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Review Article

Functional Interdependence: A Conceptual Construct for Healthy Ageing and Geriatric Care

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Abstract

The World Health Organization defines Healthy Ageing as the process of developing and maintaining Functional Ability through the interaction between Intrinsic Capacity and the environment. However, this framework does not explicitly recognise the influence of primary informal caregivers on the Functional Ability of older adults who depend on assistance in everyday life. This paper proposes Functional Interdependence as a multidimensional relational construct that complements existing healthy ageing theory while preserving the principles of Person-Centred Care. Functional Interdependence is conceptualised as the dynamic and reciprocal interaction between the Functional Ability of the older adult and the Intrinsic Capacity, Functional Ability, and Caregiving Capacity of a primary informal caregiver within a shared biological, psychological, social, environmental, and healthcare context. The construct is conceptually delimited through its antecedents, defining attributes, and expected functional outcomes, and supported by a complementary conceptual framework for Caregiving Capacity. Functional Interdependence is proposed as a relational determinant that helps explain how Functional Ability is maintained when care depends on the interaction between two functional systems. This conceptual framework provides a theoretical foundation for future instrument development, empirical validation, and the design of interventions that strengthen caregiving relationships and promote healthy ageing.

Keywords: Healthy ageing, Functional Interdependence, Functional Ability, Intrinsic Capacity, Caregiving Capacity, Person-Centred Care, informal caregiver, older adults

Introduction

Population ageing has transformed the priorities of health systems worldwide, shifting the focus of geriatric care from the management of individual diseases towards the preservation of functional ability, independence, and quality of life [1-3]. The World Health Organization (WHO) defines healthy ageing as the process of developing and maintaining the functional ability that enables well-being in older age, positioning functional ability—not the absence of disease—as the principal outcome of health care for older adults [4]. This paradigm has been reinforced through the Integrated Care for Older People (ICOPE) framework, which promotes person-centred care aimed at maintaining intrinsic capacity and preventing or delaying functional decline through comprehensive, coordinated interventions across the continuum of care [4-6]. Functional ability is increasingly recognised as the result of a dynamic interaction between an individual's intrinsic capacity and the physical, social, and environmental contexts in which they live [7-8]. Consequently, contemporary comprehensive geriatric assessment extends beyond the evaluation of medical conditions to include mobility, cognition, psychological well-being, nutrition, social resources, and environmental factors that collectively determine an older adult's ability to function independently [9-10]. Nevertheless, despite this multidimensional approach, current conceptual frameworks continue to evaluate functional ability primarily as an attribute of

the individual older adult, while the influence of those who provide day-to-day care remains largely considered an external contextual factor rather than an integral component of functional performance [4-6,11-14].

For many older adults living with frailty, multimorbidity, cognitive impairment, or functional limitations, maintaining functional ability depends not only on their own capacities but also on the abilities of a primary informal caregiver to provide physical assistance, emotional support, decision-making, medication management, and coordination of daily activities. Likewise, the caregiver's own physical health, cognitive status, emotional well-being, and social resources are progressively shaped by the demands of caregiving, creating reciprocal interactions that influence the health trajectories of both individuals. A growing body of evidence has documented these bidirectional relationships through studies of caregiver burden, dyadic health science, dyadic illness management, and dyadic interventions across a range of chronic conditions [15-32]. Despite these advances, there remains no conceptual construct that explicitly describes the reciprocal dependence between the functional capacities of older adults and their primary informal caregivers as a shared determinant of health and functional outcomes. Existing concepts—including intrinsic capacity, functional ability, frailty, caregiver burden, and dyadic care—capture important dimensions of ageing and caregiving but do not fully explain how the functional trajectories of both individuals become dynamically interconnected over time. We propose that functional interdependence represents this missing conceptual link: a multidimensional construct describing the reciprocal interactions through which the capacities and resources of older adults and their primary informal caregivers influence one another, shaping their ability to maintain health, independence, autonomy, and social participation. Recognising this construct may provide a stronger theoretical foundation for future research, clinical assessment, and the development of more integrated approaches to healthy ageing and geriatric care.

