

Comparative Effectiveness of various forms of Telemedicine for Individuals with Heart Failure: A Network Meta-Analysis

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Outline

- Quickly define what I mean by telemedicine
- Provide an example of why a standard (pairwise) Meta-Analysis is sometimes not enough
- Briefly introduce the concept of Network Meta-Analysis (NMA)
- Describe how NMA was applied to study telemedicine and the results we found



What I secretly hope to achieve...

I hope that:

- you will find the concept of NMA clear
- you will be able to see its relevance for decision making
- I will not have bored you with research methods or statistics

Telemedicine defined



- Telemedicine, a term coined in the 1970s, which literally means “healing at a distance” (1), signifies the **use of technology to improve patient outcomes by increasing access to care and medical information.**

Four elements are germane to telemedicine:

1. to provide clinical support.
2. It is intended to overcome geographical barriers,
3. It involves the use of various types of technology.
4. Its goal is to improve health outcomes.

At last year's CAHSPR Conference

Can a simple telephone intervention significantly improve health outcomes in rehabilitating Coronary Artery Disease (CAD) patients? Results from a systematic review and meta-analysis



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The Effect of Telephone Support Interventions on Coronary Artery Disease (CAD) Patient Outcomes during Cardiac Rehabilitation: A Systematic Review and Meta-Analysis

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Kotb A, Hsieh S, Wells GA (2014) The Effect of Telephone Support Interventions on Coronary Artery Disease (CAD) Patient Outcomes during Cardiac Rehabilitation: A Systematic Review and Meta-Analysis. **PLoS ONE** 9(5): e96581. doi:10.1371/journal.pone.0096581





Current evidence

- typically examined the impact of **multifaceted interventions** making it difficult to determine specifically which method of telemedicine appears most effective in a specific patient population
- One solution is to **focus on one specific well-defined intervention vs. usual care**
- This is limited in that it ignores other potentially clinically relevant interventions...**if only there was something we can do about that***



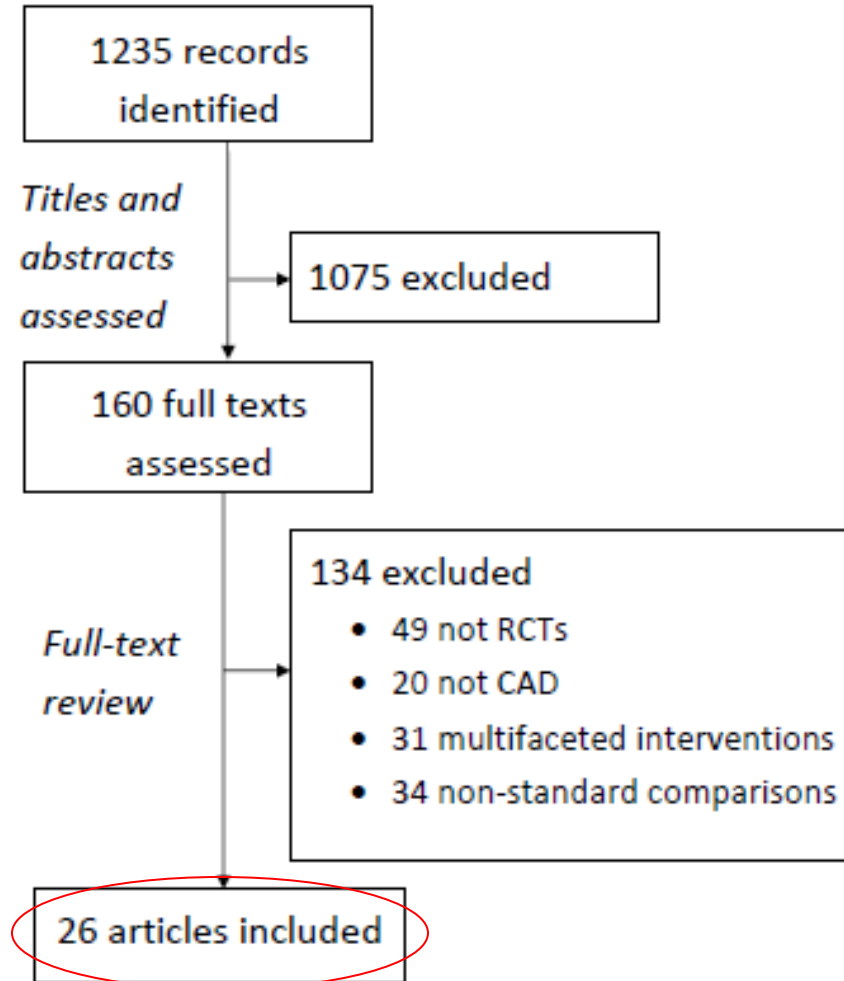


Purpose

- To examine whether or not current evidence supports the use of regular telephone follow-up alongside usual care in the follow-up of non-HF CAD patients who had recently experienced a cardiac event (defined as an MI or revascularization procedure).

