



Review

Evolving Health and Wellbeing of Thalidomide Survivors as They Age: A Scoping Review Update (2017–2025)

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Abstract

Background: Thalidomide, prescribed to pregnant women in the late 1950s and early 1960s, caused severe congenital impairments known as thalidomide embryopathy, yet the long-term health and wellbeing of survivors as they reach older adulthood remains underexplored. **Objectives:** This scoping review updates the 2017 Newbronner and Atkin review by exploring evidence published between 2017 and 2025 on the physical, mental, and social wellbeing of ageing thalidomide survivors, identifying emerging health issues, care needs, and evidence gaps. **Methods:** Searches across nine academic databases and grey literature sources identified studies reporting health, wellbeing, or quality of life among middle-aged and older adults with documented prenatal thalidomide exposure. **Results:** Thirty papers from the UK, Germany, Japan, Italy, Sweden, Canada, and Australia were included, showing pervasive musculoskeletal deterioration, chronic pain, and increased metabolic disorders. Mental health conditions, including depression, anxiety, and stress, were common and often linked to pain severity and functional limitations, alongside sensory impairments, dental issues, and functional decline, though many survivors demonstrated resilience. **Conclusions:** Ageing thalidomide survivors face complex, progressive health challenges that extend beyond congenital impairments, highlighting a need for coordinated, specialist care to support wellbeing in later life.

Keywords: thalidomide; embryopathy; health; wellbeing; ageing; HRQoL

1. Introduction

In the 1950s and 1960s, pregnant women experiencing morning sickness were given the drug “thalidomide” [1], sold by the German pharmaceutical company “Chemie Gr nenthal”. This was given for a variety of conditions, including morning sickness, as it was claimed to be safe and to have antiemetic properties. However, it had never been tested to ensure its safety for use during pregnancy [2]. Thalidomide, linked to severe birth defects when taken during pregnancy, has left survivors, now in their 60s, facing long-term effects of thalidomide embryopathy and emerging age-related health complications.

Research on thalidomide survivors’ health has increased since 2000 but remains largely focused on biomedical issues, with less attention to the complex health and care challenges they face as they age. A 2017 review by Newbronner and Atkin addressed this gap, finding that thalidomide survivors are facing more health issues as they approach later life [3]. However, the health and wellbeing of thalidomide survivors has likely changed in the



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last ten years, as they continue to age and face new challenges. This scoping review updates Newbronner and Atkin's findings about the health, wellbeing, and quality of life of thalidomide survivors.

2. Materials and Methods

Due to the broad nature of the research questions, diverse set of study designs (e.g., surveys, clinical observations, reviews) and outcomes (e.g., physical and mental health), and the varying quality of the studies, conducting a systematic review was considered unfeasible, and instead we conducted a scoping review. This was done in accordance with the PRISMA Extension for Scoping Reviews (PRISMA-ScR) Checklist (see Supplementary File S1), ensuring methodological rigour and transparency in reporting [4].

2.1. Search Strategy

We used the search strategy developed by Newbronner and Atkin [3] to gauge the scope and quality of the emerging literature published since 2017. We then modified the search strategy to improve its sensitivity and capture more relevant studies (see Appendix A). We complemented the electronic database searches by checking reference lists of articles included in the review and conducting a grey literature search on Google and Google Scholar. For each database (see Appendix B), we searched keywords related to "thalidomide" combined with terms referring to pregnancy, embryopathy, and health impacts or disabilities. This search strategy was applied consistently across all databases, with syntax adapted to the requirement of each platform (i.e., using * or \$ for truncation, and adj3 or N3 for proximity operators). To reduce the number of articles in PubMed Central that focused on molecular or genetic mechanisms, we excluded studies containing the terms or derivatives of "genetic", "biological", "sequence", and "molecular". The search comprised free-text terms applied across titles, subject headings, abstracts, and full-text fields. Database-specific controlled vocabulary was not used. Thalidomide embryopathy is a highly niche condition affecting a small, ageing population, and its long-term health consequences span multiple organ systems and disciplines. Search comprehensiveness was ensured through several complementary strategies. Extensive synonym variation and truncation were applied across multiple fields (title, abstract, subject headings, and full text where available) to capture the diverse terminology used across disciplines for thalidomide embryopathy and its wide-ranging health consequences. Searches were conducted across multiple databases spanning medical, allied health, psychological, and grey literature sources, supplemented by hand-searching reference lists and consultation with subject-matter experts, to reflect the multisystem and interdisciplinary scope of the review objectives. The initial search was conducted on 6 December 2024, and was last updated on 29 July 2025.

2.2. Eligibility Criteria

Studies were included if were published between December 2016 and July 2025 and if they reported on:

- Individuals born with impairments resulting from their mothers taking thalidomide during pregnancy.
- Thalidomide survivors' health, wellbeing, or quality-of-life outcomes.
- Outcomes of thalidomide survivors in their middle age (i.e., 40s to 60s).

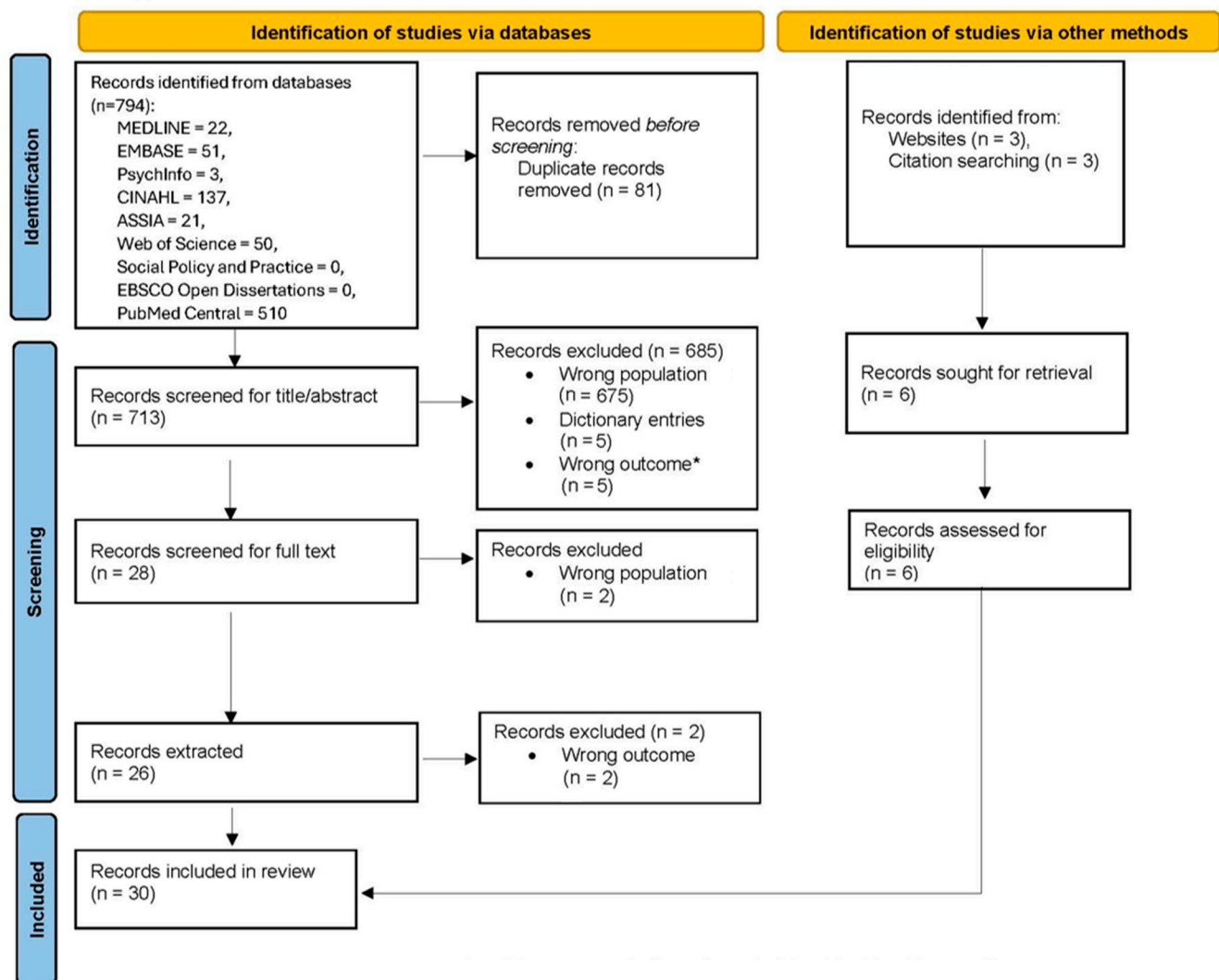
We excluded studies that:

- Focused only on the biological or molecular mechanisms of thalidomide damage.
- Did not include a population of people exposed to thalidomide in the womb.

2.3. Screening

Search results were deduplicated and screened with Rayyan [5], with titles and abstracts reviewed first, followed by full-text screening for studies not excluded in the initial stage. Approximately ~70% of titles and abstracts were independently screened by two reviewers to ensure consistency, with the remaining studies screened by one reviewer. In case of uncertainty, full-text papers were discussed in the research group and a consensus was reached. The PRISMA flow chart of the literature screening is shown in Figure 1.

