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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Purpose

To examine whether or not the evidence available today supports the use of regular telephone follow-up for rehabilitating CAD patients as a means to fulfilling the triple aim of:

1) **Improving health outcomes**
2) **Improving the patient and provider experience**
3) **Constraining cost growth**

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Background

- **CAD is one of the most common forms of heart disease that results from an impedance or blockage of one or more arteries that supply blood to the heart.**

✓ **Cardiac rehabilitation (CR) can aid recovery and reduce the likelihood of cardiac death or further cardiac illness.**

✗ **Patient participation in these programs remains suboptimal.**

- **Could specialized cardiovascular care be effectively delivered by telehealth?**

Current evidence

- Previous studies and reviews have **typically** examined the impact of **multifaceted interventions** on very **diverse patient populations.**

- It therefore becomes difficult to determine specifically **which method of telehealth appears most effective for which particular patient population.**

Research contribution

- Results from this systematic review and meta-analysis **specifically examine the impact of regular structured telephone support on CAD** patients' outcomes.

Methods

- **Data Sources:** The Cochrane Library, MEDLINE, EMBASE, and CINAHL.

- **Study Selection:** RCTs that directly compared telephone interventions with standard post-discharge care in adults following a myocardial infarction or a revascularization procedure.

- **Risk of bias:** Included studies were assessed using SIGN-50 and the Cochrane Risk of Bias tool.

Study selection flowchart

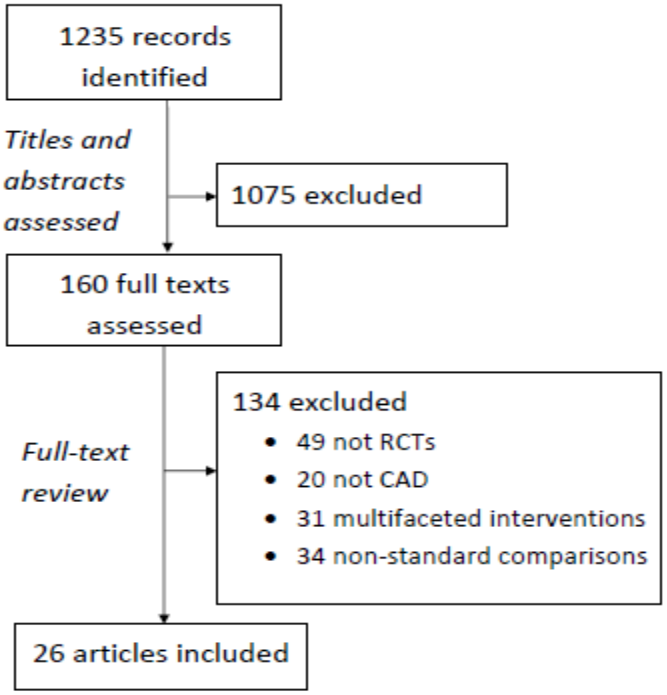

Figure 1: Flow chart for selection of studies of regular telephone support and follow-up interventions for CAD patients included in the systematic reviews and meta-analysis.

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Results

- **Characteristics of included studies:** Most studies were of either high or acceptable quality and had longer than 6 months follow-up. There was considerable variation in sample sizes of studies (range: 59-792).

- **Variations in intervention delivery:** Most commonly the intervention was delivered by a nurse. However, the number of calls made to participants did vary considerably ranging from 3 to 24.