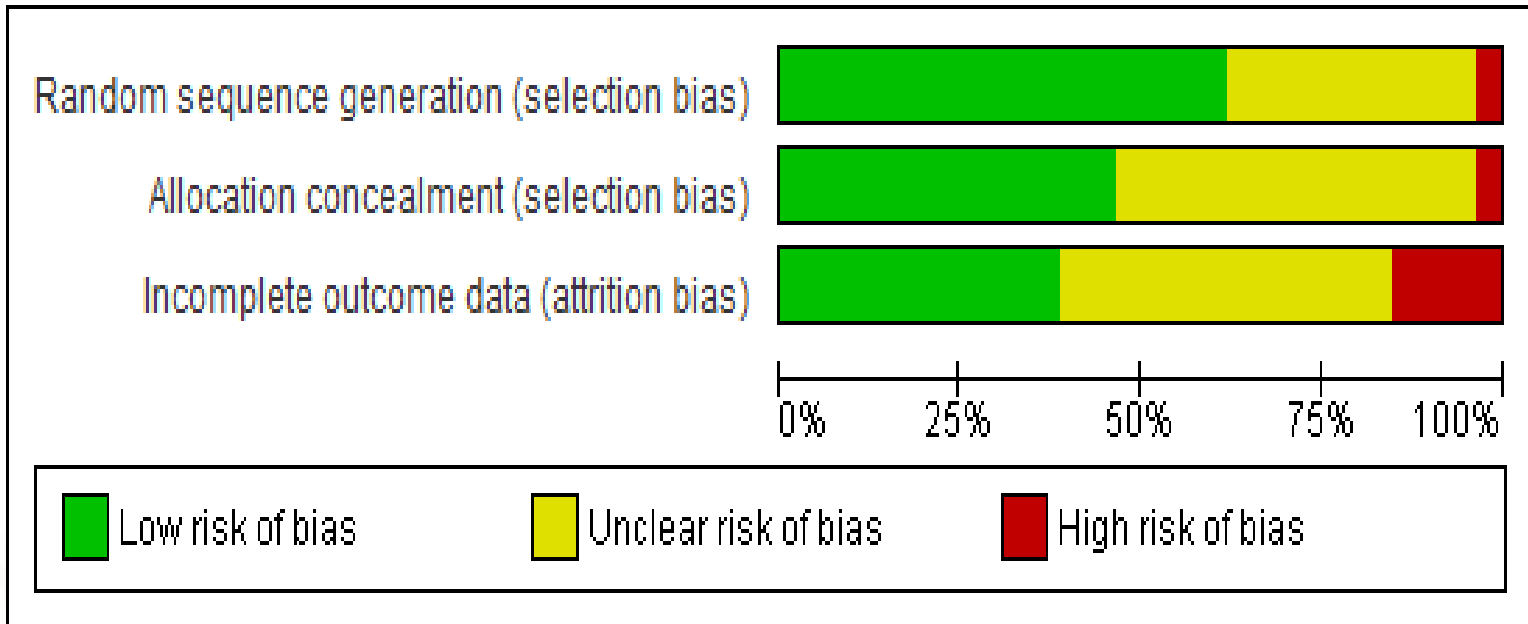


Systematic review and study selection



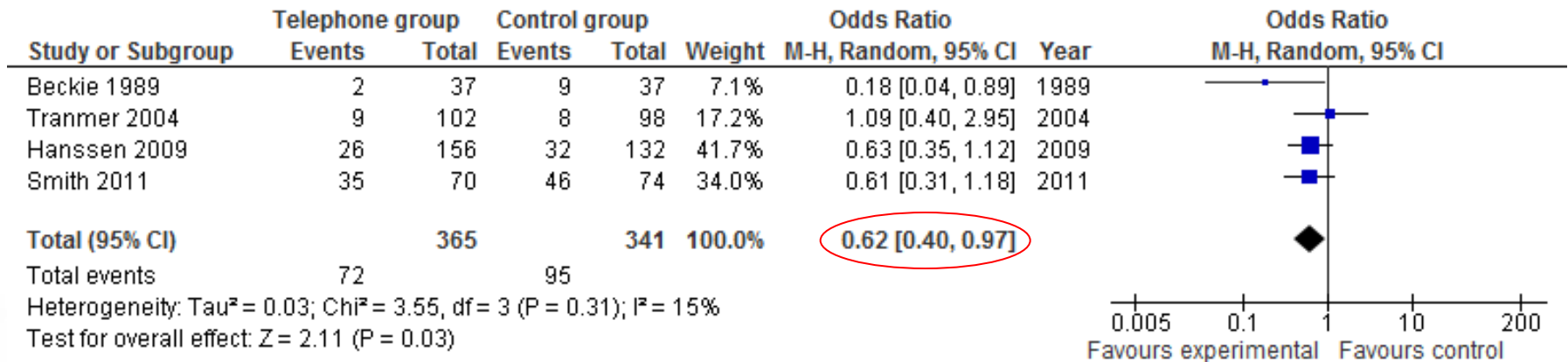


Risk of bias of included studies





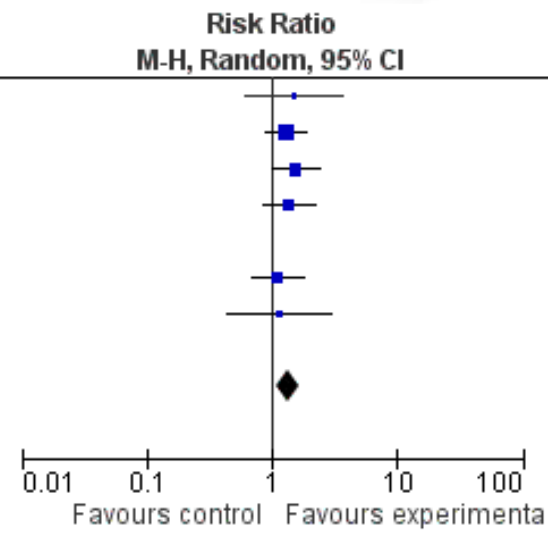
Analysis: All-cause hospitalization



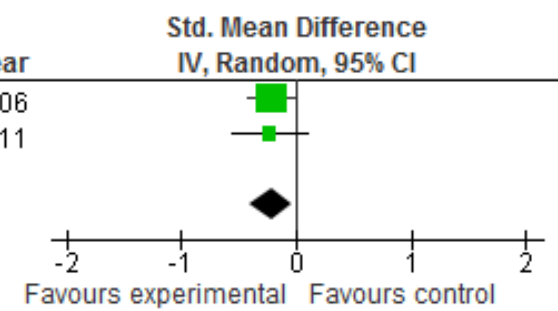


Smoking cessation and systolic blood pressure control

Study or Subgroup	Telephone group		Control group		Weight	Risk Ratio		Year
	Events	Total	Events	Total		M-H, Random, 95% CI		
Van Elderen 1994	9	30	6	30	5.4%	1.50 [0.61, 3.69]	1994	
Vale 2003	53	398	41	394	30.0%	1.28 [0.87, 1.88]	2003	
Mittag 2006	41	171	27	172	23.1%	1.53 [0.99, 2.37]	2006	
Reid 2007	23	50	17	50	18.4%	1.35 [0.83, 2.21]	2007	
Wister 2007	0	153	0	143		Not estimable	2007	
Hanssen 2009	30	156	23	132	18.3%	1.10 [0.68, 1.80]	2009	
Neubeck 2009	8	72	7	72	4.8%	1.14 [0.44, 2.99]	2009	
Total (95% CI)		1030		993	100.0%	1.32 [1.07, 1.62]		
Total events	164		121					
Heterogeneity: Tau ² = 0.00; Chi ² = 1.14, df = 5 (P = 0.95); I ² = 0%								
Test for overall effect: Z = 2.56 (P = 0.01)								



Study or Subgroup	Telephone group		Control group		Weight	Std. Mean Difference		Year
	Mean	SD	Mean	SD		Total	IV, Random, 95% CI	
Mittag 2006	132	17.1	136.1	20.6	172	70.5%	-0.22 [-0.43, -0.00]	2006
Neubeck 2011	132.3	20	136.8	17.87	72	29.5%	-0.24 [-0.56, 0.09]	2011
Total (95% CI)					243	244	100.0%	-0.22 [-0.40, -0.04]
Heterogeneity: Tau ² = 0.00; Chi ² = 0.01, df = 1 (P = 0.92); I ² = 0%								
Test for overall effect: Z = 2.44 (P = 0.01)								

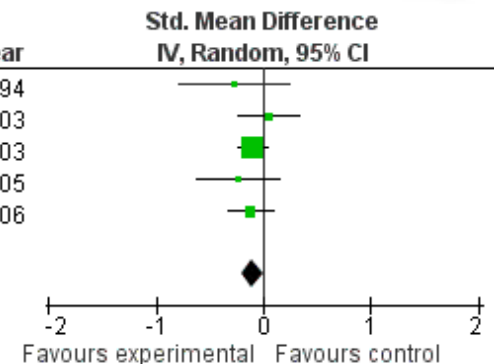




Depression and anxiety

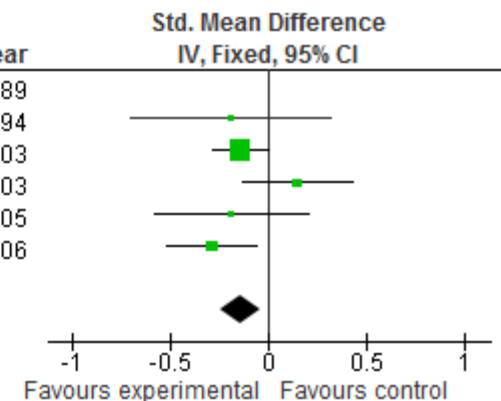
Study or Subgroup	Telephone group			Control group			Weight	Std. Mean Difference		Year
