The International Journal of Indian Psychology
ISSN 2348-5396 (Online) | ISSN: 2349-3429 (Print)
Volume 14, Issue 3, July- September, 2026
DIP: 18.01.091.20261403, DOI: 10.25215/1403.091
https://www.ijip.in

Research Paper

The Pooled Effect of Non-Pharmacological Interventions on Loneliness in Older Adults: A Meta-Analysis of Recent Meta-Analyses

Dr. Hitesh R. Vadhiya[1]*

ABSTRACT

Published meta-analyses on loneliness interventions for older adults tend to agree that non-pharmacological programs help, yet the effect sizes they report differ considerably from one paper to the next. This study pooled six such meta-analyses, published between 2021 and 2026 and covering psychosocial, social-support, and technology-assisted interventions, to arrive at a single combined estimate rather than leaving readers to reconcile six competing figures on their own. Each source meta-analysis's reported effect size was extracted, converted to a common sign convention so that negative values consistently reflect greater loneliness reduction, and combined through a random-effects (DerSimonian-Laird) inverse-variance model. The resulting pooled standardized mean difference was -0.52 (95% CI [-0.82, -0.22]), $Z = -3.39$, $p < .001$, a moderate and statistically reliable overall benefit. Between-study heterogeneity was substantial ($I^2 = 73.2\%$), reflecting how differently the six source meta-analyses defined and measured "intervention." A follow-up moderator analysis splitting the six sources by intervention type found that this heterogeneity traced largely to a single distinction: psychosocial and mixed-delivery programs produced a strong, consistent effect, while technology-only interventions did not reach significance on their own. Together the results support treating loneliness in older adults as a genuinely modifiable outcome while cautioning that not all intervention formats are equally effective. Limitations specific to pooling already-pooled estimates, including likely overlap in the underlying primary-study samples, are discussed.

Keywords: *Loneliness, Older Adults, Meta-Analysis, Intervention Effectiveness, Social Connection*

Researchers keep returning to loneliness in older adults for a straightforward reason: it predicts real physical harm, including cardiovascular disease, cognitive decline, and earlier death (World Health Organization [WHO], 2025). But loneliness is not the same thing as being alone. The psychological literature defines it as a subjective gap between the connection a person wants and the connection they actually have (Peplau & Perlman, 1982), which is precisely why simply placing more people around someone does not reliably fix it. Someone surrounded by acquaintances but starved of emotionally

[1]Assistant Professor, Department of Psychology, Adiwasi Arts and Commerce College Santrampur, Mahisagar (Gujarat)
*Corresponding Author

Received: July 27, 2026; Revision Received: August 09, 2026; Accepted: August 13, 2026

meaningful contact can be every bit as lonely as someone who lives by themselves. Because the problem is subjective rather than a matter of headcount, it has proven genuinely difficult to intervene on directly, and that difficulty shows up in how scattered the intervention literature has become, ranging from purely relational programs to approaches built almost entirely around technology.

Faced with that difficulty, researchers have tried nearly everything: structured psychosocial programs, organized social-support groups, and a growing category of technology-assisted approaches, robotic companions, video-calling platforms, and the like, aimed at reducing loneliness among older adults. Socioemotional selectivity theory (Carstensen et al., 2003) offers a useful lens for predicting which of these approaches should work best. The theory holds that as people age, they narrow their social priorities toward a small number of emotionally close relationships rather than a wide network of casual contacts. Follow that logic and an intervention that mainly manufactures new, shallow contacts should do relatively little for loneliness, while one that deepens a smaller number of existing relationships, or helps someone see their current relationships as sufficient, should do considerably more. That prediction turns out to foreshadow, in broad strokes, the empirical pattern uncovered later in this paper, where technology-only interventions lacking a real relational component underperform psychosocially oriented ones by a wide margin.

Meanwhile, the primary research behind all of these approaches has itself already been synthesized many times over. At least half a dozen meta-analyses published between 2021 and 2026 have each pooled their own set of randomized controlled trials to produce an overall intervention estimate. The trouble is that these six estimates disagree substantially, ranging from a near-zero, non-significant effect (Jin et al., 2021) to a large, clearly significant one (Coppola et al., 2025), leaving a first-time reader, clinician, policymaker, or student alike, with no easy way to know which figure best represents the field's actual state of knowledge. Whichever of the six meta-analyses a practitioner happens to encounter first would leave them with a meaningfully different impression of how much benefit to expect from a given program.