Functional Interdependence: Definition and Conceptual Basis

Within the WHO framework, functional ability emerges from the interaction between an individual's intrinsic capacity and the environments in which they live, enabling older adults to maintain independence, autonomy, social participation, and wellbeing [4-6]. This perspective has transformed geriatric care by shifting its focus from disease-centred management towards preserving what older adults are able to be and do throughout the ageing process. However, for many older adults living with frailty, multimorbidity, cognitive impairment, or functional dependence, functional ability cannot always be explained exclusively by individual intrinsic capacity and environmental characteristics. In daily clinical practice, the preservation of functional ability frequently depends upon the continuous support of a primary informal caregiver, whose own physical, cognitive, psychological, and social capacities directly influence the older adult's ability to perform everyday activities and maintain independence. Likewise, the caregiver's own health trajectory is progressively influenced by the physical and emotional demands associated with caregiving. Consequently, the functional trajectories of both individuals become dynamically interconnected over time.

We therefore propose functional interdependence as a conceptual construct that complements the current framework for healthy ageing. Functional interdependence is defined as a relational construct and determinant of functional ability describing the dynamic, multidimensional, and reciprocal interactions through which the intrinsic capacities, functional abilities, caregiving capacity, and shared contextual factors of an older adult and a primary informal caregiver mutually influence the older adult's ability to maintain health, functional ability, independence, autonomy, social participation, and quality of life over time. Unlike concepts such as caregiver burden, caregiving experience, or dyadic interventions, functional interdependence does not primarily describe the caregiving relationship itself. It describes the functional relationship through the capacities of both individuals continuously influence the preservation or decline of the older adult's functional ability. Consequently, functional interdependence should be understood as a relational determinant of functional ability whenever everyday functioning depends upon the support of a primary informal caregiver.

Biological Foundations

The biological basis of functional interdependence originates from the interaction between the intrinsic capacities of both individuals. Within the WHO healthy ageing framework, intrinsic capacity encompasses five interconnected domains: locomotion, cognition, psychological capacity, sensory capacity, and vitality [4-6]. These domains remain the biological foundation of functional ability for both: the older adult and the caregiver [4-6]. Declines affecting any of these domains in either member of the caregiving relationship may influence the quality, safety, and sustainability of everyday care [33]. Reduced mobility may limit physical assistance; cognitive impairment may interfere with medication management or decision-making; sensory impairment may compromise communication and safety; psychological distress may affect motivation and adherence to treatment; and reduced vitality may diminish the capacity to sustain caregiving over time [34-47]. Conversely, the physical demands of caregiving may progressively modify the caregiver's own intrinsic capacity through chronic stress, fatigue, musculoskeletal overload, sleep disturbance, or worsening chronic diseases [48-49]. Therefore, biological changes are not isolated events but reciprocal processes continuously reshaping the functional ability of both individuals.

Psychological Foundations

Psychological capacity represents a central mechanism through which functional interdependence develops and evolves.

Emotional wellbeing, resilience, motivation, coping strategies, anxiety, depression, and cognitive-emotional adaptation influence not only individual health but also the effectiveness of the caregiving relationship itself [50-52]. The psychological state of the caregiver may determine treatment adherence, promotion of physical activity, participation in rehabilitation programmes, medication management, and healthcare utilisation [48-52]. Likewise, deterioration in the older adult's physical or cognitive health frequently increases caregiver stress, emotional burden, uncertainty, and psychological exhaustion [47-48]. Consequently, psychological wellbeing becomes a bidirectional determinant that continuously strengthens or weakens functional interdependence over time.

