



# Gardening and Urban Agriculture as Physical Activity Interventions for Stroke Prevention in Older Adults: A Systematic Review

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**Abstract.** *Background: While physical inactivity remains a major, modifiable risk factor for stroke and long-term disability in older adults, sustaining conventional exercise routines often proves challenging. Consequently, gardening and urban agriculture are gaining traction as accessible, sustainable physical activities that actively promote healthy aging. Objective: To synthesize existing evidence, this systematic review evaluates the impact of gardening and urban agriculture as physical activity interventions for stroke prevention in aging populations. Methods: Adhering to PRISMA guidelines, we conducted comprehensive searches across the PubMed, Scopus, and Dimensions databases for literature published between 2015 and 2026. Eligibility was restricted to studies of adults aged 60 and older who engaged in horticultural therapy, community or home gardening, or urban agriculture, with reported outcomes related to cardiovascular health and active aging. Results: Out of 322 initial records, five studies qualified for full qualitative synthesis. The reviewed literature indicates that gardening interventions reliably enhance mobility, physical exertion, cardiovascular health, psychological resilience, and social interaction among older adults. By naturally mitigating sedentary behaviors and improving modifiable cardiovascular risk factors, these activities indirectly contribute to stroke prevention. Conclusion: Although methodological heterogeneity across the studies and a scarcity of controlled experimental trials preclude definitive causal conclusions, the current evidence is highly promising. Gardening and urban agriculture offer viable, cost-effective, and community-integrated strategies to advance active aging, elevate overall well-being, and reduce stroke vulnerability among older adults.*

**Keywords:** Stroke Prevention; Older Adults; Gardening; Urban Agriculture; Healthy Aging

## 1. Introduction

Globally, older adults are the most vulnerable to stroke, which continues to be a primary cause of both mortality and long-term disability. Advancing age brings a much higher risk of stroke, particularly when tied to modifiable lifestyle factors such as physical inactivity, poor diet, hypertension, diabetes, and obesity (WHO, 2023). Because the global population is steadily aging, the overall impact of stroke is projected to grow, particularly in urban areas that often encourage sedentary habits and lack accessible spaces that promote healthy living.

Consistent physical activity is a cornerstone of both stroke prevention and overall heart health. Engaging in moderate exercise directly mitigates stroke risk by lowering blood pressure, regulating glucose and lipid levels, and promoting healthy weight maintenance (Lee *et al.*, 2012). Despite these well-documented benefits, older adults frequently struggle to

adhere to conventional exercise regimens. Common barriers, such as safety concerns, physical limitations, lack of motivation, and limited access to suitable fitness facilities, often hinder long-term participation.

Gardening and urban agriculture have recently gained recognition as sustainable, accessible, and enjoyable alternatives to traditional exercise for aging populations. The practical tasks required, such as digging, watering, planting, and harvesting, naturally generate moderate physical exertion while fostering a meaningful connection with the outdoors. Furthermore, the advantages of these activities extend well beyond physical fitness; they also provide significant psychological and social benefits, including reduced stress, elevated mood, and increased community interaction (Soga *et al.*, 2017).

To advance public health and environmental sustainability simultaneously, modern city planning increasingly incorporates urban agriculture initiatives, such as rooftop farms and community gardens. For aging urban populations, these spaces are invaluable, offering safe, supportive environments that encourage regular physical activity. Notably, active participation in these gardening programs correlates with stronger cardiovascular health markers and a measurable decrease in stroke-related risk factors (Park *et al.*, 2016).

While gardening and urban agriculture are increasingly valued as health-promoting activities, specific evidence linking them to stroke prevention in older populations remains fragmented. The current literature features a wide mix of study designs, intervention lengths, and measurement techniques, complicating any efforts to draw firm conclusions. Additionally, researchers have yet to clearly identify the specific pathways driving this reduction in stroke risk, or whether the primary benefits stem from physical exertion, dietary improvements, stress relief, or increased social interaction.

A systematic review is one of the most thorough ways to gather and critically weigh all the current research on a given topic. By piecing together results from various studies, we can get a much clearer picture of whether gardening and urban farming are practical ways for older adults to prevent strokes.

With that in mind, the goal of this study is to provide a comprehensive review of current research on how gardening and urban farming can serve as practical ways for older adults to help prevent strokes. Ultimately, we hope these findings will help shape better public health initiatives, smarter city planning, and stronger community programs that keep older residents active and thriving in urban environments. This systematic review aims to synthesize evidence on gardening and urban agriculture for stroke prevention in older adults, thereby supporting Sustainable Development Goals (SDGs) 3 of ensuring healthy lives and promoting well-being for all at all ages.