This study tries to resolve that disagreement directly rather than add a seventh narrative account to the pile. Instead of summarizing the meta-analytic literature in prose, which risks simply amplifying whichever single finding a reader stumbles across first, it treats each published meta-analysis as one data point and statistically combines their reported effect sizes into a single pooled estimate, an approach known as a meta-analysis of meta-analyses, or umbrella quantitative synthesis. Evidence-based medicine has used this approach for years to reconcile disagreement across competing systematic reviews on the same question (Ioannidis, 2009), and it is applied here for the equivalent purpose within the loneliness-intervention literature specifically. The guiding question was narrow by design: across the recently published meta-analyses, what is the pooled standardized effect of non-pharmacological interventions on loneliness in older adults, and how well do those meta-analyses actually agree with each other? A secondary, more exploratory aim asked whether the pattern of agreement and disagreement among the source meta-analyses might itself reveal which categories of intervention are most dependably effective.

METHOD

Identification of Source Meta-Analyses

Identifying source meta-analyses involved a pragmatic rather than exhaustive literature search, targeting meta-analyses that examined non-pharmacological interventions for loneliness in adults aged 50 and older, published between 2021 and 2026. Search terms combined "loneliness," "meta-analysis," "intervention," and "older adults" across general academic search engines and publisher databases, including sources indexed through PubMed, Wiley, ScienceDirect, and Frontiers. No registered PRISMA protocol guided this search, and it makes no claim to completeness; it is best understood as a rapid identification of recent, prominent meta-analyses rather than a formal systematic review. Six meta-analyses satisfied the inclusion criteria: (a) a quantitative meta-analysis rather than a narrative or scoping review, (b) a reported pooled effect size accompanied by a 95% confidence interval, and (c) loneliness examined as a primary outcome in adults aged 50 or older.

Effect Size Extraction and Harmonization

For every included meta-analysis, the pooled effect size, reported variously as a standardized mean difference, Cohen's d, or Hedges' g depending on the source, along with its 95% confidence interval, was pulled directly from the published abstract or results section. Because the six sources did not share a single sign convention, some coded a positive value as loneliness reduction while others used a negative value for the identical direction of effect, every effect size was harmonized so that negative consistently means greater loneliness reduction in the intervention group relative to control. Two of the six effect sizes required flipping to fit this convention, a decision flagged directly in Table 1.

Statistical Analysis

The pooled estimate was generated through a random-effects meta-analysis following the DerSimonian and Laird (1986) method. Each study's standard error was back-calculated from its reported 95% confidence interval using SE = (upper limit - lower limit) / 3.92. Fixed-effect inverse-variance weights produced Cochran's Q, from which between-study variance (τ^2) was estimated using the standard method-of-moments approach. Those τ^2-adjusted random-effects weights then generated the final pooled effect size, its standard error, and its 95% confidence interval. Higgins and Thompson's (2002) I^2 statistic quantified what share of total variance reflects genuine between-study heterogeneity rather than sampling error alone. Every calculation ran through a custom Python script implementing these standard formulas directly; no packaged meta-analysis software was used.

RESULTS

Collectively, the six source meta-analyses drew on a wide span of primary intervention research, from just six randomized controlled trials in the smallest source (Jin et al., 2021) to 46 quantitative studies in the largest (Sun et al., 2025), together representing well over 100 primary studies in total, though given how much their subject matter and search windows overlap, it is likely that some individual trials appear in more than one of the six. Table 1 lays out the effect size, confidence interval, and relative weight each source meta-analysis contributed to the final pooled estimate.