Risk of bias

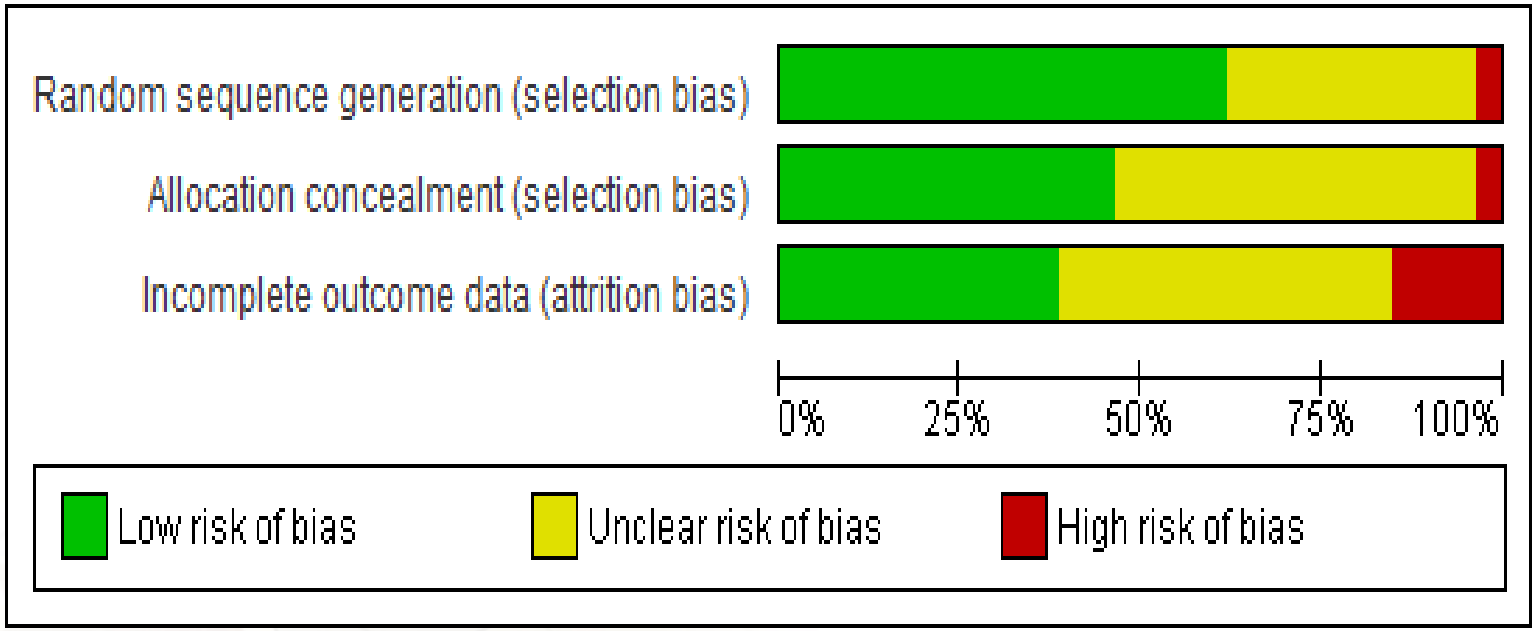

Figure 2. Risk of bias graph: Risk of bias items presented as percentages across all included studies.

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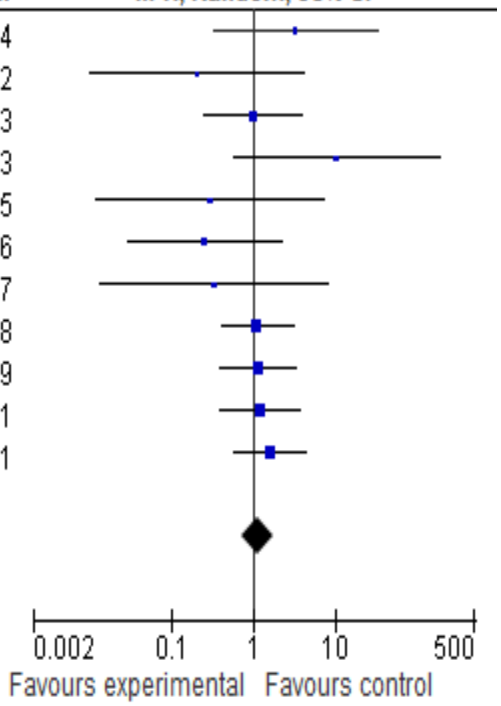
All-cause mortality