## 2. Methods

This research employs a systematic review to thoroughly assess how gardening and urban agriculture serve as exercise-based strategies for stroke prevention among aging populations. By strictly adhering to the PRISMA guidelines (Page *et al.*, 2021), this study synthesizes recent scientific findings to evaluate the tangible impact of gardening interventions on cardiovascular health, physical activity levels, and healthy aging.

This review exclusively targeted adults aged 60 and over, encompassing various aging populations, whether or not they presented with existing stroke risk factors like obesity, diabetes, or hypertension. To maintain this precise focus, any research examining younger demographics or broader populations that did not isolate older adults was excluded. The core

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interventions we analyzed spanned a wide range of gardening-based activities, including urban agriculture, horticultural therapy, and community or allotment gardening, aimed at mitigating stroke risk or enhancing overall health. Finally, to evaluate effectiveness, these interventions were weighed against control groups characterized by sedentary conditions, standard health education, alternative physical exercises, or no specific intervention.

We systematically searched PubMed, Scopus, and Dimensions for literature published between 2015 and 2026 to ensure our review captured recent developments in urban agriculture and healthy aging. Our search strategy utilized the PICOS framework to effectively combine keywords regarding the target population, interventions, and desired outcomes. Once the initial results were exported to EndNote 21 and duplicates were removed, two independent reviewers evaluated the titles and abstracts against our predefined criteria. Those who passed this initial screening underwent a full-text review by both researchers. Any discrepancies were resolved through mutual discussion, with a third reviewer consulted when a consensus could not be reached. To be included in the final analysis, studies had to report on how gardening or urban agriculture affected older adults, including stroke prevention, cardiovascular health, physical activity, and overall quality of life. We explicitly excluded editorials, opinion papers, conference abstracts, and any articles lacking accessible full texts.

To systematically gather data from the selected literature, our research team developed a standardized extraction template. For each included study, we recorded key logistical and methodological details, including the authors, publication year, geographical setting, study design, participant demographics, and cohort size. We also documented the specific intervention type, the control group, the duration of the activity, the measurement tools, and the core findings. Our primary focus during this phase was isolating direct health outcomes, such as measurable reductions in stroke risk, stabilized blood pressure, improved cardiovascular markers, elevated physical activity, and enhanced mobility. Additionally, we tracked secondary outcomes to assess broader lifestyle impacts, capturing any reported improvements in social engagement, cognitive function, mental well-being, stress reduction, and overall quality of life.

To ensure the rigor of our review, we assessed the methodological quality of the included literature using the revised Cochrane Risk of Bias Tool (RoB 2) for randomized controlled trials, along with narrative assessments for non-randomized and review-based studies (Higgins et al., 2019). To mitigate subjective bias, two independent reviewers conducted this appraisal, resolving any discrepancies through mutual discussion until consensus was reached. Furthermore, we safeguarded the reliability of our findings by implementing independent screening, rigorous duplicate checks, and standardized data-extraction protocols. Finally, the validity of this review is anchored in our strict adherence to established systematic review guidelines, exhaustive database searches, and precise eligibility criteria.

Our team conducted a narrative synthesis to outline the core characteristics, intervention methods, and primary outcomes of the selected literature. In cases where the studies yielded sufficiently uniform quantitative data, we prepared to conduct a meta-analysis utilizing either standardized mean differences or odds ratios. We planned to assess statistical heterogeneity across studies using the  $I^2$  statistic, setting a threshold of 50% to indicate substantial heterogeneity. Additionally, we conducted subgroup analyses based on

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key variables, including participant age, gender, health status, and intervention setting, and incorporated sensitivity analyses to assess the overall robustness of our conclusions.

