

Novel insights on dementia care: Multidimensional benefits of doll therapy uncovered in cross-cultural meta-analysis

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Dear Editor,

Dementia affects 57 million people globally, with projections reaching 153 million by 2050.¹ Behavioural and psychological symptoms of dementia (BPSD) occur in 97% of patients, accelerating functional decline, intensifying caregiver burden, and raising risks of institutionalisation and healthcare costs.² Given the limited efficacy and adverse effects of pharmacological agents, non-pharmacological interventions are prioritised as first-line.³ Doll therapy (DT), rooted in attachment theory,⁴ regulates emotions by activating the limbic circuit through doll interaction, offering a low-cost approach to alleviating patient distress.⁵ However, existing evidence remains insufficient to draw firm conclusions, largely because previous studies have overlooked the cultural context of dementia care and have mixed random and non-random designs. Most research has been conducted in Western contexts. This overrepresentation is particularly problematic given that China accounts for approximately 25% of the world's dementia cases.⁶ This study reviews existing literature and conducts a meta-analysis to evaluate the effects of DT based exclusively on randomised controlled trial (RCT) evidence. It comprehensively assesses the multidimensional effects on behavioural symptoms (particularly agitation), cognitive function, and emotional states, and systematically analyses moderators of therapeutic efficacy.⁷ This review synthesises the evidence from different cultures, guides the development of cultural interventions, and lays the foundation for the implementation of evidence-based, person-centred care.

According to the Cochrane Handbook⁸ and Preferred Reporting Items for Systematic reviews and Meta-Analyses 2020 guidelines⁹ (PROSPERO

CRD42024506258), the authors searched 6 English-language databases (PubMed, Embase, Cochrane Library, Web of Science, Ovid, EBSCOhost) and 4 Chinese-language databases (China National Knowledge Infrastructure, Wanfang, VIP, Chinese Biomedical Database) from inception to 26 January 2024. Eligible participants were individuals aged ≥ 65 years with a dementia diagnosis. The review compared the effects of DT with standard care or other non-pharmacological interventions. Primary outcomes included behavioural symptoms (especially agitation), cognitive function, and emotional states; quality of life was a secondary outcome (Supplementary Table S1). Two reviewers independently screened studies, extracted data, and the Cochrane Risk of Bias tool was used to assess the risk of bias. Statistical analyses in Stata version 16.0 (StataCorp, College Station, TX, US) employed standardised mean differences (SMDs) under random effects models. Heterogeneity was quantified with I^2 ; sources were explored through subgroup, sensitivity, and meta-regression analyses. Evidence quality was rated with the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) framework.¹⁰

Twelve RCTs involving 1245 participants (mean age 78.7 years, 67.2% female) published between 2017 and 2022 in Australia ($n=2$), Italy ($n=3$), Switzerland ($n=1$), China ($n=5$), and Turkey ($n=1$) met inclusion criteria (Supplementary Fig. S1). Four studies were conducted in Chinese hospitals and the remainder in nursing homes, long-term care facilities, and other social institutions; most participants had mixed dementia (60.6%). Interventions used lifelike or empathy dolls; session lengths ranged from 15 minutes to 3 hours and total intervention duration from 2 to 72 weeks (Supplementary Table S1). Risk-of-bias