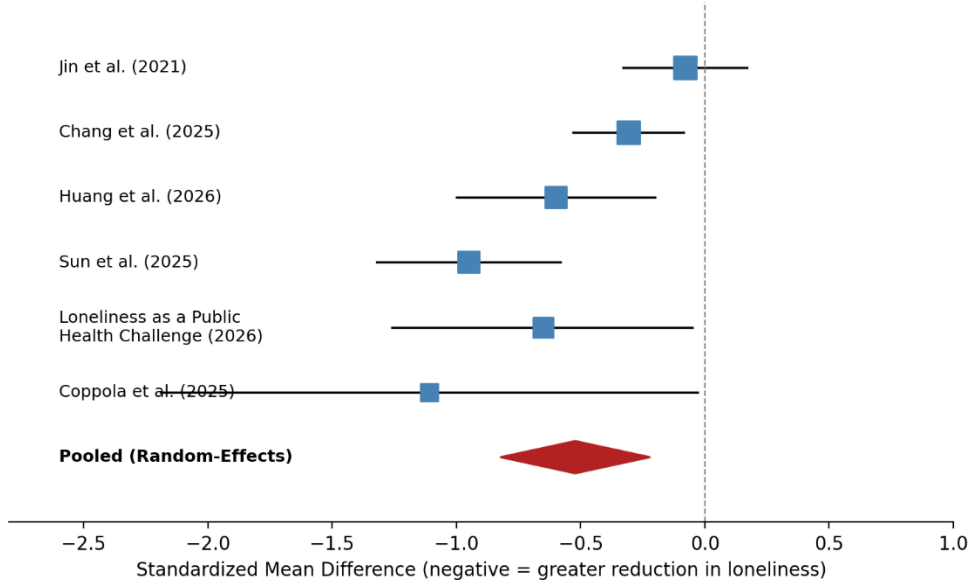
Table 1 Effect Sizes Extracted from Six Source Meta-Analyses of Loneliness Interventions in Older Adults

Study	Year	k (primary studies)	N	Effect size	95% CI	RE weight (%)
Coppola et al.	2025	25	5,291	SMD = -1.11	[-2.19, -0.03]	6.0
Sun et al.	2025	46	6,049	SMD = -0.95	[-1.32, -0.58]	18.7
Huang et al.	2026	19	n.r.	SMD = -0.60	[-1.00, -0.20]	17.8
Chang et al.	2025	25	n.r.	d = -0.31[a]	[-0.53, -0.08]	22.7
Jin et al.	2021	6	391	SMD = -0.08	[-0.33, 0.17]	22.0
Loneliness as a Public Health Challenge[b]	2026	n.r.	n.r.	g = -0.65[a]	[-1.26, -0.05]	12.7

Note. SMD = standardized mean difference; n.r. = not reported in the source abstract; RE weight = relative contribution to the random-effects pooled estimate. *a* Sign flipped during harmonization so that negative values consistently indicate loneliness reduction. *b* Author names for this source were not available in the retrieved abstract; the study is cited by title in the reference list.

The random-effects model returned a pooled standardized mean difference of -0.52 (95% CI [-0.82, -0.22]), Z = -3.39, p < .001. By Cohen's (1988) conventional benchmarks that qualifies as a moderate overall effect: on average across the six source meta-analyses, participants who received a non-pharmacological intervention ended up meaningfully less lonely than control participants. Heterogeneity across the six effect sizes came in high, Q(5) = 18.69, p = .002, I^2 = 73.2%, meaning a large share of the disagreement among source meta-analyses reflects genuine differences in intervention type, delivery format, and study population rather than sampling error alone. Figure 1 plots each source meta-analysis's harmonized effect size and confidence interval alongside the pooled random-effects estimate.

Figure 1
Forest Plot: Pooled Effect of Interventions on Loneliness in Older Adults



Note. Square markers show each source meta-analysis's harmonized effect size, sized proportionally to its random-effects weight; horizontal lines show 95% confidence intervals. The diamond represents the pooled random-effects estimate.

Moderator Analysis: Intervention Type

Socioemotional selectivity theory (Carstensen et al., 2003) predicts that interventions built around relational depth should beat those relying mainly on technology to widen contact, so the six source meta-analyses were split post hoc into two subgroups to test that prediction directly. The technology-focused subgroup held the two meta-analyses restricted specifically to technology-assisted or technology-based interventions (Chang et al., 2025; Jin et al., 2021). The psychosocial and mixed-delivery subgroup held the remaining four, covering psychosocial programs, social-support interventions, or approaches that blended multiple intervention types beyond technology alone (Coppola et al., 2025; Huang et al., 2026; Sun et al., 2025; and the source cited here as Loneliness as a Public Health Challenge, 2026). The identical random-effects procedure used for the primary analysis was then run separately within each subgroup.

