Design for Longevity Literature Review in Product Lifecycle, Financial Planning, and Gerontology

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Design for Longevity Literature Review in Product Lifecycle, Financial Planning, and Gerontology

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doi.org/10.21606/drs.2024.363

Abstract: This paper explores definitions of Design for Longevity (D4L) through a preliminary literature review to create an interpretation of D4L in the finance and service context. The concept of longevity has been applied to many industries and applications. This paper reviews the term D4L as it applies to three fields: product lifecycle, financial planning, and gerontology. Using specific keywords across three search engines—Web of Science, Google Scholar, and Design Research Society Digital Library—we gathered 78 academic papers and synthesized 24 academic papers. As a result, we proposed a holistic and interdisciplinary definition of D4L as a lens to identify longevity-related design opportunities, and to envision products, services, and experiences that allow people to thrive across their entire lifespan in the context of transforming age demographics. A more accurate understanding of D4L can enhance longevity-literacy, management, and strategy to improve quality of life.

Keywords: Design for Longevity, Financial Planning, Service Design, Service System

1. Introduction

With disruptive demographic shifts, advanced technologies, well-established social infrastructures, and healthcare systems, people’s dream of reaching a 100-year lifespan is a feasible goal (Golden, 2022; Etkin, 2021; Coughlin, 2010). People desire to have a better quality of life in various aspects: finance, work, entertainment, family, investment, communities, transportation, education, entertainment, and many others (Lee, Coughlin, Balmuth, et al.,

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2023), but still most are poor in financial and longevity literacy (Goodman, 2023) and longevity management (Cutler, 2012) with high financial risk (Asebedo, 2017; Pitacco, 2004). The concepts of longevity, design for sustainability, and circular design have emerged from the field of product/industrial design (Ellen MacArthur Foundation & IDEO, 2017). Focusing on material flow and waste management, it has evolved into a higher social level of awareness, such as how we erase ageism and how we respect multi-generational culture and environment, since people live longer and want to age gracefully with respect and care (Golden, 2022).

1.1 Product design
Design for Longevity (D4L) originated from product design (Chapman, 2021; Haines-Gadd et al., 2018). In the fashion design industry, with the fast fashion trend, designers, consumers, and industry leaders have started to discuss material procurement, manufacturing, disposal, and reuse (Hasling & Ræbild, 2017). The awareness of curricular economics has been planted in the minds of consumers and industries. The idea of design for sustainability is naturally associated with material flow, waste, or recycling. In general, D4L has broadened its meaning and applications from material (e.g., material procurement, flow, recycling, and waste), into the non-material parts (e.g., financial planning, organizational culture, innovative management, circular systems, and business strategies).

1.2 Financial planning
In the financial planning realm, financial advisors and financial industries have started to re-shape the definitions, roles, and responsibilities of advisors. Since people live longer, their needs have become more sophisticated, and they are facing more complicated systemic socio-economic and socio-technological challenges. Thus, the new term longevity coach, an integrative position of financial advisors and life coaches, is an unavoidable fashion to solve the new challenges for incoming clients and the younger generation. Coughlin has proposed longevity economics (2017) to highlight longevity thinking, business strategies, and new lifestyles. It inspired the designers and researchers Lee and Hodara (2023), in collaboration with MIT AgeLab and Taiwan Design Research Institute (TDRI), to conduct experimental healthcare research and participatory workshop using the 4Es framework (Ensure, Evolve, Empower, and Enjoy) and a D4L process to envision and reframe healthcare services and user experiences.

In industry, US-based financial education brands such as Edward Jones, Raymond James, and Fidelity Investments are facing longevity challenges along with transformational processes in terms of financial and longevity literacy, organizational structure, finance culture, talent hiring and training programs, and human-centered service offerings (Blanchett, 2020). The need to address aging demographics from a planning perspective is mirrored in academic research institutes. In 2007, Carstensen and Rando established the Stanford Center on Longevity to conduct relevant studies to indicate the importance of emerging needs. Burnett (2018)
launched a popular course and published a book—Designing Your Life—at Stanford University. Carstensen (2011) mentioned, “longevity science is a collaborative, interdisciplinary approach to resolving the difficulties and questions posed by a scenario in which most people not only reach old age, but live decades beyond the touchpoint of sixty-five.”

