Planning Healthy Aging Communities

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Planning Healthy Aging Communities

"Humans now live longer than at any time in history. But adding more years to life can be a mixed blessing if it is not accompanied by adding more life to years."

— Dr. Tedros Adhanom Ghebreyesus, WHO Director-General

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About CHPR

The University of California, Davis Center for Healthcare Policy and Research (CHPR) is an organized research unit facilitating research, promoting education, and informing policy about health and health care through interdisciplinary, collaborative research. We contribute new knowledge about access, delivery, cost, quality, and outcomes related to health and health care.

Contents

Glossary

Age friendly: A World Health Organization (WHO) concept encompassing policies, services, and structures related to the physical and social environment designed to support and enable older people to age actively—that is to live in security, enjoy good health, and continue to participate fully in society.

Age-Restricted Communities or Neighborhoods: Developments that require residents to reach a certain age, typically 55 or 65 years, to be eligible to reside in a particular community or neighborhood.

Assisted Living: Services typically provided in Continuing Care Retirement Communities such as housekeeping, meal preparation, or personal care. Assisted living is often provided to individuals needing daily assistance such as the elderly or disabled.[1]

Autism Spectrum Disorder (Autism): A developmental condition characterized by social interaction, speech and nonverbal communication challenges.[2]

Blue Space: A land use designation for areas containing water features such as ponds, lakes, or fountains.[3]

Blue Zones®: Dan Buettner, with support from National Geographic, identified 5 unique communities with populations of exceptional longevity that were eventually dubbed the "Blue Zones". The original communities include Loma Linda, California; Nicoya, Costa Rica; Sardinia, Italy; Ikaria, Greece; and Okinawa, Japan.[4,5]

Charrette: An in-depth, collaborative, interactive brainstorming and problem-solving exercise between professionals (architects and planners) and stakeholders (community members, project end-users, policy makers), to design a physical project.[6]

Co-housing Communities: Co-housing communities are smaller developments that are planned, developed, and managed by the residents themselves. Co-housing communities are typically tight-knit due to social obligations and organizations within the development. Co-housing communities are distinct in regard to their shared governance and amenities such as tools, common houses, sheds, parking lots, etc.[7]

Continuing Care Retirement Communities (CCRCs): Continuing Care Retirement Communities offer some combination of independent living, assisted living, and skilled nursing facilities on the same campus, providing a large range of services. CCRCs also include common areas, support spaces, and other wellness-focused areas such as rehabilitation and fitness centers. CCRCs can be high-rises in urban environments or single-story developments in suburban or rural areas.[8]

Dementia Villages: Dementia Villages, or Dementia Care Villages, are communities designed specifically for individuals affected by dementia. These communities often incorporate wayfinding strategies and other social, medical, and therapeutic support that residents may need. Designers of Dementia Villages strive to create "mini-villages" that allow residents to maintain a level of independence that is often lost as the disease progresses.[9]

Green Space: A land use designation for areas that contain trees, plants, or other landscaping features.[10]

Greenfield/Brownfield Developments: Greenfield refers to new, undeveloped property, usually with little to no contamination, but requiring major infrastructure investment. Greenfield is recommended for new construction, whereas brownfield describes previously developed property, usually in an urban area that requires a higher rate of contamination remediation and amendments or redevelopment overhaul.[11] Advantages of brownfield developments are often pre-existing infrastructure, property location, and potential for grants or tax breaks.

Grey Literature: Literature published by organizations, government agencies, or businesses not controlled or evaluated by commercial publishing.[12]

Intellectual/Developmental Disability (I/DD): California defines developmental disability as a substantial disability caused by a mental and/or physical impairment manifested prior to the age of 18 and expected to continue indefinitely. The following conditions are examples of developmental disabilities: cerebral palsy, epilepsy, autism, intellectual disabilities (e.g., Down syndrome), and other

conditions closely related to intellectual disabilities that require similar treatment.[13] These disorders are characterized by limited intellectual processes such as "reasoning, planning, judgement, abstract thinking, academic learning, and experiential learning."[14]

Intergenerational: Communities that include individuals across a range of generations, sometimes used interchangeably with multigenerational.

Intersection Density: The number of street intersections in a defined area. Correlates directly with block size.[15]

Master-Planned Communities (MPCs): Master-Planned Communities are typically large residential communities, sometimes with multiple neighborhoods, that encompass a range of amenities, essential services, and commercial and retail spaces.

Mixed-Use Planning: Zoning that permits housing, commercial, retail, and/or entertainment spaces within a specified area.

Multigenerational: Multiple generations living in a household or community. Sometimes interchangeable with intergenerational where a range of ages from young to old live in the same community.

Naturally Occurring Retirement Communities: These communities are neighborhoods, complexes, or communities that house a high percentage of older adults, even though the community was not planned, developed, or marketed for older adults.[16] There is no formal agreement on what constitutes a "high percentage" (e.g., 40% to 65%) or minimum age for inclusion (e.g., 55 vs. 65 years).[17]

New Urbanism: A movement to return to human-scaled urban design where: neighborhoods can be traversed in 5-minute walks from center-to-edge using walkable (short) blocks and streets, shopping and housing are in close proximity, and public spaces are easily accessible.[18]

Neurodiverse: Describes people with a broad range of neurological differences, such as autism, Down syndrome, cerebral palsy, epilepsy, attention deficit hyperactivity disorder, and also may include neurotypical people.[19] (See also: Intellectual/ Developmental Disability.)

Pedestrian-Friendly Spaces: Spaces that maximize walkability by limiting roads for cars and bikes or other pathways not restricted to pedestrian-only use.[20]

Peer-Reviewed Literature: Literature that has undergone an academic evaluation by a group of scholars and journal editors to assess its scientific claims and methods.[21]

Permeability: The extent to which an area promotes movement through street connectivity. High levels of permeability may support increased walking and access to surrounding areas.[22]

Population Density: The number of people living within a defined area.

Rapid Re-Design: A design process that cycles systematically through several stages: plan, implement, and evaluate, in rapid succession, which enables faster learning and improvement. This process can incorporate the common Plan-Do-Study-Act (PDSA) process.[23]

Street Connectivity: The directness of links and the density of connections in a street network. A well-connected network has many short links, numerous intersections, and minimal dead ends.[24]

Supportive Housing: Affordable housing with flexible, supportive services to help vulnerable people access and maintain the housing and community supports needed to help them live more independently. Independence includes choice-making (who one lives with and where).[25]

Third Places: Communal areas of shared space; alternatives to first places (homes) and second places (work environments) used by urban planners to build community. Third places is a term coined by sociologist Ray Oldenburg and refers to places where people spend time between home and work.[26] They are locations where people exchange ideas, socialize, and build relationships.[27]

Universal Design: Design of products or environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.[28]

Virtual Villages: Community-based, non-profit, member organizations dedicated to supporting people to stay in their own homes independently as they

age. For a fee, members of a virtual village are given access to social and educational activities, health and wellness programs, trustworthy businesses for outside services, medical services, volunteer services and transportation, all meant to help members stay in their own homes.[29]

Walkability: The extent to which the built environment of a neighborhood encourages people to walk.[30,31] The Walk Score measurement tool can be used to assess seven characteristics of walkability: 1) presence of a center (public space or main street); 2) large enough neighborhood (number of residents) to support businesses and public transportation; 3) mixed use of land and residents with varied incomes; 4) inclusion of parks and public spaces; 5) pedestrian-centric design with buildings close to streets and parking in back; 6) schools and places of employment close enough to walk to; 7) complete streets (as opposed to cul-de-sacs) that encourage biking, walking, and transit. Other examples of tools for measuring walkability include: Walkshed, PIndex, Pedestrians First Tools for a Walkable City, Path Environment Audit Tool (PEAT), and the Neighborhood Walking Survey.[32]

Wayfinding Strategies: Strategies that incorporate clear, intuitive, and nonverbal cues into the design of pathways so that individuals can easily navigate an area. Cues used in such strategies may include landmark objects, signage, colors, looped pathways, and sensory-stimulating design.[33]

Executive Summary

California's population aged 55 years and older is projected to increase from 28% (11.3 million residents) in 2021 to 35% (15.4 million residents) in 2050. Although 80% of older adults want to remain independent in their own homes as they age, increasing rates of age-related chronic disease and disability create barriers to achieving this. The growing population of adults with intellectual and developmental disabilities is aging as well. When taken in context with the existing housing shortage in California, there is a compelling need for innovative, inclusive communities purposefully designed to support health and independence throughout the life span. Land-use planning and community design are often overlooked elements that can help to prevent or mitigate many age-related barriers to independent living for an aging population, including those who are intellectually or developmentally disabled (I/DD).

Through an innovative synthesis of evidence from peer-reviewed literature and online reports, current guidelines and toolkits, interviews with key informants, and examples of model communities, this report describes the role of land-use planning and design in fostering healthy aging for all. **Our goal is to inform and inspire developers, planners, home builders and other key stakeholders responsible for creating innovative healthy aging communities.**

Evidence Review

Strong, consistent evidence supports specific community design features to develop healthy aging communities. Our review identified clear and convincing evidence of built environment characteristics that support improved health outcomes in older adults, including:

- **Walkable, mixed-use neighborhoods** with residential areas in proximity to commercial services and public transit supported by:
  - Shorter block length
  - Higher population density
  - Connected, but separate systems for street, bike, and walking paths
  - Wide sidewalks and walking paths made of flat, nonslip, and stable surfaces
  - Public restrooms and shaded benches
  - Street lighting
- **Third places** which provide opportunities for socialization and recreation. Grocery stores, libraries, community centers, restaurants, community gardens, and shopping centers located close to home are associated with increased physical activity, improved socialization and physical health, and slower cognitive decline.
- **Green spaces and greening** which are associated with better physical, mental, and social health and wellbeing for both older adults and persons with I/DD.
  - Parks, parklets, and natural areas
  - Greenscaping of streets, bike paths, and sidewalks
  - Minimum 50-60% tree canopy coverage
  - Gardens/gardening, particularly community gardens
  - Biodiversity

A preponderance of evidence supports access to **convenient transportation** to enhance the physical and social health of older adults. Limited evidence supports community design to improve wayfinding. Although we found insufficient evidence on community planning and design for people with I/DD, we did identify research-informed guidelines for planning and design of housing and communities for people with autism. There was insufficient evidence to identify the role of community planning and design in naturally occurring aging communities or to determine the relative impacts of multi-generational versus age-restricted communities on health.

Guidelines and Toolkits

Numerous guidelines and toolkits are available to help planners in the design process for healthy aging communities, with resources for the U.S. and California provided by the AARP, the Urban Land Institute, and the American Planning Association. Guidelines are also available for greening of communities. The California Master Plan for Aging lays out specific goals and metrics for healthy aging

communities. Guidelines offer recommendations for community design to support community members with autism spectrum disorders. Planning and design can benefit from the input of potential residents and other stakeholders; specific tools such as charrettes and rapid redesign cycles provide structures for planners, designers, and developers to engage with the community and tailor an evidence-based plan to local needs.

Model Healthy Aging Communities

The **environmental scan of model communities** did not yield any communities that incorporated all the key land use and design elements that could support healthy aging. However, we identified **35 communities that have implemented certain elements** particularly well, including some that purposefully included people with I/DD in the community. **Unique features among these models** were those that:

- **Encourage socialization** within and outside the community, as well as socialization across generations, by connecting pathways, creating permeable community or neighborhood borders, and creating interior and exterior third places.
- **Promote healthy diets** through the use of community farms or on-site farmers' markets.
- **Encourage physical activity** by providing green spaces, recreation centers, integrated and networked walking paths, and bike lanes that connect to essential services.
- **Create a 5-minute neighborhood** (a car-free environment, or networks of walking paths, with essential services within a 5-minute walk or bike ride) to encourage physical activity and socialization.

Technology

Technology plays a significant role in the structural and functional operations of healthy aging communities from fundamental infrastructure design and operations to the personal health and wellbeing of residents. The rapid pace of technology advancement and its expanded integration into the lives of older adults and healthy aging communities will only increase in the future. For planning and capital projects, it is critical to anticipate where technology advances will be in the next three, five, and ten years in terms of applications and basic infrastructure requirements. Critical planning elements include:

- Anticipating the need for **expanded infrastructure capacity** to support full access to broadband and 5G in homes, buildings, and outdoor areas
- **Backup electrical power systems** to sustain essential technology during power outages
- Sufficient **electric vehicle charging stations**
- Sustained attention to facilitating **easy technology access** for community residents while **protecting privacy** and maintaining data security.

Community Partnerships

Partnerships can facilitate the integration of retail and health services into the community. Relationships with academic institutions can facilitate learning for both residents and students and provide opportunities to conduct research that expands knowledge about healthy aging and effective community design.

Conclusion

Land-use planning and community design are important tools that can help to address the growing health and housing needs of a rapidly aging population, including those who are intellectually or developmentally disabled. Planners and developers can rely on strong evidence supporting these features of healthy aging communities: mixed-use, walkable communities with a variety of residences and access to nearby transit, third places, parks, and community gardens that are accessible by green, well-designed streets, sidewalks, and connected walking paths and bike trails.

Guidelines and toolkits related to multiple aspects of healthy community design are available to support planning and decision making. Input from potential community residents, healthy aging advocates, and other stakeholders should be sought early and often in the planning process. Such input is critical to successful design as the evidence demonstrates that “one size does not fit all”; community preferences, zoning regulations, and topography will influence design options and choices. Existing and planned model communities provide inspiration and examples that can be adapted to local community needs by planners and designers. The growing importance of secure, but easy access to reliable technology, particularly broadband internet, 5G telecommunication, and electric vehicle chargers is critical to developing a successful healthy aging community. Planning should also include incorporating back-up power options to avoid prolonged electrical outages. Partnerships between developers and academic institutions can foster development of evidence-based healthy aging communities and provide opportunities for continuing education and research.

We hope this report inspires revolutionary thinking and innovative planning to develop communities that support independent and healthy living for residents as they age.

Introduction

The rapidly increasing population of older adults is a pressing global issue. The resulting need to support healthy aging presents challenges that are recognized worldwide.[34] Aging is accompanied by an increased prevalence of chronic health conditions including obesity, diabetes, heart disease, and arthritis. Moreover, disabilities associated with aging that impact the capabilities of older adults are also a growing concern. The cost of caring for older adults is projected to grow, with U.S. expenditures for nursing homes and continuing care retirement communities (CCRCs) expected to increase by 58% from 2018 to 2027, and total costs of care projected to be $414 billion in 2030.[35] These costs are born societally and individually; 54% of older adults are projected to have insufficient savings or insurance to pay for their care in 2029.[36]

The population of adults with intellectual and developmental disabilities (I/DD) is also aging. Parents providing care for their neurodiverse adult children are aging too, placing additional strain on these families to ensure proper care for both generations. This population has both common and unique needs for optimizing healthy, independent living.

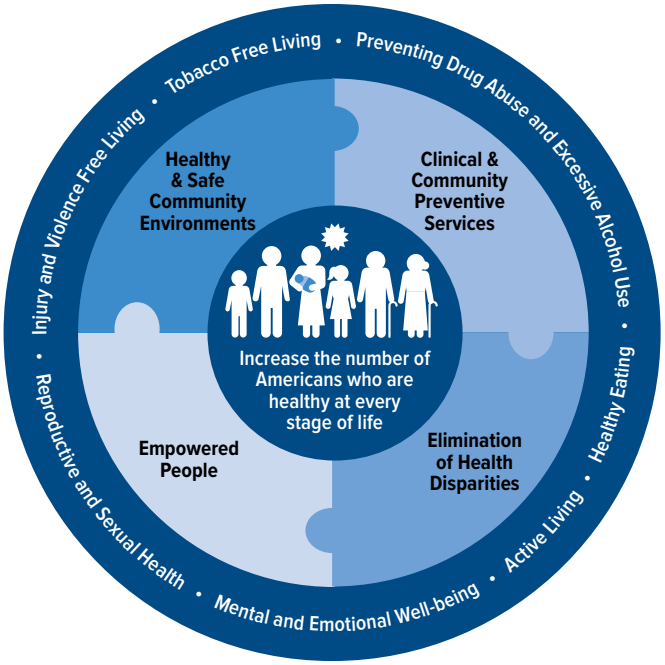
Among U.S. adults over age 50, 80% want to remain in their homes as they age.[37] Widespread development and redevelopment of communities designed to support healthy aging is an urgent imperative and brings extensive opportunity for innovation. The rapid growth in numbers of older adults inspired the first California Master Plan for Aging authored by a committee convened by the Governor.[38] As the "blueprint for state government, local government, the private sector, and philanthropy to prepare the state for the coming demographic changes and continue California's leadership in aging, disability, and equity," this master plan focuses on five goals: housing, health, community inclusion, caregiving, and economic security. With leadership from the American Association of Retired Persons (AARP) Age-Friendly Cities and Communities movement, cities (including West Sacramento and Sacramento) are making local policy changes to address the needs of their aging populations.

Experts from a cross-section of disciplines, including economists, urban planners, health care researchers, transportation experts, and sociologists are investigating effective approaches to support healthy aging. Partnerships among all levels of government, advocacy groups, industry, and academic institutions are collaborating to create, implement, and evaluate supportive policies. Integration of innovative planning and design, thoughtful technology, and effective services and programs can support healthy aging across multiple generations.[39]

> "Age-friendly environments (such as in the home or community) foster healthy and active ageing by building and maintaining intrinsic capacity across the life course and enabling greater functional ability in someone with a given level of capacity."
>
> – *WHO World Report on Ageing and Health, 2015*

Cross-disciplinary collaborations are essential because multiple factors beyond health care influence health, including genetics, health behaviors, the built environment, economic stability, and education.[40] Modifying these health determinants, including the built environment at both macro and micro levels, will have a greater impact than medical care alone for improving the quality of life for older adults. This concept, known as Social Determinants of Health, led to a movement dubbed "Health In All Policies,"[41] which seeks to incorporate health planning in sectors traditionally unaffiliated with health care such as transportation, housing, and education. This perspective is being applied globally through efforts to develop communities that support healthy aging across the lifespan.[42] An illustration of this concept is found in Figure 1.

FIGURE 1
Health in All Policies Framework



Centers for Disease Control and Prevention, 2021

The tragedy of the COVID-19 pandemic provides a stark demonstration of the health hazards of congregate living for older adults as well as the health risks of dense urban environments.[43] In this context, the influence of the built environment on health is striking. Less dense, intergenerational communities that support healthy aging offer potential benefits not previously imagined. In addition to other reasons that older adults prefer to avoid congregate living, the isolation required to reduce the risk of COVID-19 transmission in elder congregate communities resulted in further adverse health consequences related to loneliness, depression, and inactivity.[44]

Purpose of Report

This report brings together evidence to inform a frequently overlooked step in creating healthy communities: land-use planning and specific design features associated with healthy aging. Land-use planning and community design can address the health and housing needs of a rapidly aging population, including those who are intellectually or developmentally disabled. Through an innovative synthesis of evidence from peer-reviewed literature and online reports, current guidelines and toolkits, interviews with key informants, and examples of model communities, we describe the role of land-use planning and design in fostering healthy aging for all. Our goal is to inform and inspire developers, planners, home builders , and other key stakeholders who are responsible for creating new communities.

We searched the peer-reviewed literature to identify studies relevant to the planning and design of healthy aging communities, and categorized the results based on the hierarchy of evidence. Our search included research conducted in the U.S. and around the globe. We rated the evidence and focused on the highest quality evidence available (see **Chapter II**). Systematic reviews, when available,

> "As shapers of the built environment, developers can benefit from understanding community health and... how it can offer new opportunities for client, community or market assessments... Projects that advance health may also have a market advantage, while benefiting occupants and surrounding communities by providing opportunities for active living, access to light and the outdoors, and places for people of all ages, and abilities, and incomes to feel comfortable."
>
> *– Anna Ricklin, Health in All Policies Manager (Fairfax County, VA Department of Health)*

EVIDENCE RATINGS

Clear and convincing: More than 5 studies, including cohort studies or a systematic review, with concurring conclusion of effect

Preponderance: 3-5 studies, using a cross-sectional or better design, with concurring conclusion of effect

Limited: 1-2 studies, using a cross-sectional design or better, with concurring conclusion of effect

NOTE: Lack of evidence is not evidence of no effect; it means the effect is unknown.

provide the strongest evidence base. Longitudinal cohort studies can also provide strong evidence because results can suggest cause and effect relationships, unlike cross-sectional study designs, which are limited to identifying associations among factors at a point in time and cannot suggest causal relationships. Qualitative research studies, which describe a phenomenon with context, are also useful, however, sample sizes are often small and findings do not represent the broader population; they also cannot confirm causal relationships. Most authors of systematic reviews concurred with our conclusion that more and better quality research is needed to inform many aspects of land use planning and design of healthy aging communities. For example, we found very few studies of community designs to enhance health and wellbeing for those with I/DD.

A review of non-peer-reviewed reports (grey literature) and multiple content expert interviews supplemented our findings from the peer-reviewed literature. Paths for implementing these findings as part of land-use planning are found in guidelines and toolkits described in **Chapter III.** The evidence identified by this review also contributed to the evaluation of the innovative, age-friendly model communities described in **Chapter IV**.

We conducted interviews with 41 key informants spanning topics such as land use and urban planning, architecture and design, transportation, senior housing, aging and the built environment, greening, technology, and Alzheimer's Disease (see **Appendix B** for full list of key informants). We identified these experts using searches of the literature and a snowball recruiting method with initial key informants. Interviews lasted 30-60 minutes. To verify our literature search methods and findings, each interview included a request for citations about published literature in that subject area and examples of exemplary healthy aging communities that we might explore to supplement our evaluation of model communities.

Evidence and examples identified in this report span the world. Implementation of the findings in this review may be challenged by the constraints of local zoning requirements and other regulations related to community development projects. Further, there is no "one size fits all" for development and land use planning. Local conditions and community needs and preferences may require adaptation or revision of designs or strategies that are effective in different environments.

This report highlights the role that design and the use of technology can play in collaborations between developers, planners, policymakers, academic institutions, advocates for healthy aging, and other key stakeholders. Although we emphasize an applied perspective rather than a theoretical or policy perspective, our conclusions and recommendations may be used to inform policy decisions.

The modular organization of this report will help readers navigate the breadth of information available for developers, builders, policymakers, healthy aging advocates, and other stakeholders who are interested in planning inclusive, healthy aging communities. **Chapter I** provides context around the potential demand for healthy aging communities; **Chapter II** presents findings from an evidence review about how land-use planning impacts health; **Chapter III** reviews guidelines and toolkits that can inform land-use planning; and **Chapter IV** describes model communities designed to support healthy aging. **Chapter V** explores the role technology can play in healthy aging and **Chapter VI** describes the potential benefits of partnerships between academic institutions and communities. In each chapter we addressed planning and design for aging adults with I/DD, although we found limited evidence on this topic. The **glossary** provides definitions of subject-specific terminology.

I. Healthy Aging: Population Needs and Preferences

This chapter documents the growth of California's aging and neurodiverse populations and their needs and preferences regarding community and housing choices, and goals for healthy and independent aging. California's population aged 55 years and older is projected to increase from 28% (11.3 million of 40 million residents) in 2021 to 35% (15.4 million of 45 million residents) in 2050 (Figure 2a).[45] This growth is attributed to increasing longevity (due in part to improvements in health care), as well as the aging Baby Boomer population. Perhaps the most compelling statistic describing the dramatic increase in the proportion of California's aging population focuses on people 85 years and older (85+). Just within the next 10 years, this cohort is expected to grow by about 65 percent, comprising an additional 960,000 people aged 85+ years.[45] This growth rate is more than 10 times faster than the projected growth rate for California's other age cohorts, according to data from the California Department of Finance.[44] Ultimately, this cohort is expected to double in size from 8% (858,000) in 2021 to 16% (2.55 million) in 2050.[45] (Note: this estimate predates the dramatic increase in U.S. mortality among older adults in 2020 due to the COVID-19 pandemic.)

Land-use planning for communities that support healthy aging requires an understanding of projected changes in demographics that will affect supply and demand for housing and services. Figures 2a-c highlight the need for well-designed communities that enable members of the Gen X, Millennial, and Baby Boomer generations to age-in-place independently and actively.

If the local population size is less than optimal for building an innovative and profitable healthy aging community development, planners, developers, and other stakeholders may consider marketing such a community to a broader regional area as part of their planning process. For example, the California Department of Finance indicates that, by 2030, there will be almost 861,000 adults aged 55 years and older in the Sacramento region[a] and that this cohort is expected to grow to 1.05 million by 2050 (Figure 2c).[44] If this population is insufficient to support new greenfield developments, planners and developers interested in creating healthy aging communities in the Sacramento region could potentially draw from the aging cohort in the San Francisco Bay Area;[a] a similar growth rate of adults aged 55 years and older, from 2.2 million to 3.1 million by 2050 (Figure 2b), is expected for that region.

WHY 55+?

Most published projections of the aging population focus on those 65 years and older (65+). However, in the context of building new developments, which can take up to a decade to become operational due to permitting, financing, and construction, the 55+ cohort is a better indicator of the potential demand for community developments that support healthy aging. Adoption of healthy behaviors at younger ages will also confer greater health benefits overall.

Health Status: Growing Needs of a Growing Population

Rates of chronic disease and disability increase with age, and with the unprecedented growth rate of people over age 55, implementing innovative healthy aging communities will be critical for supporting healthy behaviors and meeting the growing health care needs of this population.

California adults who turned 65 years old between 2015 and 2019 are projected to live, on average, for another 23.6 years during which they will spend an average of 4.5 years with one or more limitations.[46]

[a] Bay Area Region defined by the U.S. Census: Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, and Solano Counties.

FIGURE 2A

Population Projection for California Adults Aged 55+ Years (2021-2050)

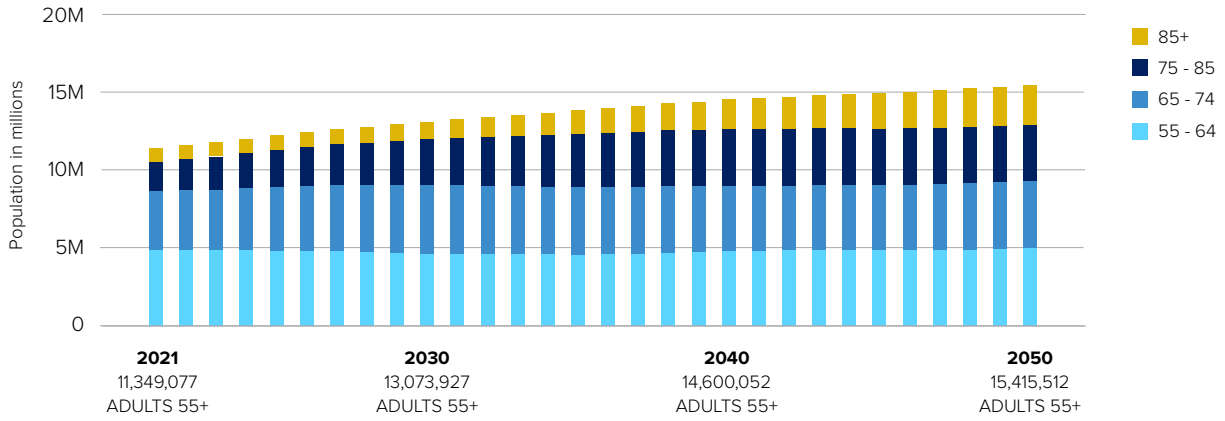


FIGURE 2B

Population Projection for Bay Area Region Adults Aged 55+ Years (2021-2050)

Bay Area Region: Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara and Solano Counties

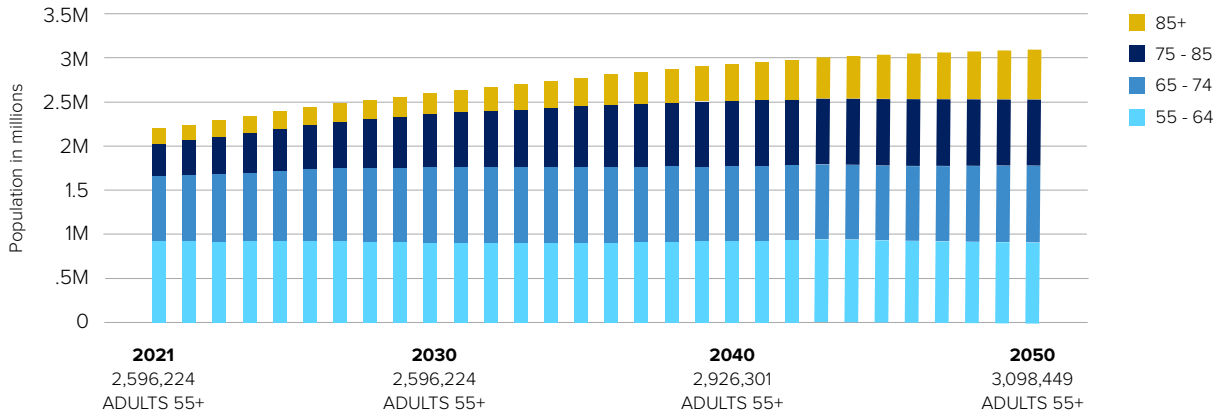
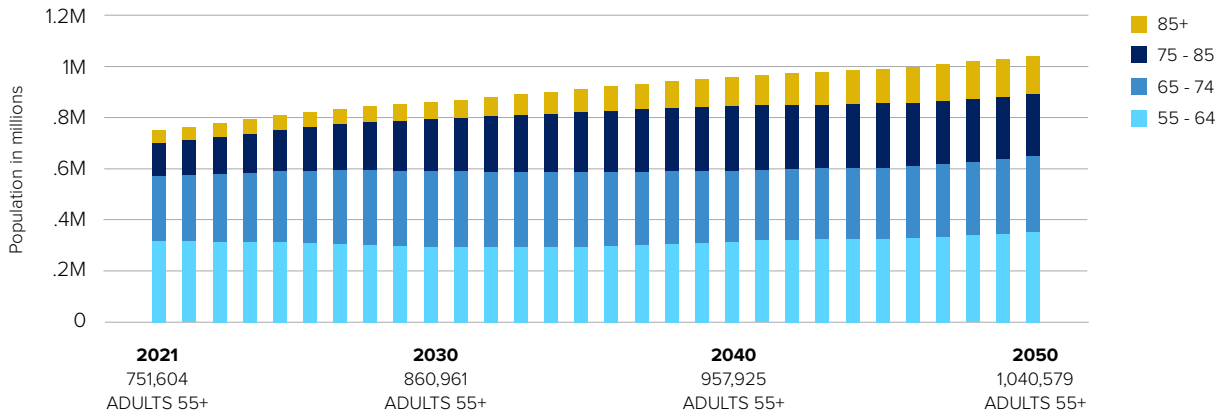


FIGURE 2C

Population Projection for Sacramento Region Adults Aged 55+ Years (2021-2050)

Sacramento Region: El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba Counties



Data source: California Department of Finance, 2021

PREVALENCE OF HEALTH CONDITIONS

Adults 65 years and older

- 70% of adults aged 65+ years in California have at least one chronic health condition
- Chronic health conditions most prevalent among Medicare enrollees in Sacramento County (2018):
  - Chronic kidney disease 21%
  - Diabetes 22%
  - Heart disease 24%
  - Arthritis 30%
  - Hyperlipidemia 46%
  - Hypertension 51%

Source: Centers for Medicare and Medicaid Medicare Chronic Conditions Dashboard. Interactive Atlas of Chronic Conditions, 2018.

The California Legislative Analyst's Office predicts that the number of older adults in California living with limitations in Activities of Daily Living (ADL; routine personal care such as bathing, eating, or dressing) and Instrumental Activities of Daily Living (IADL; tasks fundamental to independent living such as financial management, shopping, and travel outside of the home) will nearly triple by 2060. Almost two-thirds of the population age 65 years and older will experience at least one disability and two or more ADL/IADL limitations.[46] Currently, almost 10% of Californian's 65+ years old are being treated for dementia-related disease.[47]

In addition to significant rates of chronic disease, about half of older adults in the Sacramento region reported having some form of physical, mental, or emotional disability.[48] Estimates indicate that mobility-related difficulties, those requiring wheelchairs, canes, or other movement assistance, are most common, affecting 26% of people aged 65 years and older in Sacramento County.

Policymakers, planners, architects, developers, and home builders will need to accommodate the projected increases in the burden of chronic health conditions and disabilities throughout California. Innovative designs for healthy aging communities can support independent living through features including the community's layout, public transportation options, housing proximity to services, home designs, green spaces, and walking/biking paths to improve physical and emotional health.

Housing

The challenges of the growing elder population coincide with California's severe housing shortage, especially for affordable housing. The California Department of Housing and Community Development and the Sacramento Area Council of Governments projected that 153,512 additional housing units will be needed in the six-county region by 2029 (Table 1).[49] The projected housing demand spans the entire income range, but need will be greater for households with extremely low to low (40.7%) and above moderate (41.1%) levels of income,[50] indicating a need to increase supply across a range of housing by type, tenure (i.e., owner/renter), and affordability.

TABLE 1
Housing Need in the Sacramento Region through August 31, 2029

Extremely/Very-Low	25.40%	38,999
Low	15.30%	23,503
Moderate	17.60%	26,993
Above-Moderate	41.10%	64,017
TOTAL	**100%**	**153,512**

Source: California Department of Housing and Community Development, July 18, 2019.

Note: Percents calculated using American Community Survey-reported household income brackets and regional median income, adjusted for percent of cost-burdened households in the region compared with the percent of cost-burdened households nationally.

Community and Housing Preferences Among U.S. Adults

Understanding the preferences of an aging population is critical to designing and building environments that will successfully meet the self-identified needs of this growing population. The AARP Home and Community Preferences Survey, conducted in 2018, provides insight into the current circumstances and desires of adults aged 18+ years. For example, most adults aged 18-49 years **want to remain in their communities** and homes as they age (50-60%), and

among those over age 50, 80% want to remain in their homes. More than 60% of surveyed adults own their own homes, and approximately one-third said **their home required major modifications to accommodate aging needs.** About 50% of the respondents reported **currently sharing, or a willingness to share, a home as they age** (especially if they needed help with daily activities).[37] Although only 7% reported having an **accessory dwelling unit** (ADU), 70% of respondents would consider building one for a loved one who needed care (and 25% noted that an ADU could serve as housing for a caregiver).

In considering **buildings and outdoor spaces,** over 80% of respondents identified the following community features as extremely or very important: well-maintained and conveniently located hospitals and health care facilities, safe parks, and well-maintained streets with signage that is easy to read.[37] Regarding **personal transportation**, most respondents of all ages (84%) reported that they drove their own cars. Eighty-eight percent had heard of self-driving cars, but 63% were not very/not at all willing to ride in one. Respondents aged 18-49 years and those with disabilities were more willing to use a self-driving car. Ninety-three percent of adults aged 50+ years had heard of ridesharing; however, only 43% reported actually using ridesharing.[37]

Pre-pandemic AARP survey research on **socialization and support** indicated that 43% of adults aged 45+ felt a lack of companionship, 36% felt "left out," and 30% felt isolated from others. About half of the respondents were interested in joining a virtual village to help them stay in their community and, of those, half were willing to pay an annual fee (a virtual village is a service that provides access to social and educational activities, health and wellness programs, trustworthy businesses for outside services, medical services, volunteer support, and transportation to help members stay in their homes).[37]

More recent research indicates that the COVID-19 pandemic has influenced housing behavior and preferences. For example, in a 2020 PEW survey of 9,654 U.S. adults, 9% reported moving themselves (3%) or having someone move into their home (6%) due to the pandemic.[43] Of those who moved, 61% reported moving in with a parent, an adult child or another relative. Eighteen percent of those receiving a new household member reported the member being a parent or in-law. Other research has documented that, due to the disproportionate share of COVID-19 deaths occurring in nursing homes, many families are seeking alternatives to congregate facilities to care for their aging parents.[51]

Together these findings document preferences that can inform practical decisions by urban planners, developers, home builders, and policymakers to help support the self-identified needs and preferences of an aging population.