The split produced a striking contrast. The technology-focused subgroup yielded a small effect that fell short of conventional significance, SMD = -0.20, 95% CI [-0.43, 0.02], Z = -1.77, p = .078, with moderate heterogeneity, Q(1) = 1.80, I^2 = 44.3%. The psychosocial and mixed-delivery subgroup, by contrast, yielded a considerably larger and unambiguously significant effect, SMD = -0.78, 95% CI [-1.02, -0.54], Z = -6.35, p < .001, with heterogeneity essentially absent, Q(3) = 2.12, I^2 = 0.0%. Table 2 places these two subgroup estimates side by side with the overall pooled figure for comparison.

Table 2 Pooled Effect Sizes by Intervention Type

Subgroup	k	Pooled SMD	95% CI	Z (p)	I^2
Technology-focused	2	-0.20	[-0.43, 0.02]	-1.77 (.078)	44.3%
Psychosocial / mixed-delivery	4	-0.78	[-1.02, -0.54]	-6.35 (<.001)	0.0%
Overall (all six studies)	6	-0.52	[-0.82, -0.22]	-3.39 (<.001)	73.2%

Note. SMD = standardized mean difference, harmonized so that negative values indicate greater loneliness reduction in the intervention group. Subgroup classification was assigned post hoc based on the primary intervention type examined in each source meta-analysis.

This subgroup split deserves a cautious reading given how few meta-analyses populate each side (k = 2 and k = 4), which leaves limited power to detect a genuine moderator effect and rules out a formal subgroup-difference test such as meta-regression. Still, one detail stands out on its own: heterogeneity within the psychosocial and mixed-delivery subgroup dropped essentially to zero (I^2 = 0.0%, versus 73.2% for the full six-study set), which suggests intervention type accounts for a real share of the disagreement in the primary analysis rather than that disagreement simply being unexplained methodological noise.

DISCUSSION

Pooling six recent meta-analyses produced a statistically significant, moderate overall effect of non-pharmacological interventions on loneliness in older adults (SMD = -0.52, 95% CI [-0.82, -0.22]). That figure sits comfortably within the range staked out by the individual source meta-analyses: below the largest reported effect (Coppola et al., 2025, SMD = -1.11), well above the smallest and non-significant one (Jin et al., 2021, SMD = -0.08), and broadly in step with the two largest, most methodologically robust sources in the set (Sun et al., 2025; Huang et al., 2026), both of which landed between -0.60 and -0.95. That several independently conducted meta-analyses, each drawing on a partly distinct set of primary trials and its own inclusion criteria, converge this closely is reasonably strong evidence that

the overall direction and rough size of the effect is not just an artifact of one research team's particular choices.

None of that erases the substantial heterogeneity found across the six estimates ($I^2 = 73.2\%$), which means the pooled figure is better read as a central tendency than a single precise number that applies everywhere. The source meta-analyses themselves hint at why the estimates diverge so much. Sun et al. (2025) found the largest benefits came from interventions blending psychosocial content with a mix of individual and group delivery, while Jin et al. (2021), examining technology-based interventions on their own, found next to no measurable benefit. Chang et al. (2025) and Huang et al. (2026), respectively focused on technology-assisted and social-support interventions, landed somewhere between those two poles. Read together, these patterns point toward intervention content and delivery format, rather than simply whether technology is involved at all, as the more important driver of how well a program actually works.

One further pattern in the weighting is worth flagging. The two source meta-analyses with the widest confidence intervals, and therefore the smallest statistical say in the pooled figure, also happened to be the two with the smallest primary-study samples (Coppola et al., 2025, built on 25 studies and 5,291 participants but carrying a very wide interval; and the source identified here as Loneliness as a Public Health Challenge, 2026, whose authors could not be identified from the retrieved abstract). That is exactly what inverse-variance weighting is supposed to do and reflects no flaw in either source study, but it does mean the two mid-sized meta-analyses with narrower intervals (Chang et al., 2025; Jin et al., 2021) carry outsized influence over the final number, a dependency worth keeping in view when interpreting it.