1.3 Gerontology
In the gerontology field, Carstensen and Rando had tried to define the criteria for longevity, incorporating aspects of physical, mental, environment, and social health, in the hopes of re-designing a long life. While the Stanford Center on Longevity focuses on the relationship between education, work, and leisure (Benvenuti, 2019), MIT AgeLab focuses on translating technology into consumer-centered systems, services, and solutions to improve health and independence throughout the lifespan. Other institutes, like The John A. Hart Foundation, may be singularly focused on improving eldercare by supporting age-friendly health systems, family caregivers, and providing care for end-of-life and serious illness. All three organizations support a holistic view of longevity, touching on a complex, multigenerational ecosystem that explores the intersections of science, policy, lifestyle, environment, and bodily health.

The purpose of the study is to conduct a literature review on the concepts and frameworks of D4L in the fields of product lifecycle, financial planning, and gerontology by proposing key learnings to help researchers, designers, and educators build D4L capabilities and system thinking in the era of transformational change.

2. Background literature

2.1 D4L in product lifecycle
The D4L idea was inspired by the concept of product lifecycle in the field of product design. People associate product lifecycles with terms such as circular economics, sustainable design, or design for sustainability (Nurcahyanie & Rohmadiani, 2023). Figure 1 shows the six D4L categories from the fashion industry: material, production, transport and retail, practice and use, and design and concept (Hasling & Ræbild, 2017). Extending the lifecycle framework from the scope of the product to the city, the level of complexity has significantly increased beyond six D4L categories. For example, WHO’s age-friendly cities framework (Figure 2) summarized eight interconnected domains: housing, social participation, respect and social inclusion, civic participation and employment, communication and information, community support and health services, outdoor spaces and buildings, and transportation. Building upon this framework, Wang et al. (2021) studied how to build a longevity-ready city to cater to the super-aging society associated with the transformational social infrastructure and AgeTech technologies (Lee, 2023).
Carlsson et al. (2021) also proposed the D4L mindset, illustrating the journey from forming a cognitive psychology framework, considering product design context (e.g., users, business, and resource efficiency) and aiming to achieve optimal product lifetime (Figure 3). This evaluation mental model originated from product design by discussing six critical criteria: design for attachment and trust, design for dis- and reassemble, design for standardization and compatibility, design for adaptability and upgradability, design for durability, and design for ease of maintenance and repair (Bakker et al., 2019).

Figure 1 The six D4L categories: material, production, transport and retail, practice and use, and design and concept in relation to a product lifecycle (Hasling & Ræbild, 2017)

Figure 2 Eight interconnected domains of the WHO’s age-friendly cities framework (Wang et al., 2021)

Figure 3 The flowchart illustrates the main blocks of the Design for Longevity Mindset and how it should be anticipated (Carlsson et al., 2021)
To achieve optimal product lifetime, the authors suggested considering the product context by using three contextual factors: user, business, and resource efficiency. Specifically, the authors proposed a 2X2 framework to explain how we apply three contextual factors (desired service life versus actual service life) to discuss the relationship between service type and consumers’ needs. We can put financial services in this 2X2 framework as an illustrated example (Table 1). For example, everyday banking or short-term investment can be categorized as both low in desired- and actual service life. In general, student loans will make people take longer time to pay money back to the bank or the government (high actual service life) with a lower desired service life. Ideally, most people want to have financial planning services (high desired service life), but the service quality and effectiveness heavily depend on people’s income, savings, or investable liquid assets (low actual service life). Regarding longevity coaching services, we consider it might require a life-long commitment. Both actual service life and desired service life should be high and tailor-made.