	Mean	SD	Total	Mean	SD	Total		IV, Random, 95% CI	IV, Random, 95% CI	
Van Elderen 1994	23.23	6.19	30	25.15	7.58	30	4.0%	-0.27	[-0.78, 0.23]	1994
Gallagher 2003	4.3	4.6	93	4.1	4.2	103	13.1%	0.05	[-0.24, 0.33]	2003
Vale 2003	-4.9	21.31	398	-2.8	19.18	394	53.2%	-0.10	[-0.24, 0.04]	2003
McLaughlin 2005	5.7	3.6	53	6.6	3.9	47	6.7%	-0.24	[-0.63, 0.16]	2005
Mittag 2006	11	8.6	171	12.1	8.9	172	23.0%	-0.13	[-0.34, 0.09]	2006
Total (95% CI)			745			746	100.0%	-0.10	[-0.21, -0.00]	

Heterogeneity: Tau² = 0.00; Chi² = 2.00, df = 4 (P = 0.73); I² = 0%
 Test for overall effect: Z = 2.02 (P = 0.04)



Study or Subgroup	Telephone group			Control group			Weight	Std. Mean Difference		Year
	Mean	SD	Total	Mean	SD	Total		IV, Fixed, 95% CI	IV, Fixed, 95% CI	
Beckie 1989	29.78	7.72	37	43.22	11.52	37	0.0%	-1.36	[-1.86, -0.85]	1989
Van Elderen 1994	37.09	12.12	30	39.69	14.44	30	4.2%	-0.19	[-0.70, 0.31]	1994
Vale 2003	-2.2	8.1182	398	-1.1	7.0674	394	55.0%	-0.14	[-0.28, -0.00]	2003
Gallagher 2003	5.7	5.2	103	5	4.4	93	13.6%	0.14	[-0.14, 0.42]	2003
McLaughlin 2005	6.3	3.5	53	7	3.8	47	6.9%	-0.19	[-0.58, 0.20]	2005
Mittag 2006	50.8	11.3	154	54	10.8	143	20.4%	-0.29	[-0.52, -0.06]	2006
Total (95% CI)			738			707	100.0%	-0.14	[-0.24, -0.04]	

Heterogeneity: Chi² = 5.66, df = 4 (P = 0.23); I² = 29%
 Test for overall effect: Z = 2.65 (P = 0.008)





In conclusion

- After establishing the potential impact this relatively cheap, available and feasible intervention can have, we have set our sights towards comparing the main 5 forms of telemedicine interventions in **a network meta-analysis**.
- This analysis will examine the comparative effectiveness of more complex interventions for HF patients.