PRISMA flow diagram



*Wrong outcome refers to papers that did not report findings about thalidomiders' health or wellbeing.

Figure 1. PRISMA flow chart.

2.4. Data Extraction

We developed a data extraction template and extracted basic study characteristics and information on study setting, population, design, and outcomes captured (e.g., clinical area(s) covered, quality of life, health issues, and consequences of the ageing process). A sample of the studies (~20%) was double-extracted and discussed to reach consensus among two reviewers, and remaining studies were single-extracted.

2.5. Quality Appraisal

While we did not exclude any studies based on their quality, we considered it in the synthesis, leaning more on studies of higher quality. Due to the diverse nature of the

studies, we used the Mixed-Methods Appraisal Tool [6] for study quality appraisal. For the grey literature, we applied the AACODS Checklist [7]. We did not formally appraise the quality of the non-systematic literature reviews and case reports included to provide contextual background and illustrative examples.

2.6. Synthesis

We used narrative synthesis guided by thematic analysis, grouping the reported outcomes by clinical categories.

3. Results

The studies included in this review comprise case reports, cross-sectional quantitative studies, mixed-methods research, literature reviews, and grey literature (Appendix D). We also identified several additional case reports [8–12], one mixed-methods study [13], one cross-sectional observational study [14], one meeting report [15], and narrative reviews [16–18] that were relevant to the topic but offered limited information beyond the included studies, and therefore are not directly discussed. Appendix C provides details of all thirty papers. Although thalidomide was known to have officially been distributed in around 47 countries [18] and likely to have been available in more, we identified studies from only seven countries: the UK, Germany, Japan, Italy, Canada, Australia and Sweden. The scope of included studies ranged from biomedical research addressing specific health issues to surveys investigating health, wellbeing, and health-related quality of life.

3.1. Health Status

Three studies highlighted the pattern of declining health and comorbidities in thalidomide survivors. These findings extend the earlier review's finding that thalidomide survivors were beginning to feel their health was not as good as their non-disabled peers, with some reporting they felt older than their age [3]; the current evidence suggests this perceived decline has continued and accelerated. In a repeated cross-sectional survey, Samel et al. (2019) used standardised questionnaires in 2002 and 2015 to assess socioeconomic factors, medical conditions, and quality of life of female thalidomide survivors in Germany [19]. The 2002 survey collected data solely via questionnaires, whereas the 2015 wave assessed German female thalidomide survivors (104 in 2002, 115 in 2015) more comprehensively, using the EQ-5D along with physical and psychiatric evaluations [19]. Participants reported a decline in health satisfaction over time, with fewer women rating their health as "very good" or "good" (50.5% versus 37.4%), and the majority (59.9%) describing it as "fair" or "poor".

Similarly, Hinoshita et al. (2019) conducted a nationwide survey of 173 Japanese thalidomide survivors and compared their health status with that of an age-matched general population [20], finding that 39.9% rated their health as "average", 17.9% as "relatively bad", and 2.3% as "bad", compared to 53.7%, 11.8% and 1.4%, respectively, of the general population.

The Canadian "Thalidomide Survivors Contribution Program" survey showed a clear rise in the proportion of participants reporting worsening health from 2017 to 2019: the proportion of those reporting worse physical health increased from 26% to 57%, and the proportion of those reporting worse functional health rose from 21% to 45% [21]. In the 2019 survey, participants most often attributed their worsening health to the physical strain of performing daily tasks (62%), followed by the effects of pre-existing medical conditions (47%) and the emergence of new medical conditions (35%).

3.2. Quality of Life

Five studies found that, on average, thalidomide survivors reported health-related quality of life comparable to the general population.

Imai et al. (2020) assessed 51 Japanese thalidomide survivors using the SF-36 health-related quality of life questionnaire, the GHQ-28 survey for possible psychological disorders, and the Coping Strategy Questionnaire [22]. The average physical composite score of SF-36 (PCS) (48.27) and mental composite score (MCS) (46.41) for this population were close to the standardised population mean of 50, indicating that overall quality of life (QoL) remained relatively stable despite thalidomide damage. The study found that more intense pain but not hearing impairments or limb disabilities were linked to lower physical QoL, suggesting that disability type did not strongly influence either physical or mental QoL. Similarly, in a UK cross-sectional survey of 127 patients, Markiewicz et al. (2023) found a median EQ-5D-5L index of 0.6, which suggests a good QoL [23], with a majority of participants (70%) noting, however, that their health-related quality of life (HRQoL) declined with age, with worse HRQoL linked to more severe upper limb disability.

Importantly, other studies found differences between physical and mental QoL. Ghassemi Jahani et al. (2016) examined 31 Swedish thalidomide survivors and found that while physical QoL scores as measured by the SF-36 questionnaire were significantly lower than population norms (mean 40.6 versus 50), particularly among the subgroup affected by severe limb damage, mental QoL (mean 51.5) was not significantly affected [24].

Niecke et al. (2022) conducted a cross-sectional survey of 186 thalidomide survivors in North Rhine-Westphalia, Germany, assessing pain levels, psychological status, and HRQoL [25], reporting that physical HRQoL measured by the SF-36 questionnaire was significantly lower compared with both general and chronically ill populations (PCS: 33.4 vs. 45.3). Additional subgroup analyses revealed that individuals with thalidomide embryopathy and quadruple impairments have significantly poorer physical HRQoL compared to those with hearing loss. Furthermore, those without pain or with mild pain had the highest physical and mental HRQoL, while severe pain was linked to much lower scores. Individuals without mental disorders had the highest mental HRQoL, even above the general population, whereas those with somatoform, personality, or depressive disorders showed reduced physical and mental HRQoL. Interestingly, quadruple-impaired individuals, meaning those with damage or loss of function in all four limbs, had the highest mental HRQoL among impairment subgroups, while the presence of mental disorder, especially depression, was associated with the lowest mental HRQoL [25].

In agreement with studies finding lower PCS but relatively normal MCS, a UK survey of 351 thalidomide survivors conducted by Newbronner et al. (2019) using the SF-12 questionnaire showed markedly poorer physical HRQoL compared with the general population (mean score of 26.7 versus 50), while mental health was on average only slightly lower (46.5 versus 50), despite a subset experiencing substantial difficulties [26].

While physical limitations and pain seem to impact physical QoL, mental QoL is preserved, due to adaptive coping strategies, psychological resilience, levels of support and available resources, social participation, or long-term adjustment to lifelong disability.

3.3. Musculoskeletal Problems

The earlier review documented musculoskeletal problems as the most commonly researched topic, with prevalence rising from around 20% in survivors' early 40s to over three-quarters a decade later [3]; current findings confirm this trajectory has continued and provide more detailed evidence of the structural and biomechanical mechanisms underpinning these outcomes. Eight studies discussed musculoskeletal problems, which were

often widespread, affecting multiple body parts, and were described as severe, particularly among thalidomide survivors with more pronounced congenital impairments.

Sagoe et al. (2024) conducted a UK survey of data from 388 thalidomide survivors' routine Holistic Needs Assessments (HNAs), conducted through structured interviews, to explore the prevalence of comorbidities in individuals with thalidomide embryopathy, and compared with an age-matched general population sample in the UK [27]. Thalidomide survivors' HNAs are routine assessments carried out every three years by the UK Thalidomide Trust [28]. This study found that 10% of participants reported musculoskeletal problems, compared to 1.5% in the general population. A UK-based survey by Newbronner et al. (2019), involving 351 thalidomide survivors, reported that 93% of participants experienced musculoskeletal problems, including pain and/or impaired movement in joints, neck, or back, compared to 12% in the general population [26]. This discrepancy might be due to differences in what authors measured, as Sagoe et al. reported on the prevalence of musculoskeletal problems and pain separately [27], whilst Newbronner et al. (2019) reported on pain combined with the underlying musculoskeletal problems [26].

Data from a UK survey conducted by Newbronner et al. (2019) [26] showed that the most affected region was the back (72%), including conditions such as prolapsed discs, vertebral damage, scoliosis, and muscular pain. Shoulder problems (pain, reduced mobility, and joint deterioration) were also frequently reported (60%), as well as problems in hands (59%; reduced grip and dexterity), arms and wrists (56%; pain and loss of strength or movement), and the neck (55%; pain and restricted movement). Lower limb issues were also observed, including knee pain or joint deterioration (48%), hip pain or restricted mobility (46%), and ankle, foot, or toe pain and/or movement limitations (28%). Joint disorders like arthropathy (disorder of the joints causing movement limitations, inflammation, pain and stiffness) were also reported in a 2018 Japanese survey of 274 thalidomide survivors, with 15% of participants being treated for arthropathy at the time of the study [20].