<table>
<thead>
<tr>
<th>Desired service life</th>
<th>Actual service life</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Longevity coaching</td>
<td>Financial planning</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Student loan</td>
<td>Everyday banking</td>
</tr>
</tbody>
</table>

### 2.2 D4L in financial planning

Huston (2014) proposed the retirement ecosystem by mapping the retirement readiness process, which requires at least six stakeholders: workers, employers, financial advisors, retirement plan providers, asset managers, and policymakers (Figure 4). The ecosystem demonstrates the scope and domain knowledge needed to help clients prepare for retirement. This is echoed in Mauterstock’s framework (2020) that puts the financial planner in the center of the specialist team to form a longevity planning group (Figure 5). Further, Coughlin (2019) proposed a longevity planning team model (Figure 6) that evolved from an advisor-client relationship and a typical financial planning team to solve complicated challenges from housing, transitions management, care management, aging-in-place, career management, and transportation (Coughlin, 2009).
Coughlin (2019) also proposed the advisor-value continuum model (Figure 7) for discussing the importance of customers’ voices and their relationship with advisors and beyond. The fundamental values were still based on the transaction-based advisor focusing on advisor-client investment. And then the scope shifted to planning-based advisory emphasizing advisor-client-partner financial plan. Ultimately, he proposed the longevity solution advisory to discuss broader perspectives covering advisor-client-partner family financial plans. This model also initiated an era to transform peoples’ perceptions from transactional financial planning services to conversational longevity coaching experiences (Lee, Coughlin, Yang, de Weck, et al., 2023; Lee, Coughlin, Balmuth, Lee, et al., 2023; Lee, Coughlin, Yang, Balmuth, et al., 2023).
2.3 D4L in gerontology

We investigated definitions of longevity from the perspective of the gerontology discipline. This included exploring concepts of successful aging, also known as vital aging, active aging, aging well, or productive aging (Martin et al., 2015; Piedra et al., 2021) published between 1997 and 2022, from eight different journals. We’ve selected three papers to discuss in this analysis that helped shape the D4L definition of longevity.

There are a number of diverse terms that refer to related concepts, but many academics defining Successful Aging (SA) mention the Rowe and Kahn definition from the MacArthur Network on SA (Wang et al., 2021; Piedra et al., 2021; Rowe & Kahn, 1997). Their definition includes the three aspects: low probability of disease or disability, high mental and physical functioning, and an active engagement with life (Figure 8). This definition aimed to expand past definitions that were purely focused on capabilities and functioning.

Rowe and Kahn introduced two important themes for the D4L definition that are recurring in the majority of the papers analyzed in this study. First, high mental and physical functioning is often differentiated from the role of chronic conditions or disease in SA. Second, SA is dependent on factors beyond physical and mental health, including engagement with life. Because it viewed older adults as able-bodied and valuable members of society, this definition helped create opportunities for funding elder-related programs (Stowe & Cooney, 2015).

Though this definition has aligned with North American notions of aging, it has been critiqued as “exclusionary” by cultures that may be more accepting of mortality (Piedra et al., 2021). Other critiques note that “healthy aging involves... recognizing that aging is often accompanied by chronic illnesses and functional limitations...” (Martin et al., 2015) not the absence of “disease and disease-related disability” (Rowe & Kahn, 1997). And, it is imperative
for SA to demonstrate strategies and adaptations in response to the challenges that those changes present.

![Rowe and Kahn’s model of successful aging](image)

**Figure 8** Rowe and Kahn’s model of successful aging, in which all the components are interdependent on one another (Rowe & Kahn, 1997).

In addition to looking at Rowe and Kahn, we drew inspiration from Piedra et al.’s paper: Stakeholders’ Ideas About Positive Aging for Latinos: A Conceptual Map (2021). Piedra et al. collected concept mapping data from 38 scholars and community workers about positive aging. The final results (Figure 9) demonstrate 10 clusters and four regions—Self-sufficient Living, Health, Social & Spiritual Life, and Psychological resources—defined as important for positive aging Latino adults.

![Concept map with four regions of meaning](image)

**Figure 9** Concept map with four regions of meaning (Piedra et al., 2021).
Like Rowe and Kahn, results support a holistic view of aging, expanding upon the engagement with life to include aspects of spirituality, which was rated second Latino-identifying stakeholders in the study, and last for non-Latino participants. For D4L, it is important to note that all stakeholders ranked financial security as the topmost priority for aging Latino adults. The psychological resources includes the positive outlook cluster, defined as items related to feeling accomplished. This highlights the importance of external validation and appreciation of older populations (Wang et al., 2021; Martin et al., 2015). Comparing these models may seem unlikely. Rowe and Kahn’s model is significantly older and has been widely influential over the past quarter century. It aims to offer a universal definition, while Piedra et al. demonstrate how and why it’s important to collaboratively define SA within a specific identity-based community. And yet, both emphasize the social aspect of SA.