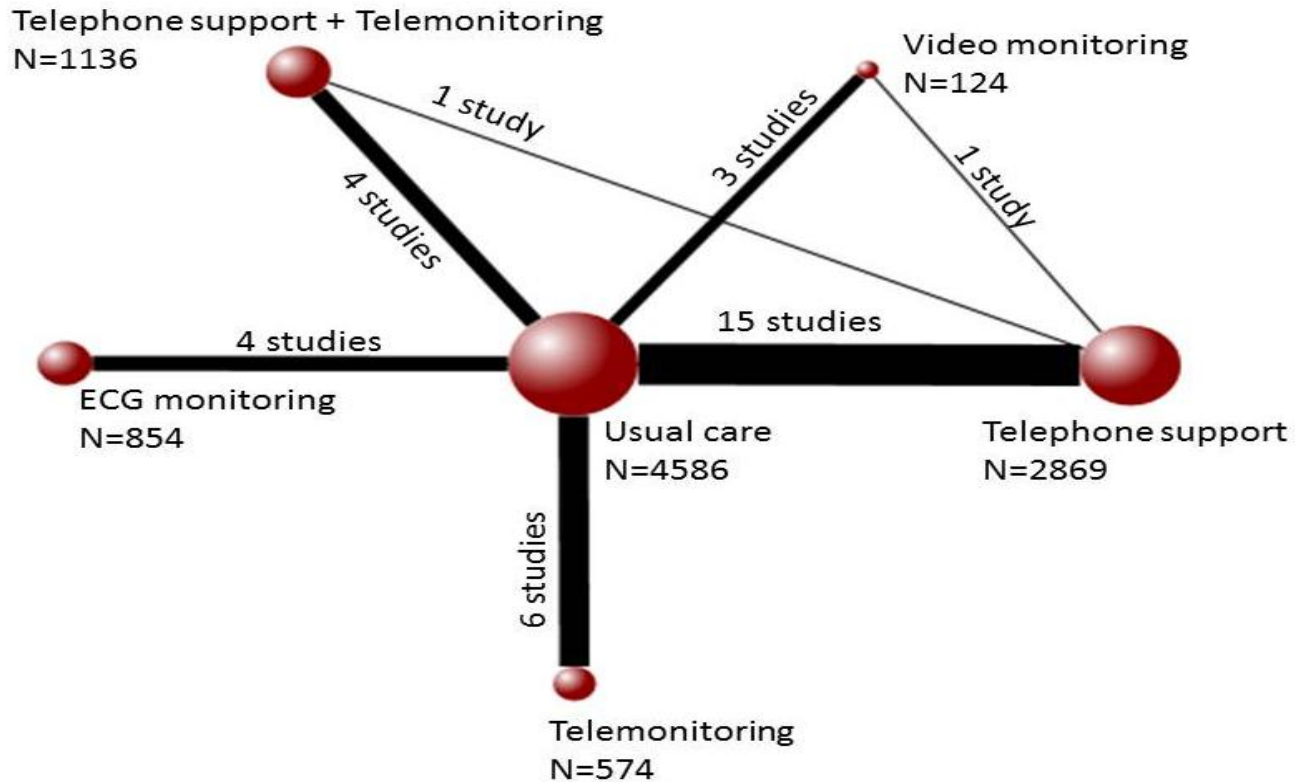
What is a Network Meta-Analysis

- Similar to a standard or pairwise meta-analysis, it allows the combination of data from individual studies but extends beyond it by
 - Comparing more than 2 treatments
 - Incorporating indirect evidence
- It is sometimes referred to as:
 - Multiple Treatments Meta-Analysis (MTM)
 - Mixed Treatment Comparison (MTC)