Adults with Intellectual and Developmental Disabilities

Those with neurological disorders are an important, but frequently overlooked subset of the aging population that has particular needs for successful healthy aging. Neurological disorders encompass a broad range of conditions such as intellectual and developmental disabilities (I/DD; including cerebral palsy, Down and Fragile X syndromes, intellectual disabilities, and autism spectrum disorders), epilepsy, and acquired disabilities (such as those resulting from head traumas).[52]

Age-specific rates of chronic disease and poor health are higher in the I/DD population than in the population overall and research indicates that for individuals with I/DD, "many of their health care needs go unidentified and unmet when compared with the general population."[53] For example, almost 20% of the Sacramento County residents with I/DD who receive state or local services have one or more chronic medical problems (e.g., diabetes, heart disease, a substance use disorder), require special health care interventions (e.g., feeding tubes, mobility aids, frequent repositioning), or are unable to walk without support.[54] About 30% take behavior-modifying drugs to control maladaptive behaviors (i.e., hyperactivity, aggression, self-injurious behavior, or poor impulse control).

California's population of people with I/DD is also increasing for several reasons. In addition to the large cohort of Baby Boomers reaching senior status and increasing longevity (although life expectancy remains lower for this population than for the population overall), the population with I/DD is also increasing due to the growing rate of I/DD diagnoses.

For example, the number of people in California with autism spectrum disorder (ASD) increased 260% from 34,903 in 2007 to 91,312 in 2017; people with ASD comprise the fastest growing segment of the I/DD community.[13] Creating healthy aging communities that are inclusive of adults with intellectual/developmental disabilities (I/DD) is practical, necessary, and will lead to better health outcomes and quality of life.

Housing Options and Life Circumstances of Adults with I/DD in California

Many adults with I/DD live with their aging parents until their parents can no longer care for them or pass away. The number of these dual-generation households will continue to grow in the foreseeable future due to gains in life expectancy and increasing rates of I/DD diagnoses. Reasons people opt for family-based care include shortages of alternative residential options,[55] personal choice, and affordable housing. About 80% of Californians with I/DD rely on Supplemental Security Income/State Supplementary Payment (SSI/SSP) as their only source of income (about $900 per month).[13]

Based on 2018 data, approximately 625,000 Californians meet the federal definition of having an I/DD. About half that number (338,000) meet the state's definition of having a developmental disability and are being served by the Department of Developmental Services (DDS) and its regional center system. Of the 164,000 adults with I/DD receiving services through DDS:[13]

- 63% live in a family home with an aging caregiver
- 16% live independently in their own home, and receive Independent Living Services/ Supported Living Services
- 15% live in a congregate residential facility
- 5% live in a skilled nursing facility
- 1% live in other settings

The Alta California Regional Center, funded through the DDS, assists people with disabilities and their families with social services in the Sacramento region (Figure 3). More than 70% of individuals with an intellectual disability in Sacramento County have mild (52%) or moderate (21%) intellectual deficits and are likely able to communicate, practice self-care, and socialize, and may therefore be able to live independently, especially with access to supportive housing. According to DDS trend data, the percentage of persons with profound, severe, or moderate intellectual disabilities has declined since 2007.[56]

FIGURE 3

California Department of Developmental Services: Alta California Regional Center

- ~23,000 active consumers*
- 40% aged 22-99 years

**Not all people with I/DD receive services through DDS due to lack of access, ineligibility, or personal choice.*

Alta California Regional Center: Client Statistics and Regions Served, 2018. Source: Alta California Regional Center, 2021.

Housing Affordability and Preferences Among Adults with I/DD and Their Caregivers

A 2018 report on the status of affordable housing for adult Californians with I/DD reported that 45% of consumer survey respondents (n=106) were living at home with their parents, and that 85% preferred to live independently, alone or with roommates (and 14% said they preferred living with family). The features of preferred housing these respondents indicated were most important to them were a safe neighborhood (76%), affordability (63%), and a location close to transportation, family and friends (39%). Half of parent/caregiver respondents with adult children living at home (n=358) indicated that they "do not want their child living in the family home forever, for their own sake and their child's sake" while 25% reported wanting their child to live with them for his/her entire lifespan.[13] Consumers

and parent caregivers cited limited finances (56% and 50%, respectively) and lack of affordable housing (47% and 62%, respectively) as barriers to achieving their preferred housing. Consumers also highlighted lack of accessible housing (17%) as a barrier.

Parent respondents with adult consumers not living at home reported that 52% of consumers lived alone or with roommates and 27% lived in a licensed group home. Sixty-two percent of parents were satisfied with their child's living arrangement. Of those who were dissatisfied, about half identified lack of affordable housing or limited finances as the major barriers to satisfaction with housing. For individuals who need long-term services and supports, several publicly funded options exist, including Medicaid Home and Community-Based Services waivers, Medicaid Intermediate Care Facilities for Individuals with Intellectual Disability, Medicare, and Social Security Supplemental Security Income (SSI). However, each of these sources requires meeting certain eligibility criteria. Many parents pay for housing at market rates and are concerned that they cannot afford it indefinitely. Parents want their off-site children to "be closer," have transportation options, and they worry about roommate compatibility and whether their children will be evicted because they "don't belong." Overall, many of these parents indicated they worried constantly about their child's situation changing for the worse.[13]

Developer/landlords (n=36) also responded to the survey. Half had experience in creating affordable housing for the I/DD community and half had never served this population. Aside from the need for reliable funding to subsidize financial support (for operations and rent), none reported concerns about renting to the I/DD community. Developers with no experience with this population were interested in learning more about the community and what it would take to develop affordable housing to meet their needs.[13]

Capital Funding Sources for Mainstream and Supportive Housing for Adults with I/DD

There has been a coordinated effort by advocacy organizations for aging adults and adults with I/DD to align opportunities to promote community living.[55] In the 1990s, California's care model for people with I/DD formally evolved from one of segregated, institutional care settings to support for a model comprising full community inclusion, universal design, and supported decision-making. This shift was codified in 2014 with the final waiver rule for Medicaid Home and Community-Based Services, which provides funds for services and supports for people with I/DD who qualify.[13] Nationally, the effort to provide more community and housing choices for neurodiverse people is being led, in part, by the First Place Global Leadership Institute. The lack of housing choices for neurodiverse adults (and their families) was documented in a recent report which also describes housing development strategies that could be used to help meet the current wide-ranging needs for housing and services.[52]

Additionally, in response to the shift to community-based housing, the California State Council on Developmental Disabilities published the Statewide Strategic Framework for Expanding Housing Opportunities for People with I/DD. This report describes nine federal and state funding sources for both mainstream housing and supportive housing development.[13] Sources include tax credits, low-income loans, and grants providing start-up or operational funding through the DDS Community Placement Plan;[57] however, NIMBY-ism, costs, and regulatory hurdles still present significant challenges. To bypass the waitlists and limited housing choices, some communities are being personally subsidized and built by families with neurodiverse adults.[58-60]

Conclusions

The proportion of the U.S. aged population is growing significantly; between 2021 and 2050 the number of Californians aged 55+ years is expected to increase by 70%. Californians in this age cohort will experience increasing rates of age-related disabilities and chronic health conditions that are associated with their longer lifespans.

Adults overwhelmingly express interest in aging in place, which has strong implications for supply and demand in relation to California's housing shortage. There is also increasing interest in and demand among adults with I/DD and their families for more affordable independent living and supportive housing choices.

These trends represent major opportunities for innovative design and development of community projects that encourage disease/disability prevention, support healthy aging, and prolong independent living.

II. Planning for Healthy Aging Communities: Evidence Review

"How can services and built environments be transformed to adjust to people's changing needs, rather than forcing people to adjust to different places as they age?"

– Emi Kiyota, Founder, Ibasho House Japan

The increasing proportion of the aged population in the U.S. and globally has led to growing interest in the development of communities and strategies to support healthy aging in homes and neighborhoods. As noted in Chapter I, older adults place a high value on independence and avoiding institutionalization. This healthy aging community movement extends beyond social policies and programs to include intentional community planning and designs that promote healthy aging.

We examined evidence from the peer-reviewed and grey literature and from content experts to identify effective land use planning and community design strategies that support healthy aging. This chapter includes reviews of "blue zones" and naturally occurring retirement communities, and provides a synthesis of the evidence available on how health and wellbeing are impacted by the built environment, community design, and greening. We specifically sought evidence about the built environment's impact on the physical and emotional health of older adults and those with I/DD and dementia.

Evidence Review Methods

As described in the Introduction, we used the hierarchy of evidence to select the strongest available evidence for our areas of focus. We primarily relied on 16 unique systematic reviews and one review of reviews, considered to be the strongest level of evidence. Individual studies that provided specifics not covered by the reviews, including detailed descriptions of particular health-related planning and design elements, were also included in our analysis. (See **Appendix A** for details of review methods). Findings from the peer-reviewed literature were supplemented with reports by non-profit and government entities (grey literature), as well as information from experts representing multiple disciplines relevant to the analysis (see Appendix B).

Limitations in the Peer-Reviewed Literature

Most studies used cross-sectional designs, which limited the conclusions that could be drawn and suggested that additional research will be needed to provide more definitive evidence. Among the 16+ systematic reviews that were identified, all but one were dominated by cross-sectional and qualitative study designs, with a limited number of longitudinal studies. Findings from these studies were generally consistent, however. **Despite these limitations, our findings regarding the overall impact of the built environment on healthy aging were robust. Elements of the built environment including walkable, mixed-use communities with proximity to commercial services, businesses, and transportation; green spaces and greening; and third places are strongly associated with positive health outcomes, including those for older adults. The evidence supports the conclusion that specific features of community design, access to transportation options, and greening can enhance healthy aging.**

Evidence Review Findings

We began our review by examining naturally occurring healthy aging communities to learn from these natural experiments. We also sought evidence comparing the health impacts of age-restricted versus multigenerational communities. We then summarized a substantial body of evidence on the health

impacts of elements of the built environment, green spaces and greening, third places, and transportation. We also summarized the limited evidence available on designs of communities to support individuals with dementia or I/DD.

Natural Healthy Aging Communities

To learn from natural experiments, we searched for peer-reviewed evidence about the built environment and community design features that contributed to extended longevity in communities with a disproportionately large proportion of people living to advanced age in good health. Our search identified two types of communities: "Blue Zones" and "naturally occurring retirement communities" (NORCs). Each has distinctive characteristics associated with healthful longevity. Due to very limited peer-reviewed literature on this topic, the following summary was based primarily on the grey literature.

"Blue Zones"

Dan Buettner, with support from National Geographic, identified five unique communities whose residents include an unusually high number of centenarians with generally low levels of chronic disease.[4]

These communities, dubbed the "blue zones," include:

- Okinawa, Japan, where women over age 70 years comprise the longest-lived population in the world
- Loma Linda, California, where Seventh Day Adventists live 10 years longer than other North Americans
- Ikaria, Greece, which has one of the lowest known rates of middle-age mortality and the lowest documented rate of dementia in the world
- Sardinia, Italy, which has the largest concentration of male centenarians in the world
- Nicoya, Costa Rica, where residents are twice as likely as U.S. residents to reach 90 years of age in relatively good health

All five communities are physically isolated from large cities; three are on islands (Sardinia, Okinawa, and Ikaria), one was on a peninsula (Nicoya) and three were on or near mountainous or hilly terrain. Based on observations across these communities, Buettner identified common socio-cultural characteristics associated with healthy aging and longevity. These characteristics include **stress reduction** through prayer, napping, and happy hour; **a sense of purpose among individuals**; a **healthy diet** that includes moderate alcohol consumption and a plant-dominated diet; and **social cohesion** through intergenerational family living, belonging to faith-based communities and associating with positive social circles that support healthy behaviors.[4,5,61]

Although the built environment was not among the blue zone characteristics deemed to promote healthy aging, U.S. communities could consider using the built environment as a catalyst for socio-cultural change. Land-use planning strategies may encourage (or inhibit) behaviors and lifestyles that mimic those in these communities with exceptional longevity. For example, using the common socio-cultural characteristics, Buettner developed the Power of 9 framework and the Blue Zones® Checklists described on the comprehensive Blue Zones® website. Several U.S. communities engaged Blue Zones® to help implement the Power of 9 practices, many of which involved land use and the built environment at the population level to improve population health. As a result, through civic and private initiatives, access to green space, public transportation options, walking/hiking trails, bike paths, parks and other public spaces for outdoor/indoor socialization was increased, and designs of streets, bike paths, and sidewalks were improved.[62]

Table 2 summarizes interventions and their outcomes from four Blue Zone® projects carried out in the U.S. from 2010 to 2016.[63] Improvements to community infrastructures and public health campaigns/programming (e.g., on healthy eating, smoking cessation, or a "Walking School Bus" for children) reportedly increased community-wide physical activity, weight loss, and self-reported wellbeing. However, no details about evaluation methods or how project analyses were conducted are publicly available, including information about possible confounding policies or programs that may have co-occurred during the same time period as these Blue Zone® projects.

TABLE 2

U.S. Community Blue Zone®* Projects (2010-2016)

CITIES	INTERVENTIONS AND OUTCOMES
Albert Lea, MN	Added 9 miles of new sidewalks and 3 miles of new bike lanes connecting businesses, parks, and neighborhoods; updated traffic signs to create safer walkways and crossings for pedestrians. Data showed a 96% increase in pedestrian traffic over 4 years and a 38% increase in biking and walking since 2009.[64] Blue Zones® estimated these improvements added 2.9 years to individuals' lifespans since Albert Lea implemented the changes.
Fort Worth, TX	Built community and school gardens to encourage healthy eating and increased bike routes and bike route signage. Instituted a community-wide exercise program (30 minutes for 3 or more days a week) that increased the proportion of residents participating in regular physical activity from 53% to 62% over 4 years; gained 4 points (to achieve a 62.5) on the Well-Being Index since inception of the project.
Spencer, IA	Added community gardens and worked with local restaurants on menu improvements, resulting in an 11% increase in community-wide fruit and vegetable consumption. Added 142 "Walking School Bus" routes to encourage physical activity in children through walking to school.[65]
Beach Cities, CA *(Manhattan Beach, Hermosa Beach, and Redondo Beach)*	Among three contiguous beach towns, the Beach Cities Health District established 37 "Walking School Bus" routes, instituted community-based smoking cessation programs and stress reduction campaigns. These interventions were associated with a reported 68% drop in childhood obesity rates (for the Redondo Beach community), a 25% increase in physical activity by children, a 15% drop in adult rates of overweight/obesity and a 36% reduction in smoking from 2010 to 2017.[66]

*Blue Zones, LLC was acquired by Adventist Health in April 2020; Adventist plans to incorporate these practices into additional community-based health care practices.[67,68]

Naturally Occurring Retirement Communities (NORC)

Complexes or neighborhoods that are not planned or marketed with older adults specifically in mind, but nevertheless house a high percentage of older adults, are classified as naturally occurring retirement communities.[16] While no specific definitions of "older adults" or "high percentage" have been established for NORCs, studies of these communities define NORCs as communities comprised of 40% to 65% of older adults, defined as aged 55 or 65 years and older.[17]

Two peer-reviewed studies described community features and associated resident behaviors in two separate NORCs. Grant-Savela et al. published a descriptive study on cross-sectional patterns of self-reported active living among older adults living in a rural, Midwestern NORC (n=197).[69] This community, classified as a long-standing resort community, offers outdoor physical activity opportunities, including walking paths, fishing, boating, biking, and golfing. A downtown area hosts numerous shops and restaurants, a yoga/Pilates studio, and two coffee shops that serve as gathering spaces for community members. Aside from walking, most physical activity occurred within households; thus, residents' physical activity levels were not associated with the community's activity centers or program offerings.

Tremoulet et al. conducted qualitative research into connections between the built environment and social health among older people living in manufactured-home parks in rural, suburban, and urban settings in Oregon (n=48). Residents living in these small (fewer than 200 homes), gated communities reported feeling safe and having high levels of social support in these communities.[16] The communities' proximity to local businesses and services provided opportunities for walking. Affordability was a key driver for many residents living there; however, because manufactured homes are often placed on rented land, concerns about long-term ability to remain on the land was a potential threat to residents' ability to age in place.

Comparisons of Age-restricted and Intergenerational Communities

Age-restricted communities are subject to different zoning regulations than intergenerational communities, which have direct impacts on land-use planning. We identified very few studies that examined differences in physical and emotional health outcomes between age-restricted and intergenerational communities, and those we found reported inconsistent findings.

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Some researchers concluded that institutional, spatial, and cultural segregation of people of different ages increases risk of isolation in later life and impedes socialization between young and old, thus inhibiting a generative society.[70] Generativity (also identified as one of the important social cohesion factors in the blue zone communities) is the concept of "giving back" to community, which provides a sense of fulfillment and meaning for all generations. Purposefully segregated communities, known as "age-restricted" communities, commonly limit residents to those 50 or 55 years and older.

Three peer-reviewed, qualitative studies identified factors with potential health implications according to each community type. Tanaka et al. examined relationships between generativity, loneliness, and quality of life in a group of Native American elders living in a rural Northern California community (n=98).[71] In this study, generativity was associated with higher quality of life scores, but not with changes in feelings of loneliness. This suggests that having opportunities for older adults to interact with younger generations may be beneficial. A qualitative study of 47 San Franciscan seniors living in senior housing cited benefits such as affordability and easy access to social opportunities and services; but the authors also noted that these seniors may have been driven to live in their age-restricted housing by a lack of parallel services, social activities, and conventional housing options in the neighborhood they lived in before.[72] In another qualitative study of 51 suburban-dwelling older adults living in an age-restricted community, Nathan et al. found that focus group participants expressed a preference for being in the company of peers their own age, especially when attempting new physical activities. As described by one participant in the study: *"When we are exercising or whatever, we are all at the same fitness level, and we've all got achy knees and achy this and that; we're not standing next to slim, trim younger people."*[73]

Multiple key informants noted that multigenerational housing can be a cultural preference or a way of life. One informant said that "In India, multigenerational living is called normal life; however, in Japan most older adults live by themselves." Several housing experts noted that, in addition to cultural preferences, medical reasons influenced the recent trend toward increasing numbers of homes with accessory dwelling units, or in-law suites. These units provide opportunities for family or non-family caregivers to live on the same property as the people they care for. Key informants also noted that intergenerational communities provide opportunities for younger neighbors to help older neighbors, which can prolong independent living. One informant reported that prospective residents for a planned healthy aging community were uninterested in living with their peers exclusively. Future research comparing intergenerational communities with age-restricted communities will contribute to a larger conversation regarding social cohesion and connectedness.

> "If you are starting with a clean slate, why would you continue to design and build only for a subset of the population?"
>
> *– Esther Greenhouse, MS CAPS Built Environment Strategist commenting on age-restricted communities*

The Built Environment and Healthy Aging

The built environment can be a significant facilitator or barrier to physical activity and mobility. Broadly speaking, **there is strong evidence that features of the built environment influence social cohesion and levels of physical activity, and improve important health outcomes for older adults.**

Physical Activity, Mobility and Impacts on Healthy Aging

Physical activity, including walking and biking, has well documented health benefits. Woodcock et al. published a systematic review summarizing the large health benefits that result from increased walking and biking, including reductions in dementia, cardiovascular disease, diabetes, cancer, depression and premature death.[74] Maizlish et al. projected substantial health effects of increased physical activity in California, including a reduction in mortality.[75] In addition, greater mobility in older adults is an important factor associated with lowering mortality (and risk of falling) and improving neuromuscular performance or muscle strength, which may in turn reduce the need

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for health care services.[76] A review of 57 studies found evidence of a relationship between mobility and the ability to maintain independence, which may support mental and social health.[76] The reviewers noted that reduced mobility can increase loneliness and health harms, especially for those who live in auto-centric communities and lose their ability to drive.

The Built Environment, Mixed Use, and Physical Activity

Twelve systematic reviews, plus a review of (11) reviews on the topic of the built environment and health concluded that well-maintained, mixed-use neighborhoods with shorter blocks, good lighting, pleasant scenery, and access to public transit increased walking among individuals of various cultural backgrounds and ages.[76-88] This, in turn, improved physical activity, increased social cohesion and social capital, and reduced rates of overweight, depression, and reported alcohol abuse.[76-79,85,89] An additional systematic review and meta-analysis focused on the impact of the built environment on obesity and cardio-metabolic health outcomes.[83] The majority of the 37 longitudinal studies analyzed were of middle-aged to older adults or older adults. The review found strong evidence that residency in neighborhoods with better walkability led to improved health outcomes through reduced obesity, type II diabetes, and hypertension. In a cross-sectional exploration of suburban communities, Wood et al. found that having a variety of housing structures within a mixed-use neighborhood was associated with stronger social networks, feelings of safety, and participation in neighborhood activities.[90]

In contrast, the lack of mixed land use was associated with poor connectivity of sidewalks, poor access to public transit, and increased dependency on cars, and which inhibited activities of daily living and independence.[76-88] Several studies provided examples of barriers to mobility and physical activity in the built environment. For example, poor sidewalk conditions and building entrances that are difficult to navigate prohibit people with chronic pain or physical or cognitive disabilities from fully participating in community-based activities, which compounds isolation, and may lead to future health challenges.[91] In a longitudinal study of 7,000 adults aged 65+ years, Letellier et al. found that older adults with less space for activity (limited activity space = requiring help to shop, unable to move without being accompanied, or confined at home or to their neighborhood) were more likely to experience very low body weight, diabetes, cardiovascular disease, depression, and dementia.[92] Keysor et al. found that the presence of high barriers to mobility was associated with

reporting a greater number of challenges to the activities of daily living.[93] Ensuring ADA-accessible and barrier-free entrances to buildings are crucial for persons with disabilities, especially as they grow older.[94-96] Unless mobility barriers are accommodated, older or disabled adults will have difficulty achieving the health benefits that result from physical activity.[97] Such barriers include:

- Inaccessible (based on ability) sidewalks, paths, or streets[98,99]
- Poorly maintained paths or sidewalk obstructions[98]
- Buildings that are difficult to access (e.g., have steps or high transitions)[91,98]
- High traffic volume and frequency of traffic accidents[100,101]
- High crime rates[99]

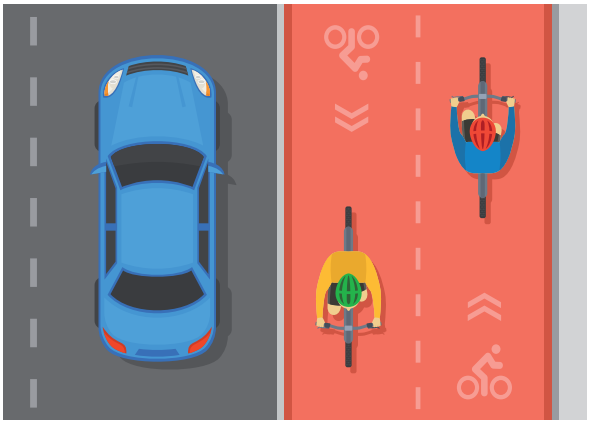
Other studies noted that barriers to safely navigating neighborhoods include the presence of sloped or hilly streets, which were associated with increased (non-transport) sitting, poor mental health, poor self-assessed health status, and functional limitations.[102-104]

NEW URBANISM

A movement to return to human-scaled urban design where neighborhoods are 5-minute walks from center-to-edge using walkable (short) blocks and streets, shopping and housing in close proximity, and accessible public spaces where (see Chapter IV for applied examples).

The U.S. Community Preventive Services Task Force has issued evidence-based recommendations on how the built environment and encouraging active transport (walking or cycling) can improve health.[88] The 2016 recommendations are based on a systematic review that included 90 studies (16 longitudinal and 74 cross-sectional).[88] The CPSTF found sufficient evidence to recommend built environment designs and strategies coordinated with enhanced pedestrian and cycling transportation systems to improve health.[88]

- **CPSTF-recommended land-use strategies** include:
  - Physically and functionally integrated, mixed-use neighborhoods (housing, retail, office, cultural uses)
  - Adoption of new urbanist designs
  - relaxed planning restrictions to reduce sprawl and increase housing affordability
  - close proximity between housing and retail/essential services, parks, and recreational facilities
- **CPSTF-recommended transportation and pedestrian designs** included:
  - Street designs that increase street connections and create multiple route options, and shorter block lengths
  - Use of sidewalks, trails, traffic calming, street lighting and landscaping
  - Bike trail systems and protected bike lanes
  - Expanded access to public transportation (frequency, locations, and connections)



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Components of Community Design

This section provides an overview of community design elements associated with healthy aging and details about specific components of community design that can impact health: street layout, sidewalk design and safety, transportation and walkability, Third Places, green spaces, and community design for adults with dementia and I/DD.

A number of studies correlate community design elements with favorable intermediate or long-term physical and cognitive health outcomes for older adults (Table 3). In particular, public restrooms, parks, streetlights, frequent benches offering good support, and high land use mix are elements with the most evidence for positive health outcomes (see Greening section for more evidence regarding parks).

TABLE 3

Community design elements associated with favorable intermediate or long-term health outcomes

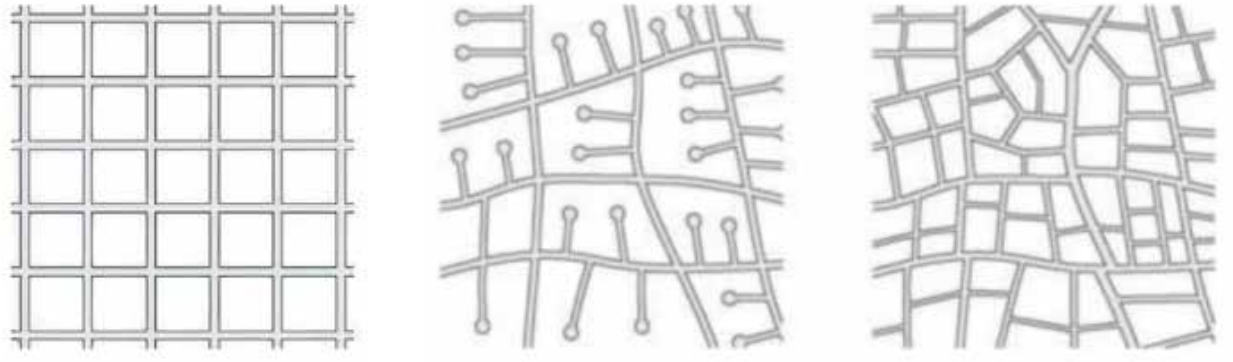
DESIGN ELEMENT	ASSOCIATED HEALTH-RELATED OUTCOMES			
	Increased physical activity	Reduced sitting	Increased walking	Other
Good neighborhood walkability	X[77,80,87]			
Streetlights	X[1,77,99,117,165]	X[374,128]		
Frequent warm (non-metal), supportive benches with armrests	X[1,77,78,84,375]	X[102]	X[117,108]	
Parks	X[77,80,110,150,152]		X[82,147]	Decreased prevalence of knee and low back pain[148] Not associated with prevalence of other chronic health conditions[378]
Public restrooms	X[77,78,84,108,374]	X[102]		
High land use mix (retail, services, homes, parks, etc.)	X[77]		X[82,87,126,376]	May reduce odds of cognitive impairment and dementia[128,379] Associated with higher BMI levels[158]
High population density			X[115,116,376]	Lower BMI[103] Decreased prevalence of knee and low back pain[148]
Easy access to building entrances	X[82,377]			
Porches	X[85]			
Drinking fountains	X[78]			
Historic buildings, monuments, and/or building of varying style			X[117]	
Blue spaces (water features such as rivers, canals, or ponds)			X[X84,117]	

Street Layout

This subsection provides a closer look at the evidence related to street layout and health considerations. Community configurations that support healthy aging and independence for adults, including those with I/DD, include streets that help orient people to residential dwellings, recreational and community facilities, retail facilities, and educational facilities. Some studies focused on micro-design elements, while others looked at macro-design elements (neighborhood-wide). Neighborhood block length is an example of a micro-design element. Satariano et al. (n=884 adults 65+ yrs) found that residents in neighborhoods with shorter median block lengths were significantly more likely to walk than residents in neighborhoods with long median block lengths.[380] Mitchell and Burton found that an irregular grid design is the easiest street layout to navigate for persons with dementia (n=45).[207]

FIGURE 4

Irregular grid patterns were the most navigable for people with dementia

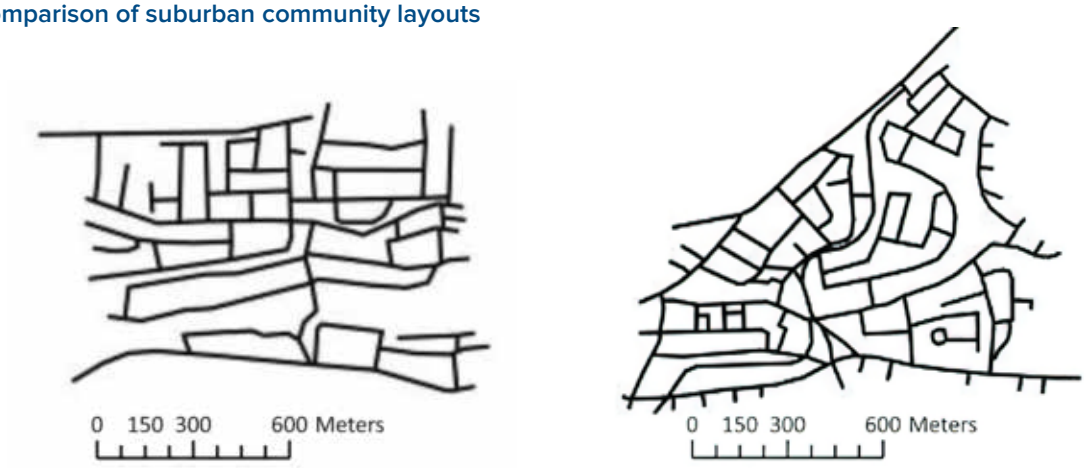


Uniform grid pattern | 'Lolipop' pattern | Irregular grid pattern

Source: Mitchell and Burton., 2010

FIGURE 5

Comparison of suburban community layouts



A. Preferred suburban community layout. B. Complex suburban community layout.

Source: Ioannou B., 2019

Ioannou (2019) conducted a case series study of 3 suburban and 2 "central" neighborhoods in Cyprus (n=25), to investigate how older adults perceive and evaluate their place of residence.[381] Respondents living in city centers scored lowest in satisfaction, due to narrow walkways, heavy traffic, and dense parking. Older adults reported having a difficult time walking in such an environment and did not feel safe. Suburban respondents reported higher satisfaction, mainly due to lower density, less traffic, and more space to walk. Of the suburban designs evaluated, the lowest scoring suburbs contained a complex street layout. The image above compares the highest scoring layout (A.) with the lowest scoring layout (B.). Although the low scoring community contained ample private green space, its streets had multiple dead ends, varying block size and orientation, and complex intersections. This stands in contrast with the highest scoring suburban community, which retained some complexity in its design, but mostly adhered to a grid-style street network with fewer complex intersections and more consistent neighborhood orientation throughout. The southern edge of the preferred neighborhood abuts a national park.

Street layouts and designs are associated with physical activity, critical to the health of older adults. Neighborhoods with high levels of street connectivity, intersection density, short block length, and diverse land use mix were associated with higher levels of physical activity, and slower rates of cognitive decline.[77,81,115,127,382-385] Other studies reported that high intersection density was associated with better physical functioning, and fewer traffic accidents involving older adults.[100,159,386-388] Three studies reported that designs that support lower traffic volume and speed limits were also associated with higher rates of physical activity, as these factors contribute to a more walkable environment.[100,159,388]

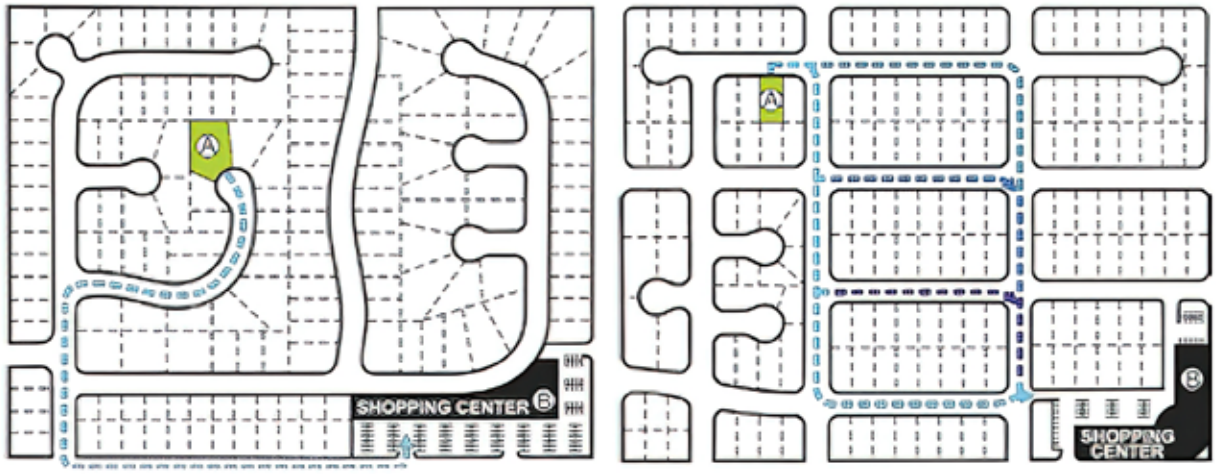
In addition to peer-reviewed evidence, many land use planners use the Complete Streets approach when designing their transportation network (roadway/sidewalk/bike path), which accommodates all users' needs to promote safety, healthy lifestyles, and accessibility.[389,390] There is no single prescribed "complete street" as each street depends on the community needs, environment, and surrounding street network, but these streets usually include several of the following features: sidewalks, bike lanes (or wide paved shoulders), special bus lanes, comfortable and accessible public transportation stops, frequent and safe crossing opportunities, median islands, accessible pedestrian signals, curb extensions, narrower travel lanes, and roundabouts.

The left side of the image below (Figure 6) shows a conventional street layout design, which creates longer trips and fewer options for travelers; the right side of the image shows shorter blocks and offers more types of travelers more flexibility and improves travel efficiency. This approach offers health benefits by increasing safe walking and biking options. The shorter block lengths (300-400 feet) reduce travel distance by providing more direct access to destinations. Complete Streets notes that smaller block length improves future development options allowing land use to evolve over time. Cities are changing their approach. For example, after updating its City Code to achieve Complete Streets, North Myrtle Beach, South Carolina now requires most blocks to be human-scaled.[391]

A specific example of roadway design is a ringed or looped pattern of roads around cities. Many European cities have become bike-centric by investing in bicycling infrastructure and prioritizing bikes over cars. A few towns have been intentionally designed from the start to be bicycle-centric. In Houten, the Netherlands, for example, cars are restricted to using loops around towns instead of direct routes to dissuade driving and encourage biking.[b]

[b] S. Handy. Personal communication, December 12, 2020.

FIGURE 6
Complete Streets: Comparison of street network design showing preferred street layout on right.



Source: Complete Streets with image by Kimley-Horn and Associates, Inc. and Digital Media Productions

FIGURE 7
Layering design techniques

Source: Building Better Townhouse Communities. Montgomery County Board of Commissioners.

Another important aspect to street design is awareness of levels of privacy and the important practice of layering design features to ease transition from private to public spaces. Figure 7 above shows an example of layering: home porch ➔ front yard ➔ sidewalk ➔ tree lawn ➔ street (see Chapter IV for design examples). The health benefits of green landscaping strategies are discussed the Greening section below.

Sidewalk and Street Design: Safety and Accessibility

Older adults are a vulnerable traffic safety group, and in 2017 accounted for 20% of all U.S. pedestrian deaths.[392] Cloutier et al. reported that 65–79-year-olds experienced the highest proportion of pedestrian/vehicle interactions at intersections compared with other age groups. Research indicates that streets and sidewalks with features that reduce falls and pedestrian-auto or pedestrian-bike accidents also increase walking. Examples of these beneficial street design and walking path features include:

- Physical boundaries between pedestrians and motorized/non-motorized transport, such as sidewalks separate from cycling paths, which are separate from car traffic.[77,84,86,142]
- Presence of zebra-striped crossings at intersections[77]

> "How do we design the layout of a community to promote walking? What kind of destination can be created within the development to walk to? Trees for shade and periodic benches enable both walking and social interaction."
>
> *– Esther Greenhouse, MS CAPS Built Environment Strategist*

- Crosswalk traffic light settings set to permit enough time for persons with mobility issues to complete the crossing safely.[89]
- High quality, flat, even, non-slip, well-maintained, and continuous sidewalks and footpaths (accessible to users of all assisted mobility devices)[77,84, 86,93, 99,119,206,386,393-396]
- Step-free transitions[377]
- Unobstructed paths and sidewalks (clear of signs, sandwich board signage, garbage cans, cars, utility poles, drainage grates, etc.)[91,119,377]

Street designs associated with more pedestrian-auto/bike interactions (near-accidents) included crossings involving arterial or collector streets and the presence of parked cars near the crossing.[397] Street designs associated with fewer pedestrian/vehicle interactions included one-way streets, distinct crossing surface materials, presence of separate bicycle paths, and presence of crosswalks.[397]

A systematic review and meta-analysis by Cerin et al found that barriers in the form of stairs, hills, slopes, puddles, narrow or lack of sidewalks, and cracked pavement inhibited the ability of persons with mobility challenges to participate in outdoor walking and generally navigate around the community.[398]

As noted in Table 3, sidewalks are a key feature for accessibility, frequently cited as important for supporting safe and walkable neighborhoods, and crucial for pedestrian safety and comfort.[77,132,142,394] Wide, flat sidewalks paved with a stable, non-slip material were most preferred.[108,373] However, sidewalks may be a source of hazards when poorly designed or not maintained. Broken sections of sidewalk can be both a tripping hazard for pedestrians and an accessibility challenge for wheelchair users.[373] (See the Sacramento County Department of Transportation, Improvement Standards: Street Improvement Standards for examples of Sacramento county-specific regulations and guidance.)