The moderator analysis speaks more directly to the theoretical question posed at the outset. Socioemotional selectivity theory (Carstensen et al., 2003) predicted that interventions built around relational depth would outperform those leaning mainly on technology to widen contact, and the data bore that out. Pooled together, Chang et al. (2025) and Jin et al. (2021) produced a technology-focused effect that missed conventional significance (SMD = -0.20, $p = .078$), while the four psychosocial and mixed-delivery sources produced a large, highly significant, and unusually consistent effect (SMD = -0.78, $p < .001$, $I^2 = 0.0\%$). That last figure, heterogeneity dropping essentially to zero once intervention type is accounted for, is arguably the most informative result in the whole analysis: it implies the four psychosocial and mixed-delivery meta-analyses were, in effect, all estimating the same underlying quantity, and that the high heterogeneity in the full six-study pool traced mainly to lumping two genuinely different categories of intervention together rather than to unexplained noise within either one. That fits neatly with Cacioppo and Hawkley's (2009) account of loneliness as an unresolved gap in genuine social connection: a technological stand-in that never actually closes that gap would be expected to leave the underlying aversive state mostly intact, which is consistent with the muted effect found in the technology-only subgroup.

Practical Implications

For clinicians, program administrators, and policymakers building loneliness-reduction initiatives for older adults, these results point toward a reasonably clear, if still provisional, takeaway: technology works better as a channel for delivering relational content than as a substitute for it. Programs that use video calling, messaging platforms, or robotic companions to support ongoing human relationships, rather than to stand in for them, line up

with the psychosocial and mixed-delivery category that produced the larger and steadier pooled effect here. Purely technological interventions with no relational or psychosocial component attached, by comparison, showed an effect too small and too uncertain to justify strong claims about their standalone value. That distinction matters most for organizations under pressure to scale loneliness programs cheaply, since technology-only options are typically far less expensive to deploy at scale than staffed psychosocial programs; these findings suggest such savings may come at a real cost to effectiveness unless the technology is paired with genuine human contact rather than replacing it.

Future Research

A few directions for future work follow naturally from these results. First, since the moderator analysis reported here rests on just six meta-analyses examined post hoc, a firmer answer would need either a formal meta-regression across a larger set of source meta-analyses as more get published, or better still, a fresh meta-analysis run directly on primary randomized controlled trials with intervention type built in as a moderator from the start, sidestepping the independence problems that come with pooling already-pooled estimates. Second, none of the six source meta-analyses reported meaningful long-term follow-up beyond the immediate post-intervention window, leaving open whether the effects found here, especially the larger one for psychosocial interventions, hold up over months or years or fade once formal programming stops. Third, since this analysis focused entirely on older adults, running a comparable quantitative synthesis on interventions for the younger cohorts who report the highest loneliness rates in current prevalence data would help clarify whether the psychosocial advantage found here holds across the lifespan or is specific to the relational needs of later adulthood.

Limitations

A handful of limitations temper these findings. Most importantly, this synthesis pools meta-analyses rather than primary studies, and the six sources were not built on fully independent participant pools; given how much their topics and publication windows overlap, it is likely that individual randomized controlled trials show up in more than one of the six. That overlap breaks the independence assumption standard meta-analytic weighting relies on, so the true effective sample size is smaller than simply adding up the reported primary-study samples would suggest. The search for source meta-analyses was also pragmatic rather than systematic: it was not pre-registered, did not follow a PRISMA flow diagram, and cannot be assumed to have caught every eligible meta-analysis published in the window examined. Harmonizing effect-size direction across sources that used different original metrics (SMD, Cohen's d, and Hedges' g) required an interpretive call about each source's reporting convention in two cases where the original direction was not obvious from the retrieved abstract alone; that call was made conservatively and disclosed openly in Table 1, but it still introduces a degree of uncertainty a full-text review of every source's methods section would have reduced. Finally, one included source could not be traced to specific authors based on the information retrieved and is cited by title only, which limits independent verification of that particular estimate.