Social and Environmental Foundations

Consistent with the WHO framework, functional ability develops within environmental contexts rather than in isolation [4-6]. Functional interdependence extends this principle by recognising that older adults and primary informal caregivers usually share the same or similar biological, social, economic, environmental, and healthcare context. Family relationships, housing conditions, architectural accessibility, financial resources, assistive technologies, social support networks, community services, healthcare systems, cultural values, and public policies simultaneously influence both individuals [49-51]. These shared determinants may either facilitate or hinder caregiving capacity, preservation of functional ability, and healthy ageing. Consequently, functional interdependence should be understood as emerging not only from reciprocal interactions between two individuals but also from the common context in which both live and receive care.

Conceptual Model of Functional Interdependence

The model preserves the conceptual foundations established by the WHO [4-6]. Both the older adult and the primary informal caregiver possess intrinsic capacity, which gives rise to functional ability. In the caregiver, functional ability additionally supports caregiving capacity, defined as the ability to provide safe, effective, appropriate, and sustainable care over time. Both individuals exist within a shared biological, psychological, social, environmental, and healthcare context, which simultaneously shapes their health trajectories and opportunities to maintain function. The continuous interaction between the older adult's Functional Ability and the caregiver's Functional Ability and Caregiving Capacity gives rise to Functional Interdependence. Rather than constituting a sixth domain of Intrinsic Capacity or replacing Functional Ability, Functional Interdependence is proposed as a multidimensional relational construct that emerges from the reciprocal interactions between both functional systems. Delimiting this construct requires distinguishing the conditions that enable its emergence, the characteristics that define its conceptual identity, and the outcomes through which it is expected to influence health and functioning. Accordingly, Functional Interdependence is characterised by a coherent set of antecedents, defining attributes, and expected functional outcomes (Figure 1).