Study or Subgroup	Telephone group Events	Total	Control group Events	Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Van Elderen 1994	3	30	1	30	3.8%	3.22 [0.32, 32.89]	1994
Vale 2002	0	121	2	124	2.2%	0.20 [0.01, 4.24]	2002
Vale 2003	4	398	4	394	10.7%	0.99 [0.25, 3.99]	2003
Gallagher 2003	4	93	0	103	2.4%	10.41 [0.55, 195.97]	2003
McLaughlin 2005	0	53	1	47	2.0%	0.29 [0.01, 7.28]	2005
Mittag 2006	1	171	4	172	4.3%	0.25 [0.03, 2.23]	2006
Reid 2007	0	50	1	50	2.0%	0.33 [0.01, 8.21]	2007
Holmes-Rovner 2008	8	268	7	257	19.5%	1.10 [0.39, 3.08]	2008
Hanssen 2009	8	156	6	132	17.6%	1.14 [0.38, 3.36]	2009
Neubeck 2011	7	72	6	72	15.8%	1.18 [0.38, 3.71]	2011
Smith 2011	10	70	7	74	19.6%	1.60 [0.57, 4.45]	2011
Total (95% CI)		**1482**		**1455**	**100.0%**	**1.12 [0.71, 1.77]**	
Total events	45		39				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 7.77$, $df = 10$ ($P = 0.65$); $I^2 = 0\%$

Test for overall effect: $Z = 0.50$ ($P = 0.61$)



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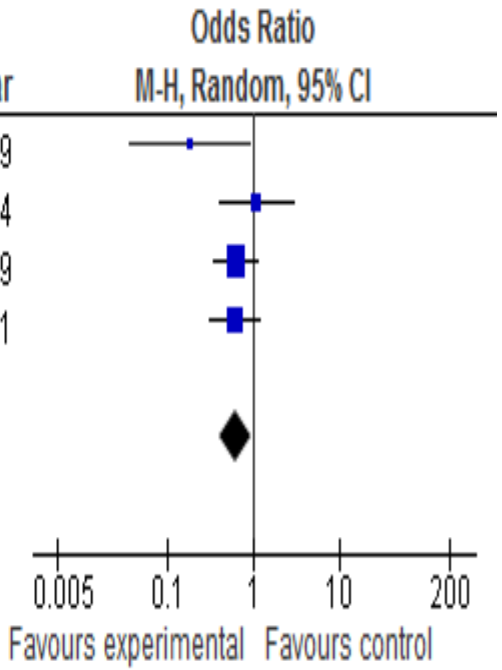
All-cause hospitalization

Study or Subgroup	Telephone group Events	Total	Control group Events	Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Beckie 1989	2	37	9	37	7.1%	0.18 [0.04, 0.89]	1989
Tranmer 2004	9	102	8	98	17.2%	1.09 [0.40, 2.95]	2004
Hanssen 2009	26	156	32	132	41.7%	0.63 [0.35, 1.12]	2009
Smith 2011	35	70	46	74	34.0%	0.61 [0.31, 1.18]	2011
Total (95% CI)		**365**		**341**	**100.0%**	**0.62 [0.40, 0.97]**	
Total events	72		95				

Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 3.55$, $df = 3$ ($P = 0.31$); $I^2 = 15\%$

Test for overall effect: $Z = 2.11$ ($P = 0.03$)



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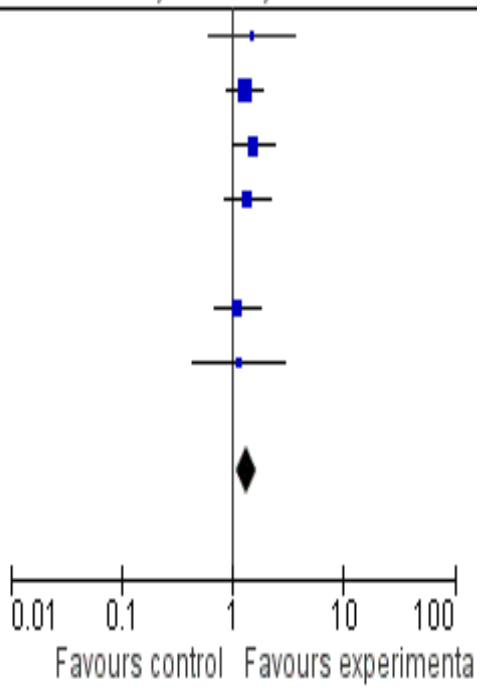
Smoking cessation

Study or Subgroup	Telephone group Events	Total	Control group Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
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: Tau² = 0.00; Chi² = 1.14, df = 5 (P = 0.95); I² = 0%