Gamache et al. systematically reviewed 41 studies related to pedestrian infrastructure designs that accommodate individuals with motor, visual and hearing disabilities.[372] They reported that most studies were of low quality; rarely tested design effectiveness in the intended group; and offered conflicting recommendations for optimal design. They concluded that design features could not address the competing needs of disparate disabilities. For example, textured sidewalks designed to assist people who are blind may be difficult for a person with a mobility disability to navigate with a walker. The authors concluded that more research is required to develop and test universally-accessible pedestrian infrastructure to support varying accessibility needs.

Curb cuts are another feature that are crucial to facilitating walkability and pedestrian safety and comfort.[73,93,373] They are especially important for individuals with vision or mobility challenges or pain from injury or arthritis who could not otherwise confidently step down from a standard curb height.[374]

Harris et al. conducted a cross-sectional web-based survey of adults aged 60+ who use a wheelchair and identified the following street design features.[373]

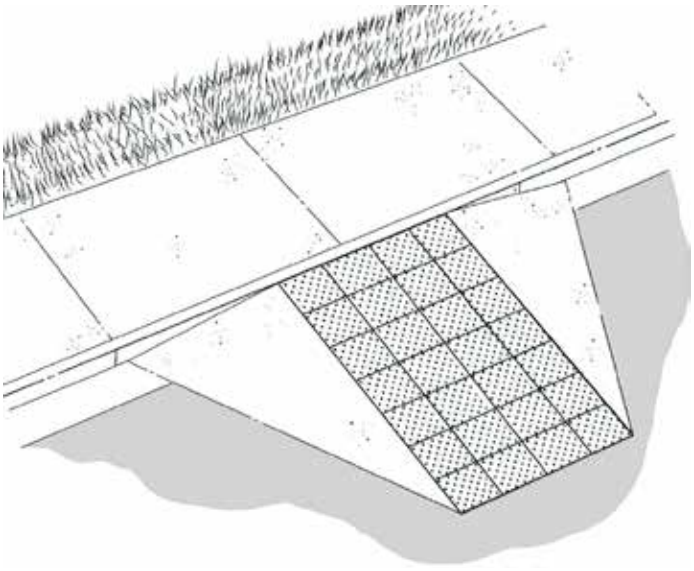
- *Barrier:* Street intersections with > 2 lanes and parking on both sides
- *Barrier:* Street crossings not at intersections with curb cuts

TOPOGRAPHY CONSIDERATIONS

Topography is an existing condition that every developer, urban planner and, ultimately, each resident must navigate. Fitzgerald and Caro identify topography as one of the "preconditions" influencing the design of an age-friendly community (in addition to population density, weather/climate, social and civic organization, health and social services.)

Although several of the Blue Zone centenarian communities had hilly terrain, this kind of terrain can be challenging for older residents as they lose mobility. Fitzgerald and Caro note that low income communities in Rio de Janeiro, Brazil or Medellin, Columbia are located on steep hills. In the case of Medellin, urban planners met the grade challenge with an escalator and gondolas that connects the city center to a hillside residential area (vertical gain of 1,260 feet), which improved access for all residents, reduced walking time (and traffic) and opened an area that was otherwise inaccessible to older people or those with physical disability.[131]

FIGURE 8
Built-up curb ramp



Example of flared curb design to facilitate mobility. Source: Information and Technical Assistance on the Americans with Disabilities Act.

- *Promoter:* "Built-up" curb ramps with flared sides (Figure 8.)

Appropriately planned street and sidewalk designs both protect vulnerable pedestrians and create a welcoming environment that supports physical health. (See **Appendix E** for proposed untested sidewalk and curb cut designs by Gamache et al.)

Crosswalks are an important safety feature for older adults.[88] Older adults and adults with mobility challenges may take longer to cross than the average traffic light permits, especially if the crossing is greater than 2 lanes in width.[73,373] This can contribute to the disproportionately high number of pedestrian-vehicle interactions seen for this population. The amount of time given to pedestrians should be long enough to permit slower walkers to cross safely before the light changes.[372, 373]

Clearly marked, zebra-striped, controlled crossings should be made available near busy intersections, bus stops, and key destination points (e.g., grocery stores, parks, shopping centers).[372] Ensuring clear sightlines for both the pedestrian and surrounding traffic are important to reduce the likelihood of collision.[397] This may involve prohibiting parking near crosswalks.[373]

Curb ramps and highly visible pushbuttons should be present to promote accessibility for both walkers and mobility device users.[372] Pushbuttons, if present, may also include a small chirp or sound to help the visually impaired, and lighting or bright coloring to help the hearing impaired locate the button, however evidence of effectiveness is inconsistent for these features.[89,372] Crossing islands should be wide enough for a wheelchair or scooter to maneuver across comfortably and confidently and include tactile paving for the visually impaired.[73,372] As mentioned above, some tactile paving has proven risky for individuals using walkers or scooters; selected materials should prove navigable for all types of pedestrians.[374]

The absence of **street lighting** was a frequently cited deterrent for evening walks.[77] Walking paths and sidewalks should be well-lit. Lighting is also an important safety concern for individuals with deteriorating eyesight.[95] The UC Davis California Lighting Technology Center researches outdoor lighting and lighting control systems that enhance visibility, safety and security, and minimize light pollution.

To keep pedestrians and non-motorized traffic safe, having separate, but distinct **cycling and walking paths** are important.[77,105] Research shows that visual cues such as colored pavement, pavement striping, or a boundary strip should be used to distinguish cycling paths from walking paths. Cycling paths should also be protected from motorized traffic with a physical boundary.

Dr. D'Agostino notes that both high-speed commuter bike routes and slower bike paths can be valuable additions to a community. They must both be designed with safety in mind; "if you're not comfortable sending your 7-year old on it, it's not good enough."[c] Dr. Handy adds that safe bike trail networks need to be designed to provide connections throughout the community, so that bicyclists have a safe route from start to finish. The network may include trails, but it can also include on-street paths that provide some level of protection for bicyclists.[d]

[c] M. D'Agostino Personal communication, January 7, 2021.
[d] S. Handy Personal communication, December 12, 2020.

Transportation and Walkability

Transportation is often cited as an important feature influencing healthy and active aging and maintaining independence.[76,105] The U.S. Community Preventive Services Task Force recommends combining transportation system interventions with land use and community design strategies in order to increase physical activity.[88] This section discusses the evidence about transportation infrastructure characteristics that promote healthy and independent living in age-friendly communities. Note that the studies about public transportation cited in this review were conducted in urban areas rather than suburban or rural communities.

Walkability

The concept of "walkability" can be described as the extent to which the built environment of a neighborhood encourages people to walk.[30] Different methods exist for measuring walkability (e.g., Walk Score, Walkshed, PIndex, Ewing's Walkability Index), which place variable emphasis on neighborhood features such as residential density, intersection density, retail floor area ratio, and land use mix.[30,106]

Loh et al. (2019) used the Walk Score to assess the walkability of the 30 largest U.S. cities. Sacramento ranked 24th for walkability based upon access to everyday needs (shopping, transit, parks, etc.) within walking distance.[107] "Walkable urban places" have high concentrations of economic activity embedded in "pedestrian-scaled" design as compared with a driving-oriented design dominating suburban communities (Table 4). Notably, 2% of Sacramento's walkable places were in the surrounding suburbs as compared with Miami, which was the top ranked city with 44% of its suburban areas designated as walkable urban places.

Loh et al. suggest that *traditional geographic classifications (central city, suburban, exurban) become irrelevant if the urban form and economic activity lens is applied to any given community; suburban areas can adopt the "walkable urban place."* They assert that there is a proven market for urbanizing the suburbs, citing suburban communities such as Watters Creek (Dallas suburb), downtown Kirkland (metro Seattle), and Avalon (Atlanta suburb). Although there appears to be a substantial untapped suburban market for walkable urbanism, developing those markets requires the low-ranking metropolitan areas, including Sacramento, to change policies and infrastructure investments that historically promoted drivable suburban development patterns. These metro areas could increase transit investment and remove outdated zoning codes that mandate types of development less preferred by the current market.[83] The authors suggest that such policy changes may improve metro economic performance and social equity outcomes.

TABLE 4
Comparison of Suburban and Urban Walkability Characteristics

	TRADITIONAL SUBURBAN DEVELOPMENT	WALKABLE URBAN DEVELOPMENT
Density	Typically low density (0.05 to 0.4 floor area ratio [building total floor area to the parcel size with 1.0 covering the parcel)	Substantially higher (1.0 to 40 floor area ratio, though mostly 1.0 to 4.0 range)
Level of mixed use	Real estate product types generally separated from one another	Relaxed zoning (i.e., "form-based zoning") allowing higher density mix of real estate products
Housing types	Similar throughout the suburb, many single-family homes	Emerging "new" mixed-use product types (e.g., rental apartments over a grocery store on ground floor)
Transportation	Cars and trucks predominant transportation mode	Multiple transportation options, (e.g., bus, rail, bicycle, motor vehicles, walking); destinations (e.g., home, work, stores, and restaurants) within walking distance (0.5 mi)

Source: Loh et al., 2019

Impacts of Personal & Public Transportation on Health

There is a notable divide in transportation options for urban, suburban, and rural residents with urban residents having greater access to public transportation than their counterparts. Four qualitative studies reported older adults having a strong attachment to their cars and relying on them heavily.[73,108-110] However, traffic accident rates increase with age and alternative transportation options to personal auto use are necessary to maintain independent living, particularly for those who lose the ability to drive.[111]

Access to public transit is an important feature for many older adults that has multiple benefits.[82,110,112,113] For example, a study of 323 older adults residing in an age-restricted community found an association between increased rates of brisk walking and those living in closer proximity to public transportation.[114] Close access to public transit has been associated with elevated social participation scores and increased walking.[113] In two separate studies, Liao et al. reported that access to public transportation was associated with lower rates of sitting and increased walking.[115,116] White et al. found a link between access to public transportation and reduced likelihood of feeling limited in social, leisure, and work activities.[110] Other researchers have noted that improving access to high quality public transportation may introduce the added benefit of reducing traffic density, which is an often cited deterrent to walking.78,101,117

Several authors have reported on the challenges older adults encounter when trying to use public transportation:

- Unsuitable timetables and scheduling (buses that run at unsuitable times or too infrequently including limited night, early morning, weekend, and public holiday services)[96,118]
- Inappropriate stop locations (bus stops not located near home, long distances between bus stop and destination, bus stops located too far apart)[118]
- Difficulty with entry and exit (getting on and off a bus difficult due to steps at entry or driver not parking close to curb)[118]
- Confusing routes or unclear signage[119]
- Insufficient space for navigating a wheelchair[120]

A study that focused on access to train/light rail stations[113] also documented similar factors that hindered older adult access:

- Distance from home to the nearest station
- Indirect walking or driving routes
- Physical accessibility within stations (e.g., working elevators/escalators)
- Train service and facility quality

Alternative Transportation Modes

Another important consideration is mobility equity, especially among young people, older populations, and persons with I/DD where mobility can be stymied by a lack of independent transportation options. Opportunities for improving access and mobility equity include bike sharing, car sharing, or ride sharing. To incentivize shared multi-modal mobility, Dr. D'Agostino of UC Davis suggests that communities could offer a "mobility wallet" that allowed residents an easy way to choose and reserve a downtown shuttle seat or scooter-, bike-, or car-share vehicle depending on the needs of their trip and their preferences. This could be offered in lieu of or in addition to a transit or parking pass.

Electric bicycles (e-bikes) have grown in popularity in recent years and may facilitate riding for older adults.[121] A 2020 scoping review of research on e-bikes suggested that their use is associated with longer trip distances than conventional bicycles and reduced motor vehicle use.[122] E-bike-sharing systems located near transit stations could improve access to public transit for those living at distances from transit stations that may discourage walking. An analysis of 12 European bike-sharing systems, which included e-bikes, suggested that such systems improve health by increasing physical activity.[123]

The Sacramento Regional Transit system is piloting a SmaRT Ride program across eight zones in the greater Sacramento Metro region (expansions of several zones was announced in early April 2021). This public ride-share program allows riders to schedule curb-to-curb or corner-to-corner rides through an app or phone number (useful for those who are less "tech savvy"). Passengers are picked up and dropped off at the nearest corner or 'virtual bus stop;' travel must be within their originating zone.[124]

Credit to Metamorworks. Source: Shutterstock.com

Looking to future travel and the role of driverless vehicles, researchers at UC Davis/UC Berkeley have conducted several naturalistic experiments to assess the potential effects of autonomous vehicles (AVs) on travel, hypothesizing that access to driverless cars may result in more travel. They provided participants of all ages a chauffeur to simulate life with an autonomous vehicle, and found that retirees increased their travel in miles by more than three times (341%) compared to an increase of only 83% more miles for the average participant.[125]

Driverless shuttles in operation today in California (e.g., in Dublin and Fremont) typically require detailed mapping efforts to ensure the AV can navigate a specific route. Clear traffic markings should be sufficient for accommodating most driverless vehicles. There are more than five shuttle vehicles approved by the CA Department of Motor Vehicles for testing on public roads without a safety driver (and a total of 56 that have approval for driverless testing with a safety driver) in California. Dr. D'Agostino notes that these vehicles are approved to operate in public road conditions, but if they enter private roads there may need to be assurances provided to the vehicle operators confirming that the right of way will conform to the design requirements of public roads.

According to Dr. D'Agostino, important land-use considerations for AVs relate to parking; some predict that an AV future will require 90% fewer parking spaces. If residents have access to AVs or AV shuttles, these vehicles would not require valuable real estate to sit idly in front of residences waiting for their riders. The AVs (especially the AV shuttles) would park themselves in more space-efficient, or visually pleasing, locations. However, to avoid too many additional vehicle-miles-traveled, such locations should not be too far from pick-up and drop-off locations. The pick-up/drop-off locations could be shared among residences where possible to minimize paved areas and maximize green space and more efficient land uses.

Several key informants also mentioned the Village-to-Village network as another resource supporting independent living, including transportation. This membership-based "virtual village" (with or without fees) enables shared exchanges of services to assist members with daily tasks and chores.[e] Sharing transportation (e.g., to doctor appointments or the grocery store) is a common service used by members. These virtual villages can be incorporated into any development or community.

The Sacramento Area Council of Governments (SACOG), a regional governing body, issued a report about age-friendly communities and transportation for older adults in 2017. They recognize that transportation is critical in order for older adults to remain independent, active, and healthy. Many regional government bodies, such as SACOG, offer developers and local planners data and transportation expertise to assist them with planning innovative transportation alternatives in new or revitalized communities.

Third Places: Socialization, Recreation, and Health

Third places are defined as spaces for socialization that are neither located at a workplace or at home. They can include shopping centers, churches, clubs, restaurants, senior centers, libraries, or outdoor spaces. Parks are considered third places and are discussed in the Community Design section of this report as well as the Greening section. A diverse mix of land use has been repeatedly identified as a factor that supports physical and mental health.[87,126-129] Findings from a systematic review and a cross-sectional study of 6,518 older adults indicated that access to community resources, close proximity to a community center, and a diverse overall land-use mix were all associated with slower cognitive decline.[81,130]

[e] M D'Agostino, J Shapira, S Collins, D Glorioso, personal communications.

Third places strongly influence a person's ability to age in place, but accessibility to those places requires forethought. Planners, architects, and builders are encouraged to consult with older adults about their needs and barriers to using such spaces.[131]

Socialization

Several studies identified third places as important for building community and socialization.[77,126,132-134] For example, a cross-sectional study found that third places were associated with social support networks.[133] A qualitative study of residents in an Australian suburb found that third places (such as clubs, shopping centers, churches, restaurants, libraries, or community centers) were the hubs for most social interaction.[132] Senior or community centers in particular were popular places for forming small clubs and meeting with neighbors.[84,135-137] An alternative to the standard senior center for men is found across the UK and Australia; "men's sheds" are communal spaces for sharing tools and equipment and serve as a gathering space to work on projects, share skills, and promote bonding. Crabtree et al. described the unique challenges older men can face with making new friends later in life and conducted a series of qualitative interviews with a sample of members of men's sheds.[138] Their work found that after joining, men's shed participants expressed improved levels of social interaction, outlook, and fitness, and decreased levels of depression, after joining.[139,140] Recently, this concept has been extended to women, with the creation of "women's sheds" in Australia, New Zealand, the UK, and Ireland, but no studies evaluating outcomes for participants have been published yet.[139,140] A different study found that dense neighborhoods were associated with residents reporting an increased number of close relationships and opportunities to meet new people (n=1,344).[137] These impacts were greatest for individuals living closer to the city center where third places are prevalent.[137]

Outdoor spaces are an important third space. Several studies found that places with ample shade or tree cover, access to public restrooms, and supportive (non-metal) benches can also function as third places and promote social interaction.[141-143] Community gardens are another type of third place, for sharing tools, knowledge, and opportunities for social bonding, physical activity, and improved nutrition.[144,145]

Image of third place with seating, greening, and walking path. Credit to Jamesteohart. Source: Shutterstock.com

CREATING A THIRD PLACE FOR OLDER ADULTS

Ibasho House was established to address challenges with a rapidly aging Japanese population and reduce the isolation often experienced by the growing cohort of people 65 years and older in Japan. Ibasho means "a place where you can feel like yourself" in Japanese. Ibasho creates more inclusive and resilient communities by ensuring that elders remain integrated and active in their communities—ensuring a sense of purpose similar to that experienced by Blue Zone® centenarians. Ibasho House was founded in response to community need following the 2011 earthquake/tsunami disaster and is adjacent to long-term disaster recovery housing for people displaced from the earthquake. Ibasho House focuses on healthy, retired elders with middle to low incomes who want to engage in meaningful activities and contribute to their communities. Resident evaluations revealed heightened self-efficacy, increased intergenerational friendships, and a deeper sense of community belonging. Elders wanted to be close (but not too close) to the center of their neighborhood for walking access to services such as an ATM, elementary school, post office and grocery store. Private funding from Honeywell, Operation USA and the World Bank helped develop, evaluate, and replicate this intergenerational approach in Nepal and the Philippines. Ibasho House founder, Emi Kiyota, has paused in pursuing partnerships with several U.S. cities due to the COVID-19 pandemic.

Third Places and Physical Health

Close proximity to a variety of services found in third places has been identified as supporting the physical health of older adults by encouraging walking and providing access to health services or healthy food that can be found among nearby destinations. These beneficial services include:

- Parks, water features, or open space[73,77,80,82,84,115,117,141,146-152] (Table 3)
- Shops, restaurants, cafes, or other miscellaneous services[77-80,82,86,126,137,142,153-155]
- Recreational facilities[77,80,84,112,135,142,151,153,156-158]
- Fitness centers or other exercise opportunities[77,159]
- Banks, libraries, and postal services[73,135,160,161]
- Cultural and historical facilities[156]

Third places associated with improved physical health, but not necessarily related to walking include:

- Affordable grocery stores with fresh foods and ample parking with wide parking spaces to accommodate mobility-assistive devices[73,84,95,108,117,135,148]
- Health services (especially pharmacies) [73]
- Few or absent fast food outlets (associated with reduced prevalence of obesity)[85]

Aesthetics, socioeconomic factors, and feelings of safety in third places were also influential factors for physical health.[142,154,162-166]

HOME DESIGN: SHARED SPACES THROUGH PORCHES, PATIOS, AND TERRACES

Aspects of the home itself may be oriented or designed to encourage neighborhood socialization. A systematic review of 93 studies by Luciano et al. identified several home features that were linked to improved neighborhood socialization including balconies, patios, porches, and/or terraces of adequate size to be accessible to older people navigating outdoor furnishings (chairs and tables). Additionally, positioning homes so that residents can overlook communal areas and other shared spaces increased socialization and decreased feelings of loneliness; for some their views might serve as their only opportunities to interact with green space which has known health benefits (see section on Greening below). Based on their systematic review and input from key informants, Luciano et al. also proposed a framework and scoring scheme for assessing the age-friendliness of housing.

Katie McCamant, a co-housing advocate, concurred with the importance of right-sized porches and patios and described many homes as having an "image of porch" that is actually too small to be functional as a comfortable place to sit. She suggested thinking of them as "a room" big enough (7-8 feet deep) for a table and chairs at sidewalk level. "This is where most people will sit. They need room to get up and move around."

Residential Proximity to Third Places and Health

The locations of third place destinations in relation to a resident's home, and the locations of destinations in relation to each other, were frequently identified as important for promoting several aspects of health. To facilitate walkability for older people, the distance from residence to essential services (e.g., bank, post office, grocery store, and leisure facilities) should be within 400-500 meters from the home.[79] Longer distances to a store were associated with reduced walking frequency among older adults in a survey of transportation habits and preferences conducted in eight Northern California urban and suburban settings. For every 400-meter increase in distance to a store, older people's walking trips (average of 2.43 trips/month) decreased by 0.90 trips per month.[167] Three separate studies have documented that residents of highly walkable, recreationally dense communities were more likely to report lower BMI and higher levels of physical activity than communities with low walkability.[168-170]

Green Spaces, Greening and Health

Greening refers to vegetation in the environment, including grasses, shrubs, and trees.[171] Research, policy, and practice regarding associations between greening and health comprise a rapidly evolving area of interest. The body of research examining the relationship between greening (including trees, parks, gardens, and other natural settings) and health is robust enough that multiple systematic reviews have been published on the impact of greening on health.[172-176] Greening has been associated with a wide variety of beneficial health outcomes, including increased physical activity, reduced overweight/obesity, and improved mental health.[173] In addition studies suggest that greening is associated

with reduced impacts of chronic diseases such as cardiovascular disease and cancer.[174,176] Residential greening may also be linked with reduced mortality.[175,176] A number of potential causal pathways for achieving these beneficial health effects have been proposed, including mediation through increased physical activity, reduced stress, enhanced social interaction, and healthier physical environments (e.g., heat and noise mitigation, reduced air pollution).[173,177]

Greening and Health in Older Adults

A recent study sought to determine the aspects of green infrastructure that were more strongly associated with better health outcomes for older individuals. The researchers found that more extensive tree canopies were associated with better scores on a composite measure of population health in seniors, including both physical and social aspects of health as measured by the English Indices of Multiple Deprivation [IMD]. They also found a strong association between better IMD health scores and living in proximity to larger patches of vegetation cover.[178] This latter finding is consistent with another study which found a positive association between eye-level street greenery and walking behavior in older adults (i.e., seniors exposed to higher levels of greenery tended to walk more).[179] Additionally, a longitudinal study of 5759 participants (aged 50 to 74 years at baseline) showed that increased exposure to greening was associated with greater preservation of physical functioning.[180] Finally, a recent systematic review including 27 individual studies suggested that, even for people with mobility impairments, health benefits in physical, mental, and social domains may be achieved through access to nature, whether via passive exposure or through active rehabilitative interventions.[181]

Mental Health

Living in greener areas was associated with up to a 37% lower odds of depression in a study of almost 250,000 Medicare beneficiaries (age 65 or older). In addition, after statistical adjustment for age, gender, race/ethnicity, and neighborhood income level, living in greener areas was associated with lower rates of both depression and Alzheimer's disease.[182] A validated, national survey of older adults aged 57-85 years found that higher levels of greenness were associated with lower levels of perceived stress; the strength of the association varied by race, level of social support, level of physical functioning, socioeconomic status, and level of physical activity,[183] which is not surprising since there are multiple drivers of stress.

At the other end of the age spectrum, a recent systematic review of 21 pediatric studies documented a beneficial association between greater exposure to green space and lower risk of emotional and behavioral difficulties (particularly hyperactivity and inattention problems) in children.[184] Based on the rapidly expanding body of literature on the benefits exposure to greening can have on mental health, international urban planners are promoting the concept of biophilic design (i.e., incorporating green spaces into communities to improve mental health for seniors and the general population).[185-187]

Gardens

The impact of gardens and gardening on health and well-being were documented in two papers

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published in 2020. A broad evidence review of the impact of gardening on health, based on results from 77 scientific papers, was used to develop a logic model to guide practice at the community level.[188] A wide range of activities were studied including viewing gardens, general gardening, and individual and community food-growing. Overall, statistically significant links were found between an array of gardening activities and improved mental well-being, increased physical activity, and a reduction in social isolation.[188] A meta-analysis of 22 studies on gardening interventions and their impacts on psychosocial wellbeing[189] found a moderate, positive effect of gardening interventions on psychosocial wellbeing. A study of Hispanic immigrants in the Midwest found that community gardening appeared to have a stronger impact on wellbeing than gardening activities focused at the individual level.[190]

Biodiversity

Biodiversity, the variety and abundance of different species within a given area, constitutes another important subtopic within the area of greening and health. While noting the need for additional research, authors of a recent review of biodiversity, human health, and green spaces studies concluded that they collectively provide evidence of a positive association between species diversity and both psychological and physical wellbeing. Furthermore, they noted that biodiversity supports ecosystem mitigation of heat, noise, and air pollution, which may mediate the benefits of green space and positive health outcomes.[191]

The impact of constructed green infrastructure on urban biodiversity was evaluated in a meta-analysis of 33 studies.[192] Interventions that were found to significantly improve biodiversity over traditional conditions included: green roofs (roofs with a vegetated surface); green walls (vegetation growing on trellises or other support structures); wetland detention basins (those surrounded by a vegetation buffer); vegetation along roads or housing developments; and yards/gardens (both residential and community gardens).[192]

Urban Planning and Greening

In the academic field of urban planning, there is a growing literature aimed at better defining greening, understanding its beneficial impacts, and exploring the significance of these findings for practice. For example, multifunctional benefits of greening have been identified including: providing habitat for facilitation of biodiversity; mitigating climate change; improving air quality, water resource management, recreation; health and well being; visual aesthetics; and increasing economic competitiveness.[193] The research on urban planning and greening has advanced to the point that a conceptual typology for greening interventions has been developed (Table 5).[194]

Technical models and guidance for green space development by urban planners are appearing more frequently in the current scientific literature.[195,196] An emerging and important concept related to green space development is "urban resilience,"[197] the ability of a system to withstand a variety of perturbations, which needs to be incorporated into the design of healthy, sustainable communities. Direct engagement of community members in planning green infrastructure, as well as other aspects of urban design, is recommended as a means of advancing urban resilience. This community engagement should include addressing equity and histories of discrimination and racism.[197,198]

Greening Resources: Local Guideposts

Key informants interviewed for this section (including executives from local and state "tree" nonprofit organizations, a CAL FIRE urban and community forestry executive, an urban planner, and an applied ecologist and senior scientist) did not have any additional suggestions for peer-reviewed evidence to include in this report. They did note that the evidence linking greening and health should be expressed in practical applications at the community level and many recommended two best practice publications (which are described in detail in **Chapter III**).

The key informants also pointed to local policies as important guideposts for planners, developers, architects, and other stakeholders (see the Folsom General Plan,[199] as an example). These important parameters must be followed (or changed) in order to build or redevelop communities. (See **Appendix D** for more examples of local greening-related excerpts from the Folsom General Plan 2035: Land Use, Natural and Cultural Resources, and Parks and Recreation;[199] the Folsom Sustainability Action Plan,[200] and Folsom Tree Resources.[201])

TABLE 5

Conceptual Typology of Practical Green Design Interventions and Associated Climate and Health Co-Benefits and Metrics[194]

DESIGN INTERVENTION	ANTICIPATED CLIMATE AND HEALTH CO-BENEFITS	GREEN CONDITIONS METRICS
Providing views from within buildings	• Adds visual biophilic experiences • Increases wildlife habitat and biodiversity • Stormwater mitigation	• % of population that can see green on a daily basis from within buildings
Planting greenery near building entrances	• Adds social gathering space • Aids orientation/navigation • Provides shade/cooling • Building energy savings (depending on aspect)	• # trees/shrubs flanking a building entrance • % of vegetation cover around building/site entrance • #buildings per block with “green entrances”
Bring nature nearby	• Adds social gathering space • Provides shade/cooling • Increases wildlife habitat and biodiversity • Stormwater mitigation	• Horizontal and vertical distance (or time) to reach closest green space • Available green space per capita (green space density) • % of population that sees green on a daily basis • Level of community ownership and decision-making power • Diversity metric
Retain mature trees	• Increases air filtration • Adds visual biophilic experiences • Adds social gathering space • Provides shade/cooling • Stormwater mitigation • Building energy savings • Increases carbon storage and sequestration • Increases wildlife habitat and biodiversity	• Naturalness (# native species, canopy stratification) • Species richness and evenness • Size (e.g., trunk diameter at breast height, height) diversity • Presence of heritage trees
Generate diversity	• Adds visual biophilic experiences • Increases wildlife habitat and biodiversity	• Diversity index of tree species • Diversity index of planted space types
Create refuges	• Provides social gathering space for cohesion and enhanced social capital • Provides shade • Increases air filtration • Increases wildlife habitat and biodiversity	• # people who can experience cool refuge at once • % canopy cover in a given site at high noon during periods of expected heat • Level of “shelter” provided by vegetation (stand density) • % population within 400 m of a cool refuge spot
Connect the canopy	• Adds visual biophilic experiences • Shade provisioning/cooling • Increases wildlife habitat and biodiversity (e.g., ecological corridors) • Stormwater mitigation	• # active transportation options (e.g., walking/biking) around green space • Presence and # of paths leading to green space versus # of physical barriers to green space • Colorfulness and arrangement (# tree-lined walks)
Optimize green infrastructure	• Mitigates urban heat islands • Increases carbon storage • Stormwater mitigation • Increases wildlife habitat and biodiversity	• % of canopy cover • Canopy volume • Leaf area index (LAI) • Area of green space

Source: Barron et al., 2019.

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Community Design Considerations for Adults with I/DD and Dementia

Adults with I/DD

Although we found no peer-reviewed studies about community design elements associated with improving health outcomes for the population with I/DD, we identified two guideline sources created by universities through their schools of architecture.[202] The purpose of these guidelines is to introduce planners and architects to the broad range of capabilities and needs of people with I/DD. In particular, those with autism have difficulties with social interaction, communication (verbal and non-verbal) and restrictive behaviors and interests. Reasons for these challenges include heightened sensitivities to light, sound, smell, and enclosed spaces.[203] Informed designs for community-based living options for people with I/DD can remove unnecessary barriers to healthy living.

Based on findings from focus groups and a charrette process, researchers from the Ohio State University Knowlton School of Architecture authored a planning and design framework that accommodates the needs of those with autism spectrum disorder.[202] Student researchers conducted focus groups with adults with autism and parents of adults with autism and followed up with a charrette exercise to identify barriers and facilitators to housing and problem-solve collaboratively. The resulting framework encompasses context-specific recommendations for developing downtown, urban, suburban, and park areas. This project won the 2019 American Planning Association's ACIP Student Project award.[204] Specific guidelines developed from this project are discussed in **Chapter III**.

The second set of planning and design guidelines for people with I/DD was generated by architecture and housing researchers at Arizona State University.[203] These guidelines, divided into exterior and interior categories, were derived from case studies of housing models designed for people with I/DD; research on therapeutic interventions for autism; and research findings on autism and the environment. Of the nine categories discussed, the following two focus on land use planning (the rest discuss interior design elements).

Neighborhood environment: Guideline developers suggest identifying well established communities with zoning laws friendly to the housing designs being adopted. In particular, close proximity to the following are key factors to the success of the development: family, support groups, and service agencies: walkable access to public transportation (for non-driver independence), grocery stores, and pharmacies; employment opportunities; day programs; medical facilities; entertainment and social options; open space, parks, and other recreational options.

Examples of Sweetwater Spectrum Community's spatial organization with clearly defined transition thresholds between private and public space. Source: Sweetwater Spectrum Community/ LMS Architects.

Outdoor spaces: Shaded areas provide safe comfortable environments for people for gardening and socializing. Outdoor lighting should be timed rather than motion-activated, both hardscapes and softscapes should be incorporated to offer a range of options for using various yard areas, and raised planters should be included for increased accessibility and to protect plants from trampling. Healing gardens provide privacy, social opportunities, and physical exercise.

Many of the Arizona State guidelines were employed in the design of the Sweetwater Spectrum Community,[58] a community for adults with I/DD (profiled in **Chapter IV**: Model Communities).[203] For example, the images below illustrate the straightforward and consistent spatial organization that provides clearly defined transition thresholds between public, semi-public, semi-private, and private spaces, which gives residents "preview and retreat" options that allow them to choose whether a new environment is right for them (in terms of noise, crowding, light, etc.) at any given time.

Community Design Considerations for Adults with Dementia

Six principles of dementia-friendly environments were identified by Mitchell: familiarity, legibility, distinctiveness, accessibility, safety and comfort.[205] People with mild to moderate dementia tend to limit themselves to their local neighborhood because it is safe, familiar and does not require motorized transport. An ambitious housing strategy in the UK called the Lifetime Homes, Lifetime Neighbourhoods that could meet the needs of older people, including those with dementia was noted in the report. This design strategy is remarkably consistent with strategies for older adults in that it recommends higher density housing in close proximity to shops; this enables residents to access local services and facilities without driving and to remain an active part of their community.

Few studies about wayfinding systems for people with brain injury, dementia, and developmental disabilities were identified by Prescott et al. but this scoping review did note that people widely used landmarks that are clear, simple, strategically located, and visible.[89] Qualitative studies consistently found that clear, easily recognizable, memorable landmarks and architectural features play an important role for this population in their ability to navigate the community.

Marquez et al. highlighted a diversity of approaches that older adults (n=35) with modest cognitive impairment utilize to navigate their communities.[206] These approaches include providing unique, visually distinct landmarks and architectural features that stand out to pedestrians, and ensuring that street signs and building numbers are clearly visible. In a study conducted with 45 community-dwelling older adults (20 with dementia), Mitchell and Burton found that streets with uniform architecture and/or complicated intersections caused disorientation for adults with dementia.[207] They also reported challenges with long, straight streets. However, in line with Marquez et al., participants in this study also used visual cues, including fixed, distinctive landmarks (church spires, permanent street furniture, colorful buildings, outdoor art, etc.), to navigate.

These studies suggest that, for people with cognitive impairment, a neighborhood with diverse and distinctive housing, notable landmarks, short blocks on an irregular grid design, and a layout that supports reorientation (clear, frequent street signs and building numbers, and an alphanumeric street naming system) best supports wayfinding needs.

Key informant, architect Eitaro Hirota,[f] noted that planners of The Village Langley (a dementia village profiled in **Chapter IV**: Model Communities) consulted with a dementia expert when designing pathways and buildings. There is prominent use of color coding throughout this development on paths, buildings and front doors to individual units to help residents with dementia maintain as much independence as possible. At forks in the pathways, multiple signals are available to residents for orientation: different plantings, written names of trees posted with a corresponding emblem, symbolic signage, and specific landmarks (e.g., water fountains or benches not replicated elsewhere). These small distinct landmarks and color-coded buildings provide breadcrumbs for wayfinding. In addition to physical landmarks and guides, some dementia care facilities use "wanderguard" systems that enable a sense of independence and freedom within a safe, geofenced area. Hirota noted the need for more empirical research to develop the most effective planning and design techniques for replication.

[f] E. Hirota. Personal communication, January 15, 2021.

Conclusions

Strong evidence confirms that specific land use and community design practices can improve health; evidence in other areas is limited or insufficient. Although we identified very limited evidence about planning for communities purposefully inclusive of adults with I/DD, guidelines developed for communities integrating adults with I/DD were generally consistent with the strong existing evidence about general planning and community design to support healthy aging.