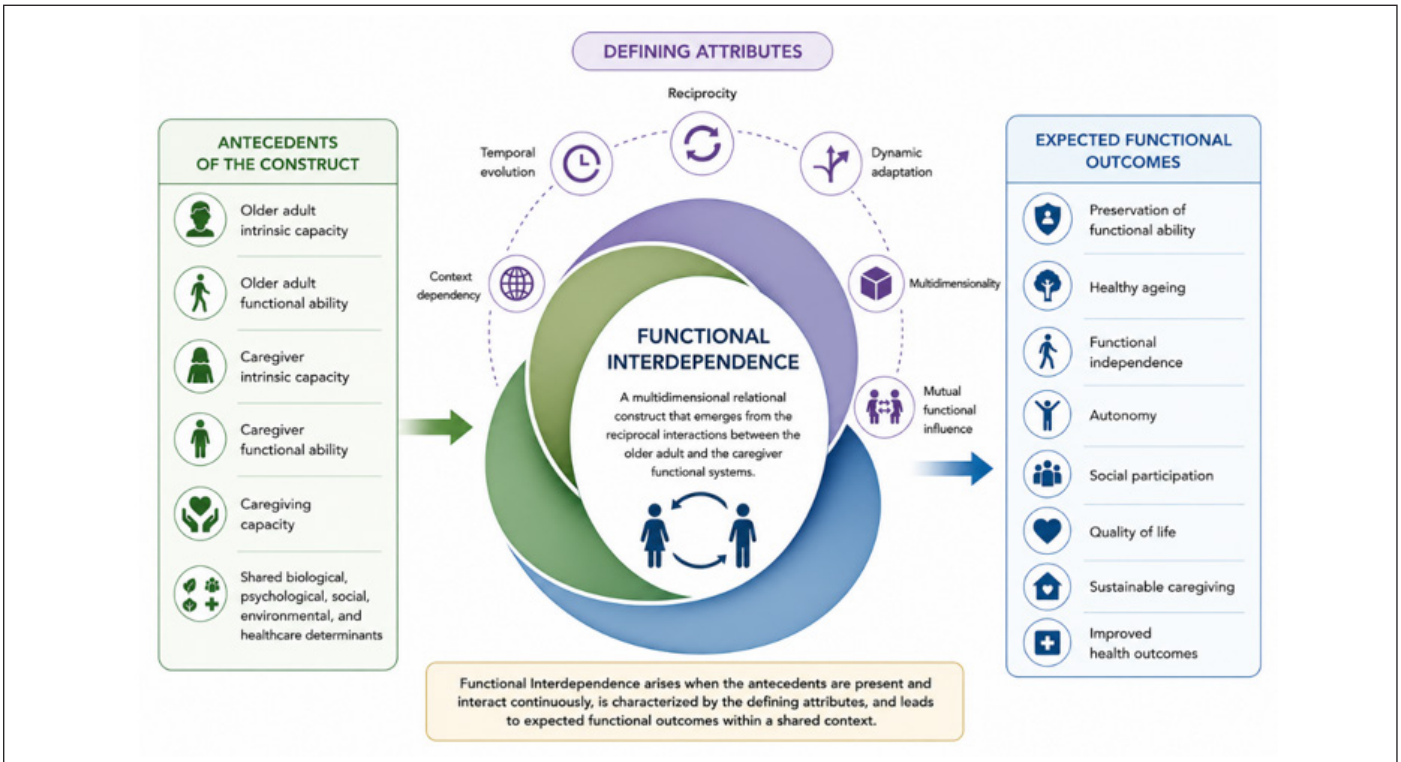

Figure 1: Conceptual Delimitation of Functional Interdependence.

Source: Authors' own elaboration based on the proposed Functional Interdependence conceptual framework. The figure illustrates the conceptual boundaries of functional interdependence through its antecedents, defining attributes, and expected functional outcomes. Antecedents represent the conditions required for the emergence of the construct, defining attributes describe its essential characteristics, and expected functional outcomes reflect its potential influence on healthy ageing, functional independence, autonomy, social participation, quality of life, sustainable caregiving, and overall health outcomes. This conceptual sequence follows the classical methodology for construct development, in which antecedents generate the phenomenon, defining attributes characterise its essential nature, and consequences represent the observable outcomes derived from the construct [52-54]. Accordingly, functional interdependence should be understood as a relational determinant operating between the functional systems of the older adult and the caregiver rather than as an individual characteristic of either person.

Importantly, this conceptual model does not challenge the principles of person-centred care. The older adult remains the principal recipient of care and the central focus of clinical decision-making. Instead, the model proposes that functional interdependence should be recognised as a relational determinant of functional ability whenever an older adult depends on a primary informal caregiver for everyday functioning. Under these circumstances, preserving Functional Ability requires not only assessing the older adult's Intrinsic Capacity but also understanding and strengthening the reciprocal relationship that supports everyday functioning. Thus, Person-Centred Care is not replaced but enriched, while Functional Interdependence becomes an additional conceptual component that helps explain why Functional Ability cannot always be fully understood without considering the capacities of the primary informal caregiver and the shared caregiving environment. To better characterise this relational construct, it is necessary to recognise that the caregiving relationship is sustained by the capacities of both individuals. Whereas the older adult's Functional Ability emerges from the interaction between Intrinsic Capacity and the surrounding environment, the caregiver contributes an additional component that has not been explicitly conceptualised within current healthy ageing frameworks: Caregiving Capacity. This component represents the caregiver's ability to transform his or her own functional resources into effective support for another person's Functional Ability and therefore constitutes one of the structural elements of Functional Interdependence.

Definition of Caregiving Capacity: Caregiving Capacity is defined as the caregiver's ability to safely, effectively, appropriately, and sustainably provide physical, cognitive, emotional, social, and practical support to an older adult according to the individual's functional needs [55]. Caregiving Capacity emerges from the interaction between the caregiver's own Intrinsic Capacity, Functional Ability, knowledge, caregiving skills, health literacy, available resources, resilience, and the surrounding social and healthcare environment (Figure 2).