A German study of 206 thalidomide survivors and 183 controls (Beyer et al., 2025) also found that musculoskeletal problems were more prevalent among thalidomide survivors compared to a control group [29]. Participants with thalidomide embryopathy had impaired hand strength (27.3% versus 0.6%), and experienced osteoarthritis in knee joints (34% versus 9.8%), hip joints (32% versus 4.9%), hands/fingers (33% versus 14.2%) and shoulders (32% versus 6%), as well as chronic muscle pain (21.4% versus 2.7%), muscle weakness (12.1% versus 0%) and osteoporosis (9.2% versus 1.6%). Compared with controls, thalidomide survivors reported significantly higher rates of reduced strengths in legs or feet (34.5% versus 11.9%), unsteady gait (15.5% versus 1.7%), weaker hands over time (48.5% versus 14.8%), and lifelong impaired hand strength (27.3% versus 0.6%), with all differences highly significant. Thalidomide survivors showed poorer lower extremity function than controls (mean score on the "Lower Extremity Function Scale" 42.6 vs. 68.5), significantly higher fall frequencies, and more fall-related injuries.

While these larger-scale survey findings suggest an increased burden of musculoskeletal impairment and functional decline among thalidomide survivors, smaller clinical and imaging studies provided important insights into the structural and biomechanical mechanisms underpinning these outcomes.

A Japanese study by Kamimura et al. (2024) with five thalidomide survivors offered radiological and clinical insights into structural musculoskeletal abnormalities [30]. Malformations were confined to the forearms and hands and CT imaging revealed characteristic abnormalities such as shoulder osteoarthritis and humeral head displacement, elbow joint hypoplasia and synostosis, and extensive wrist carpal bone hypoplasia and fusion in nine of ten upper limbs. These findings suggest both congenital and age-related degenerative changes.

A survey by Markiewicz et al. (2023) [23] found that higher QuickDASH scores, which indicate greater upper limb disability, were associated with specific anomalies such as radial longitudinal deficiency, thumb hypoplasia, and finger changes. Interestingly, more severe limb differences, like transverse or intersegmental deficiencies, were not linked to worse quality of life or functional impairment according to EQ-5D-5L and WSAS measures. Overall, disability did not always match the perceived severity of the limb difference.

Finally, a 2023 UK review article by Vargesson et al. [31] of thalidomide upper limb embryopathy provided a broader view of the long-term consequences of compensatory mechanisms, detailing how chronic overuse of structurally compromised joints can lead to secondary complications (e.g., osteoarthritis, glenoid dysplasia). Testimonies from Australian thalidomide survivors and their families, submitted to the Senate Community Affairs Committee inquiry, which aimed to examine the adequacy of support provided to Australia's thalidomide survivors and assess the ongoing impact of thalidomide on their lives, reported premature ageing and severe wear-and-tear, leading to worsened physical health, sensory neuropathy, arthritis, dental deterioration, fatigue, and weakness [32].

3.4. Pain and Neuropathic Symptoms

Pain was highly prevalent and frequently reported as both nociceptive, stemming from tissue damage in muscles, joints, or skin, and neuropathic, resulting from dysfunction or injury within the central or peripheral nervous system [23,25,26,33]. This complex pain profile was debilitating and widespread, affecting multiple body regions.

Pain prevalence varied across studies. In a survey conducted by Imai et al. (2020) in Japan that assessed pain severity among 51 thalidomide survivors, authors found that 82.4% of participants reported physical pain, with the shoulders (47.1%), lower back (41.2%), and neck (31.4%) being the most commonly affected areas, though the pain type (neuropathic or nociceptive) was not specified [22]. The high pain prevalence was echoed in a Germany study by Niecke et al. (2021), where 167 thalidomide survivors were comprehensively assessed through physical examinations, structured psychiatric interviews (SCID-I/SCID-II), standardised pain assessments (MPSS, SF-36, PainDETECT), and sociodemographic questionnaires to analyse the interplay between congenital impairments, pain, and mental health [33]. The authors identified an even higher prevalence of pain (94%), with 54% experiencing chronic pain, and 41.9% reporting "high" pain intensity. Participants (44.3%) experienced continuous and radiating (70.1%) pain. While nociceptive pain was frequent (49.7%), a significant subset reported possible neuropathological components, particularly in relation to hip pain [33]. Similarly, a UK survey by Newbronner et al. (2019) found that 49% of participants experienced generalised pain, 26% of whom reported severe or continuous generalised pain, and 23% described it as moderate or intermittent [26]. One study found lower, yet still substantial, pain prevalence. Using a cross-sectional survey design, Markiewicz et al. (2023) assessed long-term upper limb disability, function, and quality of life in thalidomide survivors in the UK [23], identifying neuropathic pain in 26% of participants [23].

Other neurological symptoms like numbness, tingling, and pins and needles were also frequently reported. According to Newbronner et al. (2019), for example, 66% of participants reported neurological problems like tingling and numbness [26], while Sagoe et al. (2024) found that 94% experienced pain, numbness, and pins and needles frequently across several areas, with 20% affected in seven or more locations [27].

Regarding treatment for pain, a Japanese survey by Hinoshita et al. (2019) reported that 21.4% of 173 participants were receiving treatment for low back pain, and 22.5% for stiff shoulders [20]. Overall, compared with the general population, thalidomide survivors were more likely to receive treatment for health or physical problems, while a greater

proportion of the general population reported receiving no treatment (25.7% vs. 18.5%) [20]. A German study of 206 thalidomide survivors and 183 controls (Beyer et al., 2025) found that 34.5% of participants were taking medications for pain (e.g., ibuprofen) compared to 10.9% in the control group, whilst 6.3% were taking opioids for pain (e.g., tramadol, morphine, oxycodone, etc.) compared to 0% in the control group [29]. Samel et al. (2019) reported a sharp increase in pain interference with daily activities, from 26.2% in 2002 to 70.4% in 2015 [19]. Only a small fraction (2.6%) reported being pain-free or not limited by pain (10.4%) in 2015, compared to 26.2% in 2002.

Overall, findings suggest that thalidomide survivors experience a high burden of chronic pain associated with neurological symptoms, with considerable consequence for functional ability, healthcare utilisation, and overall quality of life.

3.5. Endocrine and Metabolic Disorders

Four studies highlighted an emerging concern regarding dyslipidaemia (abnormal lipid level) and metabolic disorders in thalidomide survivors. Compared to the general population, the rates of diabetes and endocrine disorders observed in thalidomide survivors appeared to be higher (19% versus 12%), according to Sagoe et al. (2024) [27]. A Japanese survey by Hinoshita et al. (2019) found that 13.9% of participants were receiving treatment for dyslipidaemia and 12.7% for diabetes [20]. More recent studies by Tanabe (2023, 2024) showed even higher rates: 30–40% of participants had dyslipidaemia and 56–61% of men and 39–41% of women had fatty liver, despite most individuals not being overweight [34,35]. The studies did not establish a direct link between limb abnormalities and metabolic conditions, suggesting instead that physiological limitations resulting from thalidomide-related impairments (e.g., reduced mobility and difficulty exercising) may play a role.

3.6. Sight and Hearing Damage

Five studies reported that sensory impairments, particularly involving vision and hearing, are common.

Hinoshita et al. (2019) found that 19.1% of Japanese participants had eye diseases [20], similar to findings by two German surveys, where 12.1% of participants reported impaired vision even whilst wearing glasses, 18.4% reported ocular muscle paralysis (Beyer et al., 2025) [29], 28.7% had congenital impairments in their eyes (e.g., ophthalmoplegia, or eye muscle paralysis or weakness) and 10.4% had lagophthalmos (an inability to completely close one or both eyelids) (Samel et al., 2019) [19].

Regarding hearing impairments, Niecke et al. (2021) reported that about one-sixth of the 176 participants experienced severe hearing impairment or loss [33]. Samel et al. (2019) showed that 14.8% of participants suffered from hearing loss [19], whilst Imai et al. found that 27.4% of participants had hearing impairments [22]. A German study of 206 thalidomide survivors (Beyer et al., 2025) showed that 15.5% of participants experienced damage to their vestibular systems (e.g., damaged inner ear), 30.5% had congenital severe hearing loss, and 31.4% suffered from dizziness [29].

This suggests that visual and hearing impairments, including congenital eye abnormalities, hearing loss, and vestibular dysfunction, are prevalent among thalidomide survivors, highlighting the substantial sensory health burden.

3.7. Digestion and Dental Problems

Two studies reported on dental issues in individuals with thalidomide embryopathy, both indicating relatively high prevalence: 17.9% (Hinoshita et al., 2019) [20] and 34% (Newbronner et al., 2019) [26]. Sagoe et al. (2023) reported 52% experienced digestive, bowel, or dental problems, in contrast to 7% in the general population [27].

3.8. Breathing Problems

Newbronner et al. (2019) found that asthma or breathing problems were reported by 15% of participants, representing a notable but less prevalent health issue compared with other health conditions (e.g., musculoskeletal issues) [26].

3.9. Cardiovascular Problems

Evidence indicates a notable prevalence of cardiovascular conditions among individuals with thalidomide embryopathy. For example, Hinoshita et al. reported that 15.6% of participants were receiving treatment for hypertension [20].