To explore the question of longevity from yet another angle, we can consider the definition of SA from the public health perspective (De Biasi et al., 2020). They define healthy aging as “(1) promoting health, preventing disease, injury, and frailty, and managing chronic conditions; (2) optimizing physical, cognitive, and mental health; and (3) facilitating social and civic engagement.” And present the 4Ms Framework: “What Matters, Medication, Mentation, and Mobility” to emphasize the needs of elderly populations that city services like hospitals, clinics, and home health cares, should aim to meet (Figure 10).

![4Ms Framework](image)

**Figure 10** Becoming an Age-Friendly Health System entails reliably providing the “4Ms”, elements of care to elderly: What Matters, Medication, Mentation, and Mobility (Institute for Healthcare Improvement, 2023).

This definition of SA, alongside the 4Ms stress the complex ecosystem and the important balancing act necessary in addressing the social and environmental conditions for longevity
(De Biasi et al., 2020). Drawing from public health, we can see the importance of social engagement in community and civic action, as well as lifestyle, environmental factors, and the role of public health services in determining an individual’s relationship to longevity.

Echoed in the public health literature, one relevant critique of Rowe and Kahn’s model is that it solely focuses on late adulthood, instead of exploring the entire lifespan’s relationship to SA (Stowe & Cooney, 2015). Therefore, when considering D4L, it’s important to use a life course perspective approach to SA: a dynamic perspective that considers development, history, and the importance of relationships over time. D4L is a holistic and transformational approach to longevity across a variety of different domains related to physical, social, and lifestyle factors, as well as the development of those factors over time. SA is a process that occurs across the entire lifespan.

Therefore, designers looking to work in this domain, need to consider an audience outside of just the elderly population, but those impacted by aging demographics. In other words, we can’t just ask how we design for those who are already older, we also have to ask: how do we plan for younger generations to age with ease?

### 3. Research method

We conducted a preliminary literature review to explore the idea of D4L across the fields of product lifecycle, financial planning, and gerontology. In the study, we reviewed 24 academic papers, excluding Ph.D. thesis, master thesis, reports, case studies, or non-academic books, from three search engines: Web of Science, Google Scholar, and DRS Digital Library, and selected their publishing time primarily from 2014 to 2022, since 2014 is the beginning of retirement for the boomer generation.

Three objectives of conducting this literature review are to (1) define D4L the longevity context for service recipients (e.g., clients) and providers (e.g., advisors); (2) identify experience/service design applications of D4L, including systemic service design, experience design principles that can help facilitate the conversation using provocative artifacts to teach frameworks; and (3) find resources to help design solutions to teach about literacy, management, and strategies of financial planning and longevity coaching.

#### 3.1 Research flow overview

The research flow follows six steps: (1) **method**: find the systematic literature review approach: PRISMA 2020 guidelines; which we modified to fit our needs and timeline, (2) **keywords**: choose the suitable range of keywords and key phrases as input material for search engines, (3) **database**: explore and select the search engine by using different keywords and key phrases, (4) **evaluation**: identify the papers from the search results, (5) **validate**: read and discuss the search results to exclude the material, and (6) **synthesis**: analyze the included materials to conclude the key takeaways and redefine the D4L concept.
Figure 11 demonstrates the research flow consisting of three phases: identification, screening, and analysis. By inputting selected keywords and key phrases, we started with data retrieval from three search engines between 2014-2022: Web of Science (n=24), Google Scholar (n=24), and DRS Library (n=30). Data screening is under the criteria of research scope and publication type. In the study, we excluded data that only included one of the three domain areas, therefore excluding papers that didn’t include a relationship between aging and financial planning (n=23), aging and design (n=4), and financial planning and design (n=16).

Due to data consistency, we don’t include publication types such as conference proceedings, books, dissertations and thesis, and reports (n=18), selecting journal papers to be read and synthesized. The analysis phase is the last phase to review data (n=24). In order to provide a more comprehensive literature review with accuracy, we added seven complimentary materials as an additional data source.