Clear and convincing evidence supports:

- **Multiple built environment** characteristics to improve community walkability, increased physical activity, mobility, as well as positive physical and emotional health outcomes in older adults such as improved cardio-metabolic health, lower reported BMI, slower cognitive decline, and reduced prevalence of reported depressive symptoms, loneliness, and dementia. These characteristics include:
  - Walkable, mixed-use neighborhoods with residential areas in proximity to commercial services and shorter blocks
  - Higher population density
  - Connected but separate systems for street, bike, and walking paths
  - Wide sidewalks and walking paths made of flat, nonslip, and stable surfacing
  - Public restrooms and shaded benches
  - Street lighting
  - Access to public transit
- **Third places** provide opportunities for socialization and recreation. Grocery stores, libraries, community centers, restaurants, community gardens, and shopping centers located close to home are associated with increased physical activity, improved socialization and physical health, and slower cognitive decline.
- **Green spaces and greening** are associated with better physical, mental, and social health and wellbeing for both older adults and persons with I/DD. In particular, evidence supports the following characteristics as promoting positive outcomes:
  - Green spaces such as parks, parklets, and natural areas
  - Greenscaping of streets, bike paths, and sidewalks
  - Minimum 50-60% tree canopy
  - Gardens/gardening, particularly community gardens
  - Biodiversity

A preponderance of evidence supports:

- **Convenient private and public transportation** improve physical and social health of older adults, including:
  - Close, accessible public transportation with convenient schedules
  - Micro-transit programs, such as shuttles, ride-share options, and e-bike sharing for enhancing access to public transit
  - Planning for and installing charging stations for electric vehicles in commercial and residential settings is supported by expert opinion.

Limited evidence supports:

- **Community design to improve wayfinding** as helpful for older adults with dementia, including:
  - Irregular grid designs
  - Unique architectures
  - Well-marked winding paths
  - Color-coding
  - Visually distinctive landmarks, including landscaping

There is insufficient evidence to draw conclusions about:

- The effect land-use planning or built environment characteristics have in supporting healthy aging *in naturally occurring aging communities (NORCs and Blue Zones)*

- The impact of age-restricted communities compared with intergenerational communities on health and wellbeing of older adults; experts' opinions tended to favor intergenerational communities
- Health effects of land-use planning and design for people with I/DD; we did identify guidelines, based on focus groups and reviews of research on the needs of people with autism, developed by university architecture programs
- How automated vehicles will impact future shared mobility options; implications for parking and street design are currently undetermined

In summary, strong, consistent evidence supports a number of land use planning and community design features to develop healthy aging communities. Areas with limited or insufficient evidence offer research opportunities to identify additional features that improve health. In particular, more research is needed on the health impacts of multigenerational versus age-restricted communities, and the community design features that best support the health and wellbeing of residents with I/DD and those with cognitive impairment, including dementia. The next chapter reviews guidelines and toolkits that provide strategies for implementing the evidence-based findings in this chapter.

III. Guidelines and Toolkits for Design of Healthy Aging Communities

"Land use planning must make sure it encourages socialization, exercise, and healthy diet. So many people have chronic health conditions that increase their risk of developing Alzheimer's and other dementia later in life. Optimal land use planning can improve these conditions."

– Susan DeMarios, Alzheimer's Association

This chapter provides a summary of guidelines and tools for planning healthy aging communities. Organizations across disciplines have issued principles, guidelines, toolkits, and evaluation metrics to guide public and private entities in developing healthy aging communities. Although the lenses used by these various frameworks and tools differ, many operate under the bigger umbrella of "sustainable design," "healthy living," or "livable communities" and recognize that these broader practices benefit communities regardless of age or ability; many explicitly call out both the aging population and people with disabilities.

Most guidelines support their recommendations with evidence and not just expert opinion; however, the authors of these tools and guidelines recognize that research findings are limited, and they encourage the conduct of more research and evaluation of health and economic outcomes. There is growing recognition among industry leaders and policymakers that people want to age in their own communities and that socialization is protective of health. Technology and the built environment can enhance a person's independence, but programs and services also will play a significant role in maintaining health and independence for aging populations and for those with I/DD in the future. The issue of housing affordability arises in many organization statements.

Finally, these organizations are universal in their message regarding the importance of public-private partnerships in building healthy aging communities, whether as redevelopment projects or new greenfield developments. As described in this chapter, policy changes at the local and state levels are key elements, in combination with partnerships involving businesses (builders, developers, service providers) and educational institutions, to building healthy communities. Below we highlight international, national, and state guidelines and toolkits that may be particularly useful in planning communities to support healthy aging.

International Initiatives

WHO Global Network for Age-Friendly Cities and Communities.[208,209] Established in 2010, the mission of this network is to "foster the full participation of older people in community life and promote healthy and active ageing." It connects 1,114 cities and communities in 44 countries (~260 million people worldwide)

THE EIGHT DOMAINS OF LIVABILITY:

1. Housing—affordable and accessible
2. Transportation
3. Social Participation
4. Respect and Inclusion, emphasizing intergenerational or multigenerational urban designs and environments
5. Open Spaces and Buildings
6. Communication and Information
7. Health Services and Community Support
8. Civic Participation and Employment

to support innovative and evidence-based solutions for their aging populations. (See *AARP Age-Friendly Cities and Communities* under U.S. Initiatives below for details).[210] Communities are encouraged to make improvements across eight domains of livability.[211] This work is now under the *United Nations Decade of Healthy Ageing (2021-2030);* an effort that seeks "to coordinate governments, non-profit agencies, academia, the media, and the private sector for ten years of concerted, catalytic, and collaborative action to improve the lives of older people, their families, and the communities in which they live."[212]

Blue Zones® Healthy Community Framework: Dan Buettner's study of communities with remarkably healthy longevity—eventually dubbed "blue zones"—yielded multiple common lifestyle characteristics. Buettner later founded a company (Blue Zones®; now owned by Adventist Health) dedicated to disseminating the lessons learned through the Power of 9 framework developed from the common denominators identified in five communities in Japan, Costa Rica, U.S.A., Italy, and Greece, with exceptional longevity. The common socio-cultural characteristics are grouped into *movement, eating right, "right outlook,"* and *connectedness* (see **Chapter II:** Evidence Review).[213] The Blue Zones® certification program for communities interested in promoting healthy aging uses this framework; it requires a pledge by the entire community, among both public- and private-sector stakeholders, to commit to a 3-10-year project timeline and is generally funded through private and public support.[214] The common characteristics promoting healthy longevity are socio-cultural in nature; however, land use planning strategies in the U.S. may encourage individuals to achieve behaviors and lifestyles that mimic those in blue zone communities.

BLUE ZONES® POWER OF 9 FRAMEWORK

1. Engaging in regular movement
2. Having and striving towards a life of purpose
3. Allocating time for stress relief
4. Eating in moderation
5. Consuming a majority plant-based diet
6. Drinking alcohol moderately
7. Belonging to a faith-based community
8. Maintaining strong family ties
9. Connected to tight-knit social circles

Marston et al. (2021) note that the frameworks for WHO Age-friendly Cities and Communities and the Blue Zones® do not acknowledge technology in healthy aging.[215] Indeed, the Blue Zones® Healthy Community Framework appears to reject technology to the extent that it recommends disengaging garage door openers and replacing power tools with hand tools.[216] Marston et al. (2021) propose that a more contemporary framework would build on the foundations established by Blue Zones® and WHO Age-friendly Cities and Communities by also including roles for technology. [215]

The International Council on Active Aging (ICAA):[217] This professional association of communities for senior living hosted a forum discussing major disruptions threatening traditional age-restricted communities and their causes—practical needs exposed during the pandemic, changing attitudes among younger generations toward congregate-living settings, and affordability of such communities. Their report, Future-proof Your Senior Community adopts the WHO/AARP principles mentioned below. For example, adopting the "building for community connections" principle would integrate amenities and services with the surrounding community, thus expanding the number of offerings without having to build new infrastructure. Multigenerational communities enable family members to care for older relatives. An open boundary community that invites neighbors to share on-site amenities (e.g., restaurants, fitness centers, etc.) could produce economic benefits such as potential new residents and enhanced revenue streams. Uniquely, ICAA also makes a strong business case for "future-proofing the built and unbuilt environment," especially in light of increasing risk of epidemics and pandemics, and the likely impact of more intense storms and wildfires related to climate change. A practical example points out that the expanded use of sensor-activated building elements (such as doors, faucets), which improve access and reduce transmission of infectious agents, will not

work in the absence of electrical power, and back-up systems are therefore needed. The ICAA produced a Call to Action for the United Nations' Decade of Healthy Aging 2021-2030.

Smart and Healthy Ageing through People Engaging in Supportive Systems (SHAPES): This international technology-focused research initiative is led by the Assisted Living and Learning (ALL) Institute at Maynooth University (Ireland). SHAPES seeks to build, pilot, and deploy a large-scale, integrated and standardized open IT platform that accommodates a broad range of technological, organizational, clinical, educational and societal solutions to facilitate long-term healthy aging with high quality of life. Partners include universities, businesses, affordable housing entities, health care entities, and intergenerational housing developers. More specifically, technology and social solutions aimed at supporting older people will be tested by thousands of older adults in 15 pilots using a rapid re-design method. Examples of pilot systems include SmartBear, a continuous, objective monitoring system that integrates off-the-shelf smart consumer and medical devices (related to mental health, cardiovascular disease, balance disorders, etc.) to optimize management of comorbidities and associated risks and to promote independent living. Another project, by ADLIFE, will use digital solutions to integrate therapies and approaches that target early detection and assessment of deterioration for patients with chronic disease. It includes a Personalized Care Plan Management platform, a Patient Empowerment platform, and Clinical Decision Support Services that are interoperable with other data systems and technologies. Seventy-five health facilities across seven countries are pilot participants. In all, the pilot projects seek to facilitate advanced and well-coordinated care planning and integrated supportive care to enhance quality of life, reduce suffering and accelerate recovery for patients and their families. The effort is funded by the European Union at €21 million over 4 years (through 2023).

Agile Ageing Alliance: This organization is working to create and build consensus around a reference framework for smart age-friendly housing. This model will integrate technology into socially supportive intergenerational neighborhoods to improve health and wellbeing and reduce personal and societal financial burdens. Specifically, their 'Neighbourhoods of the Future' program is exploring innovative technologies and business and service models as part of ongoing SHAPES research discussed above.

Housing Guidelines and Toolkits for People with I/DD (Learning Disabilities)

The Housing and Support Partnership Toolkit for Local Authorities: This toolkit is designed for the British system of care and is for people with learning disabilities.[218] Although the U.S and British systems of care differ greatly, there are adaptable lessons that could be used in the U.S. in helping people with I/DD identify their preferred housing choices and supports. While it focuses on services and programs, it also addresses the need for a mix of housing models and choices to accommodate the diverse preferences and needs of the I/DD population. One key point made in this toolkit is that future residents and their family members should be engaged in planning to ensure the right housing choices are available in terms of living environment (such as independent living in single or shared units, clustered flats, or small residential care homes) and tenancy (ownership, rented at market or affordable rates, or residential care). The toolkit also discusses how adaptive technology such as use of wristbands to contact staff for assistance enables adults to live at the highest level of independence.[218]

U.S. Initiatives

AARP Age-Friendly Cities and Communities: AARP leads the U.S. affiliate organizations participating in the WHO Global Network for Age-Friendly Cities and Communities described above. AARP created a network of 200+ cities and communities that meet or are actively working toward achieving the 8 domains of livability for an aging population (listed above under the WHO Global Network for Age-Friendly Cities and Communities). Policy examples include promoting alternative, affordable, and accessible housing types near amenities and transit; encouraging universal design in new housing; and integrating public transit into neighborhoods that is designed to meet the needs of seniors and people with disabilities. AARP also offers a broad array of resources and toolkits about aging well and livability, including guides about community listening, home retrofits,

creating age-friendly parks and public spaces, and conducting neighborhood walkability audits. Locally, West Sacramento joined the network in 2015 and the city of Sacramento joined in 2019 (see the Sacramento 2035 General Plan cited below).[219]

Building Healthy Places Toolkit: This toolkit of the Urban Land Institute (ULI) focuses on the connections between health and the built environment and, through its value proposition, describes the advantages "of building health-promoting ways."[220] The toolkit includes 21 evidence-based recommendations focusing on physical activity, healthy food and drinking water, healthy environment, and social wellbeing. The ULI makes recommendations similar to those of the ICAA by encouraging planners, developers, and policymakers: to understand differing needs of various communities; to modify land-use planning and design language and practice to accommodate the demand for environments that enable healthy, active behaviors; and to measure health outcomes of interventions. ULI goes further in its recommendation to consider health and health outcomes at each stage of the real estate development process. The consumer demand for healthy environments is high, from millennials to Baby Boomers, and the industry must adapt to support health for all.

Metrics for Planning Healthy Communities:[221] This document, published by the American Planning Association with funding from the U.S. Centers for Disease Control and Prevention, explains the important intersection of public health and built environment planning and design through a social determinants of health (SDOH) framework. This guide encourages the adoption of health planning strategies and metrics to help build a cross-disciplinary cooperative of planners, public health representatives, developers, and other industry representatives to improve community health outcomes. For example, planners may effect change through their impacts on environmental exposures, social circumstances, and behavioral patterns, which account for 60% of factors influencing health status/outcomes. Accordingly, the document presents five domains in which planners may effect and measure change in health through elements of the built environment associated with SDOH. (Table 6 gives examples of domains and selected measures relevant to greenfield development). Using validated metrics produces reliable data for policy and planning decisions and encourages accountability by measuring progress. This document expands on other tools such as those compiled by the Build Healthy Places Network. By changing the built environment, planners can influence behaviors

TABLE 6
American Planning Association Metrics for Planning Healthy Communities

DOMAIN	SUBDOMAIN	SAMPLE METRICS
Active Living	Active Transportation	• Ratio of sidewalk and/or bicycle lanes to roadway miles • Percentage of population living within a half-mile distance of frequent-service transit stops
	Recreation	• Network distance to park entrances and other usable public open spaces • Acres of park land per 1,000 population
Social Cohesion	Green Infrastructure	• Percentage of tree canopy coverage
	Safety	• Number of street miles without streetlighting*
	Housing	• Percentage of households paying > 30% of monthly household income toward housing costs*
Environmental Exposures	Water Quality	• Percentage of total stormwater investment that is green stormwater investment

*Note that lower scores are better for these metrics in contrast with the other metrics where higher scores are better.

through travel options, streetscape design, and outdoor/third spaces.

Housing Guidelines and Toolkits for People with I/DD:

Additional guidelines and toolkits for people with I/DD have been developed by two university architecture and design programs (described in **Chapter II**). The Ohio State University Knowlton School of Architecture authored a planning and design framework that accommodates the needs of those with autism spectrum disorder.[202] Guidelines specific to suburban development included the following recommendations:

- **Streets:** Design multi-modal streets with bike lanes down one side of the street with one lane traveling in each direction. Use green paint (soft glow-in-the dark paint) to delineate bike lanes. Separate bike lanes from auto lanes with an 8'-wide parking lane in between. Auto lanes should be no more than 10' wide. This design is beneficial for those disinclined to drive; narrower drive lanes slow traffic to reduce pedestrian anxiety and improve sense of safety; buffering landscaping (of mid-body height) increases sense of safety and improves esthetics.
- **Wayfinding:** Place directional symbols, place names/landmarks, and signage on all walking infrastructure to indicate direction to nearby attractions. Use vertical signs with interactive maps to accompany the sidewalk wayfinding system. Researchers found that people with autism reported being overwhelmed with navigating suburban areas and desired a clear wayfinding system on the sidewalks.
- **Housing:** Build accessory dwelling units (ADU) and duplex units, which provide independent, affordable living options for adults with autism, while retaining support systems close by. Importantly, independent living allows for personal control over sound and temperature in the unit. Native, low-maintenance landscaping can help minimize outdoor sound. Walls dividing duplexes should be sound-proofed. Ideas for programs include "neighbor pairing" in which subsidized rent would be available for caregivers/mentors to incentivize their training.

Architecture and housing researchers at Arizona State University developed guidelines for designing and building communities for people with I/DD.[203] The community design recommendations include: proximity to family, support groups, and service agencies; walkable access to public transportation (for non-driver independence), grocery stores, and pharmacies; employment opportunities; day programs; medical facilities; entertainment and social options; open space, parks, and other recreational options. Specific recommendations are made regarding outdoor spaces, including: provision of shaded areas for people to garden and socialize; outdoor lighting that is timed rather than motion-activated; use of both hardscape and softscape for yard areas, and including raised planters for accessibility and to protect plants from trampling; and creation of healing gardens to provide privacy, social opportunities, and physical exercise.

California Initiatives

California's Master Plan for Aging fulfills Executive Order N-14-19 by Governor Newsom to create a plan that promotes healthy aging by creating livable communities for Californians regardless of age, or physical, cognitive, or developmental ability.[38] The plan was informed by a diverse, 35-member Stakeholder Advisory Committee, which included Heather Young, Professor and Dean emerita of the UC Davis Betty Irene Moore School of Nursing. It acknowledges the need to overcome decades of "single-family detached homes with auto-centric transportation networks separated from commercial and industrial uses." Noting that most older adults want to age in place (home or community), this 10-year plan uses the AARP Age-Friendly Communities 8 Domains of Livability as a framework for its 23 strategies grouped into five goals for building a "California for All Ages" by 2030.

CALIFORNIA MASTER PLAN FOR AGING GOALS

1. Housing for All Stages & Ages
2. Health Reimagined
3. Inclusion & Equity, Not Isolation
4. Caregiving That Works
5. Affording Aging (economic security)

The Master Plan for Aging (MPA) is intended as a dynamic roadmap for addressing the shifting social and economic landscape for older adults in California through 2030. In addition to revealing gaps in equitable access to reliable services that target the specific health, housing, economic, and caregiving needs for older adults, the MPA emphasizes improving inclusion and equity, and the importance of technology as a powerful tool in bridging gaps. Lack of access to dependable broadband connectivity and limited digital literacy are significant barriers for many older adults to use technology effectively. The MPA includes recommendations to close the digital divide by connecting older adults to their social supports and health care providers through increased use of technology. Technology recommendations for the Master Plan on Aging, including efforts to develop broadband as a utility, were led by Dr. Lindeman who served as a member of the MPA Stakeholders Advisory Committee.

Progress toward the plan's goals will be tracked via a data dashboard on aging. In recognition of the importance of the built environment, seven indicators were selected to track progress and hold communities accountable for improvements (Table 7). There is also a "local playbook" and a toolkit for use in forging public-private partnerships among local governments, communities, private businesses, nonprofits, and philanthropic organizations. This is an excellent resource for local policy makers to learn about the state's blueprint for healthy aging community goals over the short- (0-3 years), medium (3-5 years), and long term (5-10 years).

Urban Forests & Urban Greening: A Guide to Green Infrastructure for Affordable Housing & Sustainable Communities (AHSC) was produced by California ReLeaf, a statewide non-profit that convenes nonprofit and community organizations to support healthy urban forests across California.[222] The AHSC Program focuses on reducing greenhouse gas emissions through smart land-use planning and other practices to both address climate change and provide affordable clean, healthy communities. This guide provides a checklist of greening elements and strategies and case studies of successful urban greening projects.

Making Nature's City: A Science-based Framework for Building Urban Biodiversity: This framework was created by the San Francisco Estuary Institute, an organization seeking to educate planners and developers about maximizing biodiversity through land-use planning and design.[223] It comprises an evidence-based framework for linking local parks, greenways, green roofs, street trees, stormwater basins, commercial landscaping, and backyards to support biodiversity and healthy living environments.

TABLE 7

California Master Plan for Aging – Publicly Reported Indicators Related to the Built Environment

New Housing Options	Number of new housing options for aging well (under construction)
Affordable Housing	Number of subsidized housing units per 10,000 population
Types of Transportation	Percent of all trips that are transit trips (including paratransit) by adults age 60 or older
***Park Access**	Percent of adults age 60 or older who live more than half a mile from a park Percent of adults age 60 or older who live in communities with less than three acres of parks or open space per 1,000 residents
***Natural Hazards**	Percent of adults age 60 or older who live in a hazardous area (under construction)
Low-Emission Transportation	Percent of all trips that are low-emission trips by adults age 60 or older

Source: California Department of Aging. California's Master Plan for Aging, 2021.
* Note that lower scores are better for these metrics in contrast with the other metrics where higher scores are better.

County and City General Plans

General plans at the city and county levels are rich sources of data and policies for healthy aging stakeholders interested in land-use planning and design. In California, state law mandates that each jurisdiction provide a long-term vision for community development that addresses land use, circulation (transportation), housing, conservation, open space, noise, safety, and environmental justice.[224] Ultimately, a general plan is a blueprint for development on both privately and publicly owned land and is used by government officials for land-use decisions. These plans, in conjunction with state environmental laws and local zoning laws, outline the rules to which developers and home builders must adhere. State law requires that development plans and zoning be consistent with diagrams and policies in a jurisdiction's general plan.[224] Examples of local general plans include:

El Dorado County General Plan: The 2004 General Plan was last amended December 2019. In addition to the state mandated elements, El Dorado County also includes housing, agriculture and forestry, public services, parks and recreation, and economic development in its General Plan.[225]

Sacramento County 2030 General Plan: Elements of this 2030 Plan (regarding agriculture, economic development, environmental justice, and public facilities) were most recently updated in 2019. Additionally, the land-use element was updated in 2020, along with the air quality and circulation-transportation elements.[226]

Folsom City 2035 General Plan: The 2035 Plan, adopted by the Folsom City Council in August 2018 identifies "health as a lifestyle choice" as an important trend. Among its guiding principles, the 2035 plan:[199]

- Promotes mixed-use, walkable districts (town centers) to serve as social gathering places for the community
- Supports higher-density, mixed-use, transit-oriented development near light rail stations and in core areas where alternative transportation modes are planned to encourage more residents, workers, and visitors to walk, bike, or use public transit
- Provides a range of housing choices to ensure Folsom is a community for all generations, where children can grow, then raise families, and eventually age in place

Sacramento City 2040 General Plan: Sacramento's 2035 General Plan is currently being updated (in 2021) to become its 2040 Plan which will include an AARP age-friendly action plan based on community outreach and listening sessions conducted in partnership with AARP.[227]

Green Neighborhood Certification: A certification program created by the Sacramento Tree Foundation encourages developers to incorporate landscape planning into overall infrastructure planning (e.g., streetlights, sewer lines, and sidewalks). The Green Neighborhood tool can be used to cultivate partnerships between developers of new residential neighborhoods and the community and provides a step-by-step process for becoming certified as a "Green Neighborhood."[228] Note that developers have the opportunity to mandate the appropriate coverage and type of plantings in a new community through Home Owners Association (HOA) rules and regulations. Having an informed plan helps ensure a sustained, thriving green system for the community.[229]

Conclusions

We identified useful guidelines that can help developers and planners to design healthy aging communities. International initiatives are important resources for developing healthy aging communities and much of the information relevant to land use planning provides sound guidance for use in the U.S. and California, despite differences in regulatory systems. Nationally, the healthy aging movement in the U.S. is led by the AARP Age-Friendly Cities and Communities initiative. The Urban Land Institute and the American Planning Association offer guidelines and toolkits to help create healthy and sustainable communities. Guidelines have been developed for developing communities that include I/DD adults, and to support green infrastructure development. These tools are useful and relevant to informing the development of healthy aging communities. Across multiple sectors and disciplines, California policymakers and business and academic leadership are prioritizing the State's Master Plan for Aging. The policy window is open for innovative activity.

Common characteristics among these resources include:

- Consensus among guideline developers that people of all abilities want to age in place rather than in institutional settings.
- Environments that support healthy aging and independence, support physical activity, and remove barriers to socialization and community building are strongly preferred.
- Guidelines, toolkits, and recommendations recognize common barriers and needs of the aging population and populations with disabilities.
- Although there are no universal standards or metrics for defining a successful healthy aging community, both the American Planning Association and the California Master Plan for Aging have developed specific metrics related to healthy aging communities.

IV. Model Healthy Aging Communities

This chapter presents a variety of existing age-friendly communities as examples to inspire land-use planning and design for healthy aging communities. Selected model communities exemplify specific planning and design elements that support healthy aging, as noted in the evidence review (**Chapter II**).

Opportunities for creating innovative, evidence-based healthy aging communities are plentiful given ongoing demographic shifts that have created a growing interest in healthy aging and expanded demand for environments that support aging in place (**Chapter I**). Fitzgerald and Caro described ideal communities as those that combine environmental and social features to create living spaces that offer people rich opportunities for healthy, independent living as they age. Community designs will facilitate retention of older populations if they offer dense residential development near compact commercial and cultural centers close to public transportation. Denser development may also make communities more attractive to younger populations with active lifestyles. Communities that offer housing with healthy aging and universal design features located in age-friendly neighborhoods may require less age-segregated, service-supported housing such as skilled nursing facilities and assisted living complexes.[131]

Our environmental scan of model communities, primarily from public sources, did not yield any communities that incorporated all the key land-use and design elements that could support healthy aging. However, we describe 35 communities that have implemented certain elements particularly well, including some that integrate people with intellectual and developmental disabilities (I/DD) into the community (see **Appendix C** for summary table). Key features from the example communities described in this chapter, when combined, could inform a complete design plan.[9] We provide additional detail on 10 selected communities in the **Spotlight** section.

[9] Note: Some of the model healthy aging communities presented in this chapter may feature international and domestic elements which may be prohibited by local and regional planning and zoning regulations.

Classifications of Communities

This report classifies model communities into one of four community types:

Master-Planned Communities (MPC) and Village Housing Developments

- MPCs are large-scale residential developments, encompassing up to several thousand acres, built on undeveloped land, and offering substantial recreational and commercial amenities such as community spaces, retail businesses, office spaces, and essential services such as hospitals, schools, and restaurants.[230] They are most frequently found in suburban areas and generally include smaller sub-communities, such as age-restricted neighborhoods.[231]
- Village developments are smaller in acreage and population and may be built on previously developed property with existing utility infrastructure or on undeveloped property in urban, suburban, or rural settings. These developments target either intergenerational or age-restricted populations. Such communities are not centered around a social cohort in order to build and maintain the community (like co-housing, described below) but are designed to foster neighborly interactions through shared green space and communal structures, and may include cottages, single-family homes, or apartments. Unlike MPCs, they rely on the broader community's infrastructure and commercial resources.

Continuing Care Retirement Communities (CCRC)

- Also called Life Plan Communities, CCRCs offer a graduated set of services and housing options (independent living, assisted living, and skilled nursing) that allow people to age within the community.[232] CCRCs can range from small communities to large developments housing hundreds of older individuals.[233] As noted in the Introduction to this report, congregate living facilities for older adults pose particular challenges for controlling

infections and communicable diseases. Advocates for healthy aging warn of institutional warehousing, isolation and loneliness (worsened during the pandemic).[234]

Co-Housing Communities

- Co-housing communities comprise organizations of small private homes or multiunit dwellings with common spaces in which residents share resources and duties. Co-housing communities reflect vastly different social and organizational structures as compared to the other community categories profiled in this report. They are typically planned and built by and for a smaller group of people with common interests who make community decisions collectively. Co-housing communities are frequently thematic (for example, intergenerational, age-restricted, or LGBTQ- or female-only). This type of community has notable features supportive of aging in place that may inform other types of communities.[235] A co-housing advocate notes that the traditional age-restricted model is service-oriented while the co-housing model is action-oriented. The co-housing model provides purpose for its residents who serve and support each other through the co-management of their community.

Alternatives to Residential Congregate Care Communities for People with Dementia or I/DD

- Residential or congregate care communities for people with I/DD are intentionally designed for, or incorporate designs sensitive to the needs of, people with dementia and/or those with intellectual and developmental disabilities (I/DD). These communities face criticism similar to those lodged against skilled nursing facilities, which are viewed by some as providing discriminatory, isolated, institutional care that removes autonomy.[236] Many advocates of those with I/DD endorse supportive housing opportunities that enable independent living or community-based housing via small group homes, co-ops, investment based or non-profit intentional communities, or Family Home Agencies (contracted by Regional Centers) where individuals can live and interact in a neurodiverse community.[236] The U.S. Centers for Medicare & Medicaid Services (CMS) issued guidance to states in 2014 identifying facilities for I/DD that were too isolating (farmsteads, gated communities, residential schools, and clustered residences) and, therefore, ineligible for public funds.[237] These regulatory guidelines may impact the number of residential options available for adults with I/DD. Dementia villages (see first bullet below) face a similar "warehousing" controversy; some experts warn their design unintentionally isolates this population and so advocate for an alternative design: a diverse community setting with universal design that includes features appropriate for all populations. Despite the controversy, there are some universal land-use design features in targeted group care communities that are potentially translatable to any community.

> "There's still a lot of stigma around Alzheimer's disease.... People should be able to mix and mingle and belong to any community no matter what stage they are in the disease. We wouldn't have a cancer community or a diabetes community. If you had diabetes, you wouldn't feel like you needed to move to a place where everyone has diabetes."
>
> *– Susan DeMarios, Director of Public Policy at the California Alzheimer's Association*

- **Dementia Villages** These villages, some of which include family caregivers as residents, care exclusively for individuals affected by dementia and focus on supporting their independence throughout disease progression. Care provided in Dementia Villages differs from dementia care in skilled nursing facilities. Purposeful design techniques are used to imitate typical neighborhoods in a safe and controlled setting to allow individuals greater independence. Dementia Villages that we identified were all located in suburban or rural areas.
- **Communities for Adults with Intellectual and Developmental Disabilities** These residential care communities offer a range of supportive housing services that may include social, vocational, medical, or therapeutic programs for residents depending on need.[238] These communities are found in urban, suburban, or rural areas.

Evaluation and Selection of Model Communities

We identified innovative communities through internet searches, literature review, and key informant interviews. Our search for formal evaluations or studies of health outcomes associated with the profiled communities yielded few examples. The model communities included in this report meet the following criteria:

- Located in suburban or rural (greenfield developments), or in urban areas and contain unique features translatable to suburban or rural greenfield developments
- Focused on healthy living for adults including
  - those aged 55+ years, or
  - individuals with I/DD or dementia

Based on the peer-reviewed evidence, guidelines, and expert opinions, the following characteristics were used to select the model communities:

- **Mixed-use development:** the community comprises residential, retail, recreation, and community and/or office facilities
- **Well-connected streets at human scale:** Shorter block design (e.g., 200-400 linear feet long) with multiple intersections, good connectivity, and choices of walking routes including pedestrian cut-through paths in the middle of longer blocks to improve walkability, socialization, and access to services and retail[220]
- **Safety through lighting and visibility:** Streets, trails, and spaces are well lit to minimize dark and unsafe areas, sidewalks on both sides of the street, well-marked crosswalks, special pavers and curb extensions to visually highlight pedestrians and slow traffic
- **Publicly accessible amenities:** Bike racks, streetlamps, public art, benches, and bus shelters augment appealing third spaces that promote safe environments for socialization and transportation; trees to provide shade along sidewalks near benches for respite for pedestrians; maps and signage along longer paths and trails to support people walking and biking
- **Walking and biking paths:** Paths built within street network; connections to existing bicycle networks (including those in nearby developments and multiuse trails and greenways); presence of bike/scooter ride-share programs
- **Intergenerational play and recreation areas:** High quality recreation space(s) suited to the development's scale, from large neighborhood parks to parklets; parks accommodating diverse uses (dog parks, skate parks, and picnic facilities) and outdoor exercise equipment for all ages that is accessible and well-lit
- **Third places:** High quality, adaptable, multi-use spaces for gathering, play and social activities for all ages
- **Green space and natural spaces:** Maximized natural terrain to support air quality, provide shade and encourage outdoor activity
- **Social engagement** Universal design techniques maximize accessibility for all people in third place areas, including facilities for hosting cultural events and classes
- **Access to healthy food and community gardens:** Grocery store(s), recreational/public plaza spaces to accommodate farmers' markets, space for community gardens or small farms

Common Themes Across Communities

The model communities selected differ greatly in types of residents, location, size, and home types, but common themes transcend community types. This section describes features of many of the model communities including: integration of green and blue (water features) spaces; access to gardens and healthy food; the co-location of or proximity to essential services such as retail outlets, entertainment venues, and public transportation; creative use of third places (communal spaces); wayfinding features; integration of intergenerational spaces; and use of technology.

Integration of Green and Blue Spaces

Among the four community types, the integration of green, blue, and other open spaces was highly prevalent. As previously noted, studies correlate green space with lower rates of chronic illnesses and mortality. Liberal use of greening promotes daily physical activity, healthy living, and socialization among neighbors, and helps to mitigate heat, noise, and air pollution. (See evidence review in **Chapter II**.)

Due to their large land areas, MPCs are able to allocate land for a variety of green, blue, and other open spaces such as sports parks, walking or hiking trails, lakes/ponds, pools, well-maintained gardens, green landscaping, and natural conservation areas. For example, 3Roots, a 413-acre planned development in San Diego, California, will allocate 23 acres for a public park in addition to 256 acres for other green space. Rancho Mission Viejo's 23,000-acre development, located in Orange County, California, includes sports parks, playgrounds, dog parks, and pools for its 36,700 residents, in addition to 20,868 acres of nature reserve and a campground site for residents.[239] Uniquely, Serenbe (See p.68 for additional details), a 1,000-acre model located in Chattahoochee Hills, Georgia, left 70% of its land as natural, unaltered landscape to create a closer connection between their 750 residents and the Chattahoochee Hills.[240,241]

Access to Healthy Food and Community Gardens

In addition to the integration of green spaces, Rancho Mission Viejo and Serenbe have also adopted a **farm-to-table approach** within their respective communities. Evidence indicates that active participation in gardening is correlated with increased socialization and positive mental health. Rancho Mission Viejo's development resides on a historic cattle ranch and operates a sustainable farm comprising 34,000 sq. ft.; residents have opportunities to farm, harvest, and share their own crops within their community.[242] Similarly, Serenbe includes a 25-acre organic farm with more than 300 types of vegetables, fruits, and other crops.[241] Their farm serves as a major resource for their community-supported agriculture (CSA) program, weekly farmers' markets, and farm-to-table restaurants. The Village of Hope (See p.84 for additional details) in Pennsylvania is planning to include a small farm, a vertical hydroponic growing pavilion, and a variety of green spaces for community use such as wetlands and a wildflower meadow.[243]

Similar to MPCs, CCRCs, co-housing, and village-like communities often provide green spaces, which also serve as third places (communal public space), to promote physical activity, wellness, and socialization. For example, Masonic Home, a CCRC in Union City, California, developed its 267 acres to include walking trails and outdoor and indoor activity areas for their 300 residents. The 3-story apartments comprising New Ground (See Figure 9 and p.72 for additional details), an age- and gender-restricted co-housing development in High Barnet, UK, has 21 of its 24 homes oriented around a public garden.[244]

FIGURE 9
New Ground Cohousing Site Layout

Credits to architects Pollard, Thomas, Edwards (PTE). Source: New Ground Cohousing

Mixed-Use Communities

Mixed-use neighborhoods combine residential space with commercial (essential) services such as grocery stores, retail outlets, health clinics, and office space. Evidence described in **Chapter II** demonstrates a strong link between neighborhoods with mixed use and greater physical activity in older adults, higher levels of social capital and feelings of safety, and increased participation in neighborhood activities.[90,155] Of the development types reviewed, MPCs had the greatest number of mixed-use spaces, largely due to the availability of land and population density within or near their developments. For new or smaller developments that have lower density, mixed-use zoning often presents economic challenges to businesses. However, depending on the location of the development, businesses may also draw clientele from the surrounding neighborhoods. Utilization of mixed land-use may increase socialization amongst residents and encourage

one-stop-and-shop experiences that may ease the burden of daily errands.

The integration of retail and commercial spaces was common among our selected MPC models. The Summerlin development in Las Vegas, Nevada, contains a "walkable urban center" called Downtown Summerlin;[245] this 400-acre "urban core" at the heart of the development includes a movie theatre, restaurants, and popular retail stores.[246] Rancho Mission Viejo and Serenbe (see p.68 for additional details), both significantly smaller in acreage and population than Summerlin, also have retail and commercial spaces though Serenbe's retail area is smaller and less commercially mainstream. The Laguna West (See p.77 for additional details) development in Elk Grove, California, has been highlighted for its "human-scale" design and includes walking paths that link the town center, parks, community center, and residences together with the objective of promoting socialization, physical activity, and community.

