**Supplementary Material**

**Social Isolation and Cognitive Function in Later Life: A Systematic Review and Meta-Analysis**

**Supplementary Material 1: Full search terms used in all databases**

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| **Supplementary Table 1.** Full search terms used in all databases | |
| **Step** | **Terms** |
| **1** | Title OR Abstract:  social\* isolat\* OR social\* engage\* OR social\* activ\* OR social\* disconnect\* OR social participation OR social relationship\* OR social\* integrat\* OR social network\* OR social tie\* OR network\* OR social contact\* OR social\* connect\* OR active lifestyle OR engaged lifestyle OR social interaction OR social components |
| **2** | Title OR Abstract:  cognit\* OR cognitive reserve OR cognit\* lifestyle OR cognit\* health\* OR cognit\* activ\* OR cognit\* function\* OR cognit\* impair\* OR cognitive decline OR cognitive performance OR cognitive status OR cognit\* abilit\* |
| **3** | Title OR Abstract:  "late\* life" OR old\* OR elder\* OR age\* OR aging |
| **4** | #1 AND #2 AND #3 |

**Supplementary Material 2: Quality measure for assessing articles**

Each question scores either 1 (poor), 2 (fair), or 3 (very good). Scores are summed and range from 14–42 with higher scores indicating greater methodological quality.

**Aims**

1. Aims/objectives clearly described?

**Study population**

1. Characteristics of participants clearly described (inclusion/exclusion criteria)?
2. Adequate description of participants (including age, gender, and cognitive status)?
3. Characteristics of participants lost to follow up considered?
4. Cohort representative of the general population?

**Method**

1. Clear the number of years participants were followed up for?
2. Number of participants included in final analysis clear?
3. Follow up of participants long enough to detect cognitive change (at least 2 years)?

**Measures**

1. Standardized measures of social isolation used and scoring method clearly outlined?
2. Standardized cognitive measure used and scoring method outlined?

**Results and analysis**

1. Statistical methods used appropriate?
2. Adequate adjustment for confounding variables?
3. Main findings clearly outlined?
4. Can results be applied to a general population?

**Supplementary Material 3: Reducing heterogeneity by removing articles from the meta-analysis**

Heterogeneity was considerably reduced by removing two articles with large effect sizes and sample sizes [1, 2] and a third article with a large effect size and a moderate sample size [3]. The large effect sizes reported by these articles accounts for a large proportion of heterogeneity as seen by a reduction in *I*2 values after excluding these articles (Supplementary Table 2).

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Supplementary Table 2.** Random effects meta-analysis and sub-analyses for aspects of social isolation and cognitive function excluding Haslam et al. [1]a, McHugh Power et al. [2]b, and Brown et al. OCTO [3]c. | | | | | | | | | | |
|  | | **n** | **k** | ***r*** | **95% CI** | ***p*** | **Heterogeneity** | | | |
| Q | Q *p* | | *I*2 |
| **All social measures** | | | | | | | | | | |
|  | All cognitive measures a b c | 101,321 | 50 | 0.045 | 0.036, 0.054 | <0.001 | 75.450 | 0.009 | | 35.06 |
|  | Global measures a b | 70,282 | 42 | 0.048 | 0.037, 0.058 | <0.001 | 64.086 | 0.012 | | 36.02 |
|  | Memory c | 34,706 | 12 | 0.039 | 0.023, 0.056 | <0.001 | 18.164 | 0.078 | | 39.44 |
| **Social activity** | | | | | | | | | | |
|  | All cognitive measures a b c | 67,032 | 36 | 0.053 | 0.041, 0.066 | <0.001 | 75.224 | <0.001 | 53.47 | |
|  | Global measures a b | 41,406 | 29 | 0.058 | 0.043, 0.073 | <0.001 | 59.710 | <0.001 | 53.11 | |
|  | Memory c | 28,575 | 9 | 0.036 | 0.017, 0.055 | <0.001 | 15.231 | 0.055 | 47.48 | |
| **Social network** | | | | | | | | | | |
|  | All cognitive measures a | 26,624 | 16 | 0.050 | 0.029, 0.071 | <0.001 | 30.353 | 0.011 | | 50.58 |
|  | Global measures a | 26,271 | 15 | 0.045 | 0.026, 0.064 | <0.001 | 24.141 | 0.044 | | 42.01 |
| **All social measures and all cognitive measures** | | | | | | | | | | |
| **Follow-up time** | | | | | | | | | | |
|  | 2-3 years b | 38,090 | 16 | 0.044 | 0.028, 0.060 | <0.001 | 27.496 | 0.025 | | 45.45 |
|  | 4-9 years a c | 35,898 | 20 | 0.040 | 0.027, 0.053 | <0.001 | 24.940 | 0.163 | | 23.82 |
|  | | | | | | | | | | |

**Supplementary Material 4: Publication bias**

**Supplementary Fig. 1.** Funnel plots for (A) all social and all cognitive measures, (B) all social and global cognitive measures, (C) all social and memory measures, and (D) all social and executive function measures.The results of the meta-analysis may be slightly overestimated due to publication bias (Supplementary Fig. 1). Egger’s test for: (A) all social and all cognitive measures (*b* = 1.52, 95% CI: 0.746, 2.285, *p* < 0.001), (B) all social and global cognitive measures (*b* = 1.25, 95% CI: -0.014, 2.638, *p* = 0.076), (C) all social and memory measures (*b* = 1.46, 95% CI: -0.214, 3.129, *p* = 0.081), and (D) all social and executive function measures (*b* = 1.31, 95% CI: -1.141, 3.759, *p* = 0.228). This finding is unsurprising and suggests that studies with a smaller sample size that do not find a significant association between aspects of social isolation and cognitive function are less likely to be reported in the literature.

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**SUPPLEMENTARY REFERENCES**

[1] Haslam C, Cruwys T, Haslam SA (2014) “The we's have it”: Evidence for the distinctive benefits of group engagement in enhancing cognitive health in aging. *Soc Sci Med* **120**, 57-66.

[2] McHugh Power J, Tang J, Lawlor B, Kenny RA, Kee F (2018) Mediators of the relationship between social activities and cognitive function among older Irish adults: results from the Irish longitudinal study on ageing. *Aging Ment Health* **22**, 129-134.

[3] Brown CL, Gibbons LE, Kennison RF, Robitaille A, Lindwall M, Mitchell MB, Shirk SD, Atri A, Cimino CR, Benitez A, Macdonald SW, Zelinski EM, Willis SL, Schaie KW, Johansson B, Dixon RA, Mungas DM, Hofer SM, Piccinin AM (2012) Social activity and cognitive functioning over time: a coordinated analysis of four longitudinal studies. *J Aging Res* **2012**, 287438.