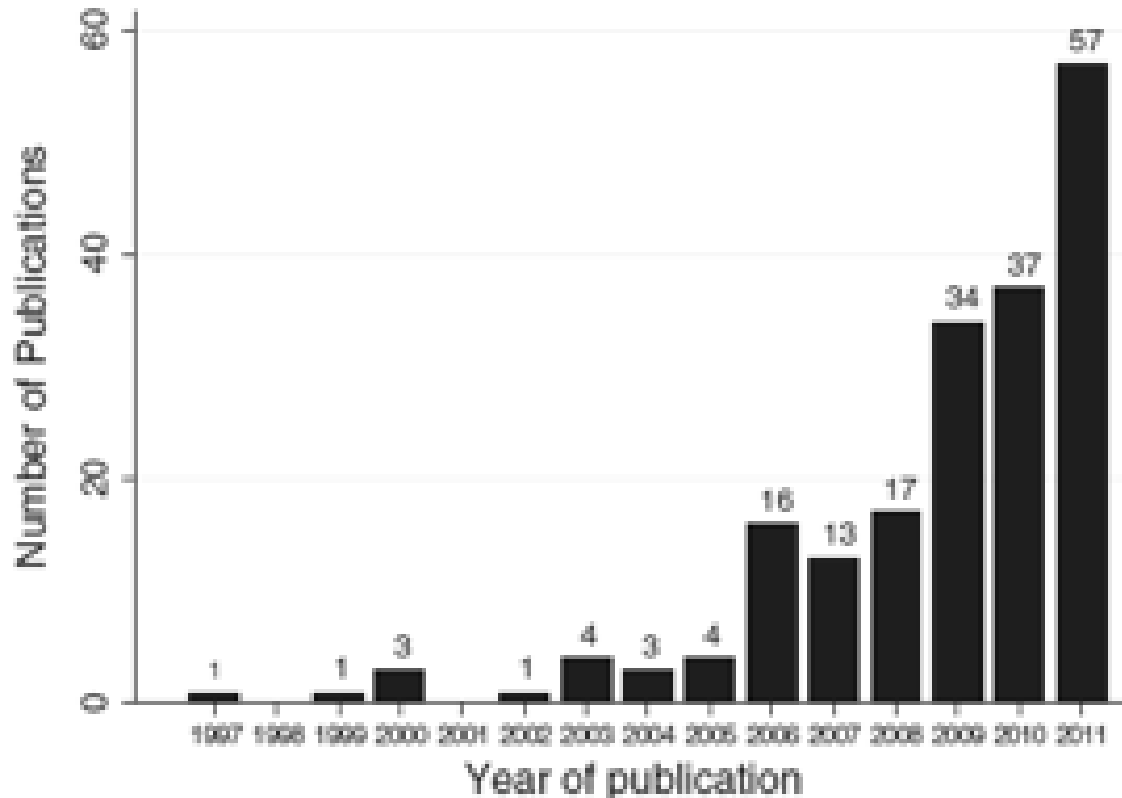




Evidence network, e.g. Mortality (total sample = 10,193)



Number of systematic reviews using NMA methodology from 1997 to 2011





Comparative efficacy and acceptability of 12 new-generation antidepressants: a multiple-treatments meta-analysis

gins, Rachel Churchill, Norio Watanabe, Atsuo Nakagawa,

BMJ

RESEARCH

Combined resynchronisation and implantable defibrillator therapy in left ventricular dysfunction: Bayesian network meta-analysis of randomised controlled trials

Simon K H Lam, MSc st

CMAJ

RESEARCH

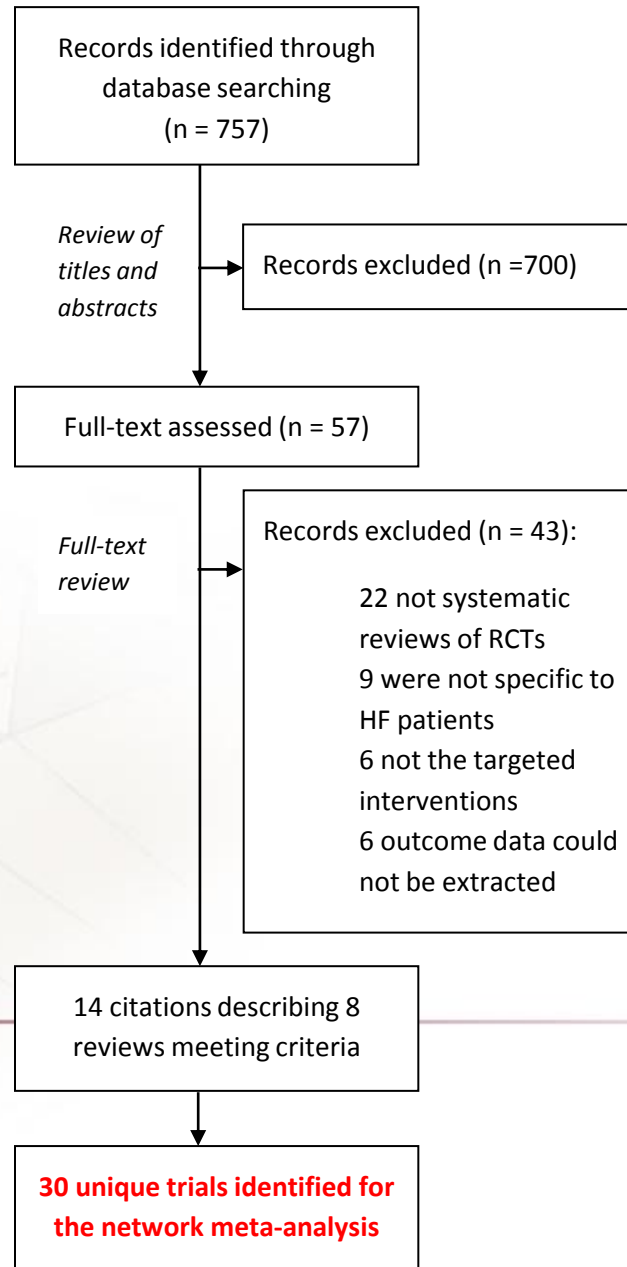
A network meta-analysis of randomized controlled trials of biologics for rheumatoid arthritis: a Cochrane overview

Jasvinder A. Singh MD, Robin Christensen PhD, George A. Wells PhD, Maria E. Suarez-Almazor MD, Rachele Buchbinder MD, Maria Angeles Lopez-Olivo MD, Elizabeth Tanjong Ghogomu MD, Peter Tugwell MD