Panasonic Corporation's CityNow division, strives to build "smart cities" informed by data gathered through advanced technology.[247] CityNow recently initiated a new project, Peña Station Next (Denver, Colorado; see p.80), expected to be completed in 2026.[248,249] The 220-acre mixed-use development is planned as a walkable community to reduce the use of vehicles within the property. It will offer 3 million square feet of office space, retail stores, restaurants and cafes, fitness and wellness centers, entertainment venues, and 818 intergenerational housing units.[250] Similarly, Meridian Water is a planned mixed-use, affordably priced development in London, UK.[251] Ultimately, plans are to build 10,000 homes among retail, commercial, and planned open spaces, and to maximize its natural border with the River Lea and Pymmes Brook; new housing is expected to break ground in 2021.

Mixed-use developments are easier to create in MPCs because their population densities are large enough to support businesses. Alternatively, developments like Serenbe include small, local retail shops and restaurants. Local retail stores and commercial spaces are integral to healthy aging communities of all sizes and are necessary for building community and promoting socialization among community members.[252] Alternative approaches for smaller communities are described below.

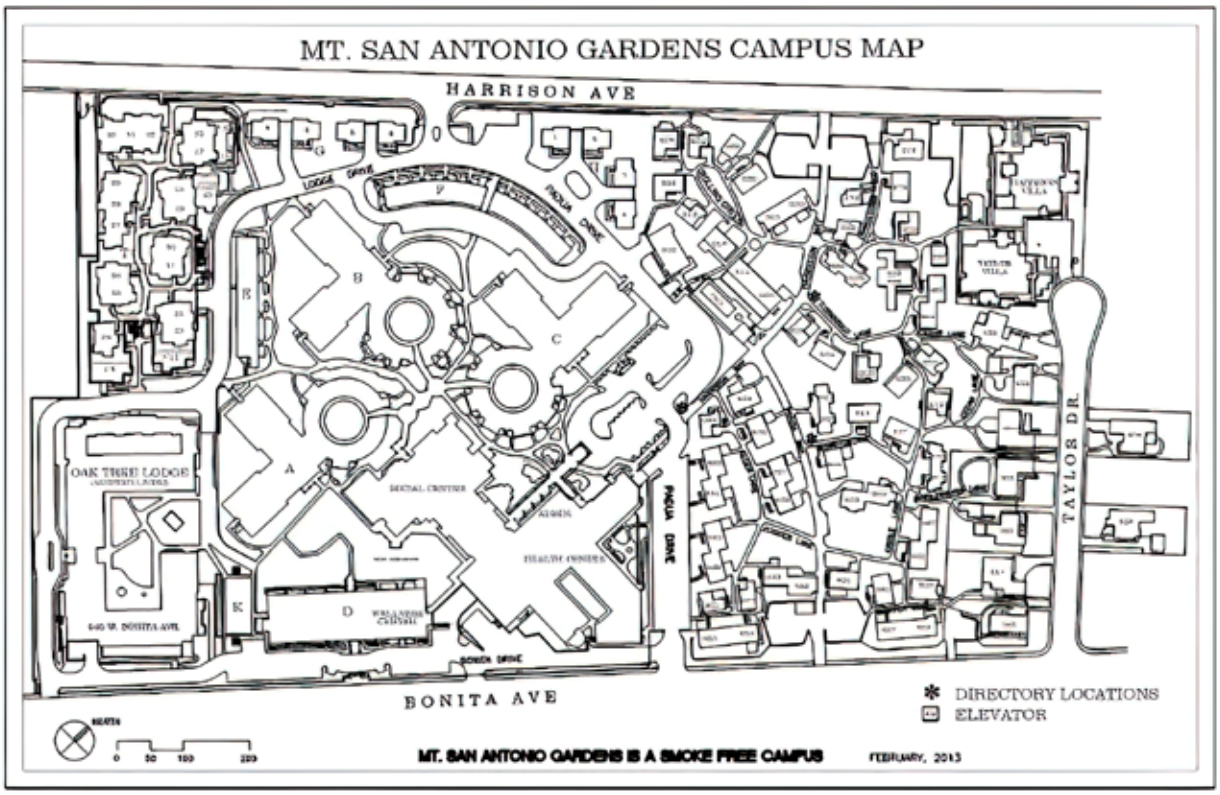
Proximity to Essential Services

Proximity to essential services plays an important role in healthy aging and may vary across community types. Clear and convincing evidence summarized in **Chapter II** suggests that accessible essential services within 400-500 meters from residences (e.g., bank, post office, grocery store, and leisure facilities) promote physical activity, social interactions and improved health outcomes.

The MPCs profiled in this report included hospitals, grocery stores, pharmacies, and other services in close proximity to housing. For example, Meridian Water's planned intergenerational community of 1,500 homes (Phases 1/2) will be accessible to retail, employment, and community spaces.[253] Summerlin allocated space for The Valley Health System to build the Summerlin Hospital within the community.[254,255] Additionally, Summerlin has 10 private schools, 16 public schools, the College of Southern Nevada Learning Center, the Las Vegas Institute for Advanced Dental Studies, and plans to add Roseman University's School of Health.[256] Downtown Summerlin, zoned for mixed-use, features grocery stores, an optometrist, banks, childcare services, and a post office. Similarly, Rancho Mission Viejo features grocery stores, a gas station, optometry services, banks, a post office, an animal hospital, as well as a 14-acre K-8 school campus.[257] Proximity to these services promotes walking and community-building for residents.

Care services are also co-located in CCRCs (e.g., integrated memory care, assisted living, and skilled nursing or rehabilitation services), but they often lack retail services. Such developments comprise a variety of home settings on one campus to offer stepped care across the phases of aging. For example, 500 residents live on a 31-acre campus at Mt. San Antonio Gardens (See Figure 10) in Claremont, California. Independent living occurs in bungalows, studios, and one- and two-bedroom apartments. When increased levels of care are required, Mt. San Antonio has 11 memory care studios and 72 skilled nursing private/semi-private rooms and two additional "Green House" homes

FIGURE 10
Mt. San Antonio Gardens Campus Map



Source: Mt. San Antonio Gardens

that provide appropriate levels of care.[258] Notably, Mt. San Antonio's Green House homes are part of a larger organization, The Green House Project, the mission of which is to further develop "small in scale, self-contained, and self-sufficient nursing home and assisted living settings that put elders at the center." The Green House homes, developed by Dr. Bill Thomas as a substitute for nursing homes, use universal designs, contain private and public spaces that are easy to navigate, and restructure the staffing and service delivery system common to nursing homes.[259] The Robert Wood Johnson Foundation supported the development and evaluation of the Green House concept from 2010 to 2018 as well as local and national expansion efforts. Research suggests that Green House homes improved their residents' quality of life.[260,261]

Due to their size, many co-housing and smaller developments may not provide essential services, retail stores, or commercial entertainment on site; however, these developments may be strategically located near shops and essential services, and sidewalks and streets are designed to facilitate resident integration with the greater community. For example, the New Ground development is near bus routes, shops, a post office, bank, physicians, hospitals, and is a bus ride away from the London Underground train system.[h] Using the greater community's retail and essential services may fill residents' needs for socialization, entertainment, and services while reducing the cost of the development.

Promoting Connections to Greater Community

Smaller planned developments are often located near pre-existing infrastructure and create permeable borders that define the neighborhood while encouraging interaction with the greater community.

[h] Maria Brenton, Senior Cohousing Ambassador at UK Cohousing and Project Consultant to the Older Women's CoHousing Project. Personal Communication, April 2021.

FIGURE 11
Drommehagen Site Layout

Credit to SLA for the landscape and Haptic for the architecture. Source: SLA

FIGURE 12
Drommehagen Permeability

Credit to Haptic Architects. Source: Haptic

Drommehagen (Drobak, Norway) is an example of a layout which promotes socialization, not only among neighbors, but with the broader community.[262] A large outdoor staircase purposefully leads the general public into the Drommehagen's courtyard/gardens while also encouraging increased activity by residents (See Figure 11).[262,263] Building "visible, enticing stairs to encourage everyday use" is one of the 19 strategies for building healthy places identified by the Urban Land Institute.

Drommehagen's three apartment buildings enclose a community garden/greenspace (see Figure 11), while also creating a permeable community that encourages bi-directional community integration. Multiple entry/exit pathways into and through the development provide access to the development's restaurants, shops, and public square (See Figure 12). Such permeability, established using open third places and intersecting pathways, can create opportunities for socialization and physical activity among development residents and with the broader community as well as appropriate foot traffic to sustain small businesses.

The Village of Hope and Share Kanazawa also purposefully created connections with their greater communities. The Village of Hope (Clearfield County, Pennsylvania; see p.84 for additional details), a public-private collaboration, will "service not only its residents, but also the greater community."[243] This 23-acre rural development will feature a Village Hall where the residents and greater community members will have access to "a health clinic, grocery store, café/restaurant, and community arts and theatre spaces."[243] The Village of Hope will include people of all ages and cognitive abilities among its residents, including those with dementia.

Share Kanazawa (Ishikawa Prefecture, Japan; see image p.58) integrates older individuals, youth with special needs, and university students with the greater community by opening on-site facilities (restaurant, café and kitchen studio utilized for classes, massage salon) and vegetable gardens to the greater commuity.[264,265] (See p.70 for additional details.) By having a mixed community "everyone learns to receive care and give care," explains Ryo Yamazaki, the Community Designer for Share Kanazawa, in a video about their site.[264]

Intergenerational Spaces

Although there is limited peer-reviewed evidence of the benefits of aging in place in an intergenerational community (see **Chapter II**), experts we interviewed emphasized the importance of intergenerational communities. Many of the model communities highlighted here also emphasize the importance of intergenerational communities to maintain mental and social health and a sense of purpose and relevance. Share Kanazawa, Marmalade Lane, Village of Hope, Grow Community (Seattle, WA) and Culdesac (Tempe, AZ) are examples of communities with an intergenerational emphasis.

Share Kanazawa. Source: Share Kanazawa

Two key informants we interviewed noted that a hybrid model of creating intergenerational spaces within or adjacent to an age-restricted choice establishes viable alternatives to meet a range of preferences. The Gavilan neighborhood in Rancho Mission Viejo and Summerlin's Regency, Trilogy, Siena, and Sun City locales are neighborhoods restricted to those aged 55+ years. [266,267] Although these neighborhood amenities, such as pools and clubhouses, are age-restricted, these residents also have access to their development's adjacent intergenerational neighborhoods where their children and grandchildren could live.

Another example of a hybrid approach is a planned retirement community adjacent to the University of California-San Diego campus (UCSD). Feedback from future older adult residents indicated that they preferred not to live exclusively with older adults;[i] thus, the initial age restriction will likely be removed from the development. The new intergenerational emphasis for this future urban village community comports with the site selection that purposefully located the village near a school and community center to increase retirees' community engagement.[268] UCSD intends to establish a living lab on site to support university research opportunities with interested community members.[268] Development of this UCSD community is on hold, however, due to COVID-19.

Third Places

Although we found no studies that specifically assessed connections between select third places and intergenerational interactions, **Chapter II** summarized evidence that third places generally tend to improve socialization and physical and mental health. Third places, such as parks, pools, stores, restaurants, or other places outside of work, school, or homes, provide natural opportunities for "chance-meets" to occur. Third places were intentionally integrated into all the models we reviewed, but they were most strongly emphasized in co-housing communities where shared spaces anchor the physical and social structure the community.

Third places are the keystone to community success among co-housing communities. Examples of shared spaces for these communities include kitchens, dining areas, common houses, woodworking sheds, community gardens or green space, or other activity spaces, which foster a tight-knit co-housing community. Orientating individual homes around these shared common spaces is another common design strategy.

In one intergenerational co-housing community, Marmalade Lane (Cambridge, UK; See Figure 13), much of the 1-acre site is dedicated to a south-facing common garden which is situated behind the community's 42 mixed-housing units; the northern corner is allocated to a car-free lane which the homes line. These elements create intentional third places, while also allocating open spaces, which are used for child play and creating a pedestrian-friendly community. One of Marmalade Lane's architects noted "The whole site is essentially a collective playground for kids."[269]

[i] D. Glorioso, personal communication, November 19, 2020.

Additionally, the Marmalade Lane community shares a common house which includes a kitchen, laundry facilities, children's playroom, an adult room, meeting rooms, gym, workshop, and guest bedrooms. Such spaces represent intentional creations of third places, where intergenerational interactions can flourish, since all age groups are targeted in the creation and design of the common house. Uniquely, parking spaces and garbage bins are located on the margins of the development to make better use of the outdoor space for resident enjoyment, but their location also creates additional third places where residents experience chance-meets (in contrast to separate driveways and garages).[270]

Third places are also intentionally created in Dementia Villages to encourage both independence and socialization among individuals affected by dementia. Specifically, Village Landais designated building and open space area, "La Bastide," that houses an auditorium, gym, hair salon, restaurant, activity rooms, media library, and grocery store.[271] Its integrated third places not only encourage

FIGURE 13
Marmalade Lane

Credit to Mole Architects. Source: Mole Architects

FIGURE 14
Heartwood Commons Site Layout

Source: Heartwood Commons

socialization among the residents, but also helps them to maintain independence in their daily lives.

Housing Orientation Can Optimize the Use of Third Places

The placement and orientation of homes around a third place may better optimize its use. For example, the design of Heartwood Commons (See Figure 14), a co-housing community restricted to those aged 55+ that is under development in Tulsa, OK, designed a rectangular site where car parking and one looped road will line the exterior of the development and homes will face an enclosed community green. The developers believe this intentional creation of a third place will create opportunities for chance-meets, in contrast to individual garages associated with each unit.

The looped road around the development also creates a traditional pedestrian-friendly center, where paths connect individual homes. Heartwood Commons will also have a centrally located community green space next to the common house, along with a dog park, workshop, garden, greenhouse with shed, and contemplative space.[272] Katie McCamant, President, CoHousing Solutions, emphasized that third places like parking lots, mailboxes, and laundry facilities give individuals opportunities to make friends on a day-to-day basis.

> "Society has natural, spontaneous socialization opportunities, or not, due to design choices. Community happens on the pathways not in meetings or scheduled events."
>
> *– Katie McCamant, President, CoHousing Solutions*

Transportation

Ensuring resident access to reliable transportation is a major factor in promoting healthy aging. Accessible transportation, like public buses, trains, and bike paths near communities, provides easy options for exploring the greater surrounding area for services, entertainment, or recreation, particularly for those who do not or no longer drive. Research shows that access to transit results in increased physical activity and improved health outcomes, as summarized in **Chapter II**.

Most notably, the Panasonic Peña Station Next is a 220-acre transit-oriented mixed-use development that will have an interconnected rail system to provide transit to the University of Colorado (Denver), downtown Denver, and the Denver International Airport for the community.[273] Within the development, Peña Station Next will be equipped with charging stations for electric cars, autonomous shuttles, bike trails, and walkways. Uniquely, Peña Station Next also describes its commitment to the V2X technologies (the "vehicle-to-everything" technology that virtually connects car systems for safety) that were recently piloted by the Colorado Department of Transportation and Panasonic.[274] Such systems will allow for communication among a network of interconnected cars to prevent accidents and reduce traffic and travel time. More commonly, many developments offer their own shuttle or chauffeur systems (e.g., Rancho Mission Viejo) to transport residents to community events and regional destinations.[266]

In addition to offering multiple transportation options such as buses, railways, and cars, creating pedestrian-friendly communities with nearby essential services are important for promoting exercise, building community and providing a healthy, independent, inexpensive transportation option for those who do not drive. "5-minute communities" offer access to services and third places withing a 5-minute walk or bike ride. Examples include Culdesac (Tempe, AZ), s a unique proposed 16-acre development that will offer a car-free community pedestrian-friendly city for its 1,000 future residents.[275] Amenities to support alternatives to personal cars, such as scooters, car-sharing, bike parking, and a light rail system, will help provide access to the development's restaurants, grocery stores, office spaces, parks, and pool to those inside and outside the development. This approach avoids relying exclusively on the development's population density to sustain local businesses.

Smaller co-housing or village communities are often built near existing transportation hubs or accessible bike lanes. Marmalade Lane's location is a 15-minute bike ride away from the Cambridge city center, schools, employment hubs, a major park, and also close to many transportation options such as bike

FIGURE 15
Grow Community's 5-Minute Lifestyle Map

Source: Grow Community

path networks, and the Cambridgeshire Guided Busway.[270] Developing new communities close to or in towns or cities will increase residents' access to essential services, transportation, and retail. Such proximity will improve the economic sustainability of essential services within the new development.

Wayfinding Strategies

When developing and land use plan or design, considering aspects that support wayfinding can help support resident satisfaction and safety (**Chapter II**). Among Dementia Villages, wayfinding strategies range from using green space to helping guide residents, landscaping for sensory stimulation, utilizing colors, and other novel strategies such as a dementia memory boxes (described below). Although these strategies are primarily utilized within dementia villages, they may be emulated for those looking to age in place in other community types.

Centrally located walkways and landmarks are common to dementia villages and may promote socialization and wayfinding for those affected by dementia.[207] In The Village Langley (British Columbia, Canada: See Figure 16) the community is focused on a garden, a water feature, general store, and a main walkway through the entire 5-acre development. According to the architect, Eitaro Hirota, the walkways were designed to intuitively guide residents to their chosen destination site. The connected walkways visually point residents to destinations and also loop around to avoid dead ends. The main pedestrian walkways are colored in a light grey to encourage walking there by everyone, and black asphalt is used to deter movement into areas that may cause agitation for some residents or areas that are not suited for residents with advanced stages of dementia. (Observational evidence suggests that black flooring may indicate a drop-off or virtual cliff for many people with dementia.[276])

Specifically, the operations staff at The Village Langley collaborated with a dementia consultant in early design phases to create an environment that is safe and intuitive for residents and thereby encourages them to be out and about. Notable design features used by the design team include

FIGURE 16
The Village Langley (British Columbia, Canada) Site Layout

Credits to Andrew Lattreille. Source: The Village Langley

colors, landmarks, and signage in addition to the basic pathway design for wayfinding. The buildings are color-coded in a way that is pleasing and easily recognizable to those affected by dementia. Landscape features and wayfinding signage are located strategically to serve as breadcrumbs to help guide residents around neighborhoods.

The Village Langley also uses the dementia memory box concept, the gathering of familiar objects that may remind an individual of certain names, locations, or people, to augment wayfinding. Easily identifiable objects, like a statue, are used as community landmarks—like the contents of a memory box—to assist in wayfinding. Creating distinct differences between two sides of a fork in the path is another technique used to help individuals recognize familiar locations. These innovative features can help to reduce wandering and improve wayfinding for individuals living with dementia.

> "The right and left side of each path is designed distinctly different so that the environmental cues will also help residents orient themselves and navigate the site such as at a fork in the road. A Bluetooth wander guard system (Blue Willow) with a wearable device is also used. The Blue Willow system allows resident specific geo-fencing of the site and between residents which will alert staff when residents approach potential problem areas in the site or come in proximity to residents that they may not get along with, so staff can approach residents before problems arise."
>
> *– Eitaro Hirota, Architect, NSDA Architect, The Village Langley*

At Gradmann Haus, living units face a courtyard containing a looping path around a garden. The path also connects to a "street-like space" to give residents access to social spaces.[277] This design offers security and independence for people with dementia. There are 18 apartments for family members or partners of those with dementia to live independently nearby.

Green space plays an important role in promoting wellbeing, enhancing wayfinding, and creating a safe environment. Dementia villages use green space to create natural perimeters, enhance wayfinding, and promote wellbeing. Natural landscaping and green spaces are intertwined within The Village Langley property, for example. This development has a small farm with animals, a sports field, a green space dedicated to yoga or meditation, and a spirit maze, and the north-east side of the development borders a viewing garden and a creek. Additionally, for Village Landais (Dax, France; see p.82 for additional details), architects took advantage of the 12 acres of open space to plant various vegetation that differs in color

FIGURE 17
Gradmann Haus Site Layout

Source: Happi. Housing for Our Ageing Population: Panel for Innovation. Housing LIN

and scent to assist wayfinding for their 120 residents. Landscaping was also used to create natural borders as another means of expanding residents' freedom of movement while also keeping them safe within the property.

Technology

Technology can play an important role in assessing and improving residents' health and wellbeing. Panasonic Smart Cities' Peña Station Next will use pedestrian crossing sensors, clean energy, autonomous vehicles, and well-integrated transit systems to improve the local environment and enhance safety.[250] Smart technologies will monitor the air quality, lighting conditions, infrastructure use, and pedestrian activity in real time; the data will be analyzed by researchers, thereby creating a living lab within the development. On a smaller scale, within-residence and exterior automated lighting systems are planned for the Village of Hope. The Village in Canada has residents wear a tracking device, connected to the Blue Willow System,[278] to warn staff of potential conflicts, for example, when two individuals with a history of disagreements are in proximity of each other.[j] Most technological innovations are incorporated at the home or personal-use level. See **Chapter V** for further discussion of technology and community planning.

[j] E. Hirota, personal communication, January 5, 2021.

Community and Housing Models for People with I/DD

There are several notable communities built solely for those with I/DD that employ some of the strategies recommended by evidence-based guidelines such as designs that ensure residents are within walkable proximity to essential services (grocery/pharmacy), public transport, employment, and outdoor spaces for exercise, socialization, education. Independent living units enable residents to have autonomous control over their living environment (e.g., light, sound, and temperature) while still having access to supportive care systems. (See **Appendix C** for model communities.)

These communities differ in how integrated their residents are with the neurotypical community. The Autism Housing Network, a foundation-sponsored entity, is an excellent national resource describing residential options for people with I/DD.[59] First Place-Phoenix (Phoenix, AZ, see photo above), which opened in 2018, provides supportive housing in an urban setting for neurodiverse adults who want to live independently (image above). This urban development is close to essential services, public transportation, and employment; residents are supported by on-site programs and partnerships with local employers and educational institutions. (See p.78.)

First Place Phoenix, AZ. Credit to First Place, AZ and Scott Sandler. Source: First Place, Phoenix, AZ.

Share Kanazawa (Ishikawa Prefecture, Japan) is a unique intergenerational community serving university students, the elderly, and young individuals with I/DD.[279] Share Kanazawa is open to the public and actively encourages the greater community to interact with its residents. (See p.70.)

Communities offering higher levels of support and services for adults with I/DD vary in their proximity to the broader community. Located in a semi-rural area, Noah Homes (Spring Valley, CA) describes itself as a "lifelong housing option that offers a range of support services for diverse population needs."[280] This development includes multiple third places such as a community center, gardens, playgrounds, orchards, and other green spaces. Ravenswood Village is located on 120 acres in a rural area 40 miles from London. Established in 1953 by four families needing housing for their children with learning disabilities, the community now houses 111 residents in 12 residential care homes, five of which provide self-contained apartments around shared living space, and has a staff unit on-site.[281] Residents choose units most conducive to their sensory needs and preferences (e.g., south-facing windows for more light; north-facing for less light; located closer or further from communal space for preferred level of socialization and activity).[282] Upgrades of existing residences and expansion of the community with 183 new homes (40% of them affordable housing) that will be open to the general community began in 2019 with the goal of creating an integrated and inclusive community.[281]

The Sweetwater Spectrum Community (Sonoma, CA) is located four blocks from Sonoma Town Square (See Figure 18). Its residential staff provides support services to 16 residents with I/DD in shared, 4-bedroom homes grouped around a car-free shared space defined by linear pathways. Residents and

FIGURE 18
Sweetwater Spectrum Community, Sonoma, CA

Source: Sweetwater Spectrum

visitors have full access to the 2.79-acre campus that also includes a community center, teaching kitchen, and farm.[58]

Two communities for neurodiverse adults that are currently under development illustrate key features important for this population. The 6.7-acre Coastal Haven development (Santa Cruz, CA) offers residents a "pocket neighborhood" to facilitate social opportunities for co-residents through an adjacent independent organic farm, a local arts center, downtown Santa Cruz, and a state park, all 1 mile or less away from the neighborhood.[60] Coastal Haven comprises 10 homes designed for universal access and offers three model types; residents choose the style and roommates they prefer (See Figure 19). The community is designed for those who are interested in an "interactive lifestyle" as each resident has a private bedroom but shares common space. Each home has a barrier-free entry, wider doorways, accessible (shared) bathroom, and a front porch with capacity to seat multiple residents. The homes face a shared outdoor space with an outdoor kitchen. The site was designed with guidance from local service providers and residents and is co-owned by residents' families. Each resident coordinates the level of services that they require as the development is not a formal service provider. It is privately funded by residents and their families.

FIGURE 19
Coastal Haven, Santa Cruz, CA

Source: Workbench and Coastal Haven

Similar to First Place-Phoenix, Independence Landing (Tallahassee, FL) places individuals with I/DD in close proximity to essential services. Expected to open in 2022, this apartment complex will offer single and double units for people seeking independent living with limited supervision and prompting. It is located within walking distance to medical offices, restaurants, pharmacies, grocery stores, and public transportation.[283,284] Vocational training and a partnership with Florida State University provide lifelong learning opportunities on-site or on the university campus.[284]

Affordability

Cost is an important factor that varies greatly among the aforementioned model communities and is critical when considering building accessible, age-friendly communities. Many higher-end master-planned communities that adopt healthy aging design features are expensive, such as Serenbe and Grow Community. Communities built for people with I/DD are also quite costly (e.g., $3,500-4,000/mo).[58,238] Several communities for people with I/DD were started by families with the financial wherewithal to create the community from the ground up (e.g., Sweetwater, Coastal Haven). Meridian Water, The Village of Hope, and Share Kanazawa, on the other hand, were built as affordable communities through public-private collaborations. Potential residents at Share Kanazawa were drawn to "a place where one can live a healthy and active lifestyle that costs less than in the capital [Tokyo]."[279] Additionally, 50% of the planned homes (for sale and rent) at Meridian Water were designated as affordable housing targeting first time buyers. By using prefabricated homes to manage construction costs, the Village of Hope targets the "middle-market" to expand access to those who do not quality for public assistance and those who cannot afford higher-end retirement housing options. Successful healthy aging communities can be built to meet a variety of price points for residents and families of different income levels.

Conclusions

A variety of model communities, varying in location, size, and target population, already incorporate various key land-use planning elements designed to enhance healthy aging; however, additional opportunities for developing innovative, evidence-based healthy aging communities are plentiful given projected demographic shifts. Community-university partnerships can provide options for conducting much needed longitudinal evaluations of resident outcomes and satisfaction and can enable ongoing innovation and improvements.

To encourage physical activity and socialization within and beyond the neighborhood, developments commonly include pedestrian-friendly spaces with ample green and blue space, connected walking paths or trails, access to variety of transportation options, and mixed use zoning with nearby essential services, retail spaces, and entertainment. Homes in these communities are frequently organized around third places such as a town square or common house.

The most unique features among these models were those that:

- Encourage socialization within and outside the community, as well as socialization across generations, through the use of connected pathways, permeable borders, and interior and exterior third places
- Promote healthy diets through the use of community farms or on-site farmers' markets
- Encourage physical activity by providing green spaces, recreation centers, well-integrated and networked walking paths, and bike lanes that connect to essential services
- Create a 5-minute neighborhood (a car-free environment, or networks of walking paths, with essential services within a 5-minute walk or bike ride) to encourage walkability

Moreover, unique models cater to specific populations, such as those with dementia, by enhancing safety and wayfinding while ensuring residents remain connected with the greater community. Finally, some models incorporate advanced technologies to promote, assess, and maintain healthy living.

Spotlights on Model Communities

Ten of the 35 model communities cited in this report are highlighted for implementing a number of innovative planning and design characteristics identified by the Urban Land Institute guidelines as contributing to healthy communities (**Chapter III**). All four community classifications are represented. These exemplary "spotlight" cases may inspire planners, developers, or other key stakeholders to emulate or adapt critical features to fit the needs of other communities. The highlighted features comport with those for which evidence exists.

These spotlights include basic descriptions of urbanicity, acreage, number of residents and units, community type, notable features, and potential concerns. Each spotlighted community also includes estimated housing costs, which are categorized as targeting high-, affordable-/middle-, or low-income markets (high costs are above average market costs for the particular area; affordable/middle costs are average market costs; and low costs are below average market costs for a particular area). (See **Appendix C** for the summary table of all 35 model communities.)

SERENBE[241,252]
Chattanooga Hills, GA

SHARE KANAZAWA[264,265]
Kanazawa, Ishikawa Prefecture, Japan

NEW GROUND COHOUSING[289]
High Barnett, UK

GROW COMMUNITY[291]
Bainbridge Island, WA

CULDESAC[285]
Tempe, AZ

LAGUNA WEST[287,288]
Elk Grove, CA

FIRST PLACE PHOENIX[286]
Phoenix, AZ

PANASONIC PEÑA STATION NEXT[247,250]
Denver, CO

VILLAGE LANDAIS ALZHEIMER[290]
Dax, France

VILLAGE OF HOPE[243,292,293]
Clearfield County, PA

SPOTLIGHT:

Serenbe

Chattanooga Hills, GA *(Nearest Major City: Atlanta, 40 minutes by car)*

COMMUNITY TYPE: MASTER-PLANNED COMMUNITY
URBANICITY: RURAL
HOUSING COST: HIGH
ACREAGE: 1,000 ACRES
 # OF RESIDENTS: 750
 # OF UNITS: 370 SINGLE FAMILY, LIVE/WORK UNITS, TOWNHOUSES, LOFT/ CONDO APARTMENTS

Unique Features: Intergenerational, agri-wellness-focused suburban development

Serenbe's 1,000-acre intergenerational model is split into four thematic areas, or "hamlets" that focus on wellness through the arts, agriculture, health, or education. Serenbe promotes an "agri-hood" approach to healthy living and supports a small organic farm to encourage farm-to-table living at home and in restaurants in the development. The 750 residents may access a Community-Supported Agriculture Program, or Farm Share, and participate in weekly farmers' markets. Green space comprises 70% of the 1,000 acres, and is dedicated to natural habitat that supports health and wellness and extends to creative "edible landscaping (e.g., blueberry bushes lining public walkways). Fifteen miles of trails weave throughout the development to link residents to nature, community amenities, and residences. Third Places at Serenbe include equestrian stables for horseback riding, an outdoor theater, and a lake for fishing, swimming, or paddle-boarding.

Other Notable Features Include:

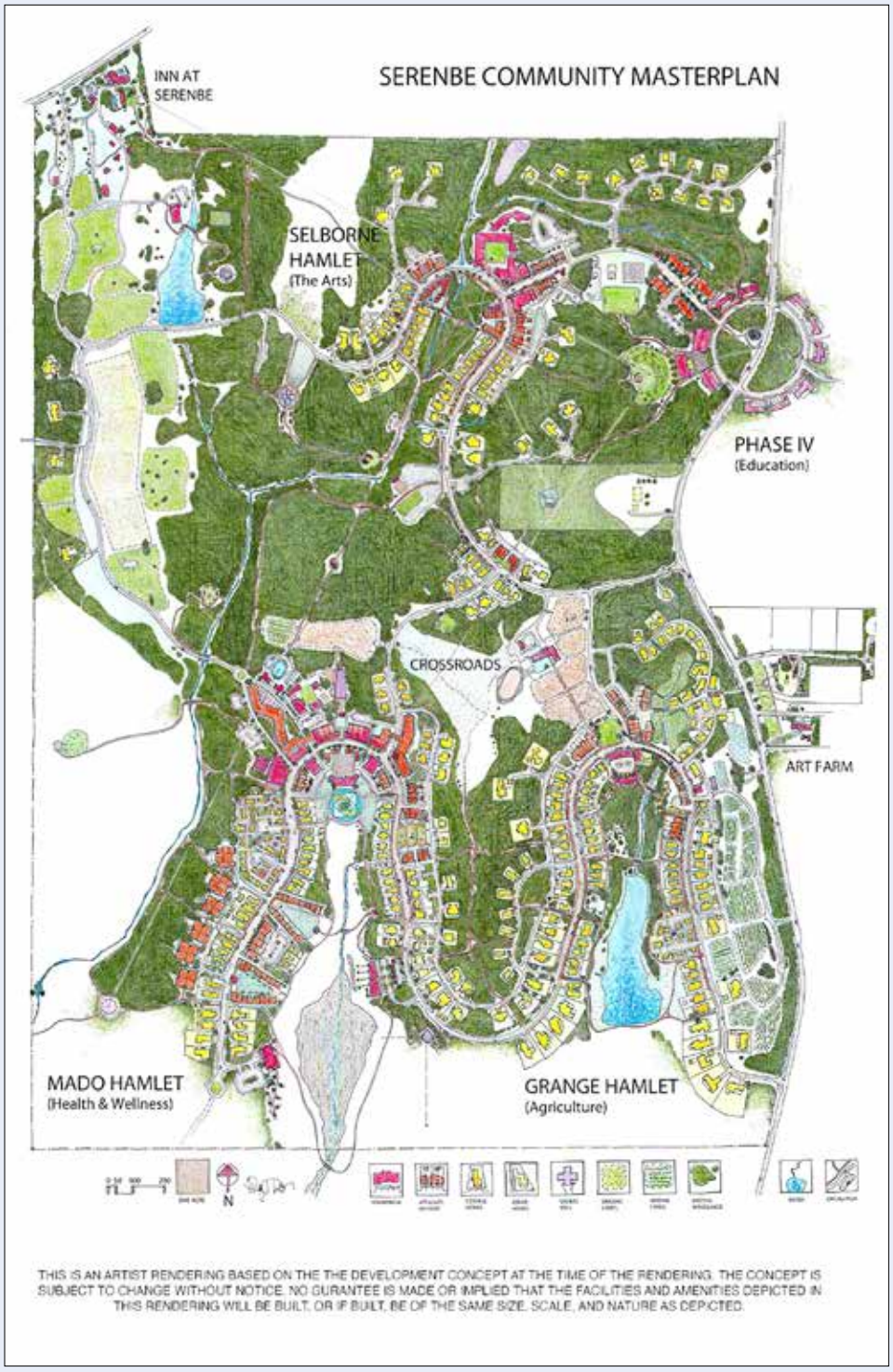
- A pre-school, elementary, and middle school. As demand increases, a high school may be added.
- Mixed-use areas of primarily small businesses reside on the property, including many restaurants and small shops
- Additional Third Places such as space for an Artist Residency Program, a painting studio, and a ballet theater.
- Inn at Serenbe provides on-site hotel space for visitors and an alternative income source for Serenbe businesses

Potential Concerns Include:

- Lack of easy access to healthcare services
- Lack of public transportation connecting to the greater community
- High housing costs may limit middle- and lower-income individuals from buying homes in this community

Serenbe Aerial View.

Serenbe Gabion Bridge.



Serenbe Community Layout.

Serenbe Blue-eyed Daisy Street.

Serenbe Farmer's Market.

Serenbe Farm Plant Sale.
All photos and map courtesy of Serenbe.

SPOTLIGHT:

Share Kanazawa

Kanazawa, Ishikawa Prefecture, Japan *(Nearest Major City: Tokyo, 6.5 hours by car)*

COMMUNITY TYPE: VILLAGE HOUSING DEVELOPMENT
HOME TYPE: APARTMENTS AND TOWNHOMES
URBANICITY: URBAN
HOUSING COST: AFFORDABLE
ACREAGE: 8.9 ACRES
 # OF RESIDENTS: 40 ADULTS (60+), 32 YOUTH WITH SPECIAL NEEDS, 8 UNIVERSITY STUDENTS
 # OF UNITS (IN BLUE): 32 UNITS FOR OLDER ADULTS, 30 UNITS FOR YOUTH

Share Kanazawa Site Plan. Source: Share Kanazawa

Unique Features: Intergenerational community focused on purposeful living for the aged and youth with special needs

Share Kanazawa, primarily built to address Japan's aging population, is a small, innovative housing development that supports healthy aging through interactions within its intergenerational, neuro-diverse community and with the greater community. This public-private partnership is managed by a non-profit organization and houses older adults, children with special needs, and university students who volunteer in exchange for rent.

Pathways into the development encourage residents from outside Share Kanazawa to frequent the small businesses on the premises. For example, children easily visit the community to buy candy from the elder-owned store by walking along a dedicated pathway from their school into the property. Additionally, the Share Kanazawa community invites residents from both inside and outside of the community to use a kitchen studio for cooking classes, a hot springs bathhouse, and a café. Encouraging community members to use the development's facilities increases socialization across generations and neuro-abilities (see site layout: blue indicates residential housing, all other colors relate to businesses and activities). This community practices a key element found among the Blue Zones: ensuring a sense of purpose among the aging residents by offering them jobs and encouraging them to actively participate in community management and decision-making. Moreover, the model promotes social, life, and job skills for youth with special needs. Share Kanazawa reports that the Japanese government uses it as a community learning lab.