A review of clinical, experimental, and imaging studies by Klein-Weigel and Ding-Greiner (2025), summarised research on the mechanisms of thalidomide teratogenicity and reviewed clinical evidence on congenital defects and vascular anomalies [36]. The authors explained that thalidomide disrupts early blood vessel formation, which secondarily impairs heart and organ development. Resulting cardiovascular malformations occur in approximately 27.3% of affected patients, can increase clinical risk and require careful cardiovascular evaluation, especially before interventions or surgery. In this context, accurate assessment of cardiovascular risk factors is essential; however, as highlighted by Newbronner and Atkin (2017), challenges in obtaining reliable blood pressure and body mass index measurements in individuals with limb differences may limit the validity of routine risk assessment and the management of conditions such as hypertension and diabetes [3].

3.10. Mental Health

High rates of mental health concerns among thalidomide survivors, especially compared to peers in the general population, were consistently reported across eight identified studies, revealing a significant and often under-addressed burden. For context, a literature review by Niecke et al. (2021) revealed that mental health issues have been largely unrecognised, possibly due to a predominantly medical focus on physical disability and an assumption that mental health was unaffected, as well as thalidomide survivors' reluctance to reveal mental suffering due to potential stigma [37].

Niecke et al. (2021) reported that 44.9% of their sample had psychological disorders as measured using the Structured Clinical Interview for DSM-IV (SCID-I/SCID-II); presence of disorders such as major depression, somatic symptom disorders, and substance-related disorders was also linked with experience of significantly greater chronic pain [33]. A similar rate was identified by a survey by Newbronner and Wadman (2021) of 182 UK thalidomide survivors, which examined the prevalence and severity of depression and anxiety by collecting self-reported data on depression (PHQ-9) and anxiety (GAD-7) [38]. The study found that more than half of participants (56.6%) reported mild to severe depressive symptoms, including 16.1% with severe or very severe depression, notably higher than in other groups of people with disabilities. Generalised anxiety disorder was also prevalent: 14.8% of participants experienced moderate and 10.2% severe anxiety, compared to 5% and 1%, respectively, in the general population. Consistent with these trends, Samel et al. (2019) noted that 46.8% of participants had been diagnosed with a mental disorder [19], while Imai et al. (2019) found that 41.2% potentially had psychiatric disorders as measured by the GHQ-28 questionnaire, with mental health strongly linked to coping styles [22]. However, greater pain severity was generally associated with maladaptive coping, which strongly predicted poorer mental health outcomes and diminished physical and mental quality of life. Positive psychological factors like self-fulfilment and goal-directedness were found to be positively correlated with overall physical and mental health scores, suggesting important potential targets for intervention.

Newbronner et al. (2019) reported that half of the participants had either experienced, or were currently experiencing, anxiety and/or depression (41% reporting anxiety and

34% reporting depression, compared to 20% of people in the general population) [26]. More recently, Sagoe et al. (2024) reported mental health issues (anxiety, depression, and loneliness) in 39–41% of thalidomide survivors depending on impairment group, compared to 9% in the general population [27]. Individuals with facial disfigurement or hearing impairment reported higher rates of mental health issues (52%), experienced significantly greater loneliness and isolation (21% versus 11%), and had higher rates of depression (36% versus 22–25%) compared with other impairment groups.

These findings also align with earlier work by Niecke et al. (2017), who documented mental disorder prevalence of 47.2%, most commonly unipolar depressive (16.5%), somatoform (14%), phobic (12.4%), and alcohol-related disorders (6.2%) [39]. Though treatment had been indicated for 80.2% of those affected in this study, only 29.7% had accessed treatment in the past year, highlighting a potentially unmet need. Hinoshita et al. (2019) found that only 9.8% of thalidomide survivors reported receiving medical treatment for depression or other mental illnesses, while 79.2% experienced feelings of worry or stress, higher than the general population (52.3%) [20]. Particularly, thalidomide survivors were most frequently worried about their own health (73%), old age and retirement (54.7%), their family's health (46.7%), financial matters (39.4%) and workplace dynamics and interpersonal relationships (33.6%).

Despite high prevalence of mental health conditions, the proportion of thalidomide survivors receiving treatment is significantly lower than the proportion affected, highlighting a potential gap in care.

3.11. Social Wellbeing

Findings from three studies underscore how visible congenital differences not only affect daily functioning but also shape psychosocial wellbeing.

Markiewicz et al. (2023) measured the extent of thalidomide survivors' psychological distress related to one's physical appearance and the impact of health conditions on daily functioning at work and in people's social and personal lives [23]. The median DAS-24 score of 35.5 indicated negative self-perception of appearance, particularly among those with more complex upper limb impairments such as radial longitudinal deficiency, thumb hypoplasia, or multiple upper limb anomalies [23]. The median WSAS score was 15.5, reflecting significant functional impairment affecting work and social life. Importantly, more severe or multiple limb differences were linked to both worse body image and more difficulty with work and social activities [23].

Thalidomide survivors in Australia (2019) also reported experiencing severe verbal and physical bullying throughout childhood and, for some, continuing into adulthood, leading to long-term emotional harm, educational disruption, and social withdrawal [32]. Participants reported that their visible physical impairments led to social isolation, exclusion, and feelings of shame or worthlessness, negatively affecting their psychological wellbeing and sense of belonging from childhood into adulthood. However, Niecke et al. (2021) reported that despite significant social pain from stigma and physical impairments, individuals demonstrated strong coping [33].

These findings address a gap explicitly identified in the earlier review, which called for greater consideration of "the social consequences of secondary damage being layered onto lifelong impairments across the life-course" [3] (p. 190). The current evidence on body image, social functioning, and psychosocial wellbeing begins to address the broader social dimensions highlighted by the earlier review, though a fully theorised account grounded in critical disability studies remains absent from the literature. Nevertheless, these findings indicate that despite enduring psychosocial challenges, thalidomide survivors demonstrate considerable resilience and adaptive coping across the lifespan.

4. Quality of Studies

The quality of the included studies was moderate to high. Most studies used well-designed cross-sectional surveys with robust sampling and validated measures. Regarding the scope of existing surveys, we found no qualitative studies, although some grey literature and case studies partially helped to fill this gap, highlighting the personal experiences of thalidomide survivors.

5. Discussion and Limitations

Evidence suggests that as they age, thalidomide survivors experience complex health challenges. Musculoskeletal and pain problems remain the most frequently reported health issues, affecting upper limbs, shoulders, back, and lower extremities. Pain often appears linked with underlying musculoskeletal disorders; indeed, many studies report these outcomes together. Both nociceptive and neuropathic pain is highly prevalent, chronic, and often severe, affecting multiple body sites. Many thalidomide survivors also experience other neurological symptoms such as numbness, tingling, and radiating pain. Consistent with Newbronner and Atkin's review (2017) [3], more recent studies confirm that secondary degenerative changes, such as early-onset osteoarthritis, develop, to an extent, in response to compensatory movement patterns and overuse of unaffected limbs. Despite declining health and chronic conditions, thalidomide survivors maintain stable HRQoL, likely due to adaptive coping, resilience, and strong social and financial support buffering the effects of worsening health. This is a notable addition from the current review, as the earlier review did not identify specific evidence regarding the stability or trajectory of HRQoL over time, though it noted that survivors perceived themselves as less healthy than their non-disabled peers.

Mental health challenges remain highly prevalent, with depression, anxiety, and stress-related disorders reported, aligning with the earlier review, which found elevated rates of depressive disorders and psychological comorbidities relative to the general population across multiple studies. Recent studies further show that pain, disability severity, unemployment, and coping strategies are linked to worse mental health outcomes. Importantly, despite the relatively high prevalence of mental health disorders, there is a notable lack of research examining access to mental health services, with only one study (Niecke et al., 2017) [39] reporting that only a small fraction of participants meeting criteria for mental disorder had used psychosocial treatment services. The structural, psychological, or social barriers that prevent individuals from seeking or receiving care are thus understudied, as well as potential interventions to improve access to mental health support. More broadly, only a few papers addressed challenges related to access to healthcare. This remains an important issue and will be explored in future publications from this research. Future studies could also examine which countries are providing adequate healthcare and/or financial support for thalidomide survivors, and which are inadequate or entirely lacking in recognition and assistance. Additionally, future research in this area may be of relevance to the thousands of people who suffer from thalidomide-like defects, such as people with phocomelia or amelia, born long after thalidomide was no longer available in most countries.

Emerging evidence extends the earlier review's findings by reporting a substantial burden of metabolic disorders, including dyslipidaemia and fatty liver, which can appear as independent risk factors like physical impairment or obesity. Healthcare access remains a persistent challenge, with frequent reports of barriers including provider unfamiliarity, underutilisation of services, and difficulties accessing tailored multidisciplinary care. This builds on evidence of gaps in appropriate care and the reliance on informal support, identified by Newbronner and Atkin (2017) [3]. Overall, recent studies reinforce the earlier findings that thalidomide survivors face declining physical health and complex care needs. In response to such challenges, a national network of multidisciplinary medical

competence centres was established in Germany to provide specialist, integrated care for ageing individuals with thalidomide embryopathy [16]. Structured, network-based approaches may offer an important framework for improving continuity, expertise, and long-term outcomes in this ageing population, and may also serve as a model for addressing the complex, evolving care needs of individuals with other lifelong disabilities.