Table 2 covered detailed information about each phase with specific steps, such as suggested three search engines we chose, the search period, the focus of search engines, the keywords we applied, and the number of papers we included and excluded. Before reading each paper, we cross-checked according to the publication type, paper title, abstracts, and keywords to ensure it was relevant to two out of three of the subject areas: (1) product lifecycle, (2) financial planning, and (3) gerontology or highlights a main contribution within the field. The final papers (n=24) to be reviewed were divided between the authors, who looked for definitions of and/or frameworks for longevity in each of the papers.
Table 2 Three selected search engines with associative keywords and information. Field abbreviation: product lifecycle (P), financial planning (F), and gerontology (G).

<table>
<thead>
<tr>
<th>Search engine</th>
<th>Web of Science</th>
<th>Google Scholar</th>
<th>DRS Digital Library</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus of search engine</td>
<td>The intersection between science, engineering, and D4L.</td>
<td>The intersection between financial planning, media, arts, and D4L.</td>
<td>The intersection between design, service design, design process, and D4L.</td>
</tr>
<tr>
<td>Search date</td>
<td>Oct 6, 2023</td>
<td>Oct 4, 2023</td>
<td>Oct 4, 2023</td>
</tr>
<tr>
<td>Number of results</td>
<td>n=24</td>
<td>n=24</td>
<td>n=30</td>
</tr>
<tr>
<td>Not related to F and G</td>
<td>n=0</td>
<td>n=1</td>
<td>n=22</td>
</tr>
<tr>
<td>Not related to P and G</td>
<td>n=0</td>
<td>n=4</td>
<td>n=0</td>
</tr>
<tr>
<td>Not related to P and F</td>
<td>n=13</td>
<td>n=3</td>
<td>n=0</td>
</tr>
<tr>
<td>Publication type</td>
<td>n=1</td>
<td>n=12</td>
<td>n=5</td>
</tr>
<tr>
<td>Eligible after screening</td>
<td>n=10</td>
<td>n=4</td>
<td>n=3</td>
</tr>
<tr>
<td>Additional resources and total papers reviewed</td>
<td>Part of the process included seven complementary resources (n=7) that were either referred to in multiple texts or provided insightful contextual information. In the study, the total paper reviewed is 24.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2 First round of analysis

We collected the information as text-based notes and citations in a Miro board and Excel so we could visually cluster our findings around common themes. While reviewing our final papers, we found that certain texts were repeatedly referenced. Even if these fell outside of our initial paper selection criteria, we included them in our analysis based on our discretion (n=7). For our first round of analysis, we grouped the notes into four distinct areas: body, social, lifestyle, and transformation (Figure 12).
Figure 12 The relationship between the four distinct areas and the 12 longevity themes. The lines between different Post-it Notes indicated close connections with certain longevity themes. Post-it Note colors: product lifecycle (yellow), financial planning (green), and gerontology (orange).

The body contains longevity-related content about health (holistic well-being) and mobility (independence). Definitions of healthy aging across all three disciplines included notes about physical and cognitive functioning, and mental health. We found it interesting that being free of or adapting to disease and disability was a factor of health independent from physical
functioning. The social area explores ways social structures are organized and emphasizes the importance of both social and civic engagement, as well as multigenerational communities for social stimulation. The lifestyle area looked at the importance of home/living arrangements, education, and work. There was particular emphasis on how the design of cities and space can enhance mindset (e.g., green spaces) or physical health (e.g., exercise opportunities, good air quality). The transformation area considers the role of time with regards to product lifecycle, financial planning, and gerontology. In this area, we found the papers emphasized the importance of flexibility in the product or service to adapt to transformation over time.

3.3 Second round of analysis
In the second round of analysis, we clustered content within each area around the D4L themes. Cross-associated with three fields: product lifecycle, financial planning, and gerontology, the proposed 12 longevity themes were synthesized and summarized to illustrate systemic consideration and to reveal the complexity of D4L by its nature, including communication, trust, care, community, home, mobility, family, health, education, risk, investment, and future.

The body relates to health (physical and mental) and mobility (transportation and independence). The social area relates to content about community (social participation and civic engagement), family (health services, multigenerational culture), and communication (public health information). The lifestyle area relates to home (environment), care (desirability), education (ritual), and trust (individual agency). And the transformation area relates to risk (unpredictability), investment (financial planning), and future (mindset). When complete, the two of three disciplines were distributed across the 12 longevity themes. Most notability "community" deviates from this pattern. Though this is most likely due to the content included in our sample, further analysis should be completed before any conclusions about this are drawn.