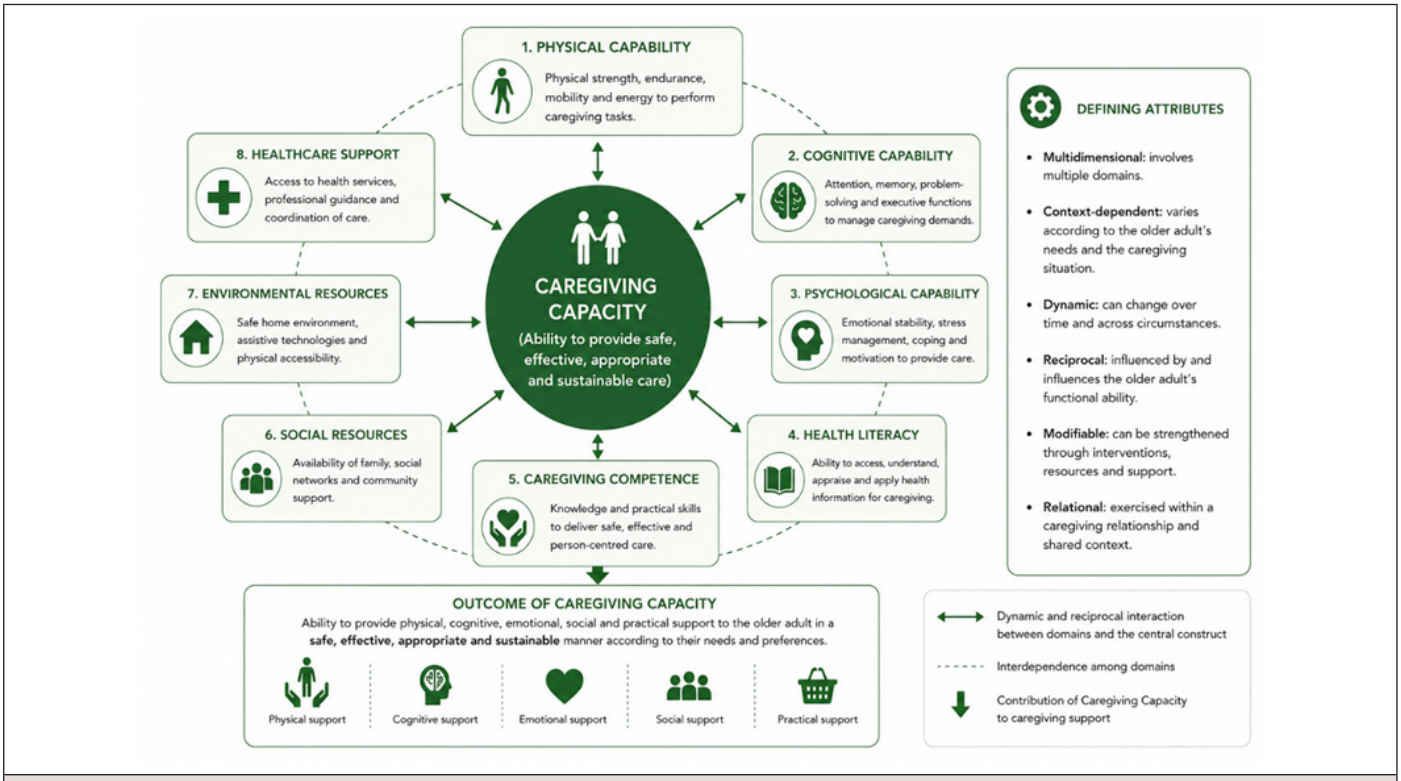

Figure 2: Conceptual framework of Caregiving Capacity.

Source: Authors' own elaboration based on the proposed Functional Interdependence conceptual framework. Caregiving Capacity is conceptualised as a multidimensional construct comprising physical, cognitive, psychological, educational, social, environmental, and healthcare-related components that collectively determine a caregiver's ability to provide safe, effective, appropriate, and sustainable support to an older adult. The framework illustrates the interdependence among these domains, their defining attributes, and their contribution to delivering physical, cognitive, emotional, social, and practical support according to the older adult's functional needs within a shared caregiving context.