Several methodological and data-related limitations were identified across the studies. For example, differences in studied populations (e.g., impairment groups and age) could limit comparability. Studies also used a range of instruments and definitions to measure mental health, quality of life, and functioning, which complicates comparisons. Recruitment bias was noted in several studies, with groups like critically ill individuals or those with the poorest mental health potentially underrepresented, and a few studies focused on a geographic or demographic (e.g., women) subset of thalidomide survivors. The lack of longitudinal data also limits understanding of how ageing interacts with lifelong physical impairments and associated health conditions, making it difficult to anticipate the long-term care needs, psychosocial challenges, and quality-of-life outcomes for thalidomide survivors. Finally, there is a lack of qualitative research exploring the lived experiences of this population, which is crucial for capturing personal perspectives on ageing, coping strategies, and the social and emotional impacts of living with a congenital disability over the lifespan.

6. Conclusions

Recent evidence underscores the complexity of health challenges in thalidomide survivors, highlighting the need for comprehensive, individualised, and multidisciplinary care that addresses both physical and psychological dimensions over the lifespan. This has important implications for healthcare and social policy, including the need for coordinated specialist services, sustained funding frameworks, and integrated health–social care planning that anticipates age-related decline.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/disabilities6040067/s1>, Supplementary File S1: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.

Author Contributions: S.B.: Search strategy development, screening, data extraction, quality appraising, analysis, writing, review and editing; A.U.: Screening, data extraction, quality appraising, analysis, writing, review and editing, supervision; E.N.: Conceptualisation and design, search strategy development, analysis, writing, review and editing; S.N.: Conceptualisation and design, analysis, writing, review and editing; J.B.: Conceptualisation and design, database selection, search strategy development, screening, analysis, writing, review and editing. All authors have read and agreed to the published version of the manuscript.

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Disability Language/Terminology Positionality Statement: In this scoping review, we refer to people affected by thalidomide embryopathy as “thalidomide survivors”; however, we acknowledge that these people might have different preferences for the use of the term.

Abbreviations

The following abbreviations are used in this manuscript:

AACODS	Authority, Accuracy, Coverage, Objectivity, Date, Significance Checklist
HNA	Holistic Needs Assessment
HRQoL	Health-related quality of life
MCS	Mental composite score
PCS	Physical composite score
QoL	Quality of life
TE	Thalidomide embryopathy

Appendix A

All searches were conducted to include papers between 1 January 2016 and 29 July 2025, which is the date of the most recent search.

Table A1. Search string used on ProQuest (fields searched: anywhere).

#1	thalidomide OR distaval OR tensival OR asmaval OR valgis OR valgraine OR sedoval OR celgene OR contergan
#2	pregnan* OR during NEAR/3 pregnancy OR in NEAR/3 pregnancy OR embryopath*
#3	#1 AND #2
#4	impair* OR damage* OR disable* OR disability* OR handicap* OR deformit* OR deform* OR affect* OR consequen* of
#5	#3 AND #4
#6	health OR health problem* OR physical health OR mental health OR illness*
#7	#5 AND #6

Table A2. Search string used on OvidSP (MEDLINE, EMBASE, APA PsychInfo, Social Policy and Practice) (fields searched: ab, hw, sh, ti, tw).

#1	thalidomide OR distaval OR tensival OR asmaval OR valgis OR valgraine OR sedoval OR celgene OR contergan
#2	pregnan* OR during adj3 pregnancy OR in adj3 pregnancy OR embryopath*
#3	#1 AND #2
#4	impair* OR damage* OR disable* or disabilit* OR handicap* OR deformit* OR deform* OR affect* or consequen* of
#5	#3 AND #4
#6	health OR health problem* OR physical health OR mental health OR illness*
#7	#5 AND #6

Table A3. Search string used on CINHALL Plus (fields searched: full text).

#1	thalidomide OR distaval OR tensival OR asmaval OR valgis OR valgraine OR sedoval OR celgene OR contergan
#2	pregnan* OR during N3 pregnancy OR in N3 pregnancy OR embryopath*
#3	#1 AND #2
#4	impair* OR damage* OR disable* OR disabilit* OR handicap* OR deformit* OR deform* OR affect* OR consequen* of
#5	#3 AND #4
#6	health OR health problem* OR physical health OR mental health OR illness*
#7	#5 AND #6

Table A4. Search string used on Web of Science (fields searched: all fields).

#1	thalidomide OR distaval OR tensival OR asmaval OR valgis OR valgraine OR sedoval OR celgene OR contergan
#2	pregnan* OR “during pregnancy” OR “in pregnancy” OR embryopath*
#3	#1 AND #2
#4	impair* OR damage* OR disable* OR disabilit* OR handicap* OR deformit* OR deform* OR affect* OR consequen* of
#5	#3 AND #4
#6	health OR health problem* OR physical health OR mental health OR illness*
#7	#5 AND #6

Table A5. Search string used on PubMed Central (fields searched: full text).

#1	thalidomide OR distaval OR tensival OR asmaval OR valgis OR valgraine OR sedoval OR celgene OR contergan
#2	pregnan* OR “during pregnancy” OR “in pregnancy” OR embryopath*
#3	#1 AND #2
#4	impair* OR damage* OR disable* OR disabilit* OR handicap* OR deformit* OR deform* OR affect* OR consequen* of
#5	#3 AND #4
#6	health OR health problem* OR physical health OR mental health OR illness*
#7	#5 AND #6
#8	(genet* OR sequen* OR biolog* OR molecu*) [Title/ Abstract]
#9	#7 NOT #8

Table A6. Search string used on EBSCO Open Dissertations (fields searched: full text).

#1	thalidomide OR distaval OR tensival OR asmaval OR valgis OR valgraine OR sedoval OR celgene OR contergan
#2	pregnan\$ OR during N3 pregnancy OR in N3 pregnancy OR embryopath\$
#3	#1 AND #2
#4	impair\$ OR damage OR disable\$ OR disability\$ OR handicap\$ OR deformit\$ OR deform\$ OR affect\$ OR consequen\$ of
#5	#3 AND #4
#6	health OR health problem OR physical health OR mental health OR illness\$
#7	#5 AND #6

Appendix B

Table A7. Databases searched.

Database	Description
EBSCO Dissertations	Theses and dissertations
EMBASE (OvidSP)	Biomedical research papers
MEDLINE (OvidSP)	Articles in life sciences, particularly biomedicine
Social Policy and Practice (OvidSP)	UK health and social care research
PsychInfo (OvidSP)	Psychological literature
CINAHL	Nursing and allied health journals
Web of Science	Science, social science, arts, and humanities studies (supports 256 disciplines)
Applied Social Sciences Index and Abstracts (ASSIA) (ProQuest)	Journal articles, conference papers and book reviews in the fields of applied social sciences and health
PubMed Central (PMC)	Archive of full-text journal literature in the fields of biomedical and life sciences

Appendix C

Table A8. Included papers summary table.

Study	Country	Aim	Population and Sample Size	Methodology
The impact of ageing on the health and wellbeing of people with thalidomide embryopathy: a comparison of the health impact with the general population [27].	UK	This study compared the health and wellbeing needs of thalidomide survivors with an age-matched sample of the general population.	392 out of the 415 individuals with thalidomide embryopathy residing in the UK participated in the study.	The study involved home visits to individuals with thalidomide embryopathy (TE), where trained interviewers conducted structured Health Needs Assessments (HNAs) using a standardised questionnaire covering 78 self-reported comorbidities. The prevalence of these comorbidities was compared to age-matched data from the 2018 Health Survey for England (HSE), although not all categories could be directly matched. Participants with thalidomide embryopathy were grouped into four sub-categories based on physical impairments to explore patterns in comorbidities.
Health-related quality of life after 50 years in individuals with thalidomide embryopathy: Evidence from a German cross-sectional survey [25].	Germany	To compare the health-related quality of life in individuals with thalidomide embryopathy in comparison to individuals of the age-adjusted general population in Germany and explore the influence of impairment patterns, pain stage, and mental disorders on physical and mental dimensions of HRQOL.	Out of 453 individuals contacted, 202 participants with confirmed thalidomide-related impairments were recruited (response rate 44.6%) and physically examined. Final analyses were based on 186 participants for primary outcomes, with smaller subsets used for secondary outcomes related to mental disorders (178) and pain (165).	Eligible participants were physically examined and assessed using standardised tools: the SF-36 for health-related quality of life (HRQOL), physical exams by orthopaedists for impairment categorisation, the Mainzer Pain Stage System (MPSS) for chronic pain, and the SCID interview for mental disorders. HRQOL outcomes were compared with age-adjusted data from the German Health Interview and Examination Survey (DEGS1), focusing on individuals aged 50–59 with chronic conditions.
A nationwide survey regarding the life situations of patients with thalidomide embryopathy in Japan, 2018: First report [20].	Japan	This study explored the socioeconomic differences in terms of healthcare and social status between thalidomide survivors and an age-matched population in Japan.	Questionnaires were distributed to 274 thalidomide survivors in Japan. Of those, 173 participants took part in the study.	This was a nationwide survey conducted on thalidomide survivors in Japan, using items that matched those of the Comprehensive Survey of Living Conditions questionnaire (CSLC), which is conducted annually in Japan to assess the population's health, wellbeing, and medical care.
Thalidomide upper limb embryopathy—pathogenesis, past and present management and future considerations [31].	UK	This literature review aims to provide an overview of thalidomide-caused upper limb embryopathy, focusing on both children and adults and highlighting the impact of age on limb differences.	N/A	This review provided an overview of the pathogenesis, clinical manifestations, and management of thalidomide-induced upper limb embryopathy across the lifespan.