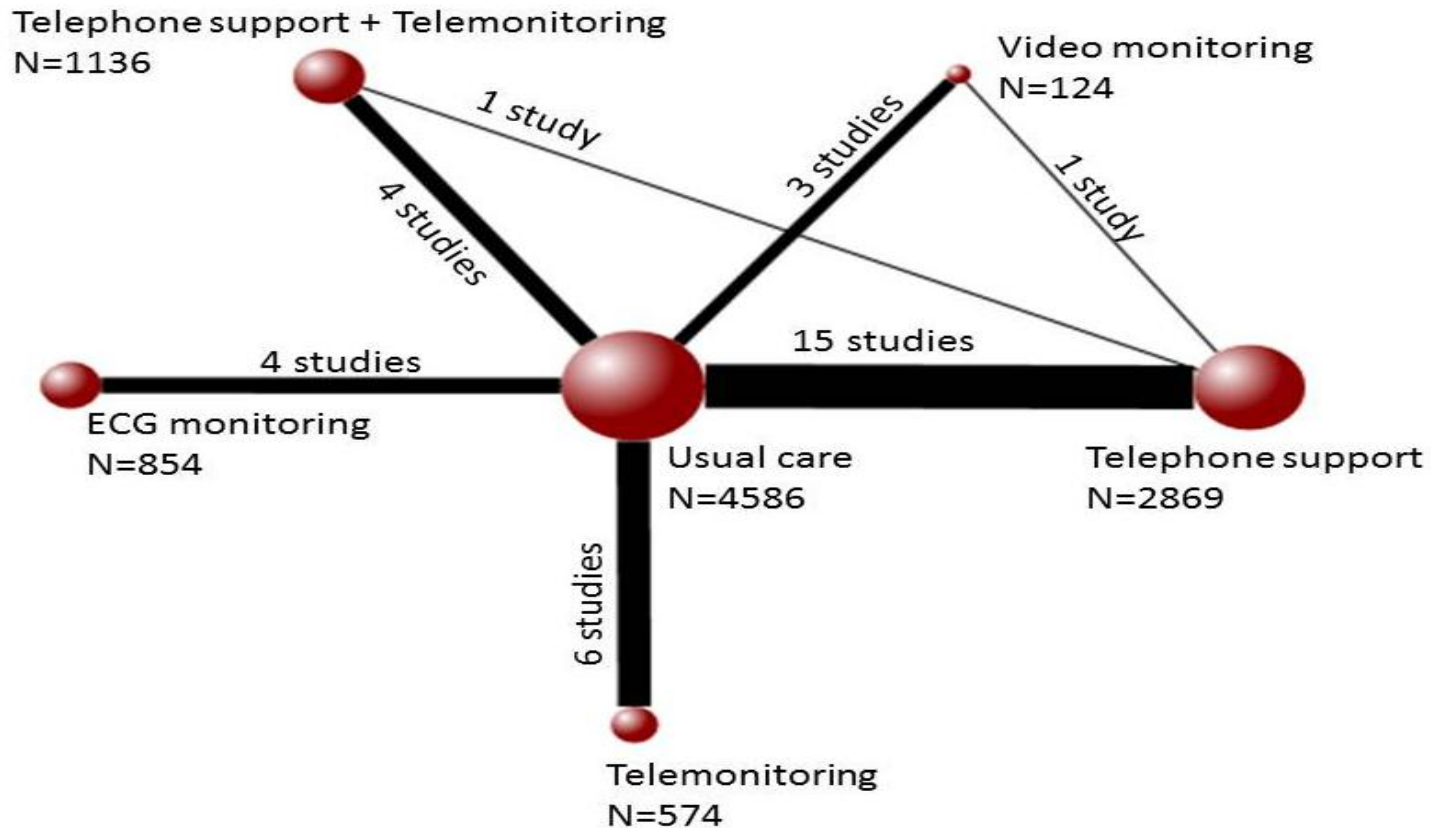
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Applying NMA methodology to Telemedicine

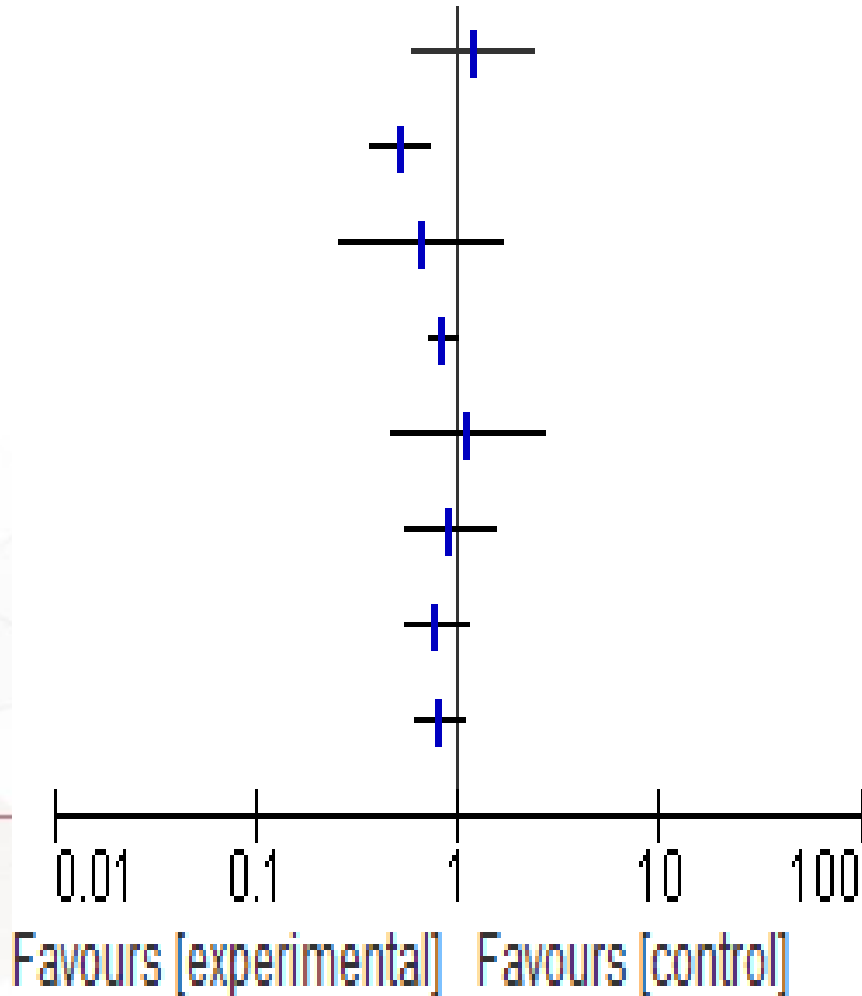




Evidence network, e.g. Mortality (N = 10,193)