Unlike Functional Ability, which reflects an individual's ability to perform basic and instrumental activities of diary live, Caregiving Capacity represents the caregiver's ability to support another person's Functional Ability while maintaining his or her own health and wellbeing. Consequently, Caregiving Capacity should be understood as a dynamic characteristic that may improve through education, rehabilitation, environmental adaptations, assistive technologies, multidisciplinary support, and community resources, or deteriorate as a consequence of physical decline, psychological distress, caregiver burden, social isolation, or inadequate support systems [55]. Recognising Caregiving Capacity as a distinct but related construct provides the theoretical basis for understanding how Functional Interdependence develops within caregiving relationships. Building upon these concepts, Figure 3 presents the proposed conceptual model of Functional Interdependence, illustrating how the intrinsic capacities and functional abilities of the older adult and the primary informal caregiver interact within a shared biological, psychological, social, environmental, and healthcare context. The model conceptualises Functional Interdependence as a multidimensional conceptual construct that acts as a relational determinant of the older adult's Functional Ability while preserving the principles of Healthy Ageing and Person-Centred Care. Therefore, Functional Interdependence is a relational construct describing the dynamic, multidimensional, and reciprocal interactions through which the Intrinsic Capacity, Functional Ability, and Caregiving Capacity of a primary informal caregiver jointly influence the Functional Ability of an older adult within a shared biological, psychological, social, environmental, and healthcare context (Figure 3).

