CEIBA (Rodolfo Llinás Program). DAF is supported by research grants from Colciencias and VCTI. PGB is partially supported by ELIXIR-GR, the Greek Research Infrastructure for data management and analysis in the biosciences. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

Introduction

In the context of evidence-based medicine, meta-analyses provide novel and useful information [1], as they are at the top of the pyramid of evidence and consolidate previous evidence published in multiple previous reports [2]. Meta-analysis is a powerful tool to cumulate and summarize the knowledge in a research field [3]. Because of the significant increase in the published scientific literature in recent years, there has also been an important growth in the number of meta-analyses for a large number of topics [4]. It has been found that meta-analyses are among the types of publications that usually receive a larger number of citations in the biomedical sciences [5,6]. The methods and standards for carrying out meta-analyses have evolved in recent years [7–9].

Although there are several published articles describing comprehensive guidelines for specific types of meta-analyses, there is still the need for an abridged article with general and updated recommendations for researchers interested in the development of meta-analyses. We present here ten simple rules for carrying out and writing meta-analyses.

Rule 1: Specify the topic and type of the meta-analysis

Considering that a systematic review [10] is fundamental for a meta-analysis, you can use the Population, Intervention, Comparison, Outcome (PICO) model to formulate the research question. It is important to verify that there are no published meta-analyses on the specific topic in order to avoid duplication of efforts [11]. In some cases, an updated meta-analysis in a topic is needed if additional data become available. It is possible to carry out meta-analyses for multiple types of studies, such as epidemiological variables for case-control, cohort, and randomized clinical trials. As observational studies have a larger possibility of having several biases, meta-analyses of these types of designs should tak
is the possibility to carry out meta-analyses for genetic as
studies, genome-wide association studies (GWASs), or data from animal experiments. It is advisable to preregister the systematic review protocols at the International Prospective Register of Systematic Reviews (PROSPERO; https://www.crd.york.ac.uk/Prospero) database [12]. Keep in mind that an increasing number of journals require registration prior to publication.

https://www.crd.york.ac.uk/Prc

Rule 2: Follow available guidelines for different types of meta-analyses

There are several available general guidelines. The first of such efforts were the Quality of Reports of Meta-analyses of Randomized Controlled Trials (QUOROM) [13] and the Meta-

Moher et al. Systematic Reviews 2015, 4:1
http://www.systematicreviewsjournal.com/content/4/1/1

SYSTEMATIC REVIEWS

RESEARCH Open Access

Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement

RESEARCH METHODS AND REPORTING

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Check for updates

The PRISMA 2020 statement: an updated guideline for reporting systematic reviews

Matthew J Page,[1] Joanne E McKenzie,[1] Patrick M Bossuyt,[2] Isabelle Boutron,[3] Tammy C Hoffmann,[4] Cynthia D Mulrow,[5] Larissa Shamseer,[6] Jennifer M Tetzlaff,[7] Elie A Akl,[8] Sue E Brennan,[1] Roger Chou,[9] Julie Glanville,[10] Jeremy M Grimshaw,[11] Asbjørn Hróbjartsson,[12] Manoj M Lalu,[13] Tianjing Li,[14] Elizabeth W Loder,[15] Evan Mayo-Wilson,[16] Steve McDonald,[1] Luke A McGuinness,[17] Lesley A Stewart,[18] James Thomas,[19] Andrea C Tricco,[20] Vivian A Welch,[21] Penny Whiting,[17] David Moher[22]

Clinical Review & Education

JAMA | Special Communication

Preferred Reporting Items for a Systematic Review and Meta-analysis of Diagnostic Test Accuracy Studies The PRISMA-DTA Statement

Matthew D. F. McInnes, MD; David Moher, PhD; Brett D. Thombs, PhD; Trevor A. McGrath, BSc; Patrick M. Bossuyt, PhD; and the PRISMA-DTA Group

Clinical Review & Education

Special Communication

Preferred Reporting Items for a Systematic Review and Meta-analysis of Individual Participant Data The PRISMA-IPD Statement

Lesley A. Stewart, PhD; Mike Clarke, DPhil; Maroeska Rovers, PhD; Richard D. Riley, PhD; Mark Simmonds, PhD; Gavin Stewart, PhD; Jayne F. Tierney, PhD; for the PRISMA-IPD Development Group

Annals of Internal Medicine RESEARCH AND REPORTING METHODS

The PRISMA Extension Statement for Reporting of Systematic Reviews Incorporating Network Meta-analyses of Health Care Interventions: Checklist and Explanations

Sources d'informations

- Cochrane: https://www.cochrane.org/
- *Cochrane Handbook for systematic review*
- *Cochrane RevMan Web / RevMan 5*

Review Manager (RevMan)

There are two versions of Cochrane RevMan: RevMan Web (online) and RevMan 5 (desktop)

Cochrane RevMan

ReviewManager (RevMan) is Cochrane's bespoke software for writing Cochrane Reviews.