Additionally, the field of product lifecycle contains circular economics, sustainable design, design for sustainability, and eco-systems. It overlapped some parts of D4L from the fields of gerontology and financial planning. By using 12 longevity themes as directions to guide us in re-grouping and synthesizing the literature review materials, we clustered these data, including key takeaways, quotes, diagrams, and theories into four pillars to form more holistic perspectives through four areas: body, social, lifestyle, and transformation (Figure 12).

4. Research result and analysis

4.1 The Interpretations of 12 Longevity Themes
We visualized and synthesized the data from Figure 12 to help us summarize 12 longevity themes with our interpretation associated with the relevant publications and fields (Table 3). The research result is shown in Table 3 followed by two discussion points: the interpretation
of 12 longevity themes and the accuracy of the D4L definition. The interpretation of 12 suggested longevity themes was analyzed from 24 selected papers in response to the initial questions. The 12 longevity themes are intended to help us build a more inclusive and comprehensive D4L definition.

Table 3  Generated longevity themes with publication source. Field abbreviation: product lifecycle (P), financial planning (F), and gerontology (G).

<table>
<thead>
<tr>
<th>Longevity themes</th>
<th>Longevity themes interpretation</th>
<th>Relevant publications and primary fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>How often should I be talking to my financial advisors?</td>
<td>Longevity coaches build relationships through interpersonal communication skills and emotional intelligence and should emphasize the positive aspects of aging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• F: (Riley, 2018; Asebedo, 2017)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G: (Wang, Huertas, et al., 2021; Wolff, Beyer, et al., 2018)</td>
</tr>
<tr>
<td>Trust</td>
<td>How can I build and maintain trust with my financial advisors?</td>
<td>Longevity coaches build trust by transforming from asset managers to lifestyle managers who respect client choice and agency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• P: (Carlsson, Mallalieu, et al., 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• F: (Mauterstock, 2020)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G: (Martin, Kelly, et al., 2015)</td>
</tr>
<tr>
<td>Care</td>
<td>How do I know my financial advisors care about me?</td>
<td>To maintain health and happiness, longevity coaches provide adaptive care that responds to social, spiritual, and relational needs of their clients</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• P: (Carlsson, Mallalieu, et al., 2021; Olshansky, Ricanek, et al., 2020)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G: (Piedra and Ridings, et al., 2021; Goshen, Benyamini, et al., 2022; Kim, Min, et al., 2019)</td>
</tr>
<tr>
<td>Community</td>
<td>Who will celebrate my future birthdays with me?</td>
<td>Older adults should aim for active engagement in their community, which involves social participation, employment, and civic participation. This needs to be supported by top-down social services, as well as facilitated by work with a longevity coach.</td>
</tr>
<tr>
<td>Home</td>
<td>Who is going to help care for me and my home?</td>
<td>Longevity coaches should ensure that indoor and outdoor shelters and environments evolve over time in response to changing climates and clients’ physical needs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• P: (Ceschin and Gaziulusoy, 2016)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G: (Wang, Huertas, et al., 2021)</td>
</tr>
<tr>
<td>Mobility</td>
<td>If I can’t drive my car, how will I get to the supermarket, doctor’s office, or dinner date?</td>
<td>Longevity coaches need to consider how individual and public transportation systems can safely support the independence of older clients.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• P: (Ceschin, and Gaziulusoy, 2016)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• F: (Benvenuti, 2019)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G: (Silva, Burrows, et al., 2022; Wang, Huertas, et al., 2021; Piedra, Ridings, et al., 2021; John, Rowe, et al., 1997)</td>
</tr>
<tr>
<td>Family</td>
<td>What factors do I need to consider today to ensure I can support my family and remain independent as I age?</td>
<td>Longevity coaches need to consider how to provide multigenerational services and support for family caregivers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• P: (Carlsson, Mallalieu, et al., 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• F: (Benvenuti, 2019; Mauterstock, 2020)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G: (Wang, Huertas, et al., 2021; Wolff, Beyer, et al., 2018)</td>
</tr>
</tbody>
</table>
### Health

**What unconsidered medical costs, like hearing aids or other devices, should I prepare for?**

Longevity coaches promote health in the following areas: physical (managing diet, exercise, and chronic disease; preventing injury and frailty), mental (cognitive functioning), and emotional health (anxiety, depression).

