



Review Article

Aging with Thalassemia and Sickle Cell Disease: A Gerontological Model of Accelerated Multimorbidity and Function-Centered Care Beyond Midlife

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Competing interests: The authors declare no competing interest.

Supplementary Material

Supplementary Table S1. Literature Search Strategy and Study Selection Process

Search Strategy

A structured literature search was conducted to identify studies examining aging, multimorbidity, and functional outcomes in adults with hemoglobinopathies (thalassemia and sickle cell disease).

Databases searched: PubMed, Scopus, Web of Science

Search period: January 2000 to December 2025

Search terms: “thalassemia”, “sickle cell disease”, “aging”, “frailty”, “multimorbidity”, “geriatric assessment” (used individually and in combination)

Study Selection Process

Step	Number of Records
Records identified	1,248
Duplicates removed	312
Records screened (title/abstract)	936
Records excluded	742
Full-text articles assessed	194
Full-text articles excluded	142
Studies included in final synthesis	52

Reasons for Exclusion (Full-text Stage)

Pediatric-only populations
Lack of aging-related focus
Insufficient clinical or functional outcome data
Case reports without generalizability
Non-English publications

Study Characteristics

By Study Type

Study Type	Number (n)	Percentage (%)
Cohort studies	21	40%
Registry/database studies	11	21%
Clinical guidelines/consensus	9	17%
Systematic reviews/meta-analyses	7	13%
Interventional studies	4	9%

By Disease Focus

Disease Category	Number (n)	Percentage (%)
Thalassemia	18	35%
Sickle Cell Disease	24	46%
Mixed populations	10	19%

Eligibility Criteria

Inclusion Criteria:

Adult populations (≥ 18 years), with emphasis on ≥ 40 –45 years
Studies addressing aging-related complications, multimorbidity, frailty or functional decline, quality of life or disability outcomes
Peer-reviewed publications

Exclusion Criteria:

Pediatric-only studies
Studies without clinical relevance
Case reports (unless conceptually important)
Non-peer-reviewed literature

Limitations of the Evidence Base

Limited prospective longitudinal studies in aging populations
Predominance of data from high-income countries
Heterogeneity in definitions of frailty, cognition, and functional outcomes
Scarcity of interventional trials targeting aging-related outcomes