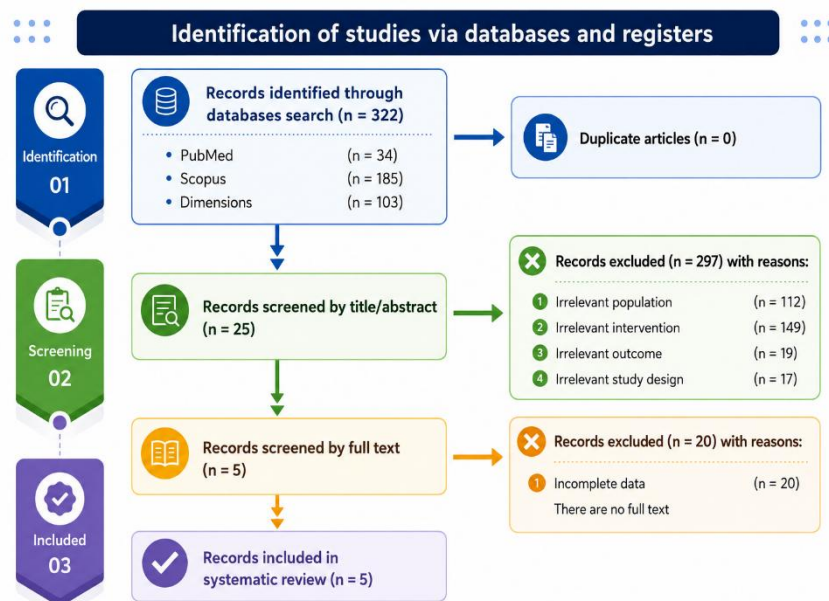
It is important to acknowledge several methodological constraints in this review. Most notably, directly comparing results across studies proved challenging due to wide variations in their core designs, intervention lengths, and measurement criteria. Furthermore, because we restricted our search to English and Indonesian publications, we may have inadvertently overlooked relevant international research. We also urge caution when drawing direct causal links, as several of the included studies utilized qualitative or observational designs rather than randomized controlled trials. Nevertheless, this systematic review provides a comprehensive and valuable synthesis of current evidence, clearly highlighting the role of urban agriculture and gardening as viable physical activities for stroke prevention in aging populations.

### 3. Results and Discussion

Our search of multiple electronic databases yielded an initial pool of 322 records, comprising 185 from Scopus, 103 from Dimensions, and 34 from PubMed. No duplicate articles were found in the databases used for the initial screening phase. During the title and abstract review, we excluded any literature that fell outside our specific scope, namely, research focused on younger demographics, unrelated interventions or outcomes, and non-scientific publications. Ultimately, only five studies passed the full eligibility assessment and were included in the qualitative synthesis. Because these final studies varied so widely in their core designs, intervention methods, and outcome metrics, conducting a quantitative meta-analysis was simply not feasible.

The five studies we ultimately included came from a wide mix of locations, spanning the United States, the United Kingdom, China, Malaysia, and the Mediterranean. They also varied widely in their design, ranging from mixed-method case studies to broad scoping and systematic reviews. The gardening activities themselves were just as diverse, ranging from high-tech indoor smart gardens to traditional outdoor community plots and horticultural therapy. While the overall quality of the research fluctuated from paper to paper, every single study agreed on one key point: gardening and urban farming consistently provided older adults with noticeable, positive health benefits.

This diagram shows that the selection process was conducted systematically and rigorously in accordance with the PRISMA 2020 guidelines, ensuring that only the most relevant and high-quality research was included in the systematic review.



**Figure 1.** Flowchart Protocol Election PRISMA Articles

The primary conclusion of this review is that engaging in gardening and urban agriculture reliably enhances the physical health, psychological well-being, and overall quality of life within aging populations. The literature frequently noted that these activities not only increase physical exertion and mobility but also actively alleviate stress and foster emotional resilience. Additionally, structured environments such as community gardens or horticultural therapy programs have been shown to strengthen social cohesion and active community participation. Collectively, these findings position gardening as a highly accessible, moderate-intensity exercise that actively promotes healthy aging and serves as a viable strategy for mitigating stroke-related risk factors (Detweiler *et al.*, 2012).

The significance of these findings lies in the fact that physical inactivity is a primary, modifiable risk factor for cardiovascular disease and stroke in aging populations. Because gardening requires repetitive physical exertion such as digging, watering, harvesting, and carrying, it naturally enhances flexibility, balance, muscle strength, and cardiovascular endurance. In fact, multiple studies in our review linked gardening to better overall mobility and stabilized blood pressure, suggesting that these activities indirectly prevent strokes by reducing broader cardiovascular risks (Aune *et al.*, 2018). This review also suggests that urban farming and gardening activities may support healthy aging by improving physical and psychological well-being. Sidossis *et al.* (2026) reported that lifestyle-based activities such as gardening, agricultural work, and outdoor movement were associated with improved muscular endurance, mobility, cardiovascular health, and emotional resilience, as well as reduced depressive symptoms among older adults. Furthermore, socially integrated outdoor activities were found to enhance life satisfaction and social connectedness, indicating that gardening may serve not only as a physical activity but also as a meaningful psychosocial intervention for elderly populations. These conclusions strongly align with existing literature,



reinforcing that regular, moderate exercise is highly effective at mitigating major stroke contributors like obesity, diabetes, hypertension, and sedentary habits.