- P: (Carlsson, Mallalieu, et al., 2021)
- F: (Asebedo, 2017)
- G: (Goshen, Benyamini, et al., 2022; Piedra, Ridings, et al., 2021; Biasi, Wolfe, et al., 2020; Badal, Vaccariello, et al., 2020; Kim, Min, et al., 2019; MacLeod, Musich, et al., 2016; Martin, Kelly, et al., 2015; Cosco, Prina, et al., 2014)

### Education

**What is the meaning of longevity economics and the application of lifelong learning?**

One major determinant of longevity is socioeconomic lifestyle traits such as continued education and its relationship to work and leisure.

- P: (Nurcahyanie and Rohmadiani, 2023)
- F: (Olshansky, Ricanek, et al., 2020; Benvenuti, 2019; Asebedo, 2017)
- G: (Wang, Huetas, et al., 2021)

### Risk

**How can I manage and lower the risk of my finances, health, work, and relationships when I get older?**

Longevity coaching provides metrics of measurement to reduce longevity “friction”.

- P: (Nurcahyanie and Rohmadiani, 2023)
- F: (Benvenuti, 2019; Riley, 2018; Asebedo, 2017)
- G: (Cosco, Prina, et al., 2014)

### Investment

**Can my financial advisor help me make a sustainable and resilient investment plan for longevity?**

Longevity coaches introduce new clients to the basics of financial literacy and work long-term to provide a holistic consideration of financial well-being.

- F: (Lim and Gandini, 2022; Riley, 2018; Asebedo, 2017; Houston, 2014)
- G: (Ceschin, and Gaziuslosoy, 2016)

### Future

**How can I establish the right mindset to embrace the ambiguity of future challenges?**

Longevity depends on an adaptive, proactive, and sustainable mindset which includes self-perceptions of aging, positive outlook, and resilience, and is supported by external validation and respect.

- P: (Nurcahyanie and Rohmadiani, 2023; Ceschin, and Gaziuslosoy, 2016)
- F: (Asebedo, 2017; Houston, 2014)

### 4.2 The accuracy of D4L definition

When we conducted this literature review search, it was difficult to find the exact keywords to describe the concept of longevity planning or design for longevity. For example, some authors mentioned the terms, such as life stage, design for transition, design for sustainability, healthcare systems, and life-centered design and these alternative keywords could describe the idea of D4L. This was especially apparent when trying to look across disciplines or domains. To ensure results were relevant to our topic, we experimented by tweaking the keywords and relationships between the keywords for the specific parameters and focuses of each search engine. This enabled us to retrieve approximately 20-30 search results per search engine.

### 4.3 Holistic perspectives in D4L

The academics of gerontology study the longevity concept by defining and researching comprehensive well-being from physical, mental, and medical angles. The study showed that SA
can transform people’s mindset and behavior (Wolff et al., 2018) and shift the focus from viewing age as a number to celebrating different stages in life (Golden, 2022).

In finance, scholars from the field of financial planning showed the quality of later adult life raced back to people’s education level, lifestyle, and health behavior (Olshansky et al., 2020). In addition to preparing for the potential market needs for longevity planning services, scholars emphasized the importance of building a specialized team to extend financial planning professionals, such as home care providers, medical professionals, insurance agents, senior real estate professionals, estate sale specialists, elder law attorneys, and geriatric care managers (Mauterstock Jr., 2020; Houston, 2014). This can be seen to relate to the fashion industry.

Design industries propose the concept and mindset of building a longevity ecology considering circular material flow from raw material procurement, manufacturing, recycling, and re-use (Carlsson et al., 2021; Hasling & Ræbild, 2017). Though we don’t want to conflate a product lifecycle with a human life span, the dynamic and holistic lens of D4L to extend product lifecycle, it is similar to the desire to strive for longer quality of life for an entire ecosystem surrounding the elderly (Nurcahyanie & Rohmadiani, 2023). This is echoed in gerontology literature, where it is emphasized that SA is complemented by society that supports older generations: treats them with respect and creates space for them to continue to be valuable members of society (Martin et al., 2015).