Share Kanazawa also includes: a main building, which houses the restaurant, common room, bathhouse, a beer garden/cafe, elder daycare and kitchen; an alpaca farm (therapy for individuals with disabilities); laundry facilities; an art studio for the students; a sports facility; and vegetable gardens. These features not only keep the Share Kanazawa residents engaged and active but also draw local residents from outside into the community, increasing opportunities for resident socialization. Such village layouts can shape both how the community's residents interact with each other and how they interact with the community at-large.

Other Notable Features Include:

- Public bus transportation is available at the site
- Healthcare is provided through affiliated Hokuriku Hospital (3 kms away), and there is an elderly daycare service office and a home-visit long-term care station on the premises

Potential Concerns Include:

- Couples may live together, but larger spaces for accommodating families are lacking

Residential unit at Share Kanazawa, Kanazawa, Ishikawa Prefecture, Japan. Source: Share Kanazawa

SPOTLIGHT:

New Ground

High Barnet, UK *(Nearest Major City: London, 30 minutes by train)*

COMMUNITY TYPE: CO-HOUSING
HOME TYPE: APARTMENTS
URBANICITY: SUBURBAN
HOUSING COST: AFFORDABLE
ACREAGE: 2.1 ACRES
 # OF RESIDENTS: 26 WOMEN (AGES 50+)
 # OF UNITS: 25 APARTMENTS (11 1-BDRM; 11 2-BDRM, 3 3-BDRM FLATS)

Unique Features: Proximity to essential services and transportation

As an alternative to living alone, the New Ground community was developed and is managed by and for a group of 26 women (the Older Women's Co-housing Group). Residents, who range in age from 50 years to early 90s, help support each other with aging in place and remaining independent. Following Dutch co-housing guidelines, the community's close proximity to a busy street and town (less than 100 meters) provides multiple transportation options (i.e., car, bus, and the London Underground train) for residents to easily access essential services and local resources such as the local hospital, medical offices, post office, bank, local shops, and a public library. A variety of green spaces can be reached on foot.

The development layout mimics a boomerang shape with 1-, 2-, and 3-bedroom flats in two 3-story buildings enclosing the community green space. To promote physical activity and socialization, a community garden and an additional vegetable patch are maintained as part of the green space.

New Ground residents agree "to look out for rather than look after each other." During the COVID-19 pandemic, for example, the community has been taking advantage of and benefiting from the planned layout to stroll through the gardens and hold socially-distanced gatherings and activities.

Other Notable Features Include:

- Parking lot in the periphery to maximize pedestrian-friendly and green spaces
- Mobility scooter spaces in parking garage
- Common spaces and kitchen for communal dinners and activities
- Secret "culture" garden and craft shed to support collaborative creative works
- Shared laundry facilities
- Guest suite available for residents' visitors
- Car-sharing (limited parking spaces)
- Recipient of multiple housing design awards
- Supports co-housing research

Potential Concerns Include:

- Lack of intergenerational housing option

New Ground Co-housing, High Barnet, London. Credit to the architects: Pollard, Thomas, Edwards (PTE).

New Ground Co-housing site plan. Credit to the architects: Pollard, Thomas, Edwards (PTE).

'New Ground' Co-housing Community. Credit to Maria Brenton.

'New Ground' Co-housing Community, garden view. Credit to Maria Brenton.

SPOTLIGHT:

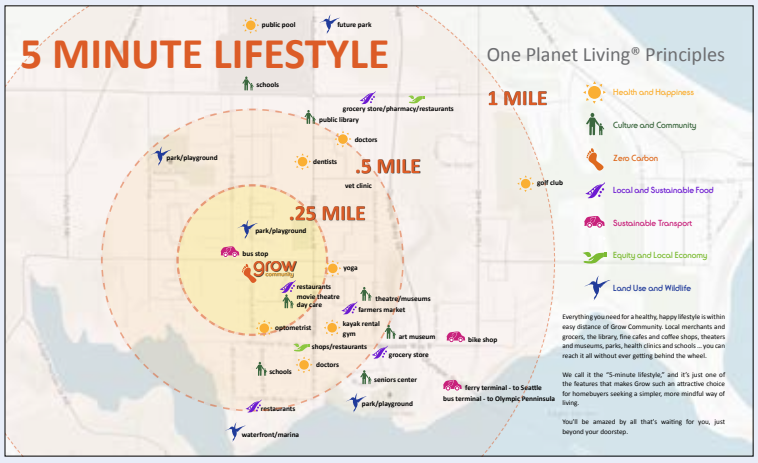
Grow Community

Bainbridge Island, WA *(Nearest Major City: Seattle, 35 minutes by ferry)*

COMMUNITY TYPE: VILLAGE COMMUNITY
HOME TYPE: APARTMENTS, TOWNHOMES, SINGLE FAMILY HOMES
URBANICITY: SUBURBAN
HOUSING COST: HIGH
ACREAGE: NA
 # OF RESIDENTS: NA
 # OF UNITS: 131

Unique Features: Promotes an intergenerational, 5-minute lifestyle within an environmentally sustainable community

Grow Community, located on Bainbridge Island (5 mi by 10 mi) off the coast of Seattle, has taken an innovative approach to community building through the use of a "5-minute" lifestyle and a One Planet Living plan. One Planet Living aims to create a sustainable community where eco-friendly resources and approaches are used during and after development to build and maintain the community. Grow Community's 131 homes are within 5 minutes from most local services by walking or biking. Bainbridge Island publishes a map of public restrooms, an important amenity in age-friendly communities. Annual reviews of Grow Community document an 85% increase in residents' walking habits and a 30% increase in residents' biking habits since move-in. In addition to its 5-minute lifestyle, residents also have access to city life, if desired, via a 35-minute ferry ride to Seattle. As part of One Planet Living, communal gardens are central to each pocket neighborhood and play an integral role in creating community and improving health. This community dedicated 60% of its space to green space and 65% of its residents participate in gardening. Additional survey data documented that 70% of its residents believed their mental and physical wellbeing had improved since moving into the community. Grow Community exemplifies how a small community can improve physical activity and overall health through land use planning and community design.



Grow Community's 5-Minute Lifestyle. Source: Grow Community

Other Notable Features Include:

- Community center for resident use
- Underground parking to maximize green space
- Sustainable home features such as solar panels, energy efficient appliances, and use of renewable materials
- Offers single-level floor plans (60% of homes) with elevators for those who may not be able to take the stairs
- Communal car for community use

Potential Concerns Include:

- High housing costs limit middle- and lower-income individuals from buying homes in this community
- There is a medical center on the island, but higher levels of specialty care require travel to Seattle

Above: Grow Community Site Plan. Source: Grow Community
Left: Grow Community. Copyright Grow Community. Source: BioRegional

SPOTLIGHT:

Culdesac

Completion Expected in 2022

Tempe, AZ

COMMUNITY TYPE: MASTER-PLANNED COMMUNITY
HOME TYPE: APARTMENTS
URBANICITY: URBAN
HOUSING COST: HIGH
ACREAGE: 16 ACRES
 # OF RESIDENTS: APPROXIMATELY 1,000
 # OF UNITS: 636 APARTMENTS

Unique Features: Car-free, pedestrian-oriented community emphasizing shared spaces

Culdesac's 16 acres are expected to be 100% car-free in keeping with the innovative "5-minute lifestyle" model in which essential services are readily available within a 5-minute walk. Although the residents must agree to not own a car while living in the development (no parking is offered), this pedestrian-friendly community offers a variety of transit options, including walking, car-sharing programs, biking, and scooters, as well as an adjacent light rail stop providing connection to the airport, downtown Tempe, and Arizona State and other universities and colleges in the area. The developers allocated 24,000 square feet for retail space and an additional 35,000 square feet for additional amenities; these will include grocery stores, restaurants, co-working spaces, and pools.

For those nterested in age in place, this "5-minute city" with various transit options is a noteworthy model.

Other Notable Features Include:

- Open spaces include walkways, plazas, and parks for residents
- Shared fire pits, grills, and hammocks encourage socialization
- "Extend Your Home On Demand" allows rental of a guest suite, podcast studio, storage, office space and hosting space, plus the Makerspace (craft shop)

Potential Concerns Include:

- Access to health services for individuals with mobility problems or experiencing an emergency may be more difficult without access to a personal vehicle

Culdesac Site Plan by Opticos Design. Image provided courtesy of Opticos Design, Inc.

SPOTLIGHT:

Laguna West

Elk Grove, CA *(Nearest Major City: Sacramento, 15 minutes by car)*

COMMUNITY TYPE: MASTER-PLANNED COMMUNITY
URBANICITY: SUBURBAN
HOUSING COST: MIDDLE MARKET
ACREAGE: 1,045-ACRES
 # OF RESIDENTS: 8,414 RESIDENTS
 # OF UNITS: 3,370 SINGLE-FAMILY AND MULTI-FAMILY HOMES

Unique Features: Aspects of New Urbanism including focus on accessible home fronts (shorter front yards, garages moved to alleyways behind the house)

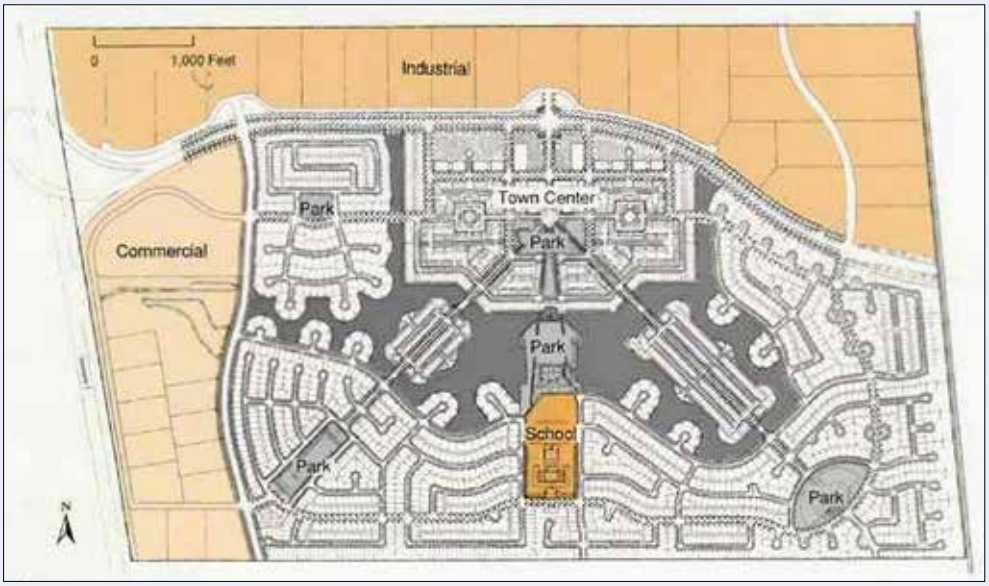
Laguna West, a mature master-planned community located in Elk Grove, CA, was an early effort in the New Urbanism movement, designed to return a "human-scale" to communities and re-introduce sociability amongst suburban neighbors through Third Places. Built in 1994, the development consists of three communities, Laguna West, Lakeside, and Stone Lake, surrounding a 73-acre lake lined with walking paths and fishing areas. The development is pedestrian-friendly, and garages are de-emphasized (by building alleyways for garages). Sociability is promoted through larger front porches and a shorter front yard distance to sidewalks. Its residents may also access Third Places such as the community center, sports fields, parks, a riparian zone, and walking trails. Main roads and paths, lined with trees (traffic calming and heat reduction strategies), are purposefully integrated to connect parks, the town center, and residences to promote walkability. The development also includes commercial and office space. A development-wide tree canopy and an HOA mandate of two trees per home (with one species per block) were included in the original plan.

Other Notable Features Include:

- Local restaurant choices

Potential Concerns Include:

- Lack of access to public transit options
- Lack of access to essential services
- High number of cul-de-sacs, which interrupt street connectivity



Laguna West Site Plan. Source: ULI Case Study

SPOTLIGHT:

First Place Phoenix

Phoenix, AZ

COMMUNITY TYPE: SUPPORTIVE HOUSING FOR NEURODIVERSE ADULTS
HOME TYPE: APARTMENTS
URBANICITY: URBAN
HOUSING COST: ~$4,000/MO
ACREAGE: NA
 # OF RESIDENTS: 79
 # OF UNITS: 55

Unique Features:

First Place (Phoenix, AZ) offers housing for neurodiverse adults who want to live independently and meet qualifying criteria (e.g., are able to: independently manage medications and personal hygiene, recognize and respond to an emergency, feed themselves without physical prompting [food preparation skills are not required, etc.]). There are 55 apartments (studio, one- or two-bedroom) in a four-story building; the first floor houses communal space with a health and wellness center, a culinary teaching kitchen, lounges, a community center, and offices (including the First Place Global Leadership Institute – an advocacy and research organization focused on housing solutions for neurodiverse adults, and the Transition Academy Program, a 2-year life skills training program for adults with autism intending to live independently). Residential units are on upper floors, which also offer communal spaces such as a fitness center and game room. Onsite services, in addition to the Transition Academy Program, include employment services, and vocational training.

First Place, Phoenix, AZ. Credit to Good Eye! Media. Source: First Place

Rent includes housing, utilities, access to amenities and support with shopping, budgeting, daily living skills, transportation and navigation, culinary skills, and household management. Support specialists coordinate diverse social activities, and a vocational coordinator assists interested residents with identifying their skills and interests in conjunction with providing individual career-search guidance. Annual leases are renewable in perpetuity for residents in good standing.

First Place is located in downtown Phoenix within walking distance of essential services and public transportation. Through partnerships with Arizona State University (research and educational initiatives), the Arizona Diamondbacks, CVS Pharmacy (training and employment opportunities), Arizona School for the Arts (peer mentors), Phoenix College/GateWay Community College (education for lifelong learners with special abilities) and other organizations, age-friendly, intergenerational socialization and community engagement opportunities and are offered to, and in support of, the neurodiverse residents.

Other Notable Features Include:

- Pool
- Organic Garden
- BBQ Area

Potential Concerns Include:

- High cost of living may limit lower income individuals from living here.
- The community is limited to neurodiverse adults and some may feel isolation.

First Place Layout. Source: First Place.

Amenities near First Place. Source: First Place.

SPOTLIGHT:

Panasonic Peña Station NEXT

Completion Expected in 2026

Denver, CO

COMMUNITY TYPE: MASTER-PLANNED COMMUNITY
HOME TYPE: APARTMENTS
URBANICITY: URBAN
HOUSING COST: MIDDLE MARKET
ACREAGE: 220 ACRES
 # OF RESIDENTS: NA
 # OF UNITS: 1,329

Unique Features: a "live-in-lab" community using advanced technology

Peña Station Next is a "smart city" informed by data gathered through advanced technology. CityNow recently initiated this mixed-use development of 3 million square feet of office, retail, and commercial space, as well as restaurants and cafes, fitness and wellness centers, entertainment venues, and 818 intergenerational housing units. Panasonic's mixed-use Peña Station NEXT is unique for integrating advanced technology into this proposed development to improve the lives of its residents through real-time data collection. The technology will monitor residents' behavior and/or interactions associated with the surrounding environment, traffic, car use, and air quality, thus creating a live-in-lab community. The development will also host a pilot program to reduce traffic and accidents by creating a virtual communication system between automobiles. The community will house a health & wellness center that will provide traditional medicine, alternative healthcare, and health education. This transit- and technology-focused community will serve as a model for those interested in using technology to optimize healthy aging.

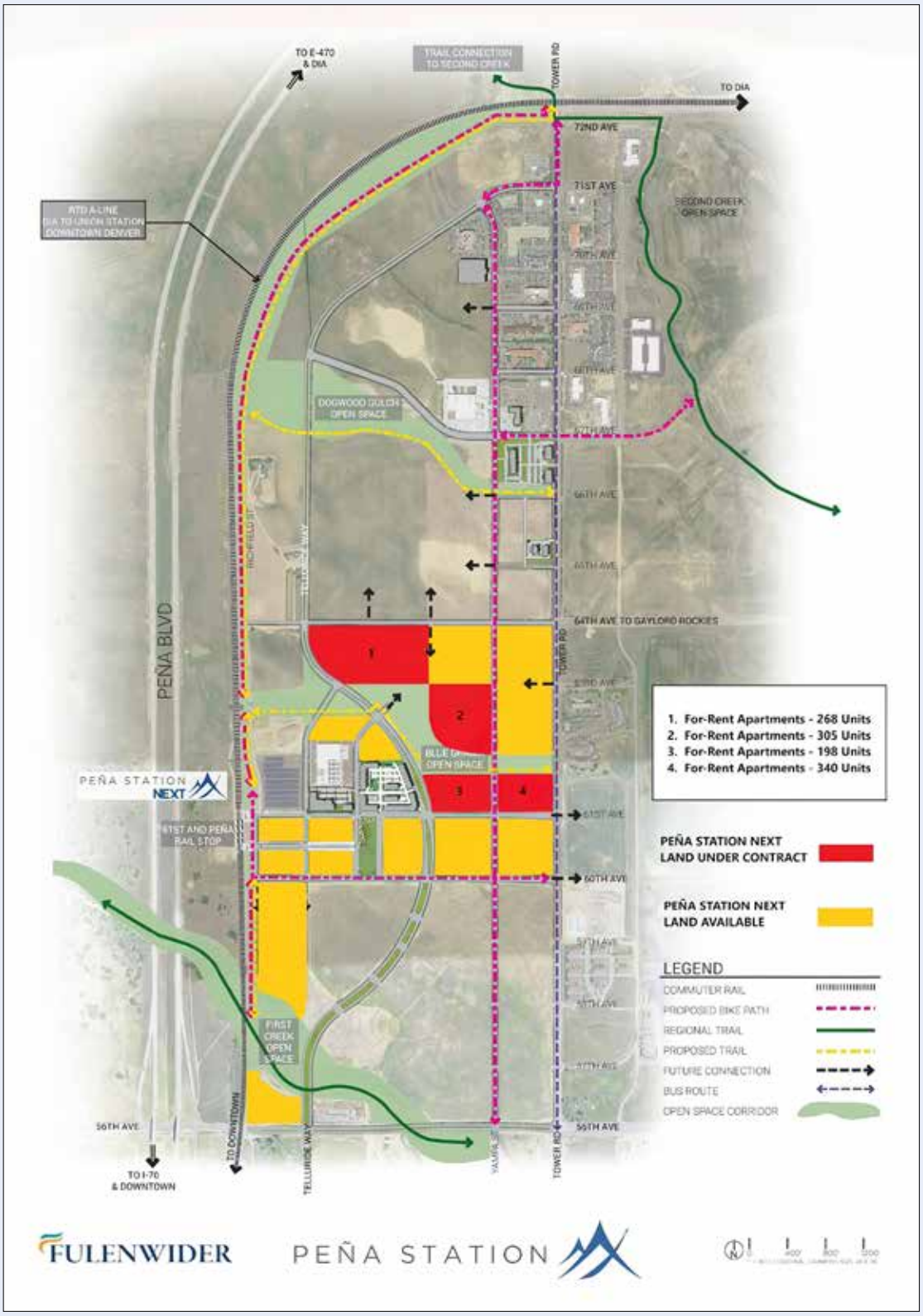
Other Notable Features Include:

- Transit options including charging stations for electric vehicles, bike lanes, autonomous shuttles, and a railway system connecting to the Denver airport, downtown Denver, and University of Colorado destinations
- Walkable inner-community for pedestrian-friendly activity

Potential Concerns Include:

- Technological concerns about data privacy and willingness to be monitored

Rendering of Peña Station NEXT @ 61st and Peña Rail Stop. Source: Panasonic Peña Station NEXT.



Peña Station NEXT Proposed Layout. Source: Panasonic Peña Station NEXT.

SPOTLIGHT:

Village Landais Alzheimer

Dax, France *(Nearest Major City: Toulouse, 3 hours by car)*

COMMUNITY TYPE: DEMENTIA VILLAGE
HOME TYPE: APARTMENTS
URBANICITY: SUBURBAN
HOUSING COST: AFFORDABLE
ACREAGE: 12.3 ACRES
 # OF RESIDENTS: 120 RESIDENTS (10 <60 YRS) WITH 120 EMPLOYEES AND 120 VOLUNTEERS
 # OF UNITS: 16 HOUSES (7-8 RESIDENTS EACH)

Unique Features: Creative Wayfinding and Research Partnership

Village Landais is a "mini village" that implements innovative wayfinding techniques to support individuals affected by dementia. Using colors, sensory gardens, open spaces, and looping walking paths ensures resident safety and wellbeing. Residents are encouraged to care for the community garden and animals at the mini-farm as part of the therapeutic care approach taken here.

The Village is designed so that an individual with dementia can be free to move around the premises independently. Security is described as "soft" in that architectural and landscaped elements limit wandering without the impression of a restrictive enclosure. Moreover, mixed-use spaces, like a supermarket and hair salon, have been included to promote independence. 120 volunteers support interactions between residents and the broader community (although this program, and allowing outside visitors, has been put on pause due to the COVID-19 pandemic). Volunteers share their activities and interests with residents and benefit from the infrastructure and activities available in the Village, such as concerts in the auditorium, painting in the activity room, or reading in the media library.

Rendering of a Third Place at Village Landais. Credit to NORD Architects and Champagnat & Gregoire Architectes

The community also hosts a government research partnership with the Departmental Council of Landes and the Agence Régionale de Santé Nouvelle-Aquitaine. A 5-year study to demonstrate the validity of the Village's care system for people with Alzheimer's disease is being conducted in the on-site resource and research center. Ethical and research committees, with representation from doctors, researchers, advocacy organizations, and Village staff, work together to review potential studies and ensure they are ethically implemented. Topics under study have included quality of work for professionals and quality of life for villagers, caregivers, and volunteers; evolution of the social perception of the disease with the general public and general practitioners; and a socio-economic analysis of the Village. The overarching research goal is to determine (and ultimately disseminate) the most effective designs, strategies, and programs for treating Alzheimer's Disease.

Other Notable Features Include:

- Access to green space such as ponds, gardens, and a farm (with chickens and donkeys)
- Access to Third Places for socialization such as salons, a library, lounges, and a town square
- Adaptations in order to remain open during the COVID-19 pandemic

Potential Concerns Include:

- The community is limited to those with dementia and their caregivers and some may feel isolation

Credit to NORD Architects and Champagnat & Gregoire Architectes

Village Landais Site Plan. Credit to NORD Architects and Champagnat & Gregoire Architectes

SPOTLIGHT:

Village of Hope

Proposed

Clearfield County, PA *(Nearest Major City: Philadelphia, 4 hours by car)*

COMMUNITY TYPE: VILLAGE HOUSING COMMUNITY
HOME TYPE: MINKA HOMES
URBANICITY: RURAL
HOUSING COST: MIDDLE MARKET
ACREAGE: 23 ACRES
 # OF RESIDENTS: NA
 # OF UNITS: 51

Unique Features: Repurposed school property used for an intergenerational aging-in-place community that is intended as "a living testing ground of best practices" for a community inclusive of people with cognitive impairments

The Village of Hope, situated on a 23-acre former elementary school site, will be a multigenerational, multi-ability, co-living development that welcomes people with dementia. Initial plans call for five distinct pocket neighborhoods anchored by a Village Hall described as "a social, commercial and artistic hub that…is a destination and resource for the broader community." An additional 70-acre acquisition is under consideration. Homes in each of the neighborhoods will encircle their own "village green" to encourage socializing and interaction with nature.

The Village of Hope will allow aging-in-place and purposefully strive to support "neighbors helping neighbors" regardless of age or cognitive ability. This public-private collaboration (among the local Area Agency on Aging, Mature Resources Foundation, the Pennsylvania Department of Aging, and Minka Homes) is building spaces to intentionally draw in community members by offering essential services for the broader rural community. Specifically, the Village Hall will house a telehealth technology-enabled health clinic, grocery store, café/restaurant, and community arts and theatre space that will be accessible to residents and members of the greater community. Ana Pinto da Silva, co-founder and CEO of Minka Homes + Community, said one of the aims of this community project is to increase food security through the establishment of an onsite grocery store since many in the greater community live far from grocery stores.

In addition to bridging communities, Village of Hope is designed to serve as a prime example of promoting socialization through use of green spaces and using universal wayfinding strategies to support diverse communities. Looped paths and sensory-stimulating landscape elements (e.g., contrasting colors and scents) will be incorporated to assist in wayfinding and memory-building for those with limited cognitive function. The Village of Hope will be car-free, but offer connected parking along its periphery; service roads and paths will be "surface friendly" to pedestrians, bikers, electric carts and persons with wheelchairs and walking devices. Paths will connect residences, the Village Hall, lakes, and wooded areas. Gardening sites will be designed to be easy to access for older adults and include shading devices to preserve the energy of the older gardeners. These types of landscape elements encourage exercise to improve or prolong mobility.

This partnership with Minka Homes will provide 51 "smart homes," comprising 1- or 2-bedroom homes. All homes will provide a house-wide porch to ease transition from private to public space and facilitate socialization. Homes will be be telehealth-enabled, which will support the developers' intent to facilitate hospital-at-home care as well as end-of-life care. The homes will be affordable, modular units that are universally designed with aging in place in mind. The prefabricated design (implemented using a 3-D printer) lowers costs to about $60,000 per home (total cost ranging from $80,000 to $100,000) and rents will be capped at 30% of a resident's income. Safety features automated exterior lighting, which will be strategically placed to support walking around the community, and interior lighting, designed to turn on when a resident steps out of bed. See the Village of Hope Master Plan Book for details.

Other Notable Features Include:

- Use of a public-private partnership to plan and build the community
- Wayfinding implemented for individuals with dementia; specific strategies include sensory-stimulating landscaping, looped pathways, and contrasting colors
- Affordable for most in the middle market due to prefabricated nature of the homes
- Third Places, such as green and blue spaces, café and restaurant, a farm, and community arts and theater space
- Interior paths and walkways are car-free and pedestrian- and bike-friendly
- Technology for safety, well-being and health integrated into each home

Potential Concerns Include:

- Lack of robust alternative options for transportation to offsite essential services
- Lack of proximity to a major health facility
- Potential zoning challenges due to the innovative, modular approach to home construction

Photos: Layout and Third Place rendering. The Village of Hope. Source: Village of Hope.

V. Digital Technology in Healthy Aging Communities

The rapidly changing field of digital technology is influencing the future of health care and has a specific and profound role to play in the development and functioning of healthy aging communities that are also inclusive of adults with intellectual and developmental disabilities (I/DD). This chapter explores the ways in which technology currently supports healthy aging; reviews key technologies currently used to support healthy aging; presents emerging technology solutions that should be considered by planners and developers, including lessons learned from COVID-19; and provides a discussion of current and proposed policies at the state and federal levels that are likely to influence planning and development. It is important to note that this chapter does not address infrastructure-related technologies (energy and water); rather, it contains important context for planners, developers, policymakers, and other stakeholders about how the public will use evolving digital technology and integrate it into their daily lives. This chapter concludes with a list of findings and recommendations that can be used to frame decisions about how to best incorporate technology in planning and developing healthy aging communities. Central to these findings and recommendations is a core principle: *Technological solutions need to be understood in the context that technology will rapidly evolve in the next decade and beyond – planners must consider where technology and the use of it will be, rather than where it is today.*

The findings presented in this chapter were compiled from reviews of peer-reviewed literature and the grey literature (the latter with an emphasis on government, industry, association and policy documents), and from interviews with content experts from the technology, senior living, built environment, and health care sectors. We included input from both the public and private sectors and conferred with innovation directors, policymakers, and technology futurists to ensure findings reflect multi-sectoral perspectives. Technology companies referenced in this chapter are provided as examples only and references should not be considered as an endorsement for a specific company. Only technology companies that have a market presence and/or evidence base of support have been included.

Primary Uses of Technology to Support Healthy Aging

Technology that effectively supports healthy aging must be considered in the context of the end users' needs and abilities. To help identify and organize these needs, Coughlin and Lau developed a hierarchy of quality aging needs in relation to technological innovation. These include health, safety, connectivity, contribution, and legacy. (Figure 20).[294] Additionally, the Task Force on Research and Development for Technology to Support Aging Adults[295] has identified six primary areas, critical to the independence and well-being of the aging population, in which digital technology has been successfully used to assist aging. These include: key activities of independent living (hygiene, nutrition, and medication), cognition (monitoring, training, and financial security), communication and social connectivity, personal mobility, transportation, and access to health care.[294,295] These focus areas align with the WHO's priority domains for healthy aging communities (see Chapter III), most notably the built environment, transportation, housing, communication, and health services, all of which will be addressed further in this chapter.[296]

Activities of Independent Living

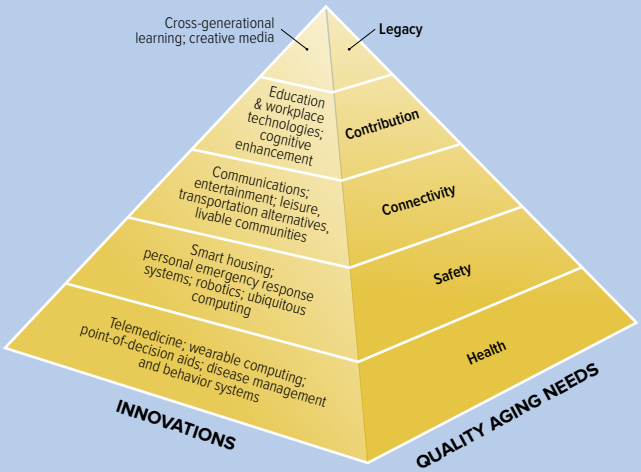
Independent living requires the ability to execute various activities. The basic activities performed daily, denoted as Activities of Daily Living (ADLs), include personal hygiene, dressing, eating, maintaining continence, and mobility. More complex self-care activities, denoted as Instrumental ADLs (IADLs), include managing finances, transportation, meal preparation, home maintenance, communication,

FIGURE 20
An Integrated Approach Toward Technology and Quality Aging

Older adults use of technology-enabled interventions aligns with Maslow's *Hierarchy of Human Needs*, a theory of human motivation. The manner in which older adults apply technology to improve health and independence, can be divided into the following categories:

- Physiological needs (health and wellness)
- Safety, security, and environmental sensors
- Belongingness (communications and social engagement)
- Esteem needs
- Self-actualization (learning, information, entertainment, and contribution)

Coughlin has framed these categories as a hierarchy of quality aging needs of health, safety, connectivity, contribution, and legacy



(Source: Coughlin & Lau, MIT AgeLab)

and managing medication. Developers and planners designing healthy aging communities need to be aware of technologies such as sensors, applications (apps), and robots that can help assist with these activities. The three areas often identified as benefiting the most from technological advancements are hygiene, nutrition, and medication management. In addition, assistive technologies, while often worn or used independently, increasingly utilize digital connectivity and are integrated with information technology (IT) solutions.

Cognition

Adults commonly experience cognitive changes as they age, with increasing prevalence at older ages. Though varying in severity, these changes can interfere with independent living and personal safety, including the ability to manage chronic health conditions. There are numerous technologies available or under development that help monitor changes in cognition, provide mental training, and coordinate financial management in order to reduce the impact of cognitive decline and increase the ability to live independently. Although the evidence base for the effectiveness of these technologies is still limited, a robust cognitive fitness movement that claims to enhance brain function and memory using technology-enabled programs has emerged. Companies such as EverSafe and True Link Financial address one of the key issues related to cognitive decline: managing financial assets and decision making. These companies have developed online resources to manage and track financial assets and transactions and help to prevent elder abuse related to finance. Technology-enabled systems like these will need to support increasingly complex services for the management of financial resources and assets for older adults and family caregivers.

Communication and Social Connectivity

Communication by older adults encompasses the physiological ability to utilize multiple senses, the ability to understand each other, and the ability to communicate across close and long distances. As they age, older adults may face communication

Credit to Mego Studio. Source: Shutterstock.com

challenges due to hearing loss, visual impairment, language and cultural barriers, and social isolation. The technologies that support healthy aging by strengthening older adults' connections with their personal, professional, and broader networks in a community include hearing devices (including next-generation hearing devices and systems), translation tools (e.g., Google Translate), and social media apps. COVID-19 revealed the importance and utility of these kinds of technologies in reducing social isolation; the use of communication technologies to improve interpersonal connectivity is projected to continue supporting older adults in reducing isolation beyond the COVID-19 pandemic.

Personal Mobility

The ability to move comfortably and safely is necessary for independent living. Mobility has a broad definition and refers to all movement including getting out of bed, walking, exercising, driving, and using public transportation. As adults age, they often become less mobile, and may lose control over their movement and become more prone to falls. In addition to an array of personal devices that support mobility (e.g., transfer devices, remote monitoring, automated vehicles), planning for enhanced infrastructure (i.e., broadband, power, and technology support) is critical to any community design (see broadband discussion below). Technologies for personal use can support assisted movement, in-home rehabilitation, and safety monitoring, as well as help older adults maintain access to their homes and the surrounding community. Given that falls are the greatest cause of morbidity and mortality for older adults, preventing and tracking falls are key uses for technologies designed to maintain the wellbeing of individuals in single-family homes or congregate settings (e.g., SafelyYou). The greatest single use of technology by older adults in the U.S. is for personal emergency response systems (PERS), which may be considered as integral to healthy aging from a community-wide perspective. Appliance detectors (e.g., stove use detectors) and smart home systems (e.g., Google Nest Hub) may also help to provide a secure and safe environment for aging adults.

Transportation

Mobility beyond the home and neighborhood is necessary to access social, health, and business facilities. As adults' physical and cognitive abilities change as they age, their transportation needs and requirements change as well. Some older adults drive without assistance, some may require assistance, and many others rely on public transportation and ride hailing services. Technologies to support these needs include vehicular modification, advanced assistive technologies, and systems to more easily access public transportation, ride hailing services, and paratransit systems (see **Chapter II** for evidence regarding health outcomes and transportation). As more electric vehicles come online, there will be a greater demand for charging stations both across the community and at home.[297] Technologies that support these services require significant broadband and technology system support (e.g., SilverRide or Lyft).

As described in **Chapter II**, fully autonomous vehicles are an inevitable development and will be

DEMANDS OF ELECTRIC VEHICLES

By 2035 all new cars sold in California should be zero-emission based on the governor's executive order. Advocates of zero-emission vehicles note there are currently an inadequate number of EV charging stations to achieve that goal. About 90% of California's charging stations are in residential areas, but only 18% are located at multi-unit dwellings where ~50% of Californians live.

Mollie D'Agostino, Policy Director of the 3 Revolutions Future Mobility Program at the UC Davis Institute of Transportation Studies noted that new greenfield developments have an advantage in being able to properly plan for charging stations for personal electric vehicles. A master-planned community could more easily install Level 2 chargers at residences or in parking lots or public spaces at relatively lower costs as compared to the costs of upgrading parking lots or multiple home outlets.

an alternative transportation option for people who cannot or choose not to drive.[298] Although these vehicles are not yet widely deployed, the advent of artificial intelligence (AI) and the application of 5G to communication systems has greatly increased the viability of autonomous vehicles as being a transportation alternative for older adults. Autonomous vehicle technology requires vehicles to have sensors to enact travel in the most efficient way without human intervention.[299] The main benefits of autonomous vehicles for older adults arise when the burden of operating the vehicle is taken out of the hands of a driver. Generally, autonomous vehicles are able to reduce travel times, car accidents, and traffic congestion.[299] For older adults, researchers anticipate that autonomous vehicles will improve overall driving safety, increase comfort and ease of using a car, and provide an opportunity for older drivers to continue meeting their mobility needs even after experiencing age-induced physical and cognitive changes.[299] In addition, older adults can obtain more access to societal engagements that they were previously excluded from, including but not limited to employment opportunities, social and leisure activities, shopping, and public health and medical services.[298] Although early applications of autonomous vehicles have primarily been limited to healthy aging campuses with structured routes, planners should include infrastructure (i.e., appropriate pavement markings) and technology support (5G capacity to facilitate car-to-car communication) for autonomous vehicles into their designs for new healthy aging communities.[300,301]

Image of autonomous vehicles using sensor technology to maintain safe driving distances. Credit to Metamorworks. Source: Shutterstock.com

Access to Health Care

The healthcare system involves different participants with multifaceted functions and strategies, including patients, families, caregivers, clinicians, communities and community services, as well as social services and support systems. Older adults with multiple chronic conditions often receive fragmented, suboptimal, and contradictory care in multiple care settings. Technologies are not only capable of supporting older adults in carrying out activities of daily living but can also support access to health care and the collection of health information for older adults, family caregivers and providers alike. In many cases, technology enables older adults to participate in maintaining their own health and being proactive with their family and health care team. Technologies that support access to health care include software and hardware systems that can be worn or embedded in the home or residence to monitor older adults and/or support health and health care remotely. Many of these technologies provide an objective assessment of a person's ability to live independently, allow health care providers to identify the early onset of disease, and help health care providers coordinate needed care and services. These technologies include remote monitoring technology, electronic health records, residential monitoring and sensor systems, reminder systems, medication management systems, vision and hearing support, robotics, and palliative care support. Finally, coordination of health care activities through digital technologies, such as telehealth, may significantly increase the effectiveness and efficiency of health care delivery.