Direct evidence



Comparison	Trials	OR (95% CI)	I ²
VIDEO vs UC	3	1.20 (0.61, 2.37)	0%
TM vs UC	6	0.52 (0.37, 0.72)	19.3%
STS vs VIDEO	1	0.67 (0.27, 1.67)	NA
STS vs UC	15	0.85 (0.73, 1.00)	13.2%
STS vs STS & TM	1	1.11 (0.47, 2.64)	NA
STS vs ECG	1	0.93 (0.55, 1.57)	NA
STS & TM vs UC	3	0.79 (0.55, 1.14)	0%
ECG vs UC	4	0.83 (0.63, 1.08)	3.8%

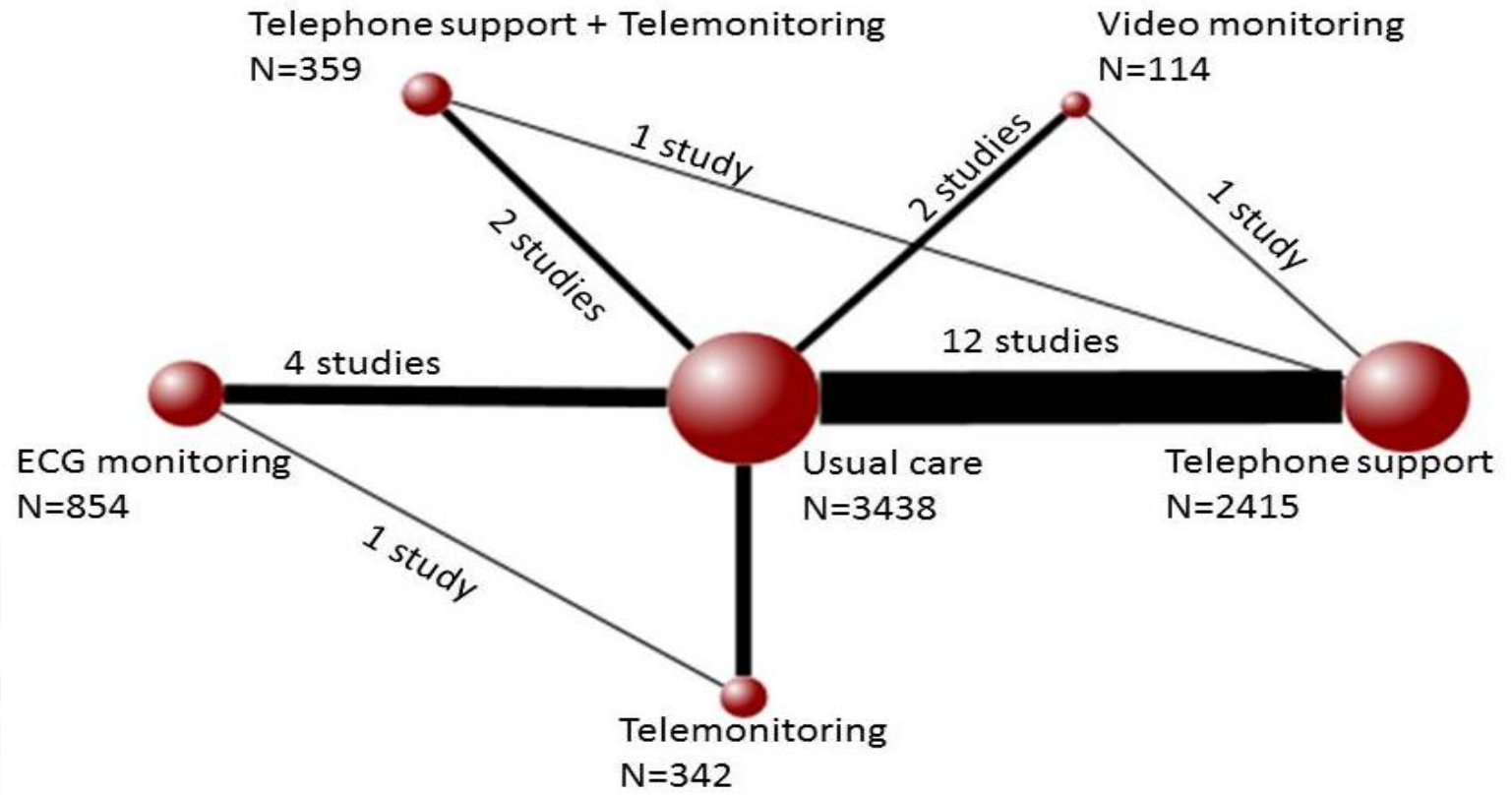
Staircase diagram for all-cause mortality



STS	NA	1.11 (0.47, 2.64)	0.67 (0.27, 1.67)	0.93 (0.55, 1.57)	0.85 (0.73, 1.00)
1.50 (0.96, 2.30)	TM	NA	NA	NA	<u>0.52</u> <u>(0.37, 0.72)</u>
1.04 (0.67, 1.60)	0.70 (0.39, 1.23)	STS & TM	NA	NA	0.79 (0.55, 1.14)
0.68 (0.34, 1.39)	0.45 (0.20, 1.01)	0.65 (0.29, 1.46)	Video	NA	1.20 (0.61, 2.37)
1.02 (0.72, 1.45)	0.68 (0.42, 1.15)	0.98 (0.59, 1.65)	1.50 (0.70, 3.18)	ECG	0.83 (0.63, 1.08)
<u>0.80</u> <u>(0.66, 0.96)</u>	<u>0.53</u> <u>(0.36, 0.80)</u>	0.77 (0.51, 1.15)	1.18 (0.58, 2.35)	0.78 (0.57, 1.06)	Usual Care