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Core methods

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2. **Determining the scope of the review and the questions it will address**
3. **Defining the criteria for including studies and how they will be grouped for synthesis**
4. **Searching for and selecting studies**
5. **Collecting data**
6. **Choosing effect measures and computing estimates of effect**
7. **Considering bias and conflicts of interest among the included studies**
8. **Assessing risk of bias in a randomized trial**
9. **Summarizing studies and preparing for the synthesis**
10. **Analysing data and undertaking meta-analyses**
11. **Undertaking network meta-analyses**
12. **Synthesizing and presenting findings using other methods**
13. **Assessing risk of bias due to missing results in a synthesis**
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Specific perspectives in reviews

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20. **Economics evidence**
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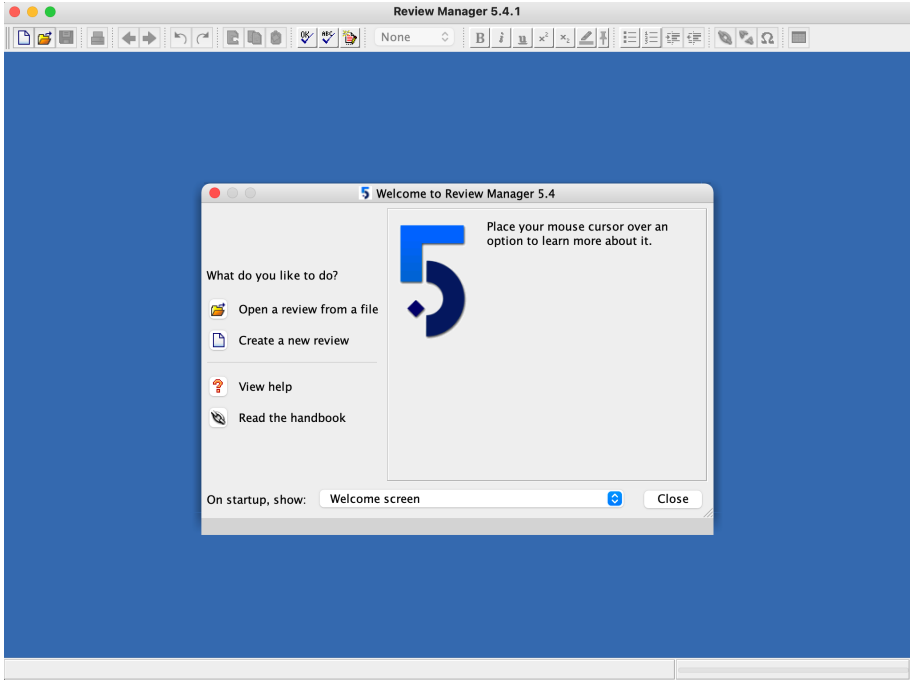
23. **Including variants on randomized trials**
24. **Including non-randomized studies**
25. **Assessing risk of bias in a non-randomized study**
26. **Individual participant data**

Outils pour la méta-analyse

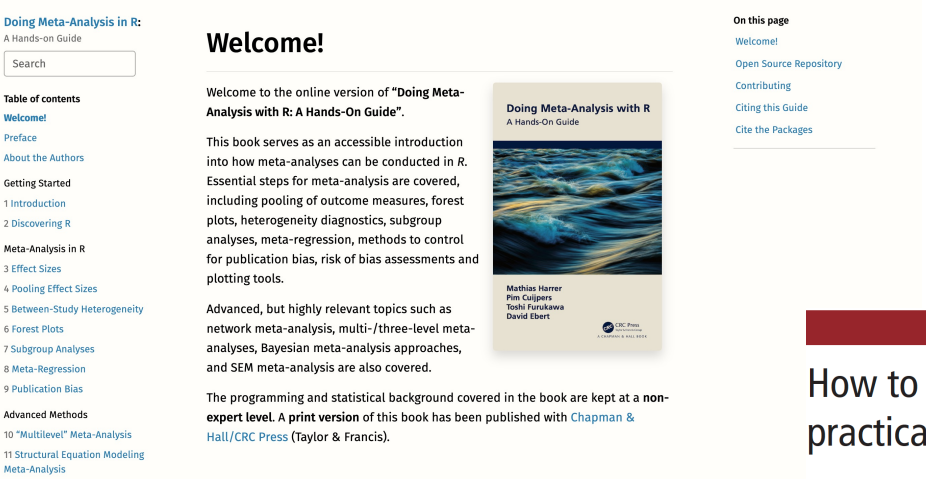
- Review Manager *



* https://training.cochrane.org/online-learning/core-software-cochrane-reviews/revman/revman-5-download/download-and-installation

Outils pour la méta-analyse

- Tutoriels:
  - https://bookdown.org/MathiasHarrer/Doing_Meta_Analysis_in_R/



Doing Meta-Analysis in R:
A Hands-on Guide

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11 Structural Equation Modeling Meta-Analysis

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Welcome to the online version of **"Doing Meta-Analysis with R: A Hands-On Guide"**.

This book serves as an accessible introduction into how meta-analyses can be conducted in *R*. Essential steps for meta-analysis are covered, including pooling of outcome measures, forest plots, heterogeneity diagnostics, subgroup analyses, meta-regression, methods to control for publication bias, risk of bias assessments and plotting tools.

Advanced, but highly relevant topics such as network meta-analysis, multi-/three-level meta-analyses, Bayesian meta-analysis approaches, and SEM meta-analysis are also covered.

The programming and statistical background covered in the book are kept at a **non-expert level**. A **print version** of this book has been published with Chapman & Hall/CRC Press (Taylor & Francis).

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How to perform a meta-analysis with R: a practical tutorial

Sara Balduzzi , Gerta Rücker , Guido Schwarzer

En pratique

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Comment construire et écrire une méta-analyse ?

David GASQ *

Cours optionnel de DES MPR – Généralités en méthodologie pour la MPR

28 juin 2022 - 20 minutes + 10 min de discussion

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