Additional Technology Considerations

When assessing the breadth of and demand for technology, planners might also consider integrating technologies used for lifelong learning, family caregiving, and supporting special populations and older adults in the workforce.

Lifelong Learning

Technology makes it possible for people of all ages to continue pursuing their interests and developing new skills; it transforms the way we receive and process information, collaborate and communicate with

one another, and engage in various learning activities. As adults experience changes in their physical and cognitive abilities over time, their functional and learning capabilities are also impacted. Evidence shows that intellectual stimulation is important to retaining or improving cognitive function. Assistive technologies can provide personalized support for all students, regardless of age or disability, to learn effectively.[302] The Osher Lifelong Learning Institute and the Posit Science BrainHQ program, two very different technology-enabled learning platforms, are examples of the technologies currently available.

Family Caregiving

Technology has become an indispensable part of family caregiving; it can be used to help with service scheduling and delivery, managing chronic illness, improving caregivers' and older adults' socialization and support, and providing information and resources on a "just in time" basis. If employed to its fullest, technology can improve the physical, economic, and psychological wellbeing of family caregivers. Family caregivers are often more knowledgeable about emerging technology innovations than their older relatives or relatives with disabilities and are able to recommend technologies that will support both their relative and themselves. Because they are frequently the decision makers for technology choices for their relatives, they should be considered key informants for healthy aging community planning efforts.[303,304]

Older Adults in the Workforce

Technology can enable a more inclusive and productive workforce, by helping to bring members of older populations into the workforce. New technologies support learning new skills, and training tailored to the cognitive and physical needs and skills of diverse individuals. In addition, assistive technologies can mitigate physiological changes (e.g. hearing, vision) for older adults who want to, and increasingly have to, remain in the work force.[305] Planners should be aware of technologies and associated infrastructure that can support an older workforce. For example, more sophisticated technology and connectivity will be needed to support AI-enabled assistive hardware and software used to enhance an individual's skills. Healthy aging communities can be catalysts for creating new jobs and enabling older adults to continue participation in the workforce from their own residences.

Persons with Intellectual and Developmental Disabilities (I/DD)

Planners should anticipate the needs of special populations who will reside in healthy aging communities. For example, persons with I/DD, regardless of age, face difficulties with communication and socialization which can add complexities to their learning and functioning.[306] Assistive technology solutions provide various tools to help people with autism in different aspects of their lives, including communication and social skills, education (reading, writing, and math), executive functioning, sensory challenges, safety, and activities of daily living. These technologies range from low-tech (e.g., stress balls), to mid-tech (e.g., visual timers), to high-tech (speech-to-text software).[307] The provision of assistive technology is not sufficient to ensure effective use of technology in its own right—rather, individuals with I/DD require systematic and intensive instruction in order to learn how to use these tools.[308] The characteristics of people with I/DD, and the various technologies available, suggest additional factors that should be considered when planning healthy aging communities: population diversity, a range of physical and cognitive abilities, the range of technology solutions, and the need for digital training and support.

Credit to Petrushin Evgeny. Source: Shutterstock.com

Infrastructure Necessary to Support Digital Technology

Reliable Electrical Power

All the technologies described in this chapter require a source of reliable electrical power. In some cases, loss of electrical power can be life-threatening for disabled adults dependent on oxygen concentrators, hemodialysis, or ventilators. Electrical grid failures during extreme heat events substantially increase the risk of heat exhaustion and heat stroke.[309] Robust back-up systems of electrical power will be critical for the successful use of digital technologies in healthy aging communities. Increasing reliance on technology (for communication, activities of daily living and transportation) has increased dependency on electricity. The environmental effects of climate change, such as major storms, heat waves, and more frequent and intense forest fires, have already led to more frequent and longer lasting power outages that jeopardize the feasibility of reliance on technology. It is predictable that these types of events will continue to increase in frequency and duration.

Building reliable primary and/or back-up power sources (e.g., solar, wind, battery storage, natural gas) that are not simultaneously susceptible to a natural event could ensure that older and disabled adults with a particular need for technology would not lose power. This might be an important selling point for people of all ages considering relocation – steady electricity supply can no longer be taken for granted.

Broadband

Broadband is central to the success of all healthy community planning and design. The Federal Communications Commission (FCC) defines broadband as "high-speed Internet access [that] allows users to access the Internet and Internet-related services at significantly higher speeds than those available through 'dial-up' services."[310] Broadband's high-speed transmission technology allows information to move faster than traditional telephone or wireless connections, making it a reliable method for easily connecting with the digital world.

AARP has noted that improved connectivity can help meet the needs of older adults in five areas: personal fulfillment, health preservation, social connectedness, functional capability and activity, and caregiver support.[311] The reliability that broadband brings to internet access is essential for older adults who want to access government forms and information or financial services, participate in social networking and engagement networks, or use medical and monitoring devices that enable aging in place. The advent of the COVID-19 pandemic spurred the need to provide more medical services online, and broadband has been instrumental to implement the expansion of telehealth.[312]

Credit to Casezy Idea. Source: Shutterstock.com

The minimal broadband speed increased due to increased bandwidth needs associated with maturing technology. The California Public Utilities Commission defines broadband (download/upload) as having a minimum speed of 6/1 Mbps, which is slower than the Federal Communications Commission (FCC) definition 25/3 Mbps (Table 8).[313] The FCC, which updated the minimum speed requirement in 2015, considers this speed to be sufficient for those with light to moderate use (requiring basic or moderate levels of service). An estimated 12% - 22% of households in California have no wired broadband and another 9% reported no access to cellular or other high-speed data plans. Reasons cited for lack of connectivity included prohibitive cost, ability to connect elsewhere, and no internet service available in their community.[314]

As a result of the pandemic, broadband access is being elevated among policymakers and stakeholders,

TABLE 8
Understanding Broadband Speeds

DSL VS CABLE VS FIBER SPEEDS		
TECHNOLOGY	**DOWNLOAD SPEED RANGE**	**UPLOAD SPEED RANGE**
DSL	5 to 35 Mbps	1 to 10 Mbps
CABLE	10 to 500 Mbps	5 to 50 Mbps
FIBER	250 to 1,000 Mbps	250 to 1,000 Mbps

INTERNET SPEED CAPABILITIES				
0-5 MBPS	**5-40 MBPS**	**40-100 MBPS**	**100-500 MBPS**	**500-1,000+ MBPS**
• Checking email • Streaming music on one device • Searching on Google	• Streaming video on one device • Video calling with Skype or Facetime • Online gaming for one player	• Streaming HD video on a few devices • Multiplayer online gaming • Downloading large files	• Streaming video in UHD on multiple screens • Downloading files quickly • Gaming online for multiple players	• Doing a lot of almost anything

Source: Center for Connected Health Policy, 2021

including those in California who are actively engaged in increasing the minimum broadband speed requirement and removing broadband deserts in unconnected and under-connected urban and rural communities (see policy discussion below).[314] Key issues for planners include ensuring broadband quality, accessibility, and affordability. Quality is measured by bandwidth (speed) and stability issues, which impact live video communication, streaming, and users' ability to operate multiple devices simultaneously.[315] Underlying broadband availability is the issue of affordability – including the costs of broadband installation, maintenance, and internet service. Planners should be aware of the ongoing policy debate and associated potential changes to bandwidth requirements (including federal versus state bandwidth standards) to ensure new developments provide robust access to residents and can support future advances in information technology. The currently proposed federal infrastructure legislation includes $100 billion for expansion and support of high-speed broadband.[316]

5G

5G is shorthand for the 5th generation standard of mobile communications technology, which provides wireless networking at data speeds 20 times faster than previous speeds and latency levels 10 times lower than current delays.[317] Similar to its predecessors (i.e., 1G, 2G, 3G, and 4G LTE), 5G also uses radio waves to seamlessly transmit data throughout a smart device ecosystem. Data are transferred more efficiently and quicker than ever before. Ultimately, faster network speeds equate to greater capability for handling all the connected devices likely to be present in the lives of older adults in the near future. 5G is being applied to household health monitoring devices, video communications systems for interacting with family, friends, and health providers. 5G can also support medical situations in which elderly patients must be operated on remotely. For instance, if a surgeon had to use a robotic arm to operate on an elderly patient due to logistical constraints, 5G connections help to ensure that no delay occur while the surgeon directs the robot's actions or in the real-time visual feedback that the surgeon is receiving.[317] 5G

Credit to Steve Heap. Source: Shutterstock.com

Credit to Kanut Photo. Source: Shutterstock.com

speed and latency advances are fundamental to the viability of many technology-enabled solutions, such as autonomous vehicles. Planners and developers should plan for ubiquitous use of 5G when building new healthy aging communities and in all technology applications used by older adults, families, and providers.[317]

Key Technologies Currently Used to Support Healthy Aging

There are currently a broad array of technologies and technology-enabled platforms that support older adults in maintaining their health and wellness in their communities. Rapidly changing technology-enabled interventions include key digital technologies that are integral to supporting healthy aging. This section highlights three key current technology categories that provide context for planning for sufficient broadband and cellular infrastructure over the next decade: wearables, sensors/IoT, and telehealth.

Wearables

Wearable technology, also known as wearables, comprise electronic devices that are worn on or within the body to detect, analyze, and transmit information from the people wearing them. Recent developments allow wearable devices to be embedded in clothing, worn as jewelry, and implanted within or placed on the body. Smartwatches and activity trackers are common current applications. Although only 3.3% of all users of wearables are 65 years or older, wearables are rapidly being adopted as a means of supporting autonomy and quality of life in older adults.[318] Wearable health-monitoring devices can provide immediate feedback on vital signs, such as heart rate and blood pressure. Wearables can also provide physicians with updated information about an older adult's activity levels, which can result in more quickly addressing impairments in their cognitive function, mobility, or psychosocial functioning. As the costs and designs of wearables improve, healthy aging communities may be able to support older adults, their families, and providers through the use of wearables, whether for safety and security, health care monitoring, or enhanced socialization.

Sensors/IoT

Interconnected sensing technology, commonly referred to as the Internet of Things (IoT), is revolutionizing aging in place by meeting the needs of older adults. Sensors collect information which can be processed through machine-learning techniques to determine behavior patterns and health states from the collected data. IoT devices include smartwatches, smart home sensors, cameras, microphones, and both indoor and outdoor tracking devices. These devices provide objective, reliable remote monitoring, that can be used to support older adults.[319] Sensors can remind older adults to take specified medications at regular times via timely reminders from their smart medication dispensers, or can help caregivers develop treatment plans based on behavioral profiles extracted from a IoT sensor.[320] Planners and other stakeholders will need to anticipate installation of sensor-based devices that provide reliable, efficient, and affordable options for monitoring behaviors and measuring cognitive and

physical health statuses. The IoT also helps power wearable devices that can help people with autism spectrum disorder navigate their days with a greater sense of safety and security. For example, Awake Labs builds software for smartwatches that tracks the wearer's reactions (e.g., raised heart rate) and sends warnings to caretakers when the user is feeling stressed.[321] As discussed later in this chapter, sensors and IoT devices are core technologies for smart homes, smart buildings and smart cities, but also raise privacy concerns.

Telehealth

Telehealth has become an essential technology that planners will need to fully incorporate into healthy aging communities. It encompasses a broad variety of technologies and tactics for delivering virtual medical, health, and education services when patient and provider are not in the same location. Over the past decade, adoption of telehealth has slowly increased; essentially, before COVID-19, telehealth was only a niche area of health care. COVID-19 changed everything. Private and public payors changed reimbursement policies to allow health systems and

Credit to Nattakorn Maneerat. Source: Shutterstock.com

health care providers to pivot sharply to remote care. Telehealth includes telephone and technology-based remote communication, live video, mobile health, remote patient monitoring, and store-and-forward technologies. Continued or increased use of telehealth in healthy aging communities will largely depend on whether reimbursement for all telehealth modalities by all payors will become permanent.

Emerging and Future Technology Solutions

The rapid advancement of technology and data science, coupled with changes in expectations by health care providers, family caregivers and older adults themselves, requires careful consideration of emerging technologies by planners and developers. In addition to core infrastructure requirements for connecting to technology and supporting its multiple uses in healthy aging communities, several significant technology advances will have a significant impact in the next three to five years. These include, but are not limited to, voice first technology, virtual reality/augmented reality, robots, and smart homes/smart cities. These technology advances are supported by rapid and significant changes in data and data analytics, which need to be considered for their impacts on both infrastructure and service decisions.

Voice First

In the future, nearly all building, communication, and supportive services used by older adults will be activated via a voice first interface. Voice First refers to the category of voice-controlled applications and devices that leverage natural language processing, artificial intelligence, and machine learning.[322] Voice First addresses a fundamental challenge for older adults: the ability to effectively and efficiently use and master technology-enabled interventions and devices. A Voice First approach is a leap forward from its predecessors ("mobile first") in the quality of its technology interactions for aging adults.[323] Voice First technologies are simple but functional for users, providing reliable responses to questions ("What time does yoga start today?") and commands ("Ask the nurse to stop by"), and include explanations for how to use new features.[322] These technologies can evolve without requiring user upgrades, so individuals at essentially any "tech proficiency" level can master them.[322] Additionally, devices and systems that are enabled with Voice First are relatively affordable. Many stand-alone basic unit prices range from $40-70 one-time costs, though Wi-Fi connectivity is a prerequisite for use.[323] In 2020, as the pandemic brought on spikes

in social isolation, communities of seniors quickly adopted voice-enabled technologies to improve residents' mental wellbeing and social activity.[322]

Virtual Reality/Augmented Reality

Immersive experience technologies such as Virtual Reality (VR), Mixed Reality, and Augmented Reality (AR), that simulate interactive real-life scenarios to provide a sensation of "reality" and "being there," will be widely implemented in healthy aging communities.[324] The use of these technologies can mitigate spatial and physical constraints to provide a desirable environment, situation, and experience to users.[325] Virtual reality also offers the ability to perform tests in an adaptive environment that can be adjusted according to various patients' needs. The use of VR systems for treatment of diseases and injuries has been already explored, such as for brain damage, poststroke intervention, and musculoskeletal recovery, as well as for administering cognitive restructuring therapies, implementing exercise routines, and treating memory problems. In general, VR technology serves as a valuable tool to improve quality of life for older adults, their families, and their caregivers. Virtual humans have been created to provide older adults living on their own with a customized 3D personal-care assistant to support healthy behaviors and reduce loneliness.

Service providers, health practitioners, social entrepreneurs, and technology developers have expanded the use of VR/AR beyond traditional entertainment purposes. For example, balance training has been shown to be effective in reducing risks of falling, which is a major concern for older adults. Usually, exercise programs are individually prescribed and monitored by physiotherapeutic or medical experts. Unfortunately, supervision and motivation of older adults during home-based exercise sessions cannot be provided on a large scale. Augmented reality (AR), in combination with virtual coaches, has been applied to this challenge.[326] Similarly, AR technologies such as apps, games, and books can positively affect people with I/DD in various domains of their lives such as social interaction, communication, facial emotion recognition, and functional skills. AR is especially suitable for people with I/DD because it utilizes visual learning.[327] VR and

Credit to Nattakorn Maneerat. Source: Shutterstock.com

AR are also increasingly serving as preferred training modalities for health care, hospitality, and other areas requiring experiential workforce training. Embodied Labs is an evidence-based, immersive VR-based training platform for caregivers and service providers. Virtual training platforms allow trainees to immerse themselves in virtual labs that simulate real-life situations faced by older adults, by simulating patients' perspectives and conditions, and thus helping them to provide more effective care.

Robotics

Robotics not only includes physical robots, but also advanced analytics, particularly machine learning. Robotics is widely used for monitoring, surveillance, and helping older adults with basic tasks of everyday living. However, robots are now being developed not only to respond to an individual's needs, but also to learn and modify their behavior based upon their user's needs and requirements. This is especially useful for older adults who need assistance in maintaining mobility, health, safety, and social connectedness.[328] Robots and robotics are increasingly being utilized in various community health care functions such as with surgeries, telemedicine, drug delivery, patient management, helping older adults with physical and cognitive rehabilitation, and more.[329] Additional benefits of robots are that they are highly efficient in doing repetitive tasks, can address many basic patient needs for extended periods of time, can be easily accessed by users at their discretion, and keep spaces clean and orderly on a regular basis. Overall, robots have been shown to improve satisfaction for both older adults and their health care providers, as well as facilitating

independent living in a range of residential settings while ensuring improved safety and security.[330] Robotics represents one more example of why future reliance on multiple technologies must be considered in design of healthy aging communities.

Built Environment: Smart Homes and Smart Cities

Planners and developers should anticipate that smart homes will be central to any future community development plan. Smart homes are already emerging as a primary model for how to use technology to support aging in place by older adults, a model that also emphasizes improving an individual's autonomy.[331] A smart home is a dwelling that "incorporates a communications network that connects key electrical appliances and services, and allows them to be remotely controlled, monitored, or accessed."[332] Fundamentally, smart homes consist of three key components: physical components, a communications system, and an information processing system powered by artificial intelligence.[333] The physical components (sensors, microcontrollers, and actuators) collect environmental data and transmit it to a central controller (called a smart home "gateway" or "hub") that accumulates and interprets the information.[332,333] The communications system, consisting of wired or wireless networks (such as Bluetooth, Wi-Fi, Wi-Max, and ZigBee), connects the home environment, physical components, and information processing system to allow the transmission of information.[333]

Several classifications of smart home technologies exist for aging populations: Pal et al. use the following functional categories: health monitoring, environmental monitoring, providing companionship, social communication, and recreation and entertainment.[334] Across these categories, smart technologies are used to address key needs of elder residents, including "emergency assistance, fall prevention/detection, reminders, medication administration, and assistance for those with hearing, visual, or cognitive impairments."[335]

The current research on smart homes and smart buildings focuses on underlying technologies (e.g., sensors, IoT) and less so on adoption by end-users, which remains low.[336] However, there are widely accepted models, including the Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), and Theory of Planned Behavior (TPB), that can be used to explain older adults' motivations for adopting or not adopting smart home technologies.[334] A TAM study conducted by Pal et al. found that an older adult's compatibility with technology and automation, as well as comfort in using technology, are indicative of their comfort with using the functions of smart homes. On the other hand, older adults are more inclined to not want to use a smart home if the costs are too high or they have concerns about their privacy.[337] While psychological experiences of older adult users with smart homes have not been studied thoroughly, most older adults are more favorably inclined toward using a smart home if it is easier it is for them to use, especially if it improves their efficiency in conducting tasks, and if it offers a pleasurable experience for them.[338] Smart home technologies can benefit people with I/DD and their families as well; for example, use of sensors and cameras, as in the Vivint® Home Security system, provide monitoring to reduce hazards, and prevent wandering.[339] It should be noted that smart homes and smart buildings have comparable technology functions, although smart buildings (i.e., multi-family residential buildings, commercial buildings, and industrial buildings) encompass larger community structures.[340] As older adults occupy apartments as well as single-family homes, it is important to consider smart buildings in planning for healthy aging communities.

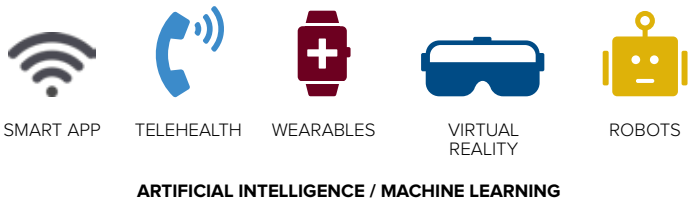
To maximize health and wellbeing of older adults, smart homes should be considered in the context of fully integrated smart cities. IT connectivity is a key feature of both a smart home and a smart city. The architectural and engineering disciplines play a large role in addressing design imperatives for IT infrastructure in the buildings within a smart city.[341] In terms of architectural contributions, zoning for greenfield developments should require seamless wireless connectivity for internet-enabled devices. In terms of engineering contributions, zoning for high-rise buildings to maintain uninterrupted line-of-sight is critical to ensuring more cost-effective wireless connectivity. These imperatives are addressed through local and state building codes, which vary greatly across the country. Currently, smart city concept models are

dominated by the information and communications technology-led (ICT-led) model. While advanced ICT infrastructure has its benefits, it should be noted that the ICT-led model can over-prioritize the digital aspect of urban development.[342] Rather than an end goal, ICT should be viewed as a tool that can enable connectivity within smart cities, and planners should aim for a more balanced development.

Changes in Technology Due to COVID-19

Changes in the use and application of technologies for older adults, family caregivers, and providers has not yet been evaluated thoroughly; however, anecdotal evidence from key informants from multiple relevant sectors has suggested that certain technologies have had more pronounced effects than others.

FIGURE 21
Top Five Trends in Senior Care Technology Due to COVID-19



Source: Ginna Baik, Strategic Business Development Manager for CDW Health

As a result of COVID-19 protocols and accompanying rapid changes in the behaviors of older adults and in their needs, five specific technologies have expanded in use and acceptance. Representatives from the technology, health, and gerontological sectors that we interviewed noted significant increases in the use of smart homes, telehealth, wearables, virtual reality, and robotics (Figure 21).[343] These technologies were particularly useful during the pandemic when social distancing was required and activities had to be conducted remotely. Reports from key informants indicate that these technological changes are not only here to stay, but that planners should anticipate increased expectations among older adults and health care providers to having greater access to low-cost, reliable technology.

Key Considerations for Planners in the Design and Use of Technology

There are several cross-cutting issues important to design, implementation, operation, and maintenance of information technology (IT) systems for healthy aging communities. Establishing an efficient and sustainable technology infrastructure depends in part on the demographics and proposed uses of the technology by the communities that will use it. The key areas that should be addressed include system installation; user-friendly design, adoption, and training; system(s) support and maintenance; and privacy and security.

System Installation, Design, and Maintenance

Communication and network infrastructure systems are crucial for supporting an aging population. These systems are required to transmit and exchange information. Design parameters may include: timeliness of information needed; inclusion of alarms/notifications (high importance, low bandwidth); data management and transmission; need to "store and forward" data (acquire and store locally, transmit when needed); capability to implement "live interactive devices" such as video over phone or the internet; maintenance of data quality/integrity; management of data volumes ranging from low data ranges (e.g., wearables, transactional) to high data ranges (e.g., video, telehealth); and remote control (for use in closed loop applications or to remotely set parameters).[344]

Implementing Information Technology (IT) systems can present many challenges to planners, developers, and builders. Some of the more universal challenges include:

- Maintaining day-to-day system dependability, including availability, reliability, maintainability, and maintenance support
- Lack of system availability at various times or locations due to cellular telephone coverage or global positioning systems (GPS) signal visibility. (Inconsistent broadband coverage in existing urban buildings and remote areas often prevents universal rollout of technologies in a community.)

- System resiliency in emergency or disaster situations when power or services are significantly impacted. Offering alternate functionality or leveraging alternative infrastructure for electrical power can ameliorate this risk. Possibilities that should be explored for back-up electrical power include solar or wind power with battery storage or back-up community generators
- Providing robust cybersecurity for connected devices
- Meeting additional wireless spectrum requirements for IoT-connected devices
- Providing additional technology infrastructure and support for use in smart homes and the broader environment (Smart home technology is still relatively immature, but improvements in system integration, sensor deployment, and data algorithms should enhance the ability of connected environments to address issues such as disability prediction and health-related quality of life, e.g., fall prevention)
- Implementation of reliable technologically-enabled methods to verify personal identity, such as wearable technology, biometrics, and geolocation[345]

User-Friendly Design, Adoption, and Training

Technology selection, design, adoption, and training are critical points during design of a healthy aging community. Universal design, i.e., providing accessible technologies to people regardless of age or disability, is essential for older adults who may experience varying cognitive and physical capabilities, as well as for those with I/DD. In addition, adopting usability standards and the applying them to technological design can ensure efficient and effective support for older adults.

Current federal and industry standards focus on IT access rather than usability. Some standards for accessibility for telecommunications services and web content have been outlined in the Telecommunication Act Accessibility Guidelines (TAAG) and the Web Content Accessibility Guidelines (WCAG). The TAAG and WCAG standards have as their express purpose to make information and communication technology and internet websites more accessible to persons with a disability.[346] But to ensure accessible and *usable* services, universal design principles must be applied to information and communication technologies.

Privacy and Security

Privacy and security considerations need to be a high priority for all aspects of technology and data use in healthy aging communities. Many people are reluctant to use monitoring and sensor technology because of privacy concerns. Two categories of privacy should be considered: (a) privacy of the individual, and (b) security and privacy of data. Technology solutions should aim to achieve a balance between the need for personal safety and individual privacy with respect to data security. Chief among these issues is the need to be able to support HIPAA-compliant encryption and the secure transmission of personal health information and data. Other areas regarding the highest level of privacy include cybersecurity risk management, authentication systems for older adults (preferably using unobtrusive biometrics or other methods to avoid data tampering), consideration of security vulnerabilities associated with IoT devices, applications, and smart homes. Recommendations for incorporating cybersecurity considerations into technology system design and implementation include the NIST Cybersecurity Framework and NIST Cybersecurity for Internet of Things Program.[347]

Emerging Federal and State Technology Policies Important to Land Use Planning

Given the significant policy and funding changes occurring at the federal and state level that influence technology, particularly given changes that have occurred or are being proposed in 2021 due to COVID-19, planners, developers, and other stakeholders should carefully monitor federal and state technology policies and related funding to determine current and long-range implications for the development of healthy aging communities. Key federal and state of California initiatives that should be monitored are reviewed below.

Federal Broadband Initiatives

The federal government has set new priorities for applying cutting-edge broadband technology requirements to facilitate access to and exchange of information and knowledge that heavily impacts the economic, educational, and health care issues that are integral to age-friendly communities. Limitations in high-capacity broadband accessibility, particularly in rural areas throughout the country, reveal the importance of expansion and affordability of broadband connectivity. Through initiatives like the Emergency Broadband Benefit Program, Rural Digital Opportunity Fund, A-CAM Program, and the Connect America Fund Phase II Auction, the Federal Communications Commission (FCC) is allocating significant funding for the expansion, accessibility, and affordability of broadband in underserved, hard to reach areas and rural locations in an effort to minimize the digital divide that disproportionately affects vulnerable populations. The FCC also launched the Digital Opportunity Data Collection initiative to help improve data collection that will enhance broadband mapping to better inform long-term, sustainable decisions in areas like land use planning.

Federal Telehealth Programs

The FCC launched the COVID-19 Telehealth Program in response to inadequacies in access to health care that emerged with the onset of the pandemic. Congress has approved and allocated funds through the Coronavirus Aid, Relief, and Economic Security (CARES) Act to be used for initiatives that will provide immediate expansion of telecommunications services to support health care providers in staying connected with vulnerable and underserved populations. Through the Connected Care Pilot Program, the FCC further supports initiatives that involve critical aspects of telehealth such as remotely monitoring patients, increasing broadband access for low-income high-risk patients, and usability of video visits.

Federal American Rescue Act and (Proposed) Infrastructure Plan

The Federal American Rescue Act allocated funds in a pivotal move to help redirect resources to federal agencies in order to mobilize efforts to meet the emerging health care needs of Americans in the midst of COVID-19, including those in the I/DD community.[348] While still under development, the Administration's forthcoming Infrastructure Plan proposes additional funding to support broadband and telehealth expansion. The California Health Care Foundation (CHCF) recognized the impact that COVID-19 had on many health care providers as they faced unprecedented telehealth barriers. Through The Tipping Point for Telehealth Initiative the CHCF provided a precursor to the federal initiatives by addressing ways to mitigate barriers to the provision of telehealth at the provider level by funding projects that support education, technical assistance, and the implementation of telehealth capabilities for health care providers.

Governor's Broadband Initiative

The California Broadband Council's Broadband for All Action Plan responds to growing concerns about inequitable access to high-capacity broadband. As noted earlier in this chapter, California has fallen short in meeting the national minimum requirements for dependable broadband necessary for meeting the basic needs of Americans. Although much of California seemingly has access to broadband, when considering geographic barriers, availability, affordability, digital literacy, and minimum tech requirements, less than half of the population living in rural and tribal areas have adequate broadband connectivity, and broadband deserts also remain in some urban areas.[349] The Broadband for All Action Plan requires state agencies to develop a specific road map to identify and address the multiple challenges to providing affordable broadband. California, through required involvement of numerous state agencies and commissions, will implement a plan to bridge the broadband equity gap through new regulations, policies, and funding. The goals of the initiative will address the digital divide in alignment with the Governor's Master Plan on Aging (see **Chapter III**), and federal broadband initiatives.

Conclusions

Technology plays a significant role in the structural and functional operations of healthy aging communities, from fundamental infrastructure design and operations to the personal health and wellbeing of residents. The rapid pace of technology advancement and its expanded integration into the lives of older adults and healthy aging communities will only increase in the future. For planning and capital projects, it is critical to anticipate where technology advances will be in the next three, five and ten years in terms of applications and basic infrastructure requirements. This requires incorporating current technology standards and regulations as well as tracking proposed policy changes and likely changes in industry standards and regulations. It is equally important, however, that designers of healthy aging communities assess not only future technology infrastructure needs but anticipate the likely uses, or potential uses, of technology by future residents of the community and their families as well as service providers across industries.

VI. Opportunities for Healthy Aging Community Partnerships

There is strong evidence of the physical, emotional, and social health benefits of mixed-use developments that position essential services within walking distance of residential neighborhoods. This chapter describes a burgeoning recognition among developers, planners, and policymakers of the value of partnerships among health care, retail, and academic entities in creating successful healthy aging communities. Integrating housing, health care, retail, and academic spaces can improve population and individual health through increased physical activity, healthy retail options, and academic resources to promote social interaction and engagement across the lifespan. The examples described in this chapter provide a range of options to accommodate residents' preferences, needs, and resources as age-related conditions impact independence and autonomy. As noted in the chapter on model healthy aging communities, every community is subject to different market pressures, state and local regulations and ordinances, and population needs and preferences; thus, the following examples of partnerships given in this chapter are intended to provide inspiration for creating innovative healthy aging communities rather than specific direction.

Integrating Essential Services

This section reviews options for integrating two types of essential services–health care and retail services–in close proximity to residential units. Two resources provide a guide for creating successful small town centers/downtowns. A report by the Delaware Valley Regional Planning Commission (DVRPC) focused on elements necessary to revitalizing older suburban retail areas. The analysis of 71 communities yielded strategies and best practices that are also generalizable to new community developments, especially those focused on healthy aging. Among the elements identified as contributing to successful town centers/downtowns were niche retail businesses (with little competition in the surrounding area), minimum sidewalk widths of 8 feet to accommodate foot traffic, formal business management operations, and street parking.[350] Similarly, the Urban Land Institute issued a report several years earlier outlining development of successful town centers.[351]

As noted in both reports, a market feasibility analysis of current and future supply of and demand for essential (and residential) services will be important for shaping a comprehensive land-use plan for healthy aging communities. Such an assessment will inform the type, volume, and design of these essential services and define potential partnership opportunities. Below, we describe several models that might be considered for improving the proximity of health care and retail options to residents in a healthy aging community; these models, or elements therein, can be adjusted based on development size and community need.

Changes in health care delivery are underway and, as noted in the digital technology chapter (**Chapter V**), new methods for delivering care are shifting services away from traditional settings like hospitals, offices, and "senior care" facilities toward the home. Recent examples of this shift include the creation of Hospital-at-Home programs in which complex care is delivered by clinicians in the home (e.g., echocardiograms, x-rays, oxygen therapy, intravenous fluids or medications, respiratory therapy, pharmacy services, and skilled nursing services).[352] In addition, the expansion of telehealth visits as an alternative to office appointments and rethinking the design and role of nursing homes have been motivated by the COVID-19 pandemic.

Embedding a Primary Care Clinic within a Community Resource Building

The following examples were implemented by organizations serving different populations. The "medical suite" model used by Continuing Care Retirement Communities (CCRCs) incorporates a small primary

Erickson Living Medical Suite. Source NFD Interior Planning and Design

Central City Concern, Blackburn Center, Portland, OR.
Source: Central City Concern

care unit on site in a centrally located community building. CCRCs offering this service report a reduction in emergency room visits and hospitalizations as well as increased resident and family satisfaction with the convenience and quality of care.[353-355] Erickson Living, a national chain of CCRCs, launched its own medical group that employs primary care physicians with geriatric experience to provide care at on-site medical suites.[356] Residents can schedule same day or next day 30-minute appointments to discuss new issues or to manage chronic diseases (upper image). Staff physicians also have access to specialists for patient referrals and some locations also offer an on-site pharmacy. Another example of this on-site clinic model are those offered at affordable and transitional housing developments that include health clinics and social services to provide care for residents (lower image).[357,358] Local health systems have partnered with non-profit service organizations to build and staff the primary care clinics, medical offices and/or palliative care suites. These buildings generally house retail, pharmacy, clinical and other resident social services at street level with residents living on upper floors. Non-residents also have access to these services.

Planners and developers of smaller healthy aging communities might consider partnerships with local health care organizations to incorporate a medical suite (and/or social support services for adults with I/DD) in a multi-use building (e.g., retail, library, recreational facilities, arts and culture, etc.) or with multi-unit housing. Telehealth connectivity could provide access to specialists in more distant medical centers. As a smaller scale alternative, a community center could provide telehealth offices or kiosks designed to support patients with limited digital literacy, perhaps staffed by a medical assistant or nurse. This essential service could be supported not only by neighborhood residents, but also by those in surrounding developments without such services.