Test for overall effect: Z = 2.56 (P = 0.01)



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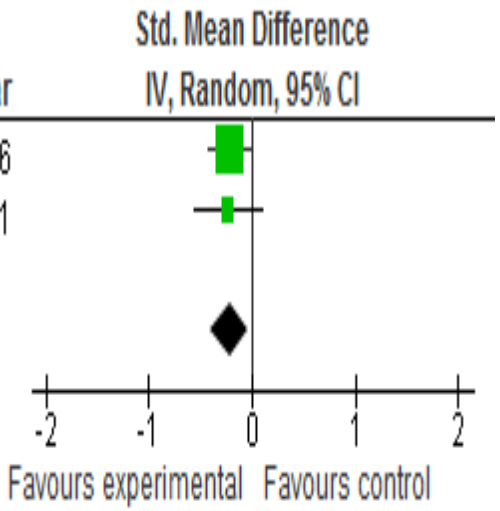
Systolic blood pressure

Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Mittag 2006	132	17.1	171	136.1	20.6	172	70.5%	-0.22 [-0.43, -0.00]	2006
Neubeck 2011	132.3	20	72	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: $Z = 2.44$ ($P = 0.01$)



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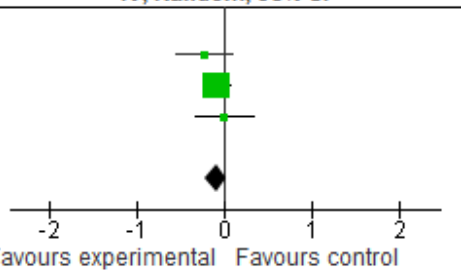
Low-density lipoprotein levels

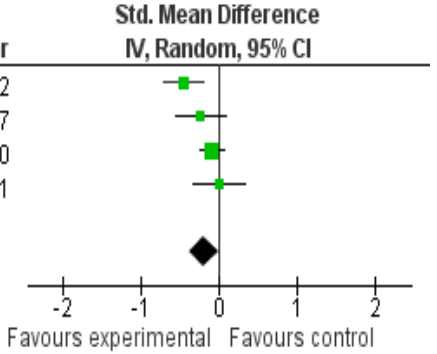
Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Vale 2002	3.11	1	121	3.57	1.0126	124	0.0%	-0.46 [-0.71, -0.20]	2002
Smith 2007	2.1	0.8	70	2.3	0.9	74	14.7%	-0.23 [-0.56, 0.09]	2007
Ma 2010	94.7	31.3	351	97.79	35.1	338	70.6%	-0.09 [-0.24, 0.06]	2010
Neubeck 2011	2.2	0.8511	72	2.2	0.8511	72	14.8%	0.00 [-0.33, 0.33]	2011
Total (95% CI)			**493**			**484**	**100.0%**	**-0.10 [-0.23, 0.03]**	

Heterogeneity: Tau² = 0.00; Chi² = 1.00, df = 2 (P = 0.61); I² = 0%
Test for overall effect: Z = 1.56 (P = 0.12)



Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Vale 2002	3.11	1	121	3.57	1.0126	124	25.3%	-0.46 [-0.71, -0.20]	2002
Smith 2007	2.1	0.8	70	2.3	0.9	74	19.6%	-0.23 [-0.56, 0.09]	2007
Ma 2010	94.7	31.3	351	97.79	35.1	338	35.3%	-0.09 [-0.24, 0.06]	2010
Neubeck 2011	2.2	0.8511	72	2.2	0.8511	72	19.7%	0.00 [-0.33, 0.33]	2011
Total (95% CI)			**614**			**608**	**100.0%**	**-0.19 [-0.39, 0.00]**	

Heterogeneity: Tau² = 0.02; Chi² = 7.07, df = 3 (P = 0.07); I² = 58%
Test for overall effect: Z = 1.96 (P = 0.05)