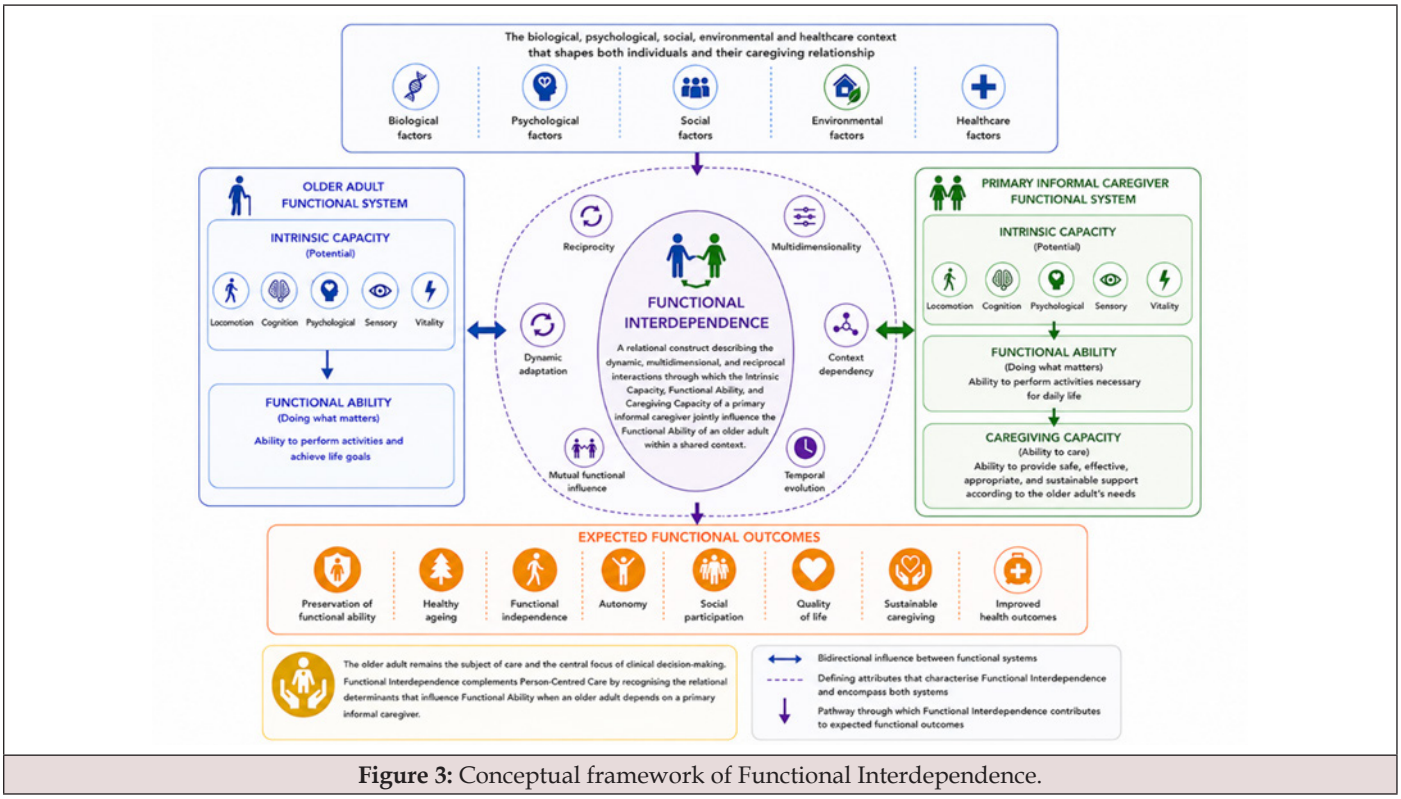

Figure 3: Conceptual framework of Functional Interdependence.

Source: Authors' own elaboration based on the proposed Functional Interdependence conceptual framework. Functional Interdependence is conceptualised as a multidimensional relational construct emerging from the dynamic interaction between the functional systems of an older adult and a primary informal caregiver within a shared biopsychosocial and healthcare context. The model illustrates how the caregiver's Intrinsic Capacity, Functional Ability, and Caregiving Capacity jointly influence the older adult's Functional Ability while preserving the principles of Person-Centred Care and contributing to shared functional outcomes.

Implications for Healthy Ageing and Geriatric Care

Recognising functional interdependence has important implications for research, comprehensive geriatric assessment, and integrated care. First, it provides a theoretical explanation for why interventions directed exclusively at the older adult may be insufficient when functional ability is strongly influenced by the caregiver's own capacities. Second, it offers a conceptual basis for incorporating relational determinants into comprehensive geriatric assessment without modifying the principles of person-centred care. Finally, it establishes a theoretical foundation for future research aimed at operationalising, measuring, and validating functional interdependence as a clinically meaningful construct. Rather than replacing the current WHO framework, functional interdependence extends it by recognising that, whenever everyday functioning depends on a primary informal caregiver, preserving functional ability requires understanding not only the older adult's capacities but also the dynamic interactions occurring within the caregiving relationship. This perspective may facilitate the development of more integrated strategies for promoting healthy ageing while maintaining the older adult as the central focus of care.

Conclusion

Functional Interdependence provides a novel conceptual framework for understanding how the reciprocal relationship between an older adult and a primary informal caregiver influences Functional Ability within a shared biopsychosocial and healthcare context. By integrating Intrinsic Capacity, Functional Ability, and the newly defined construct of Caregiving Capacity into a single relational model, this framework extends current healthy ageing theory while remaining fully consistent with the principles of Person-Centred Care. Rather than shifting the focus away from the older adult, Functional Interdependence recognises that maintaining Functional Ability frequently depends on the dynamic interaction between both members of a caregiving dyad.

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Competing Interests.

Authors have declared that no competing interests exist.

Authors' Contributions

All authors contributed to conceptualization (ideas, formulation, or development of research goals and objectives), analysis, writing - original draft (preparation, creation, and/or presentation of the published work, specifically writing the initial draft), writing - review and editing (preparation, creation, and/or presentation of the published work by the research group, specifically critical review, commentary, or revisions, including pre- or post-publication stages), and visualization (preparation, creation, and/or presentation of the published work, specifically data visualization/presentation).

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