All-cause hospitalization



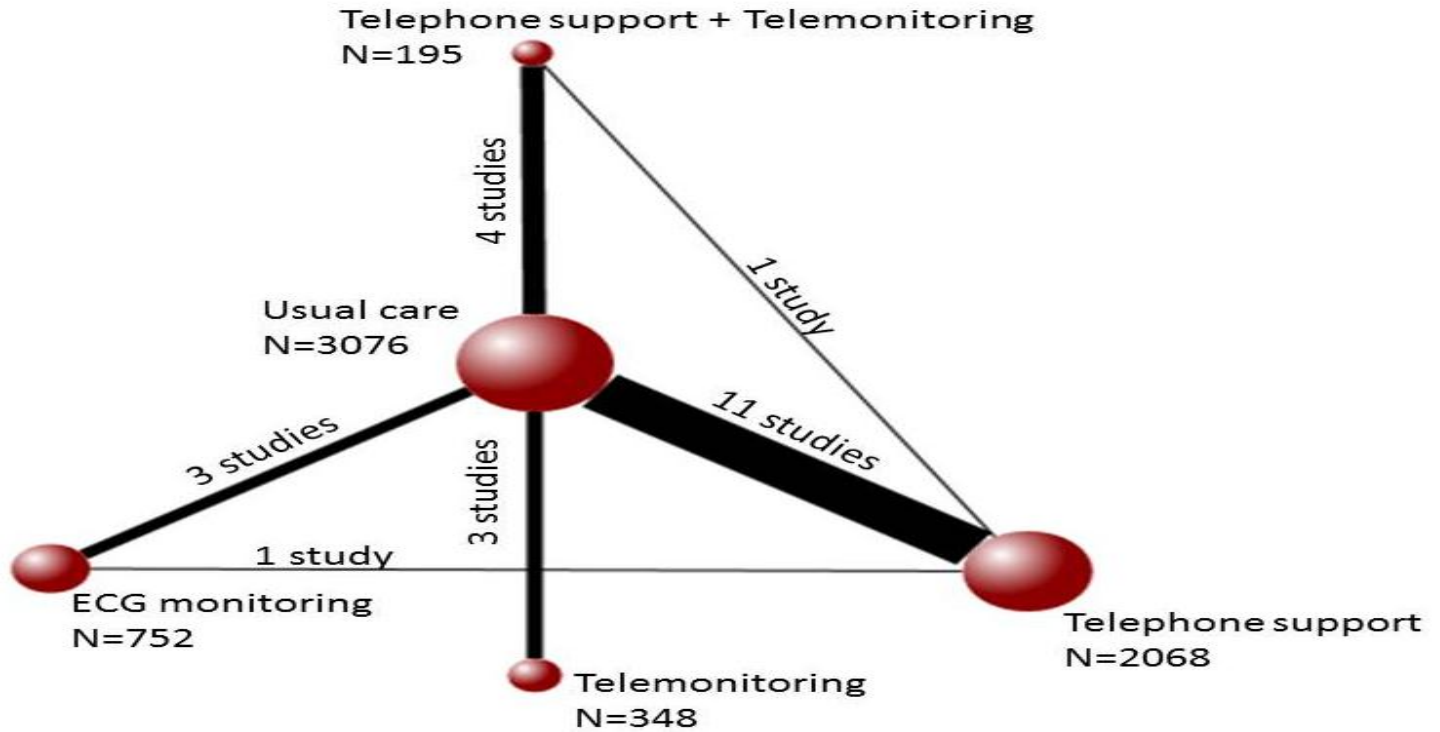


All-cause hospitalization

Structured Telephone support	NA	0.98 (0.60, 1.61)	1.09 (0.49, 2.44)	0.91 (0.59, 1.39)	0.86 (0.77, 0.97)
1.18 (0.73, 1.91)	Telemonitoring	NA	NA	NA	0.70 (0.51, 0.96)
0.84 (0.56, 1.28)	0.71 (0.38, 1.33)	Telemonitoring & Telephone support	NA	NA	1.28 (0.82, 2.00)
1.10 (0.53, 2.25)	0.94 (0.40, 2.12)	1.32 (0.57, 2.96)	Video monitoring	NA	0.74 (0.40, 1.35)
0.89 (0.64, 1.24)	0.76 (0.44, 1.27)	1.06 (0.63, 1.78)	0.81 (0.38, 1.76)	ECG monitoring	0.99 (0.81, 1.20)
0.88 (0.74, 1.06)	0.75 (0.48, 1.18)	1.052 (0.68, 1.63)	0.80 (0.39, 1.65)	0.99 (0.74, 1.34)	Usual Care



Hospitalization due to HF





Hospitalization due to HF

Structured Telephone support	NA	0.74 (0.34, 1.62)	0.78 (0.46, 1.32)	<u>0.76</u> <u>(0.65, 0.89)</u>
1.08 (0.70, 1.84)	Telemonitoring	NA	NA	<u>0.70</u> <u>(0.51, 0.98)</u>
0.67 (0.34, 1.34)	0.62 (0.27, 1.35)	Telemonitoring & Telephone support	NA	1.11 (0.58, 2.12)
0.98 (0.68, 1.40)	0.90 (0.50, 1.47)	1.46 (0.68, 3.01)	ECG monitoring	<u>0.70</u> <u>(0.55, 0.91)</u>
<u>0.69</u> <u>(0.56, 0.85)</u>	<u>0.64</u> <u>(0.39, 0.95)</u>	1.03 (0.53, 1.99)	<u>0.71</u> <u>(0.52, 0.98)</u>	Usual Care



Conclusions

- 1st time comparison of the 5 main forms of telemedicine for HF patients.
- Main findings:
 - TM as well as STS interventions were both found to be more effective than UC in reducing deaths and HF hospitalizations.
 - ECG interventions were also more effective in reducing HF hospitalizations compared with UC.
 - There were no other significant differences found across the interventions compared.
- These new comparisons can provide guidance to clinicians considering telemedicine for their HF patients. However, more adequately powered randomized controlled trials of sufficient follow-up are needed to compare the effectiveness of these interventions against one another.



Thank you for your time!

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