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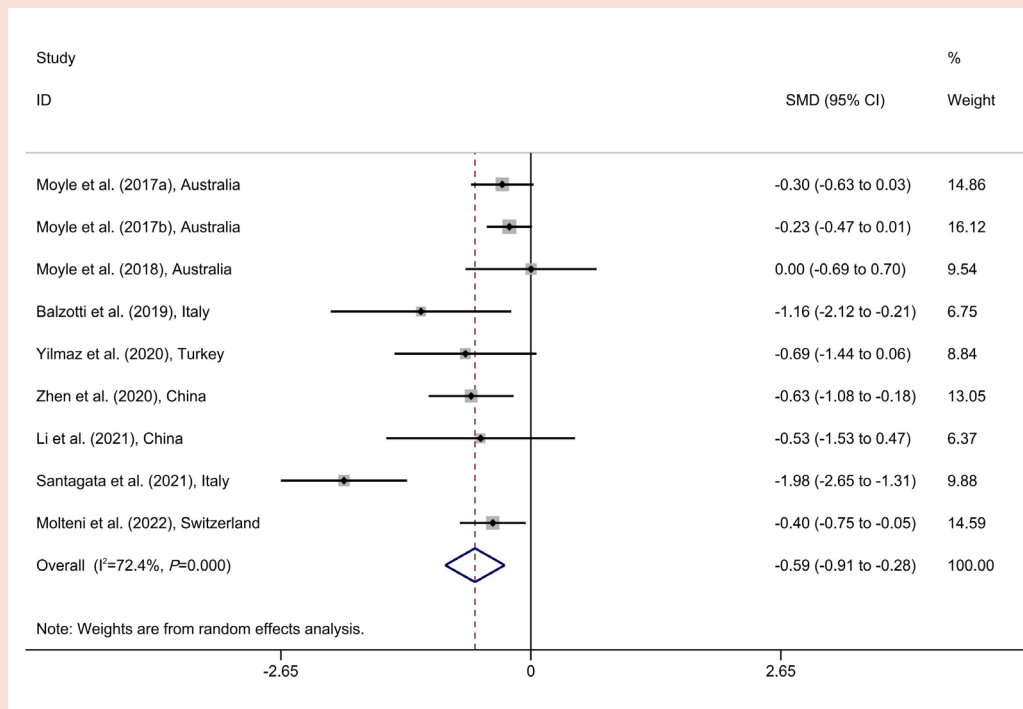
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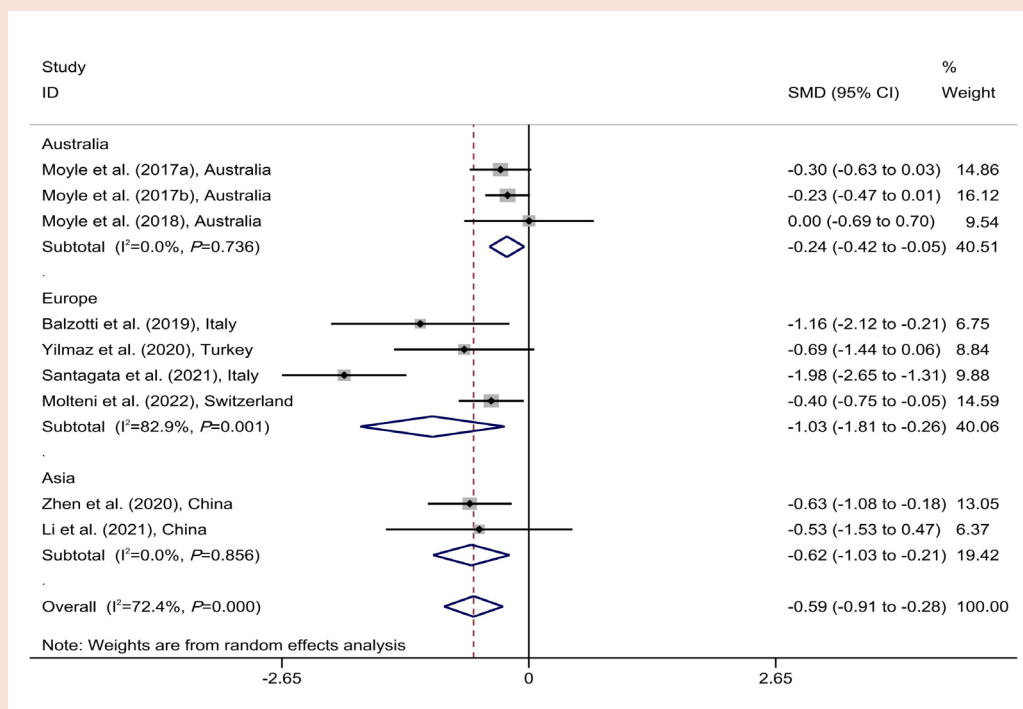
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Fig. 1. Forest plots of agitated behaviour and subgroup analysis. (A) Forest plots of agitated behaviour. (B) Subgroup analysis of regional differences. (C) Subgroup analysis of intervention design. (D) Subgroup analysis of control group.