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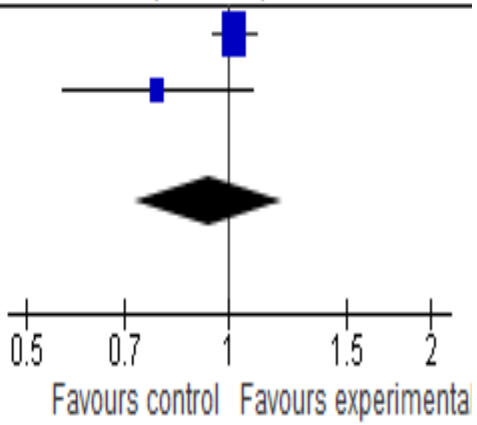
Medication adherence

Study or Subgroup	Telephone group Events	Total	Control group Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Vale 2003	311	398	302	394	67.4%	1.02 [0.95, 1.10]	2003
Neubeck 2011	32	72	41	72	32.6%	0.78 [0.56, 1.08]	2011
Total (95% CI)		**470**		**466**	**100.0%**	**0.93 [0.73, 1.20]**	
Total events	343		343				

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 2.59$, df = 1 (P = 0.11); $I^2 = 61\%$

Test for overall effect: Z = 0.53 (P = 0.60)



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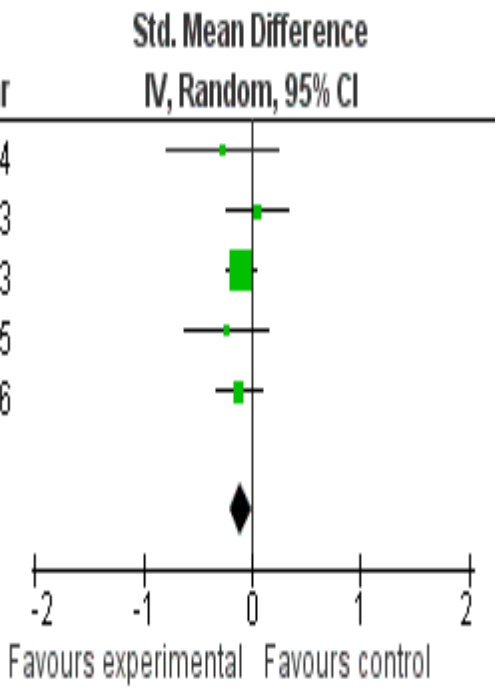
Depression

Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
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)



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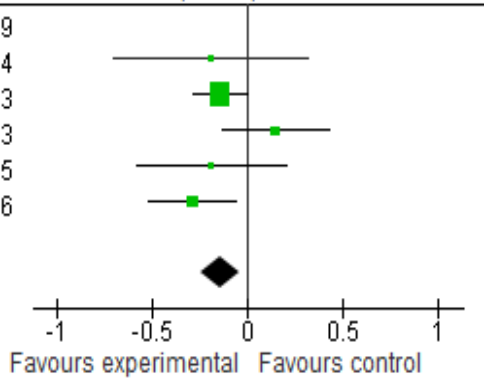
Anxiety

Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Fixed, 95% CI	Year
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: $Chi^2 = 5.66$, $df = 4$ ($P = 0.23$); $I^2 = 29\%$

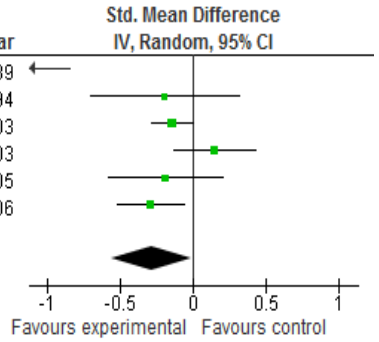
Test for overall effect: $Z = 2.65$ ($P = 0.008$)



Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Beckie 1989	29.78	7.72	37	43.22	11.52	37	12.8%	-1.36 [-1.86, -0.85]	1989
Van Elderen 1994	37.09	12.12	30	39.69	14.44	30	12.8%	-0.19 [-0.70, 0.31]	1994
Vale 2003	-2.2	8.1182	398	-1.1	7.0674	394	21.3%	-0.14 [-0.28, -0.00]	2003
Gallagher 2003	5.7	5.2	103	5	4.4	93	18.2%	0.14 [-0.14, 0.42]	2003
McLaughlin 2005	6.3	3.5	53	7	3.8	47	15.4%	-0.19 [-0.58, 0.20]	2005
Mittag 2006	50.8	11.3	154	54	10.8	143	19.5%	-0.29 [-0.52, -0.06]	2006
Total (95% CI)			**775**			**744**	**100.0%**	**-0.29 [-0.56, -0.01]**	