The results of this review strongly support the existing literature on the psychological and social benefits of gardening for aging populations. Specifically, the reviewed studies consistently linked gardening activities to elevated emotional well-being, reduced stress, greater life satisfaction, and stronger social connections. These outcomes naturally mirror broader findings in gerontology and public health, which emphasize that mental health and active social engagement are critical components of healthy aging. Therefore, structured gardening programs offer a comprehensive approach to senior health, simultaneously increasing physical activity, building emotional resilience, and fostering community involvement (Howarth *et al.*, 2020).

Building on the comparison between gardening and conventional exercise, a particularly compelling finding from this review is the role that community and therapeutic gardens play in sustaining active aging. Specifically, recent research from Malaysia and the United Kingdom demonstrates that structured gardening initiatives and green retirement environments significantly enhance elderly participants' independence, daily mobility, and social engagement (Wan Ali @ Yaacob *et al.*, 2022). These results confirm that gardening goes far beyond a basic physical workout; it is a rich, socio-environmental experience. By seamlessly integrating social interaction, leisure, and a sense of productivity, gardening naturally overcomes the barriers of traditional exercise regimens, proving to be a highly enjoyable, culturally acceptable, and sustainable alternative for older adults.

The results are shown in the following table. Article Characteristics and Risk-of-Bias Table.

**Table 1.** Characteristics of Included Studies

| Study (Author , year) | Country         | Study design    | Sample Size (n)                       | Intervention type                                         | Comparator                     | Primary Outcome                                                                                      |
|-----------------------|-----------------|-----------------|---------------------------------------|-----------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------|
| Liu et al., 2025      | Malaysia /China | Thematic Review | 25 studies included                   | Smart indoor gardens (SIGs) for elderly                   | Not applicable                 | Improved satisfaction, emotional well-being, accessibility, and social engagement among older adults |
| Jef et al., 2025      | United Kingdom  | Scoping Review  | 25 studies; total participants = 3318 | Community-based food interventions and gardening programs | Varied across included studies | Improved dietary quality, physical health, mental well-being, and social connectedness               |

| Study (Author , year)         | Country                 | Study design            | Sample Size (n)     | Intervention type                                                | Comparator                               | Primary Outcome                                                                                    |
|-------------------------------|-------------------------|-------------------------|---------------------|------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------|
| Wan Ali @ Yaacob et al., 2022 | Malaysia                | Mixed-method case study | 20 participants     | Green garden retirement care and therapeutic outdoor environment | Not applicable                           | Improved quality of life, active ageing, and social interaction among elderly residents            |
| Sidossis et al., 2026         | Mediterranean countries | Systematic Review       | 27 studies included | Traditional Mediterranean Physical Activity (TMPA)               | Varied across included studies           | Improved physical and mental health, functional capacity, and emotional resilience                 |
| Detweiler et al., 2012        | United States           | Literature Review       | Not specified       | Therapeutic gardens and horticultural therapy                    | Traditional rehabilitation/care settings | Reduced pain, stress, agitation, medication use, and falls; improved attention and quality of life |

**Table 2.** Risk of Bias Assessment (RoB 2)

| Study (Author, year)          | Randomization Process | Deviations from Intended Intervention | Missing Outcome Data | Measurement of Outcome | Selective Reporting | Overall Risk  |
|-------------------------------|-----------------------|---------------------------------------|----------------------|------------------------|---------------------|---------------|
| Liu et al., 2025              | High risk             | Some concerns                         | Low risk             | Some concerns          | Low risk            | High risk     |
| Jef et al., 2025              | Some concerns         | Some concerns                         | Low risk             | Low risk               | Low risk            | Some concerns |
| Wan Ali @ Yaacob et al., 2022 | High risk             | High risk                             | Some concerns        | Some concerns          | Low risk            | High risk     |
| Sidossis et al., 2026         | Some concerns         | Some concerns                         | Low risk             | Some concerns          | Low risk            | Some concerns |

| Study (Author, year)   | Randomization Process | Deviations from Intended Intervention | Missing Outcome Data | Measurement of Outcome | Selective Reporting | Overall Risk |
|------------------------|-----------------------|---------------------------------------|----------------------|------------------------|---------------------|--------------|
| Detweiler et al., 2012 | High risk             | High risk                             | High risk            | Some concerns          | Some concerns       | High risk    |

Note: RoB 2 assessments were conducted narratively based on the methodological information provided in the articles. Some articles were reviews/scoping reviews, so the randomization domain was not fully applicable as in RCTs.