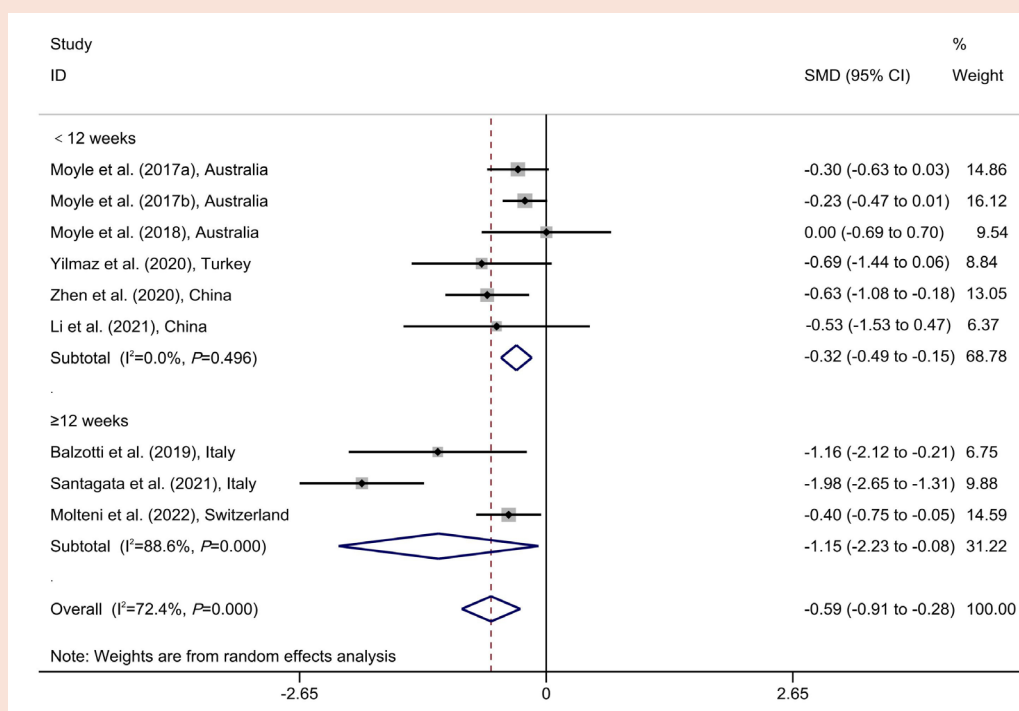
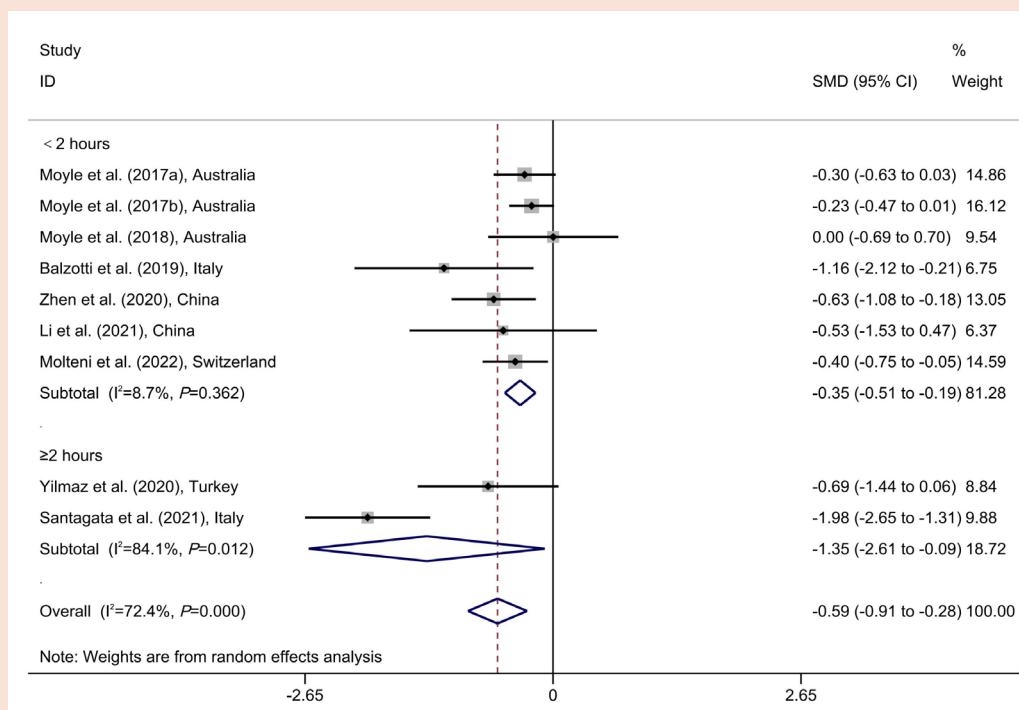
A. Forest plots of agitated behaviour.