Table A8. Cont.

Study	Country	Aim	Population and Sample Size	Methodology
Poor balance, bilateral upper limb phocomelia, no previous exercise: a challenging combination for fall prevention in a middle-aged thalidomide survivor [12].	UK	To explore balance issues and fall risks in a thalidomide survivor through targeted physiotherapy and exercise interventions.	This is a case study focusing on a single male beneficiary of the Thalidomide Trust in his mid-50s. The beneficiary, experiencing balance issues and back pain due to upper limb shortening, was referred by the Thalidomide Trust to a local physiotherapist in Glasgow to improve mobility, reduce pain, and establish a sustainable exercise routine.	Data were collected through clinical assessments, balance tests, physiotherapy sessions, and subjective feedback, with outcomes measured by improvements in mobility, balance, pain levels, and functional ability pre- and post-intervention.
Metabolic disorders in thalidomide embryopathy [34].	Japan	To investigate metabolic conditions in thalidomide survivors.	The study included 65 Japanese thalidomide embryopathy patients.	Data were collected from medical health checkups conducted between 2017 and 2019, including metabolic parameters and imaging for fatty liver, and were analysed to identify associations between metabolic conditions and physical characteristics.
Metabolic disorders in thalidomide embryopathy [35].	Japan	To investigate metabolic conditions in thalidomide survivors.	The study included 51 Japanese patients with thalidomide embryopathy.	Medical health checkup data from 2017 to 2018 were analysed, including metabolic and liver function parameters, with comparisons made between patients with and without fatty liver or limb abnormalities.
Skeletal computed tomography findings of upper extremities in middle-aged persons with thalidomide embryopathy [30].	Japan	To analyse the three-dimensional-CT and multiplanar reconstruction (MPR) findings of the upper extremity skeletons in individuals with thalidomide embryopathy to understand the bone deformities, joint instability, and osteoarthritis as they age.	The study involved five individuals with thalidomide embryopathy.	Full-body CT scans were conducted between October 2022 and February 2023, and 3D-CT and MPR analyses of upper extremity skeletons were performed.
Chronic pain in people impaired by thalidomide embryopathy: An explorative analysis of prevalence, pain parameters and biopsychosocial factors [33].	Germany	To assess the frequency, location, intensity, nature, and severity of chronic pain in individuals with thalidomide embryopathy, and to explore its associations with various biopsychosocial factors.	The study population consisted of people with thalidomide embryopathy in North Rhine-Westphalia, Germany, with a final sample size of 202 participants.	Data were collected through physical and psychiatric assessments, standardised pain interviews, and questionnaires, with pain evaluated using MPSS and PainDETECT, psychological disorders diagnosed via structured interviews (SCID-I/SCID-II), and analyses performed using SPSS version 26 and R version 3.5.0. with descriptive statistics and non-parametric tests.

Table A8. Cont.

Study	Country	Aim	Population and Sample Size	Methodology
Depression and anxiety symptoms in UK thalidomide survivors: A brief survey [38].	UK	To gather information about the patterns of symptoms of depression and anxiety among UK thalidomide survivors.	The study surveyed 413 UK thalidomide survivors, excluding 53 individuals due to capacity, severe mental illness, or living outside the UK, with 182 completed questionnaires returned.	Data were collected via a postal questionnaire including biographical information, depression (PHQ-9), and anxiety (GAD-7) scales, and analysed using descriptive statistics and point-biserial correlations in SPSS (version not stated) to explore associations between work status and mental health.
Quality of life and pain in patients with thalidomide embryopathy in Japan [22].	Japan	The aim of this study is to assess psychological and psychiatric problems, as well as the quality of life, in patients with thalidomide embryopathy.	The study recruited 51 participants with thalidomide embryopathy who underwent health checkups at three Japanese medical centres between 2014 and 2017 and consented to participate out of 67 eligible patients.	Data were collected using self-administered questionnaires covering demographics, pain severity (NRS), mental health (GHQ-28), quality of life (SF-36), coping strategies (CSQ), and time perspective scales.
Mental health of people with thalidomide embryopathy: Traumatic shadow of prenatal thalidomide exposure [37].	N/A	This review aims to provide a better understanding of the high prevalence of mental health disorders that emerge in the second half of life among people with disabilities caused by prenatal thalidomide exposure.	The review focuses on thalidomide survivors, primarily adults in later life, with no specific sample size as it is a literature review.	A literature review was conducted examining empirical research on the biopsychosocial sequelae and mental health issues experienced by thalidomide survivors, discussing emerging questions and barriers to care.
The health and quality of life of thalidomide survivors as they age—Evidence from a UK survey [26].	UK	The study aimed to investigate the health and wellbeing of UK thalidomide survivors, identify the health issues they face in their mid-50s, and assess how these problems affect their quality of life and employment status.	351 UK thalidomide survivors from a population of 467 beneficiaries of the Thalidomide Trust.	A cross-sectional survey using questionnaires (SF12 Health Survey) distributed by mail, online, or by telephone interview; data analysis included descriptive statistics, Pearson correlation to examine relationships between impairment severity and quality of life, and hierarchical regression to explore factors influencing health-related quality of life.
National Competence Network Contergan—Ensuring medical care for people with thalidomide embryopathy [16].	Germany	To highlight the establishment of a national network of multidisciplinary medical competence centres in Germany and provide an overview of the key medical care needs of ageing individuals with thalidomide-induced body and sensory impairments.	N/A	This is a review article summarising existing scientific evidence and clinical experiences from general medicine, orthopaedics, pain therapy, sociomedical, and psychosomatic–psychotherapeutic perspectives, discussing current challenges and future tasks in medical care.

Table A8. *Cont.*

Study	Country	Aim	Population and Sample Size	Methodology
Autologous breast reconstruction in a patient with thalidomide embryopathy: case report [8].	N/A	To demonstrate the feasibility and safety of using the deep inferior epigastric artery perforator flap technique for breast reconstruction in a patient with thalidomide embryopathy, specifically with phocomelia.	Single case study of a 49-year-old woman with typical thalidomide-induced upper limb phocomelia and multicentric breast cancer.	Clinical observation and detailed narrative documentation of the patient's treatment journey, including surgical decision-making, outcomes, and long-term follow-up over 11 years, with a focus on flap viability, postoperative recovery, and patient satisfaction.
Life situation of women impaired by thalidomide embryopathy in North Rhine-Westphalia—A comparative analysis of a recent cross-sectional study with earlier data [19].	Germany	To describe the current life situation of women impaired by thalidomide embryopathy in North Rhine-Westphalia, Germany, and compare findings from a 2015 study with earlier data collected in 2002.	Women officially recognised as thalidomide-impaired residing in or born in North Rhine-Westphalia; sample sizes were 104 women in 2002 and 115 women in 2015.	In the N2002 study, a custom-developed questionnaire was used to collect data on socioeconomic characteristics, current medical conditions, access to healthcare, and the extent of assistance needed. Additionally, quality of life was assessed using the German version of the WHO QOL-BREF questionnaire. In the P2015 study, the questionnaire included questions on socioeconomic and demographic data, comorbidities, medical care, satisfaction with received medical care, and the extent of care needed. Health-related quality of life was evaluated using the German version of the EQ-5D descriptive system.
Thalidomide and unilateral limb defects: the Italian chapter of a never-ending story [17].	International	To review existing literature on thalidomide embryopathy, focusing on the occurrence and recognition of unilateral limb defects caused by thalidomide exposure.	N/A	This is a literature review analysing previously published case series and articles.
Age-related changes in patients with upper limb thalidomide embryopathy in the United Kingdom [23].	UK	The aim of the study was to assess the long-term upper limb disability, HRQoL, functional impairment, self-perception of appearance, and prevalence of neuropathic pain in patients with upper limb thalidomide embryopathy.	The participants were living patients aged 59 to 64 years with congenital upper limb differences due to thalidomide exposure, identified from the Thalidomide Trust records, with 127 patients responding to the questionnaire.	The questionnaire used included several validated patient-reported outcome measures (PROMs) to assess long-term upper limb disability, health-related quality of life (HRQoL), functional impairment, self-perception of appearance, and neuropathic pain. These PROMs were the Quick Version of Disabilities of Arm, Shoulder, and Hand (QuickDASH), EuroQoL 5-Dimension 5-Likert (EQ-5D-5L) index, Work and Social Adjustment Scale (WSAS), Derriford Appearance Scale 24 (DAS-24), and Neuropathic Pain Scale (NPS).

Table A8. Cont.