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 26.81$, $df = 5$ ($P < 0.0001$); $I^2 = 81\%$

Test for overall effect: $Z = 2.04$ ($P = 0.04$)



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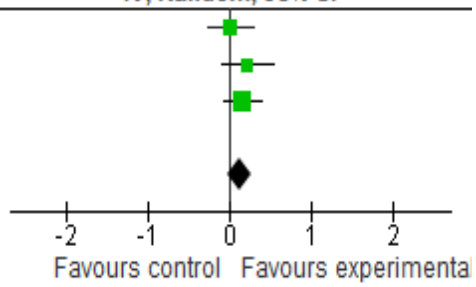
Quality of life

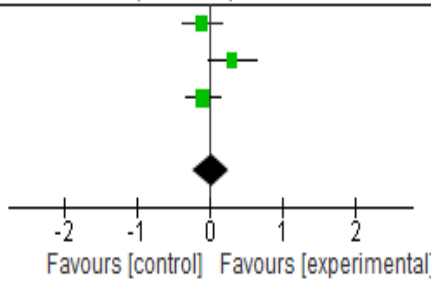
Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Tranmer 2004	36.3	6.4	102	36.2	7.5	98	31.8%	0.01 [-0.26, 0.29]	2004
Smith 2007	44.8	10.3	70	42.5	10.5	74	22.8%	0.22 [-0.11, 0.55]	2007
Hanssen 2009	50.73	8.62	156	49.46	8.45	132	45.4%	0.15 [-0.08, 0.38]	2009
Total (95% CI)			**328**			**304**	**100.0%**	**0.12 [-0.03, 0.28]**	

Heterogeneity: Tau² = 0.00; Chi² = 0.97, df = 2 (P = 0.62); I² = 0%
Test for overall effect: Z = 1.53 (P = 0.13)



Study or Subgroup	Telephone group Mean	SD	Total	Control group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Tranmer 2004	50.4	11.5	102	51.7	11.9	98	33.3%	-0.11 [-0.39, 0.17]	2004
Smith 2007	54.5	7.6	70	51.7	10.3	74	28.3%	0.31 [-0.02, 0.64]	2007
Hanssen 2009	50	10.35	156	50.97	9.56	132	38.4%	-0.10 [-0.33, 0.14]	2009
Total (95% CI)			**328**			**304**	**100.0%**	**0.01 [-0.23, 0.26]**	

Heterogeneity: Tau² = 0.03; Chi² = 4.60, df = 2 (P = 0.10); I² = 57%
Test for overall effect: Z = 0.10 (P = 0.92)



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Consistency with other studies

- In **Barth (2008)** and by **Neubeck (2009),** telephone support was found to **significantly promote smoking cessation.**

- **Neubeck (2009)** also demonstrated that participants in the telephone group had **significantly lower systolic blood pressure**. Similarly, they found **no strong evidence for reductions in total deaths.**

Limitation

- Given the nature of the intervention it was **not feasible to blind participants** and as such, some concern remains with regards to the risk of performance bias.

Conclusion & Implications for Practice

- The following constituents of CR programs can be feasibly delivered using telephones a medium: **routine monitoring, counseling, and educating**.

- And since telephone support and monitoring appears more effective in reducing certain risk factors than others, **physicians may identify, depending on each patient's rehabilitation goals, which patients would be most likely to benefit** from the intervention.

Future Research

- 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.**

- The results of this step will establish which intervention is superior and inform the **design of an intervention trial** comparing the number one ranked treatment to the standard of care.

Take home message

- Our findings are **in support of the delivery of a regular telephone intervention alongside usual care** for monitoring and supporting coronary artery disease patients following a cardiac event.

- Telephone support may help **increase access to care and reduce the burden** on the healthcare system through effective cardiac risk reduction and fewer hospitalizations.

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Acknowledgements

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- Contributors:
  - **George Wells**
  - **Shu-Ching Hsieh**
  - **Heather Sherrard**
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  - **and Agnieszka Szczotka**

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Questions?

Thank you!

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