B. Subgroup analysis of regional differences.



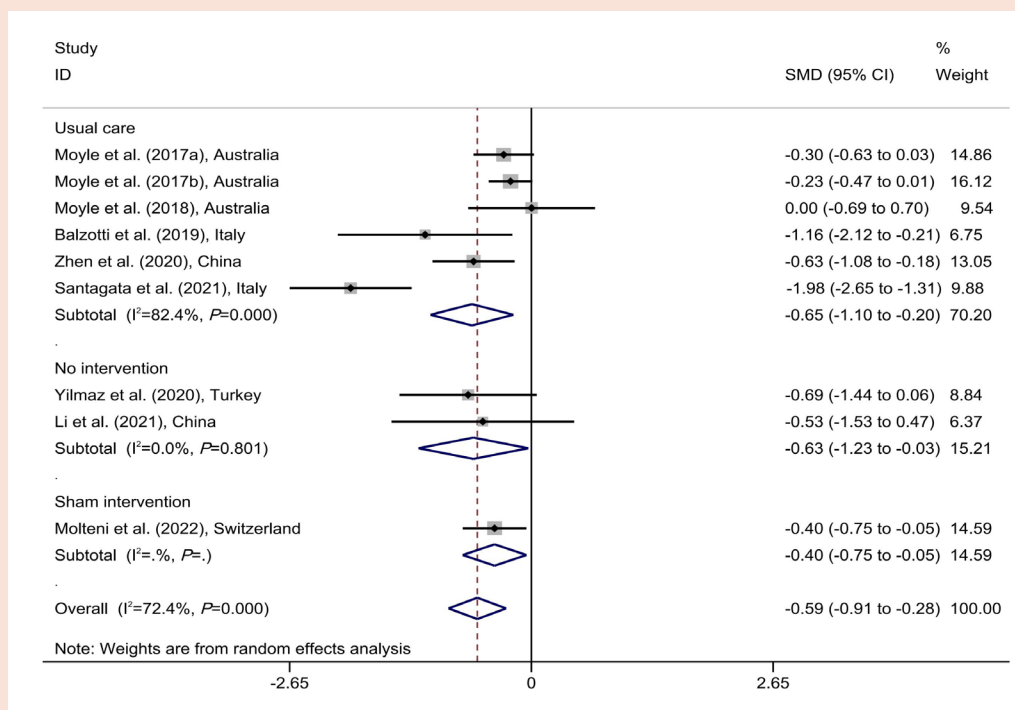
C. Subgroup analysis of intervention design.



assessment showed good data integrity and appropriate randomisation in most trials, although allocation concealment and blinding required improvement (inter-rater kappa = 71.4–100.0%; Supplementary Table S2).

The meta-analysis demonstrated that DT significantly reduced agitation—the outcome supported

by the high-quality evidence (9 studies, $n=845$) and the only outcome awarded a high GRADE rating (Supplementary Table S3). The pooled effect was $SMD=-0.59$ (95% confidence interval [CI] -0.91 to -0.28, $P<0.001$; $I^2=72.4\%$) (Fig. 1). Egger's test showed no publication bias ($P=0.119$). Sensitivity analysis identified 1 outlier (Santagata et al.¹¹; $SMD=-$

D. Subgroup analysis of control group.

CI: confidence interval; SMD: standardised mean difference

1.98); its removal reduced heterogeneity to $I^2=5.1\%$ while preserving significance ($SMD=-0.36$, $P<0.001$), confirming robustness.

Subgroup and meta-regression analyses identified key moderators of efficacy. Regional differences revealed varying effect sizes: Europe¹² ($SMD=-1.03$, 95% CI -1.81 to -0.26), Asia¹³ ($SMD=-0.62$, 95% CI -1.03 to -0.21), and Australia¹⁴ ($SMD=-0.24$, 95% CI -0.42 to -0.05), underscoring the influence of cultural contexts on acceptance and implementation. Intervention intensity showed that longer session length (≥ 2 hours; $SMD=-1.35$, 95% CI -2.61 to -0.09) and greater total intervention duration (≥ 12 weeks; $SMD=-1.15$, 95% CI -2.23 to -0.08) produced markedly larger effects than shorter regimens. DT also showed the greatest advantage over standard care ($z=2.82$, $P=0.005$) (Fig. 1). Meta-regression confirmed region (coefficient = 0.39, $P=0.023$) and session length (coef = -1.04, $P<0.001$) as independent predictors; doll type and participant characteristics were non-significant ($P>0.05$).