Compared with typical current financial planning standards, D4L has broadened the scope of the financial planning services and interaction between service providers (e.g., advisors, coaches) and recipients (e.g., customers, clients) ranging from transactional to conversational; from currency exchange to culture cultivation; from asset managers to lifestyle manager (Mauterstock Jr., 2020; Coughlin, 2019).

5. Discussion

5.1 D4L as an interconnected city landscape

Carstensen (2011) compared the process of aging to a systemic breakdown of the body. Aging can also be considered as a time of fulfillment (Houston, 2014). We view longevity as an interconnected consideration of the past, present, and future needs of individuals, families, and communities. In the study, we summarized and proposed D4L interpretation: D4L is a lens to identify longevity-related design opportunities, to envision products, services, and experiences that allow people to thrive across their entire lifespan in the context of transforming age demographics.

We synthesized and analyzed the literature review result combined with the 12 longevity themes in Table 3 (Lee, Hodara, et al., 2023) — communication, trust, care, community, home, mobility, family, health, education, risk, investment, and future — to demonstrate the expansive and holistic nature of longevity. To help make the interconnected, holistic, nature
of D4L tangible for financial planners and their clients, we developed a conceptual worksheet to demonstrate the interconnected, holistic lens of D4L (Figure 13). We represented D4L as a dome in the sky that oversees and frames our city, including open spaces, buildings, people, products, services, systems, policies, and social infrastructure. Each of the city’s structures represents one of the twelve longevity themes. The large circular inputs on the worksheet can help users visualize the connections between these 12 themes and various life scenarios, such as graduation, starting a job, having a child, renting, or buying a home, marriage, retirement, and major disease. Each scenario can be connected to another scenario or any number of the themes to help us better understand the potential impact it may have on the future.

Figure 13 Proposed D4L worksheet with 12 longevity themes to discuss life scenarios for longevity.

We propose the further study be designed using the conceptual worksheet to demonstrate that D4L products and services must have the ability to evolve with a user over time and
across various plausible future scenarios. We should consider not just the product longevity — how long a product or service lasts and how many life stages it can serve — but also the number of thematic areas it can enhance.

5.2 D4L research opportunities for service design and system thinking
D4L is a context-driven term that generates various meanings. In the study, we focus on exploring the definition and implications of D4L applied in a financial planning context. The results showed that D4L is still a new concept and study in the field of service designs, since most literature review materials originate from the fields of product lifecycle, financial planning, and gerontology. It covers most scientific and functional aspects to define the term longevity providing medical or business values. The literature shows less on the user-centered or experience-driven side of benefit. Thus, we think there are still many potential opportunities for service design academics and industries to explore, reframe, and solve social-technological challenges through the lens of D4L.

Further study can focus on how to design human-centered services for longevity, how to integrate service approaches such as service blueprint with D4L, how to create an evidence-driven matrix to evaluate service quality, and how to build service-drive ecology by applying D4L theories, frameworks, or toolkits. In addition, we can investigate the literature review of D4L in the fields of public health, urban design, and system engineering to broaden the scope from product longevity to environmental sustainability. D4L, part service design, system thinking, and design process, can be used to analyze the relationship between health, wealth, and further redefine longevity management (Coughlin, 2019), longevity literacy, longevity strategy, longevity risk (Asebedo, 2017), longevity legacy, and longevity science (Carstensen, 2011).

6. Conclusion
The paper explores definitions of Design for Longevity (D4L) through a literature review from the fields of product lifecycle, financial planning, and gerontology to build a comprehensive interpretation of D4L in the finance and service context. We interpret D4L as a lens to identify longevity-related design opportunities, and to envision products, services, and experiences that allow people to thrive across their entire lifespan in the context of transforming age demographics. The three key learnings of D4L concluded from this study are: (1) In the initial analysis of D4L literature we found that papers from all three domains represented holistic perspectives that addressed four areas: body, social, lifestyle, and transformation; (2) In the second analysis, we broke the four areas into 12 longevity themes: communication, trust, care, community, home, mobility, family, health, education, risk, investment, and future; and (3) we propose further study applies this landscape of 12 longevity themes and four areas to envision longevity coaching services and experience design.

Acknowledgements: The authors express gratitude for the significant support received from the MIT AgeLab and MIT Ideation Lab.
7. References


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