Study	Country	Aim	Population and Sample Size	Methodology
Mental disorders in people affected by thalidomide [39].	Germany	To determine the prevalence of mental disorders among individuals affected by thalidomide.	193 thalidomide-affected individuals from North Rhine-Westphalia, Germany.	Participants were recruited via postal invitations and patient support groups; mental disorders were assessed using structured DSM-IV clinical interviews (SCID-I/SCID-II), self-report questionnaires, and clinical assessments for severe cases. Data were analysed using SPSS and R, with descriptive statistics, contingency tables, exact binomial tests for proportions, confidence intervals, and relative risk calculations at a 5% significance level.
Health-related quality of life and function in middle-aged individuals with thalidomide embryopathy [24].	Sweden	To evaluate the effect of limb malformations on HRQL and extremity function in middle-aged individuals with thalidomide embryopathy.	31 individuals with thalidomide embryopathy from Sweden.	Participants were recruited through the National Thalidomide Society and completed validated questionnaires including SF-36, EQ-5D, DASH, and RAOS to assess HRQL and limb function.
Thalidomide embryopathy as possible cause of anterior sacral meningocele: A case report [11].	Germany	To report and discuss a rare case of anterior sacral meningocele (ASM) in an adult with thalidomide embryopathy presenting with acute urinary symptoms.	A single 54-year-old male patient from Germany with congenital facial palsy and inner ear malformation linked to thalidomide embryopathy.	Clinical examination, urine analysis, abdominal ultrasound, CT scan, and MRI were used to diagnose urinary tract infection, kidney stone, and incidental ASM with sacral agenesis.
Middle-aged individuals with thalidomide embryopathy have undergone few surgical limb procedures and demonstrate a high degree of physical independence [14].	Sweden	To investigate the need for orthopaedic surgery, use of orthotic devices, and the level of physical function and independence in middle-aged individuals with thalidomide embryopathy, comparing those with severe limb deficiencies and those requiring disability adaptations to others.	31 thalidomide survivors.	Data were collected through patient-administered questionnaires including a modified General Function Score to assess physical function and the WHO questionnaire to evaluate physical load at work and physical activity during leisure.
Brief report: “The legacy of thalidomide”—A multidisciplinary meeting held at the University of York, United Kingdom, on 30 September 2016 [15].	UK	To explore the ongoing impact of thalidomide on survivors, focusing on their health, lifestyle adaptations, ageing, and how multidisciplinary knowledge can improve support and care.	Middle-aged UK thalidomide survivors with congenital impairments such as limb and hearing damage; no specific sample size as this is a meeting report.	Multidisciplinary meeting featuring presentations, personal testimonies, and discussions involving beneficiaries, historians, clinicians, scientists, and social scientists. The report synthesises insights rather than quantitative data analysis.

Table A8. Cont.

Study	Country	Aim	Population and Sample Size	Methodology
Physical activity promotion in the thalidomide population [13].	UK	To understand the lived experiences of thalidomide survivors regarding physical activity and to co-develop an intervention to improve motivation, confidence, and participation in physical activity within this population.	Participants were UK-based thalidomide survivors aged 55–61. Phase 1 included 31 individuals; 12 participated in the intervention design (Phase 2), and 10 took part in the pilot intervention (Phase 3), with 7 completing it.	This study used a Participatory Action Research (PAR) approach across three phases to explore and promote physical activity among thalidomide survivors aged 55–61. The pilot intervention, co-designed by survivors, included psychoeducational videos, support sessions, and a buddy system, and was evaluated using validated tools: Godin LITEQ and SQUASH (physical activity), PALMS (motivation), Exercise Self-Efficacy Scale (confidence), PHQ-9 and GAD-7 (mental health), and SF-12 (general health).
Cardiovascular manifestations of thalidomide embryopathy [36].	International	To describe cardiovascular abnormalities in individuals affected by thalidomide embryopathy and assess their clinical relevance for vascular and cardiologic management, including the potential increased frequency of arteriosclerotic disease.	The authors review and discuss cardiovascular malformations and age-related vascular conditions observed in patients with thalidomide embryopathy.	Thalidomide embryopathy is associated with clinically significant cardiovascular abnormalities that can influence disease management, with evidence suggesting differences in the occurrence and presentation of arteriosclerotic diseases compared with the general population.
Ultrasound-guided nerve block with intravenous moderate sedation for dental surgery in thalidomide embryopathy with facial hyperalgesia [9].	Japan	To demonstrate the use of ultrasound-guided nerve block (USG-NB) with intravenous moderate sedation to manage dental surgery in a patient with thalidomide embryopathy who experienced facial hyperalgesia and severe dental anxiety.	A single 62-year-old Japanese woman with bilateral upper limb agenesis, facial hyperalgesia, and multiple comorbidities (including glaucoma, prior nephrectomy and oophorectomy, and chronic constipation) was treated and observed.	Clinical management involved ultrasound-guided maxillary nerve block combined with intravenous sedation. Data were gathered via clinical observation, imaging (panoramic X-rays, ultrasound), intraoperative monitoring (SpO ₂ , ECG, BIS, RASS), and patient-reported outcomes related to pain and anxiety.
Development and function of a natural reverse shoulder in a patient with thalidomide-induced dysmelia [10].	Germany	To describe the unique anatomical and functional development of a naturally reversed shoulder joint in a thalidomide survivor with upper limb phocomelia and secondary osteoarthritis.	A single 59-year-old German man, born in 1961 with bilateral phocomelia due to thalidomide embryopathy.	The report used longitudinal clinical evaluations and imaging techniques (X-ray, CT, MRI) to assess joint anatomy and function. The findings were analysed descriptively to document musculoskeletal adaptation and osteoarthritic progression.

Table A8. Cont.

Study	Country	Aim	Population and Sample Size	Methodology
Support for Australia's thalidomide survivors [32].	Australia	To assess the adequacy, responsibility, and provision of compensation and support for Australia's thalidomide survivors, including the Australian Government's role.	This is a report covering submissions received by the Senate Community Affairs References Committee.	The report highlighted profound and lifelong impacts of thalidomide injuries on Australian survivors, including severe congenital malformations, chronic health conditions, and psychosocial challenges that worsen with age.
Evaluation of the Thalidomide Survivors Contribution Program 2015 to 2019 [21].	Canada	To evaluate how effectively the Thalidomide Survivors Contribution Program (TSCP) supported thalidomide survivors and delivered its activities.	Surveys with TSCP beneficiaries (exact number not reported).	The evaluation found that the Thalidomide Survivors Contribution Program significantly improved many thalidomide survivors' ability to age with dignity by enhancing access to supports, treatments, and financial stability, though some needs, particularly related to ongoing therapy and specialised care, were not fully met.
Risk of Falls and Fractures in People with Thalidomide Embryopathy [29].	Germany	To determine whether fall events occur more frequently in individuals with thalidomide embryopathy and lead to more serious injuries than in those not affected.	Survey with 206 thalidomide survivors and 186 controls.	This survey showed that people with thalidomide embryopathy have significantly more sensory and strength impairments and experience more frequent and severe falls and injuries than nonaffected controls.

Appendix D

Table A9. Overview of the included studies.

Type		Number
Mixed methods		1
Case reports		5
Reviews		5
Observational studies (i.e., clinical examinations)		1
Quantitative descriptive studies		2
Cross-sectional quantitative studies (i.e., surveys)		13
Grey literature		3
Country	UK	8
	Germany	7
	Japan	6
	Sweden	2
	Not specified (reviews)	5
	Canada	1
	Australia	1
Number of participants		1–388
Focus	Physical health	30
	Mental health	11
	Quality of life	6
	Social wellbeing	5

References

- Kim, J.H.; Scialli, A.R. Thalidomide: The Tragedy of Birth Defects and the Effective Treatment of Disease. *Toxicol. Sci.* **2011**, *122*, 1–6. [CrossRef] [PubMed]
- Thalidomide. Science Museum. Available online: <https://www.sciencemuseum.org.uk/objects-and-stories/medicine/thalidomide> (accessed on 1 May 2026).
- Newbronner, E.; Atkin, K. The changing health of Thalidomide survivors as they age: A scoping review. *Disabil. Health J.* **2018**, *11*, 184–191. [CrossRef] [PubMed]
- Tricco, A.C.; Lillie, E.; Zarin, W.; O'Brien, K.K.; Colquhoun, H.; Levac, D.; Moher, D.; Peters, M.D.J.; Horsley, T.; Weeks, L.; et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann. Intern. Med.* **2018**, *169*, 467–473. [CrossRef] [PubMed]
- Ouzzani, M.; Hammady, H.; Fedorowicz, Z.; Elmagarmid, A. Rayyan—A web and mobile app for systematic reviews. *Syst. Rev.* **2016**, *5*, 210. [CrossRef] [PubMed]
- Hong, Q.N.; Pluye, P.; Fàbregues, S.; Bartlett, G.; Boardman, F.; Cargo, M.; Dagenais, P.; Gagnon, M.-P.; Griffiths, F.; Nicolau, B.; et al. *Mixed Methods Appraisal Tool (MMAT) Version 2018 User Guide*; McGill University, Department of Family Medicine: Montréal, QC, Canada, 2018; Available online: http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/attach/127916259/MMAT_2018_criteria-manual_2018-08-01_ENG.pdf (accessed on 1 May 2026).
- Tyndall, J. Authority, Accuracy, Coverage, Objectivity, Date, Significance Checklist. Flinders University. Available online: <https://fac.flinders.edu.au/dspace/api/core/bitstreams/e94a96eb-0334-4300-8880-c836d4d9a676/content> (accessed on 1 May 2026).
- Grünherz, L.; Fertsch, S.; Andree, C.; Munder, B.; Schulz, T.; Wolter, A.; Abdallah, A. Autologous breast reconstruction in a patient with thalidomide embryopathy: Case report. *AME Surg. J.* **2022**, *2*, 39. [CrossRef]
- Kawauchi, A.; Ito, T.; Ishii, A.; Matsumoto, K.; Maeda, S. Ultrasound-Guided Nerve Block With Intravenous Moderate Sedation for Dental Surgery in Thalidomide Embryopathy With Facial Hyperalgesia. *Spec. Care Dent.* **2025**, *45*, e70074. [CrossRef] [PubMed]
- Kimmeyer, M.; Lehmann, L.-J.; Gerhardt, C.; Schmalzl, J. Development and function of a natural reverse shoulder in a patient with thalidomide-induced dysmelia. *JSES Rev. Rep. Tech.* **2021**, *1*, 60–64. [CrossRef] [PubMed]
- Croci, D.M.; Dalolio, M.; Schaeren, S.; Wasner, M.G.; Mariani, L.; Jost, G.F. Thalidomide Embryopathy as Possible Cause of Anterior Sacral Meningocele: A Case Report. *Birth Defects Res.* **2017**, *109*, 1390–1392. [CrossRef] [PubMed]
- Morrison, D. Poor balance, bilateral upper limb phocomelia, no previous exercise: A challenging combination for fall prevention in a middle-aged thalidomide survivor. *BMJ Case Rep.* **2020**, *13*, e231345. [CrossRef] [PubMed]