For the remaining outcomes, DT improved overall behavioural symptoms (7 studies; $SMD=-0.95$, 95% CI -1.38 to -0.53, $P<0.001$, $I^2=66.2\%$), with parallel subgroup patterns favouring European studies and longer session length (Supplementary Fig. S2). Sensitivity analyses confirmed robustness despite

heterogeneity. Quality of life demonstrated a large, consistent gain (4 studies; $SMD=1.00$, 95% CI 0.81–1.18, $P<0.001$; $I^2=0.0\%$, moderate-quality evidence; Supplementary Fig. S3). Cognitive function showed a positive but non-significant trend (5 studies; $SMD=0.70$, 95% CI -0.05 to 1.45, $P=0.068$, $I^2=93.5\%$; Supplementary Fig. S4). Narrative synthesis revealed additional benefits for emotional states (reduced anxiety and depression, increased happiness) and other behavioural symptoms (apathy, irritability, and eating behaviour).

These findings indicate that DT significantly reduces overall behavioural symptoms and agitated behaviours while improving emotional states. Subgroup analyses showed that longer session lengths and European settings are associated with greater effectiveness, highlighting the critical role of sustained engagement and cultural factors. For agitation specifically, sensitivity analysis confirmed Santagata et al.¹¹ as the primary source of heterogeneity, attributable to its rigorous design and high-quality care delivery. Meta-regression and subgroup analyses verified that longer session length (≥ 2 hours), longer total intervention duration (≥ 12 weeks), and regional differences independently enhanced efficacy, aligning with attachment theory's emphasis on prolonged interaction for emotional bonding and regulation.

Notably, most of the studies with a session length of more than 2 hours and a total intervention duration of more than 12 weeks were conducted in Europe, which means that the effectiveness of DT is related to cultural factors and intervention design. In Asia, particularly in China, dementia care is inevitably influenced by ethical norms, demographic structure, and family caregiving practices. Moreover, most of the included studies were conducted in hospital settings and focused on specific patient subgroups. These settings are not conducive to fully realising DT's therapeutic potential for complex psychosocial needs. By contrast, European studies place greater emphasis on diversified activity-based interventions and emotional support, and the effectiveness of DT is relatively high. In Australian studies, the effectiveness of DT is relatively low, which is inevitably related to the intervention parameters and nursing environment.

In contrast, quality-of-life gains remained consistent across populations, affirming DT's universal provision of emotional support, psychological comfort, and social belonging. Cognitive effects displayed a complex cross-cultural pattern and overall non-significance, with stronger potential in culturally congruent Asian hospitalised populations due to early stimulation, while European studies focused on emotional support yielded mixed results, possibly reflecting differences in intervention objectives, patient subgroups, and assessment tools.

This is the first meta-analysis to analyse DT only from the perspective of RCTs, in order to eliminate the influence of design confounding, and to explore the differences between cultures through sensitivity analysis, GRADE and other methods, to enhance confidence. Nevertheless, there are some limitations, including the methodological heterogeneity, such as the unclear allocation concealment, the small sample size, the different protocols, and the geographical concentration, of which 5 studies were conducted in China, all in the hospital environment. The diagnostic scope was also limited, focusing on Alzheimer's disease and not analysing the aetiology. In addition, the intervention time is relatively short (4 weeks). The cultural adaptation framework (particularly regarding family-centred care in Asian contexts) remains underdeveloped, which restricts its applicability. Accordingly, future research should prioritise culturally tailored protocols (e.g. family-supervised community kits), large multicentre trials with extended follow-up across contexts, and investigations into neurobiological mechanisms connecting emotional security to behavioural and cognitive gains, thereby reinforcing the imperative for locally responsive evidence-based interventions.

In conclusion, DT is a valuable, cost-effective addition to dementia care that meaningfully improves behavioural symptoms, emotional states, and quality

of life, particularly when delivered with adequate session length, sufficient total intervention duration, and cultural sensitivity. By providing, to the authors' knowledge, the first quantitative evidence of cross-cultural variation and intervention intensity effects through rigorous subgroup, sensitivity, and meta-regression analyses, this study advances the field towards truly personcentred, culturally inclusive, and resource-optimised interventions worldwide.

Supplementary materials

Fig. S1. PRISMA diagram flow of the study selection process.

Fig. S2. Forest plots of overall behaviour and subgroup analysis.

Fig. S3. Forest plots of quality of life.

Fig. S4. Forest plots of cognitive function.

Table S1. General characteristics of the included articles.

Table S2. Summary of risk of bias judgements for each study.

Table S3. Summary of findings.

Ethics statement

Not applicable, as no study participants were involved.

Declaration

The authors declare that they have no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript. There is no conflict of interest or funding to declare.

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Keywords: *behavioural symptoms, cultural adaptation, dementia, doll therapy, non-pharmacological intervention, nursing, quality of life*

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