Despite these compelling findings regarding the social and physical benefits of gardening, we must acknowledge alternative explanations for these health outcomes. Notably, several studies in this review used cross-sectional or observational designs (Dahlkvist *et al.*, 2016), which inherently limit our ability to establish strong causal links between gardening interventions and stroke prevention. The observed health improvements might also be heavily influenced by external variables naturally associated with gardening, such as increased exposure to restorative green spaces, elevated social support (Lindsay Smith *et al.*, 2017), healthier dietary habits, or the fact that participants who volunteer for gardening often possess pre-existing healthy lifestyles. Consequently, while the current evidence strongly supports gardening as a healthy aging strategy, we must interpret these findings cautiously and avoid making direct causal claims regarding stroke reduction.

To further contextualize our findings, we must address the methodological shortcomings present in the reviewed literature. Our quality assessment revealed several red flags regarding how some of these studies were conducted. For instance, research by Wan Ali @ Yaacob *et al.* (2022) and Detweiler *et al.* (2012) all carried a high risk of bias, often struggling with proper randomization, participants deviating from the assigned gardening tasks, or missing data at the end of the trial. Furthermore, direct comparisons across the literature proved difficult due to substantial heterogeneity in participant demographics, program duration, and the specific outcomes being measured. Crucially, the bulk of this research evaluated general health promotion and active aging rather than explicitly tracking long-term cardiovascular events or stroke incidence. Consequently, while gardening clearly promotes a healthier lifestyle, the evidence positioning it as a direct, standalone stroke prevention strategy remains indirect and limited.

The implications of this review extend to a broad spectrum of stakeholders, including healthcare providers, urban planners, policymakers, and community organizations dedicated to elderly health promotion. Interventions centered on gardening and urban agriculture offer highly accessible, cost-effective, and community-driven strategies to increase physical activity and overall well-being among aging populations. Strategically integrating these activities into public health frameworks, rehabilitation centers, and elderly care facilities can actively foster healthier aging while mitigating key, modifiable stroke risk factors. Ultimately, designing inclusive urban green spaces and community gardens naturally encourages active, sustained participation among older adults (Wang & MacMillan, 2013).

While the overall results of this review are highly encouraging, several methodological limitations warrant consideration. Most notably, the small pool of eligible studies and their highly heterogeneous designs made it impossible to conduct a robust quantitative meta-



analysis, thereby limiting the generalizability of our findings. Additionally, the existing literature heavily relies on self-reported data and lacks the long-term follow-up necessary to definitively track stroke incidence or major cardiovascular morbidity. Our language parameters, restricting the search to English and Indonesian publications, may also have inadvertently excluded relevant international research. Finally, because our synthesis includes several review-based articles rather than relying solely on experimental trials, the overall strength of the evidence supporting gardening as a direct stroke prevention strategy should currently be viewed as moderate.

Moving forward, the research community must prioritize high-quality randomized controlled trials and longitudinal studies to directly measure how gardening impacts cardiovascular outcomes and stroke risk factors in older adults. By adopting standardized outcome measures, increasing sample sizes, and extending the duration of these interventions, future studies can easily overcome current comparability issues and significantly strengthen the existing evidence base (Ali *et.al.*, 2019). Furthermore, while the overarching advantages of gardening are clear, further investigation is required to determine the optimal "dose," specifically identifying the exact frequency, intensity, and types of gardening activities that yield the maximum health benefits for aging populations (Scott *et.al.*, 2015).

## Conclusions

In conclusion, gardening and urban agriculture serve as highly effective, multidimensional interventions that promote physical activity, psychological resilience, and social cohesion among aging populations. The synthesized evidence indicates that these activities actively mitigate modifiable stroke risk factors by enhancing cardiovascular health and overall mobility. These findings align closely with established gerontological research, underscoring the critical roles of moderate physical exertion and social engagement in healthy aging. Moreover, structured gardening programs offer a practical and accessible alternative to conventional exercise regimens. By integrating productivity, leisure, and social interaction, gardening naturally fosters greater long-term adherence. Although current conclusions are somewhat constrained by methodological variability and a scarcity of rigorous experimental data, the collective evidence firmly positions gardening as a valuable, non-pharmacological strategy for stroke prevention. Future research must prioritize robust longitudinal and randomized controlled trials to strengthen this evidence base and identify the optimal frequency, intensity, and duration of gardening interventions for older adults.

## Conflicts of Interest

The authors declare no conflict of interest.

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