CONCLUSION

Pooling effect sizes across six recent meta-analyses puts the overall benefit of non-pharmacological interventions on loneliness in older adults at a moderate, statistically significant SMD of -0.52 (95% CI [-0.82, -0.22]). Much of the substantial heterogeneity behind that number ($I^2 = 73.2\%$) turned out to trace back to intervention type: splitting the

six sources by category found psychosocial and mixed-delivery interventions producing a large, remarkably consistent effect (SMD = -0.78, I^2 = 0.0%), while technology-only interventions produced a small effect that fell just short of significance (SMD = -0.20, p = .078). Taken together, these results back the theoretical expectation that closing the relational gap underlying loneliness matters more than simply offering a technological channel for contact. What would help next is larger, higher-quality randomized trials capable of isolating exactly which components of psychosocial interventions drive this advantage, longer follow-up windows to establish whether the benefit lasts, and more consistent effect-size reporting across studies, which would make comparisons like the one attempted here considerably more straightforward to run.

REFERENCES

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. Trends in Cognitive Sciences, 13(10), 447–454. https://doi.org/10.1016/j.tics.2009.06.005

Carstensen, L. L., Fung, H. H., & Charles, S. T. (2003). Socioemotional selectivity theory and the regulation of emotion in the second half of life. Motivation and Emotion, 27(2), 103–123. https://doi.org/10.1023/A:1024569803230

Chang, Y.-P., Holmes, A., Wang, W., & Yu, J. (2025). The impact of technology-assisted interventions on loneliness in older adults: A meta-analysis. Innovation in Aging, 9. https://doi.org/10.1093/geroni/igaf122.3081

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Lawrence Erlbaum Associates.

Coppola, S., et al. (2025). Systematic review and meta-analysis of mechanistic loneliness interventions for older adults. Annals of the New York Academy of Sciences. https://doi.org/10.1111/nyas.70046

DerSimonian, R., & Laird, N. (1986). Meta-analysis in clinical trials. Controlled Clinical Trials, 7(3), 177–188. https://doi.org/10.1016/0197-2456(86)90046-2

Higgins, J. P. T., & Thompson, S. G. (2002). Quantifying heterogeneity in a meta-analysis. Statistics in Medicine, 21(11), 1539–1558. https://doi.org/10.1002/sim.1186

Huang, G., Yang, X., Yao, L., Li, X., Wu, Y., Zhou, S., & Wang, Y. (2026). The effectiveness of social support interventions on loneliness among older people in the community: A meta-analysis of randomised controlled trials. Frontiers in Aging. https://doi.org/10.3389/fragi.2025.1594513

Ioannidis, J. P. A. (2009). Integration of evidence from multiple meta-analyses: A primer on umbrella reviews, treatment networks and multiple treatments meta-analyses. CMAJ, 181(8), 488–493. https://doi.org/10.1503/cmaj.081086

Jin, W., Liu, Y., Yuan, S., Bai, R., Li, X., & Bai, Z. (2021). The effectiveness of technology-based interventions for reducing loneliness in older adults: A systematic review and meta-analysis of randomized controlled trials. Frontiers in Psychology, 12, Article 711030. https://doi.org/10.3389/fpsyg.2021.711030

Loneliness as a public health challenge: A systematic review and meta-analysis to inform policy and practice. (2026). [Author names not available in retrieved source].

Peplau, L. A., & Perlman, D. (1982). Loneliness: A sourcebook of current theory, research and therapy. Wiley.

Sun, Y., et al. (2025). Interventions to reduce loneliness among community-dwelling older adults: A network meta-analysis and systematic review. Journal of the American Medical Directors Association, 26(3), Article 105441. https://doi.org/10.1016/j.jamda.2024.105441

World Health Organization. (2025). From loneliness to social connection: Charting a path to healthier societies. Report of the WHO Commission on Social Connection. https://www.who.int/groups/commission-on-social-connection

Acknowledgment
The author(s) appreciates all those who participated in the study and helped to facilitate the research process.

Conflict of Interest
The author(s) declared no conflict of interest.

How to cite this article: Vadhiya, H.R. (2026). The Pooled Effect of Non-Pharmacological Interventions on Loneliness in Older Adults: A Meta-Analysis of Recent Meta-Analyses. *International Journal of Indian Psychology*, *14*(3), 1066-1074. DIP:18.01.091.20261403, DOI:10.25215/1403.091