13. Newman, H.; Leicht, C.; Papathomas, A. Physical Activity Promotion in the Thalidomide Population. Thalidomide Trust. Available online: https://thalidomidetrust.org/wp-content/uploads/2022/01/Promoting_Physical_Activity_Thalidomide_Survivors_FinalReport2021.pdf (accessed on 1 May 2026).
14. Jahani, S.A.G.; Danielsson, A.; Karlsson, J.; Brisby, H. Middle-aged individuals with thalidomide embryopathy have undergone few surgical limb procedures and demonstrate a high degree of physical independence. *PLoS ONE* **2017**, *12*, e0186388. [CrossRef] [PubMed]
15. Newbronner, E.; Vargesson, N.; Atkin, K. “The Legacy of Thalidomide”—A Multidisciplinary Meeting Held at the University of York, United Kingdom, on September 30, 2016. *Birth Defects Res.* **2017**, *109*, 296–299. [CrossRef] [PubMed]
16. Beyer, R.; Peters, K.; Schulte-Hillen, J.; Stück, V.; Niecke, A. National Competence Network Contergan—Ensuring medical care for people with thalidomide embryopathy. *Dtsch. Med. Wochenschr.* **2022**, *147*, 1281–1285. [CrossRef] [PubMed]
17. Terracini, B. Thalidomide and unilateral limb defects: The Italian chapter of a neverending story. *Epidemiol. Prev.* **2021**, *45*, 302–309. [CrossRef] [PubMed]
18. Sjöström, H.; Nilsson, R. *Thalidomide and the Power of the Drug Companies*; Penguin: Harmondsworth, UK, 1972.
19. Samel, C.; Albus, C.; Nippert, I.; Niecke, A.; Lungen, M.; Pfaff, H.; Peters, K.M. Life situation of women impaired by Thalidomide embryopathy in North Rhine-Westphalia—A comparative analysis of a recent cross-sectional study with earlier data. *BMC Womens Health* **2019**, *19*, 51. [CrossRef] [PubMed]
20. Hinoshita, F.; Beppu, H.; Shioji, S.; Fujitani, J.; Imai, K.; Tajima, T.; Tagami, T.; Ohnishi, S. A nationwide survey regarding the life situations of patients with thalidomide embryopathy in Japan, 2018: First report. *Birth Defects Res.* **2019**, *111*, 1633–1642. [CrossRef] [PubMed]
21. Office of Audit and Evaluation Health Canada and the Public Health Agency of Canada. Evaluation of the Thalidomide Survivors Contribution Program 2015 to 2019. 2020. Available online: <https://www.canada.ca/content/dam/hc-sc/documents/corporate/transparency/corporate-management-reporting/evaluation/thalidomide-survivors-contribution-program/thalidomide-survivors-contribution-program-eng.pdf> (accessed on 1 May 2026).
22. Imai, K.; Sone, H.; Otomo, K.; Nakano, Y.; Hinoshita, F. Quality of life and pain in patients with thalidomide embryopathy in Japan. *Mol. Genet. Genom. Med.* **2020**, *8*, e1464. [CrossRef] [PubMed]
23. Markiewicz, M.; Stirling, P.; Brennan, S.; Hooper, G.; Lam, W. Age-related changes in patients with upper limb thalidomide embryopathy in the United Kingdom. *J. Hand Surg. Eur. Vol.* **2023**, *48*, 773–780. [CrossRef] [PubMed]
24. Ghassemi Jahani, S.; Karlsson, J.; Brisby, H.; Danielsson, A. Health-related quality of life and function in middle-aged individuals with thalidomide embryopathy. *J. Child. Orthop.* **2016**, *10*, 691–703. [CrossRef] [PubMed]
25. Niecke, A.; Peters, K.M.; Alayli, A.; Lungen, M.; Pfaff, H.; Albus, C.; Samel, C. Health-related quality of life after 50 years in individuals with thalidomide embryopathy: Evidence from a German cross-sectional survey. *Birth Defects Res.* **2022**, *114*, 714–724. [CrossRef] [PubMed]
26. Newbronner, E.; Glendinning, C.; Atkin, K.; Wadman, R. The health and quality of life of Thalidomide survivors as they age—Evidence from a UK survey. *PLoS ONE* **2019**, *14*, e0210222. [CrossRef] [PubMed]
27. Sagoe, K.; Owens, W.A.; Loyd, R.; Varley, R. The impact of ageing on the health and wellbeing of people with thalidomide embryopathy: A comparison of the health impact with the general population. *Disabil. Rehabil.* **2024**, *46*, 5029–5037. [CrossRef] [PubMed]
28. Thalidomide Trust. Holistic Needs Assessment. Available online: <https://thalidomidetrust.org/wp-content/uploads/2020/08/Holistic-Needs-Assessment-Easy-Read.pdf> (accessed on 1 May 2026).
29. Beyer, R.; Höller, A.; Schön, G. Risk of Falls and Fractures in People with Thalidomide Embryopathy. *Z. Orthop. Unfallchir.* **2025**, *164*, 143–150. [CrossRef] [PubMed]
30. Kamimura, C.; Fujitani, J.; Aizawa, I.; Saitome, I.; Fujiwara, S.; Haga, N. Skeletal computed tomography findings of upper extremities in middle-aged persons with thalidomide embryopathy. *Intractable Rare Dis. Res.* **2024**, *13*, 185–189. [CrossRef] [PubMed]
31. Vargesson, N.; Hooper, G.; Giddins, G.; Hunter, A.; Stirling, P.; Lam, W. Thalidomide upper limb embryopathy—Pathogenesis, past and present management and future considerations. *J. Hand Surg. Eur. Vol.* **2023**, *48*, 699–709. [CrossRef] [PubMed]
32. Parliament of Australia. Support for Australia’s Thalidomide Survivors. Available online: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Community_Affairs/ThalidomideSurvivors (accessed on 1 May 2026).
33. Niecke, A.; Ramesh, I.; Albus, C.; Lungen, M.; Pfaff, H.; Samel, C.; Peters, K.M. Chronic Pain in People Impaired by Thalidomide Embryopathy: An Explorative Analysis of Prevalence, Pain Parameters and Biopsychosocial Factors. *PPMP Psychother. Psychosom. Med. Psychol.* **2021**, *71*, 370–380. [CrossRef] [PubMed]
34. Tanabe, A. SAT678 Metabolic Disorders In Thalidomide Embryopathy. *J. Endocr. Soc.* **2023**, *7*, A68–A69. [CrossRef]
35. Tanabe, A. 7055 Metabolic Disorders In Thalidomide Embryopathy. *J. Endocr. Soc.* **2024**, *8*, A549–A550. [CrossRef]
36. Klein-Weigel, P.F.; Ding-Greiner, C. Cardiovascular manifestations of thalidomide embryopathy. *Vasa* **2025**, *54*, 299–304. [CrossRef] [PubMed]
37. Niecke, A. Mental health of people with thalidomide embryopathy Traumatic shadow of prenatal thalidomide exposure. *Psychotherapeut* **2021**, *66*, 518–523. [CrossRef]

38. Newbronner, E.; Wadman, R. Depression and Anxiety Symptoms in UK Thalidomide Survivors: A Brief Survey. *Disabilities* **2021**, *1*, 23–29. [[CrossRef](#)]
39. Niecke, A.; Peters, K.; Samel, C.; Forster, K.; Lungen, M.; Pfaff, H.; Albus, C. Mental Disorders in People Affected by Thalidomide. *Dtsch. Aerzteblatt Online* **2017**, *114*, 168–174. [[CrossRef](#)] [[PubMed](#)]

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