The Health Village Model

For communities of a larger scale, a Health Village concept may be a viable option. These villages are large, mixed-use redevelopment projects that expand health and non-health care options at existing hospital campuses with the goal of fully integrating bordering neighborhoods. They have goals similar to those of healthy aging communities: they are designed to promote physical activity through greening, provide access to fresh and healthy foods, and promote social interaction. In addition, they offer a wide range of health care options to fit the needs of all residents across the lifespan and of differing abilities, provide space to explore new models of health care technology and delivery, and serve as an incubator for researchers and companies to launch new innovations.[359] Real estate developers are partnering with some health care systems to create Health Villages that include preventative care, inpatient and outpatient services, post-acute care, long-term care, and health education alongside retail, commercial, education, and residential units.[360]

For instance, the Sea View Healthy Community (Staten Island, NY) is an 80-acre neighborhood public-private revitalization project planned to upgrade an historic hospital campus into a healthy aging community (Figure 22). The development will

FIGURE 22
Sea View Healthy Community (Staten Island, NY)

Source: Master Planning the Healthy Community/ Sea View, NYCDEC

promote activity by connecting trails to surrounding nature preserves and parkland, and expand access to healthy food through community farms, grocers, and farm-to-table restaurants and cafés. It will include a health clinic, wellness center and a range of housing options that include assisted living and support programs for developmentally disabled residents. Note the residential density adjacent to the proposed campus, which can also support the health care and retail services.[361]

Union Village (Henderson, NV), self-described as the "first integrated health village in the world," is another large development anchored by an acute care hospital that is in the process of building retail centers, residential apartments, a senior care center, and a cultural center on 228 acres.[362]

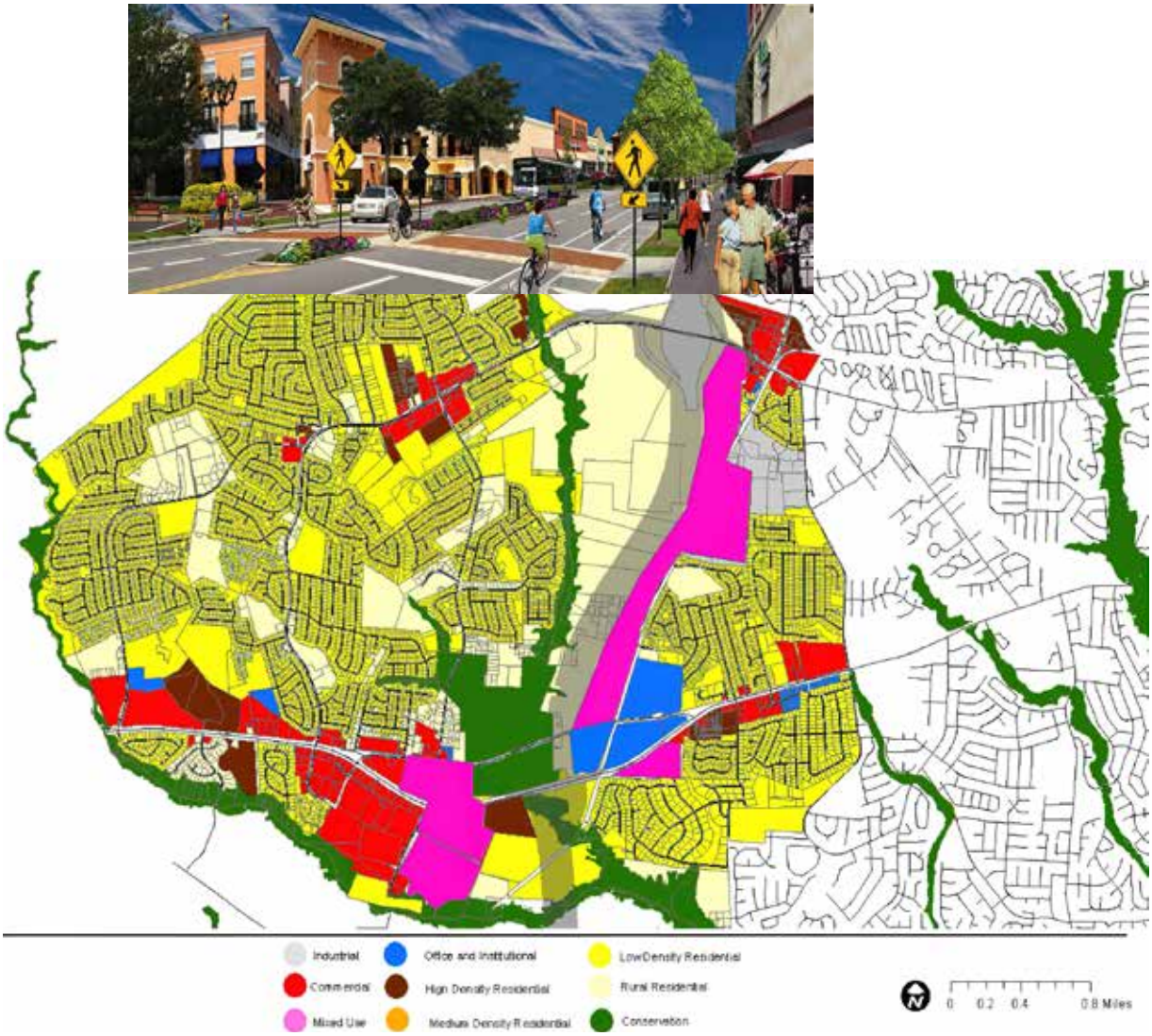
The Fayetteville Medical Village (North Carolina) seeks to build an integrated multi-use community incorporating health care, employment, retail services and housing.[363] Figure 23 illustrates a vision of this planned, walkable, mixed-use, and multi-modal pedestrian- and bike-friendly community within the mapped land use plan.

Newly developed communities without a hospital campus also have an opportunity to site essential retail options within a 100-200-acre Health Village that can be scaled to meet the immediate needs of residents based on the density of proposed housing options.

Academic and Research Partnerships

Retiring near college campuses is becoming a popular option for many older adults because of the close proximity to classes, lectures, and cultural

FIGURE 23
Fayetteville Medical Village Plan



Source: City of Fayetteville Medical Village Plan, City of Fayetteville

and athletic events. Many CCRCs are located near college campuses and have established both informal and formal relationships with the neighboring institutions such as participating in continuing education and research programs. This university-based retirement community partnership concept is well-established across the United States with more than 80 established academic CCRC partnerships. Some institutions are joining the Age-Friendly University Global Network, which focuses on engaging people across the life span.[364] This global network is a spin-off from the WHO Age-Friendly Cities and Communities program (Chapter III). Member universities follow age-friendly principles to create multi-generational learning environments and encourage opportunities for career development late in life. Developers and communities can partner with an academic institution to develop local facilities and programs and provide unique opportunities to improve

THE 10 AGE-FRIENDLY UNIVERSITY PRINCIPLES:

1. To encourage the participation of older adults in all the core activities of the university, including educational and research programs.
2. To promote personal and career development in the second half of life and to support those who wish to pursue "second careers."
3. To recognize the range of educational needs of older adults (from those who were early school-leavers through to those who wish to pursue Master's or Ph.D. qualifications.
4. To promote intergenerational learning to facilitate the reciprocal sharing of expertise between learners of all ages.
5. To widen access to online educational opportunities for older adults to ensure a diversity of routes to participation.
6. To ensure that the university's research agenda is informed by the needs of an aging society and to promote public discourse on how higher education can better respond to the varied interests and needs of older adults.
7. To increase the understanding of students of the longevity dividend and the increasing complexity and richness that aging brings to our society.
8. To enhance access for older adults to the university's range of health and wellness programs and its arts and cultural activities.
9. To engage actively with the university's own retired community.
10. To ensure regular dialogue with organizations representing the interests of the aging population.

Source: Age-Friendly Universities are Finally Here, Forbes

the lives of residents by increasing social and intellectual engagement. Such partnerships provide academic institutions with new opportunities to pursue community-based participatory research, provide intergenerational learning enrichment, and offer training opportunities for students.

University-community partnerships range from basic services to richer, bi-directional relationships with older adults as adjunct teachers or research participants in addition to being students themselves or arts patrons. Partnership examples include satellite or virtual classrooms being offered to aging residents in their homes or at a local community center and students-in-residence programs where students provide a few working hours/week to older adults in exchange for free housing.[365] Case Western Reserve University and Cleveland Institutes of Art and Music partner with a CCRC within walking distance of the schools to bring student cultural performances, continuing education classes, and assistance to staff therapists. Other examples include an affordable senior housing complex in Sacramento that partners with a local university nursing program for supervised nurse trainees to provide basic care to interested residents. Pacific Retirement Services (PRS), a non-profit housing developer, develops unique communities that promote healthy aging, lifelong learning, and research activities. Its forthcoming Mirabella-Arizona State University development markets university-led research activities to potential residents as part of the community amenities. Oregon Health Sciences University, Georgia Tech, and UC Davis are also engaged in university-community partnerships.

Longitudinal research relationships between local universities and their communities are rare but do result in significant health findings. The University of Western Australia oversees the Busselton Health Study, an on-going cohort study of residents who participate in research about cardiovascular disease, pulmonary function, diabetes, and cancer.[366] The Framingham (Massachusetts) study may be the most well-known longitudinal study in the U.S. Implemented in 1948, it is now managed by Boston University and has recruited its 3rd generation of community partners. The stability and longevity of this program enables research to move beyond behavioral indicators and medical intervention to include more sophisticated genetic research along familial lineage.[367] Framingham research led to identification of commonly understood risk factors for cardiovascular disease such as high blood pressure and high cholesterol.

Conclusions

As noted in **Chapter II** of this report, walkable mixed-use developments, with services located 400-500 meters from residences, foster increased physical activity and social interactions, with documented improvement in health. There is precedent for mixed-use areas that successfully include essential services including retail and restaurant/café options, health care services for medium- to large-scale developments, and room to experiment with technology on smaller scales such as tele-health offices or kiosks. Low population density can limit the economic viability of certain mixed-use community designs, but right-sizing village-like areas that invite surrounding communities to visit, shop, and use services can ensure a thriving micro-economy.

Some planners, developers, and local community stakeholders have engaged with universities to develop healthy communities. An academic institution can be an important partner to help distinguish healthy aging developments; such partnerships can lead to new research opportunities for improving the health and independence of residents. They can also provide older adults with academic teaching or learning opportunities, intellectual stimulation, and social engagement. Partnerships can serve as an economic catalyst to support the expansion of a community's essential services. University students can take advantage of service-learning opportunities that also benefit residents. Additionally, if the community is large enough, academic partners may contribute to the development of a health village central core.

VII. Findings and Recommendations

The growth of California's aging population will place greater pressures on health care and social services over the next 40 years. Although the "age wave" of older adults is the impetus for worldwide focus on (re) designing healthy aging communities, the principles of healthy universal design apply to all, including those with physical and developmental disabilities, and families with young children. This report provides insight into critical first steps in the development of healthy aging communities through evidence-based land-use planning and design.

Most people have strong preferences to remain independent in their own homes as they age. These preferences, coupled with the housing shortage in California, create a unique opportunity for developers, planners, and other stakeholders to create innovative communities to support healthy aging for diverse populations. These communities support people as they age while retaining access to their established social networks (friends, family, clubs, place of worship) and essential service networks (health care, barber, grocery store, social services, etc.). Although public and private support services for older adults and others will always be required, community design can support health and independence, reduce and/or accommodate disability, decrease demand for long-term care, and improve quality of life.

Limitations

This report is not a systematic review of evidence and our searches may have missed some relevant literature or model communities. However, this review provides a reasonable summary of how land-use planning and design can impact health and highlights communities incorporating some of the elements critical to healthy aging. The focus of this report is on land-use planning and the built environment with conclusions and recommendations directed primarily to planners, developers, builders, and housing advocates. There is very limited discussion of policy, programs, and services despite the critical role they play in supporting healthy aging; however, we conclude with some recommendations for public policy consideration, since existing land-use planning and development policies may inhibit innovative evidence-based or experiential community design. ULI and APA guidelines offer well-developed comprehensive strategies for creating healthy aging communities and planners, developers as well as policymakers should refer to the ULI toolkit for guidance and inspiration on community design features when developing healthy aging communities.

Community Composition

Community planning and design is not one-size-fits-all for older adults or adults with I/DD. It is influenced by land-use planning constraints (zoning laws, financing, and physical and political environments), as well as by preferences of potential residents. Considerations include whether the community will be homogenous or heterogenous (intergenerational vs. age-restricted; neurodiverse vs. I/DD-only) and their proximity to amenities and services, family and friends, and urban cores.

Age-restricted developments are preferred by some older adults; however, intergenerational communities are supported by expert recommendations. Surveys demonstrate preferences for aging in place in intergenerational communities, where support from neighbors reduces isolation, enhances socialization, and improves sense of purpose and generativity, all of which promote healthy aging.

Cross-disciplinary partnerships among stakeholders are critical to planning and building innovative developments. Private and public financing —sometimes in partnership—plays an important role in achieving thriving communities that are inclusive of people with I/DD. Stakeholder groups, comprised of older adults, adults with I/DD and their families or caregivers, have been used effectively by housing organizations and schools of architecture to produce recommendations and guidelines to meet needs of subpopulations including older adults and those with I/DD or dementia.

Recommendations

Planners and developers of a healthy aging community might consider:

- Soliciting input from potential future residents and stakeholders to inform community design and characteristics. Charette and rapid re-design tools can add important input on design choices in a short time frame.
- Building a mix of housing choices (e.g., lofts, apartments, townhouses, single-family homes of varied sizes, with and without accessory dwelling units) naturally attracts different age cohorts and produces intergenerational communities inclusive of single people and couples, those with and without disabilities, young families, multigenerational families, and older adults. A range of housing options for residents with incomes ranging from low to high will be needed, particularly for those whose income derives primarily through Social Security or Disability.
- Forming a network comprised of disability housing advocates (focused on I/DD, dementia, etc.), planners, architects, developers, and builders can help to educate the public and policymakers and generate public support for more affordable housing for older adults and adults with I/DD; inviting affordable housing developers to partner in developments can leverage public monies to support housing and amenities.

Community Design

Land-use planning and design can influence behavioral patterns related to physical activity and socializing through mixed-use development that includes essential services and third places as destinations within walking distance of residences (400-500 meters). There is clear and convincing evidence that health can be enhanced through the design of walkable mixed-use neighborhoods, which foster social interaction and physical activity. Specifically, physical and emotional health is enhanced by close proximity to retail and service destinations and recreation options, as well as amenities such as walking paths, benches, parks, and public restrooms.

Recommendations

Planners and developers of a healthy aging community should consider:

- Building multiple, thematic neighborhoods in developments with significant acreage including interconnected bike trails, walking paths, and transit to connect the neighborhoods and meet the varied preferences of people interested in healthy aging.
  - Themes might include age-restricted, intergenerational, or pocket (mini) neighborhoods for people with I/DD who are interested in shared housing options.
  - Third places such as parks, community centers, small retail, and libraries can create hubs or nexus points linking thematic neighborhoods.
- Marketing new healthy aging developments across regional areas rather than focusing exclusively on the local environs. The broader reach will draw an adequate population to ensure the economic viability of local retail/essential services in mixed-use communities.
- Using a grid or irregular grid street pattern to increase walking by residents and improve navigation for those with cognitive impairment.
- Designing interconnected streets, walking paths, and bike trails to support multiple transit options for residents of all abilities. This approach will better support patronage of local retail and essential services, improve community-building and socialization, and promote more physical activity.
- Creating permeable borders to compensate for fewer residents in smaller healthy aging developments. This design strategy encourages bi-directional flow so that residents from adjoining/contiguous communities have easy and welcoming access to the development's retailers, and internal residents can easily seek complementary retail and other services outside of the immediate development. Connected bike and walking paths facilitate that flow.
- Employing universal design techniques such as low/zero barrier entries, wide doorways, accessible bathrooms and building single-floor residential units will accommodate a diverse group of people and require little-to-no retrofitting to prolong healthy and independent living.

Transportation

Transportation plays an important role in maintaining independence and provides critical access to employment, health care services, and social and cultural activities. Strategically placing communities near public transportation benefits those who do not drive. Limited, but consistent evidence suggests that access to convenient private and public transportation supports the physical and social health of older adults. The autonomous vehicle market will continue to grow, thus, providing more options for those with limited driving skills. Accessible, nearby public transportation with convenient schedules can increase older adults' physical activity and social interactions. Last mile transportation with e-bikes, shuttles, and on-demand ride-share opportunities can facilitate the use of transit. Use of electric cars is increasing and requires planning for adequate charging stations; California seeks to achieve 100% zero-emission car sales by 2035.

Recommendations

Planners and developers of a healthy aging community should consider:

- Developing plans for robust community transit with well-connected light rail and bus options to enable travel for those who cannot or prefer not to drive. Transit should support individuals with physical disabilities and cognitive impairment. It should also connect distant parts of large developments and connect suburban or rural communities with service areas.
- Building bus stops with shaded benches, clear signage, and wide sidewalks to promote transit use. Planning considerations include well-lit benches, shelters, and waiting areas for transit; parking areas for on-demand transportation and shuttles when not in use; and e-bike parking areas at light rail stations, retail areas, and neighborhoods.
- Creating neighborhood multi-modal, macro- and micro-transit hubs that include: last mile connections through shuttles (possibly including autonomous vehicles); on-demand transportation and micro-transit options with mini ride-shares; on-demand e-bikes; and car-share systems.
- Installing adequate numbers of publicly available charging stations to accommodate the growing use of electric vehicles. Charging stations should be available in destination third places such as retail sites, community centers, parks.

Community Accessibility and Safety

Proper street and sidewalk design fosters healthy aging by improving pedestrian safety, enhancing walkability, and assisting with wayfinding for individuals with disabilities. Well-lit streets and sidewalks are an important safety feature to reduce falls and injuries.

Recommendations

Planners and developers of a healthy aging community should consider:

- Designing walkable communities with well-connected streets composed of shorter blocks (human scale), well-marked crosswalks, and narrower streets to facilitate crossings (but still accommodate public transportation).
- Including front porches of sufficient size to accommodate tables and chairs, and balconies that overlook common spaces. These strategies facilitate social interaction, thus improving emotional health.
- Building sidewalks that are at least 5-feet wide to allow partner walking and room for people using assistive devices to pass by comfortably. Well-designed curb cuts facilitate accessibility and safety for people using assistive devices.
- Providing median crossing islands in wider streets to allow slower pedestrians to safely pause while crossing.
- Using a variety of traffic calming strategies such as curb extensions, roundabouts, narrowed streets.
- Layering landscaping between the roads, sidewalks and homes to ensure pedestrian and resident privacy and safety.
- Planting native and drought-tolerant landscaping along streets to provide habitat for birds, insects, and other wildlife, provide shade, and create a sense of place.

- Using automated street lighting to illuminate sidewalks to encourage more physical activity and socialization and reduce falls.
- Designing enticing stairs for developments with hilly terrain (image below) will encourage everyday physical activity. Design options include integrating public art and greening.
- Including unique landmarks, plantings, and street, sidewalk, and neighborhood color schemes to enhance wayfinding for those with cognitive impairment.

Stairway positioned mid-block shortens longer blocks and improves neighborhood connectivity. Credit to EQRoy. Source: Shutterstock.com

Community Greening

Optimizing community access to green space and water features improves mental and physical health as well as quality of life. There is clear and convincing evidence of the beneficial impact of greening on health, including exposure to green space, tree canopy, gardens/gardening, and biodiversity. Consistent research findings confirm that greening is associated with better health and wellbeing in physical, mental, and social domains, including subpopulations of children, adults, the elderly and persons with I/DD. Tree canopy can improve air quality, reduce temperatures and improve residents' social and physical activity. Greening also may reduce greenhouse gas emissions and enhance biodiversity.

Recommendations

Planners and developers of a healthy aging community should consider:

- Including greening in all aspects of new and existing healthy aging developments. Strategies include: conservation of natural areas; design of large parks, parklets, and/or community gardens; significant street canopy coverage; and integrating greening into third places.
- Engaging diverse potential and existing community residents to gather input and define preferences as part of planning community greening and development.
- Consulting with certified arborists and licensed landscape architects as part of planning and building a healthy aging development.
- Planting a significant green canopy (50-60% coverage) with large trees of diverse species to enhance shade in lots, along streets, and outdoor third places.
- Incorporating trees and understory vegetation along sidewalks, park trails, and bike paths to make using these routes more attractive, ecologically sustainable, and comfortable.
- Allotting a minimum of 3,500 square feet per community garden, which will allow for 10-12 garden plots. Garden sites should offer a minimum of 6 hours of direct sunlight and be located in a mostly flat location.
- Identifying natural areas for conservation, which will preserve habitat and support biodiversity. These areas can be integrated with walking and biking paths that encourage physical activity.

Technology

Technology is a critical component of any healthy aging community. Ideally, planning and design for healthy aging should "future-proof" communities by anticipating technical innovations as well as the changing needs of populations over time. Reliable electrical power is critical for basic activities of daily life and especially in light of our increasing dependence on technology. Reliable electricity with a robust back-up system is critical to the success of a healthy aging community. Every form of technology described in this report (for communication, health care, transportation) requires electrical power. Anticipated increases in use of broadband and 5G over the coming years will require infrastructure planning that accommodates expanding demand.

Consultation with future users is as essential in planning for technology as it is for other aspects of

a healthy aging community. Implementing universal design principles can enhance accessibility to users, particularly older adults and those with I/DD.

Recommendations

Planners and developers of a healthy aging community should consider:

- Developing an appropriate and flexible infrastructure in anticipation of growing demand for technologies and services that are internet- and power-dependent. This includes the ability to accommodate broadband internet, 5G (wireless), and power capacity needs for 10+ years into the future.
- Ensuring wide access to broadband and 5G services in buildings, and outdoor areas in new and redeveloped communities.
- Incorporating redundant energy options in the planning and development process.
- Protecting privacy and security as central tenets when selecting and implementing any technologies.
- Engaging end-users in all technology decisions, with a special emphasis placed on including older adults in the user design and selection process. Planners should pay particular attention to universal design principles that focus on enhancing the user interface of technology devices for older adults and those with I/DD.
- Challenges with evolving technology and expected obsolescence. Technology advances and planned obsolescence require anticipating continuous upgrades in hardware and software, and building in contingency plans such as consultant support.
- Carefully choosing technologies for the healthy aging community. All technology-enabled systems should be subject to rapid-cycle testing and evaluation to test reliability, accuracy, efficiency, and impact before adopting. This process could also provide opportunities for participating in research and innovation programs, particularly with academic partners.
- Developing a tracking system for changes in federal and state regulations, policy, and funding. External factors such as changes in policies, regulations, and funding, can have a significant impact on program goals and operations, which increases the importance of planners' being aware of the latest developments.

Partnerships

Some planners, developers, and local community stakeholders have partnered with universities to develop healthy communities. A partner academic institution can help to distinguish healthy aging communities. Such partnerships can provide older adults with academic teaching or learning opportunities, intellectual stimulation, and social engagement. They can also serve as an economic catalyst to support expansion of a community's services. Academic institutions benefit from educational opportunities for student service-learning that also benefit residents. Research partnerships may identify strategies to improve the health and independence of residents. Additionally, if the community is large enough, academic partners can contribute to a health village central core.

Recommendations

Planners and developers of a healthy aging community should consider:

- Conducting market feasibility analyses to assess demand for retail or essential service (including health care services) options among future residents. Based on those outcomes, plans for essential services can be appropriately scaled based on anticipated need and guided by models described in this report.
- Centrally siting grocery, retail, and restaurants options close to residential units. A pedestrian-oriented shopping row can anchor a community with centralized parking and car-free zones to promote walkability and social engagement. These zones can be infilled in future phases of development after additional housing is built to ensure economic viability for businesses and expand services based on residents' needs and preferences for the types of essential services offered.
- Engaging partners to integrate a variety of health care facilities (if market feasibility findings warranted a need):
  - Small, private telehealth office or kiosk inside a community building that is staffed accordingly to assist residents with navigating digital devices and connectivity issues.

  - Small clinic or medical suite inside a community building to deliver primary or urgent care or specialty care via telehealth connections.
  - Multi-use health village to support residents in the community and the surrounding area. Facilities may include an acute care hospital, skilled nursing facility, post-acute rehabilitation, mental health care, wellness center, and/or pharmacy.
- partnering with academic institutions and other stakeholders to provide:
  - Student service learning opportunities which also benefit residents.
  - Educational and cultural arts opportunities for residents to audit classes or attend lectures or events online or in person.
  - Teaching opportunities for residents to contribute to the education of students by giving lectures, participating in panels, or tutoring students.
  - Research opportunities for university researchers to engage with residents in studies of a variety of subjects related to healthy aging.

Policy

Policymakers and stakeholders may want to adopt a "health in all policies" framework to consistently support healthy community design. This framework, by definition, would be woven into planning among multiple disciplines such as transportation, urban planning, and construction. Local policymakers interested in developing a healthy aging community should obtain community input on the needs and preferences of residents through surveys and other mechanisms.

Recommendations

Policymakers and stakeholders interested in supporting healthy aging communities should consider:

- Meeting regularly with residents and stakeholders to gather input on current and planned healthy aging communities.
- Reviewing and adopting relevant APA Metrics for Planning Healthy Communities to assist with coalition building and achieving goals in healthy planning.
- Supporting the adoption of land-use strategies that to expand affordable housing opportunities for people with I/DD – as long as these measures result in independent living where consumers have choice, independence, and community integration.[13]
- Supporting amendments to zoning codes:
  - To allow for accessory dwelling units as an effective land-use strategy for expanding housing,
  - To enable other effective strategies discussed in this report (or cited sources) that might not be in local compliance.

Summary

Planners and developers can rely on strong evidence supporting the following features of healthy aging communities: mixed-use walkable communities with a variety of residences and access to nearby transit, third places, parks, and community gardens, accessed by green well-designed streets, sidewalks, and connected walking paths and bike trails. Secure, but easy access to technology, particularly broadband internet, 5G telecommunication, and electric vehicle chargers will have growing importance. Incorporating redundant energy options to avoid prolonged electrical outages is an important part of the planning process. Input from potential community residents, healthy aging advocates, and other stakeholders should be sought early in the planning process. Guidelines and toolkits related to multiple aspects of healthy community design are available to support planning and decision making. Existing and planned model communities offer ideas and inspiration to planners of future communities. Partnerships between developers and academic institutions can foster development of evidence-based healthy aging communities and provide opportunities for education and research.

Appendix A: Evidence Review Methods

To understand how factors related to land use planning may affect the health and wellbeing of older adults and adults with intellectual and developmental disabilities, we reviewed the evidence to:

1. Uncover unique features or characteristics of **naturally occurring retirement communities** (including blue zones) that show evidence of supporting healthy aging.
2. Identify **community designs and land use models** that show evidence of supporting healthy aging.
3. Understand what **transportation** elements exist that have shown evidence of supporting healthy aging.

The evidence review search was inspired by a series of questions:

- What communities, such as Blue Zones, have been identified as supporting healthy aging/longevity?
- What characteristics of naturally occurring retirement communities or Blue Zones support healthy aging?
- What characteristics of naturally occurring retirement communities or Blue Zones should be considered in terms of land use planning?
- Are there differences in physical and mental health outcomes for older adults (aged 55+) living in multigenerational versus age-restricted communities that are attributable to community design?
- What ancillary community design elements are associated with improved health outcomes in older adults or adults with disabilities?
- What land use planning guidelines exist for developers building suburban developments that support healthy aging?
- What community layout configurations (i.e., street layout) support healthy aging and independence for adults, including those with intellectual/ developmental disabilities?
- Which planning and land use models are most effective in promoting independent living among the aging population, including those with intellectual / developmental disabilities?
- What types and locations of facilities support the physical, mental, and social health of older adults and adults with intellectual /developmental disabilities?
- What transportation infrastructure characteristics are most critical to promoting healthy and independent living and age-friendly developments?
- How does having access to personal or public transportation support the physical, mental, and social health of an aging population? For those with intellectual /developmental disabilities?
- How does design of sidewalks, bicycle paths, and walking paths support the physical, mental, and social health of an aging population? For those with intellectual /developmental disabilities?
- What street and walking designs support safety and wayfinding for older adults, and adults with intellectual /developmental disabilities?
- What impact does greening have on healthy aging?

Peer-reviewed Literature:

With the aid of a medical librarian, we conducted a search of peer-reviewed literature across 10 databases from 2005 through 2020. The search yielded 4,362 articles, which underwent abstract review. Of those, 235 abstracts were selected for full text review, for which 133 were selected for analysis. Ten percent of excluded full text articles were dual-reviewed for consistency. We found 17 reviews (composed of qualitative and cross-sectional studies), 5 cohort studies, 84 cross-sectional studies, 9 mixed methods, 19 qualitative studies, and 1 case-control study. Additional articles that did not initially meet criteria were added to the report to provide context.

Because the healthy aging and greening literature is richer than that of land use planning, a separate search was conducted using the same 4,362 articles identified by the medical librarian. We reviewed 571 greening papers for relevancy and 103 were

selected for full-text review. Of these 103 articles, 45 were analyzed. Of these 45 papers, information from 32 are reported based on relevance and quality of the methods. The 32 papers were in the following categories: 1 randomized controlled trial, 12 literature reviews or meta-analyses (including studies using cross-sectional, longitudinal, and randomized controlled trial designs), 2 cross-sectional, 1 descriptive, 2 longitudinal, 1 mixed methods, 1 case-control, and 12 conceptual, guideline, or methods-related.

Grey Literature

Where little to no peer-reviewed literature was found, we searched the internet for reports, guidelines, briefs, articles across websites hosted by government agencies, professional societies, and the housing industry (inclusive of for-profit and non-profit organizations).

HIERARCHY OF EVIDENCE

Hierarchy of evidence ranks the rigor of research studies based on methodology employed. Research is generally classified as experimental or observational, with experimental results indicating an intervention as the cause of an outcome, whereas observational results are less certain and simply imply a correlation between an intervention and outcome. The hierarchy, in descending order of strength, is as follows:

- Systematic reviews
- Meta-analyses
- Randomized controlled trials
- Cohort studies (longitudinal)
- Case studies/reports
- Cross-sectional studies
- Qualitative studies
- Case control studies,
- Case studies/reports
- Expert opinion

Appendix B: Key Informants

NAME	TITLE	ORGANIZATION
Zia Agha, MD	Chief Medical Officer	West Health
Ginna Baik	Strategic Business Development Manager	CDW Healthcare
Cindy Blain, MBA	Executive Director	California ReLeaf
Natalie Brubaker, MA	Education Director	Canopy
Scott Collins	President & CEO	LinkAges
Mollie D'Agostino, MPP	Policy Director	3 Revolutions Future Mobility Program, University of California, Davis
Ana Pinto da Silva, MA	Co-Founder & CEO	MINKA Homes + Communities
Susan DeMarois	Director Public Policy	Alzheimer's Association
Thomas Dougherty, MArch	Architect	Archer and Buchanan Architects
Danielle Glorioso, LCSW	Executive Director	Center for Healthy Aging, University of California, San Diego
Manny Gonzalez, FAIA	Managing Principal	KTGY's 55+ Practice Group
Ester Greenhouse, MS, CAPS	Built Environment Strategist Consultant; Strategic Director	AARP International; TC Age Friendly Center for Excellence
Susan Handy, MS, PhD	Professor	Department of Environmental Science and Policy, University of California, Davis
Eitaro Hirota, AIBC	Architect	NSDA Architects, The Village at Langley
Kamal Jethwani, MD	Founder	Decimal.health
Laura Kilgore	Director of Marketing	Lennar Corporation
Emi Kiyota, PhD	Founder, Director Environmental Gerontologist	Ibasho House Japan
Colin Koch	Land Operations Manager	Brookfield Properties
Mei Kwong, JD	Executive Director	Center for Connected Health Policy
David Lindeman, PhD	Director	CITRIS Health
Kammy Lo, MS, MBA	Board President	Canopy

NAME	TITLE	ORGANIZATION
Catherine Martineau, MS, ABD	Executive Director	Canopy
Ty Mayberry, MS	Integrated Services Engagement	CDW Healthcare
Katie McCamant	President	CoHousing Solutions
John Melvin	State Urban Forester	California Department of Forestry and Fire Protection
Rafi Nazarian	Associate State Director	AARP California
Kari Olson	Chief Innovation & Technology Officer	Front Porch
Laurie Orlov	Founder	Aging and Health Technology Watch
Davis Park, MS	Vice President	Front Porch Center for Innovation and Wellbeing
Sheri Peifer, MSG	Senior VP, Chief Strategy Officer	Eskaton
Melissa Ponce	Master's Candidate, Design Real Estate	Harvard University; Minka Homes
Jeremy Porteus	Chief Executive	Housing LIN
Gregor Rae	CEO & Co-Founder	BusinessLab
Anna Ricklin, AICP, MHS	Health in All Policies Manager	Fairfax County, VA Health Department
Rigo Saborio	President & CEO	St. Barnabas Senior Services
Joel Shapira, MA	Chief Orchestrator	Beyond Age
Erica Spotswood, PhD	Senior Scientist, Applied Ecologist	San Francisco Estuary Institute—Aquatic Science Center
Robert Sherry	Urban Planner (Retired)	Sacramento County
Ray Tretheway	Executive Director	Sacramento Tree Foundation
Michelle Velky	Vice President, Sales & Marketing	Lennar Corporation
Frances Wright	Head of Community Planning	TOWN, Marmalade Lane

Appendix C:
Model Healthy Aging Communities*

*Property area, units, and population provided when available.

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
MASTER PLANNED COMMUNITIES (MPC)				
3Roots (San Diego, CA, USA) *Proposed*	Urban	Intergenerational	• 413 Acres • 1,800 Single Family Homes, Apartments, and Townhomes	• Parks, including a 23-acre park, trails, and open spaces (256 acres) • Roots Collective, a mixed-use space which includes restaurants, cafes, shops, and retail and a total of 160,160 square feet of retail and commercial space • Transit friendly options via Mobility Hub (such as ride share, private shuttles, connections to bus transit, and bike repairs)
Culdesac (Tempe, AZ, USA) *Proposed*	Urban	Intergenerational	• 16 Acres • 636 Apartments • 1,000 residents	• Car-Free Community (Bike Parking, Rideshare, Light Rail, Scooters available as alternative transportation) • Co-working Office Spaces • Grocery Store • Parks • Pedestrian-Friendly Spaces (Walkways, Plazas) • Restaurants • Retail (16,000 square feet)
Laguna West (Elk Grove, CA, USA)	Urban	Intergenerational	• 1,045 Acres • 3,370 Single-Family and Multi-Family Homes • 8,414 Residents	• 73-Acre Lake with Fishing Areas and Walking Paths • Commercial and Office Spaces • Community Center • Garages in alleyways behind homes • Large Front Porches • Parks • Restaurants • Riparian Zone • Shorter Front Yards • Sports Fields • Walking Trails
Meridian Water (London, UK) *Proposed*	Urban	Intergenerational	• 210 Acres • 10,000 Mixed-Tenured Homes in a Mixed-Use Development	• Entertainment Space (Music Theatre, Cinema, etc.) • Health Services • Open Spaces • Parks • Railway Station • Retail Space • Schools • Waterway

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
Panasonic Smart Cities, Pena Station NEXT (Denver, CO, USA) *Proposed*	Urban	Intergenerational	• 220 Acres • 1,329 1-, 2-, and 3-Bedroom Multi-Family Units in a Mixed-Use Development	• Access to Train Station (Connects the Denver International Airport, Downtown Denver, and the University of Colorado) • Commercial Space (1 million sq. ft.) • Community Wi-Fi Access • Electrical Vehicle Charging Station • Fitness and Wellness Centers • Fitness Center • Health and Wellness Center • Innovative Technology (Virtually connected cars, pedestrian crossing sensors, autonomous vehicles, sensors to monitor air quality, lighting, pedestrian activity) • Living Lab (Where the installed technology will monitor to improve the community) • Office Space • Pocket Communities (Residents live within a block of green space) • Recreation Trail • Restaurants and Cafes • Retail Space (300,000 sq. ft.)
Rancho Mission Viejo (Orange County, CA, USA) **Gavilan at Rancho Mission Viejo** (55+ Neighborhood) (Orange County, CA, USA)	Rural	Intergenerational with Age Restricted Neighborhoods	• About 23,000 Acres • Envisions 14,000 Single Family Homes, Townhouses, and Apartments by 2030 (on 6,000 acres), • Currently 10,000 residents (Envisions 40,000 by 2030)	• Campsites • Clubhouses • Extensive Trail System for hiking • Local Nature Reserve • Restaurants • Retail Areas • Sports Fields and Courts • 3 Farms for Community Connections • 55+ Age-Restricted Neighborhoods with separate amenities (Pools, Spa, Restaurant, Parks, and Clubhouses)
Serenbe (Fulton County, GA, USA)	Rural	Intergenerational	• 1,000 Acres • 370 Single Family, Live/ Work Units, Townhouses, Loft/ Condo Apartments • Approximately 750 residents	• Central Lake with Dock for Swimming, Paddle Boarding, or Canoeing • Edible Landscaping • Extensive Trail System • Lake • Organic Farm: Farm to Table • Outdoor Theatre • Pedestrian-Friendly • Retail Areas • Roads for Cyclists • Stables • Sports Fields and Courts

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
Summerlin (Clark County, Nevada, USA)	Suburban	Intergenerational with Age Restricted Neighborhoods	• 22,500 Acres • Single Family Homes, Townhouses, and Condos • Approximately 46,213 residents	• Business Parks • Community Parks • Downtown Summerlin Retail Area (400 acres) • Extensive Trail System • Fitness Facility • Hospital • Playgrounds • Sports Fields and Courts • Swimming Pools
The Villages (Sumter County, FL, USA)	Rural	Age Restricted (55+)	• 3,558 Acres • Single Family Homes, Villages, and Apartments • Approximately 79,372 residents	• Entertainment Spaces • Extensive Trail System • Market Squares • Recreation Center • Restaurants • Retail • Sports Fields and Courts • Theater • Town Squares • Urgent Care Facilities
CONTINUING CARE RETIREMENT COMMUNITIES (CCRC)				
Fairview Care (Albany, Auckland, New Zealand)	Suburban	Age Restricted (65+)	• 20 Acres • Mix of 131 Villas, 4 Townhomes, 63 Apartments, 47 Care Rooms	• Bowling Green Area • Common Building and with Care Unit • Gated Community • Medical Support • Croquet Area
Hartrigg Oaks (York, UK)	Suburban	Age Restricted (60+)	• 152 1- and 2- Bedroom Bungalows and 43 Nursing Care Beds	• Coffee Shop • Community Building • Guest Room • Gym with Spa Pool • Hair Salon • IT Facilities • Library • Minibus for Social Outings • Private Gardens • Restaurant • Small Shop
Masonic Homes of California (Union City, CA, USA)	Suburban	Age Restricted (60+)	• 267 Acres • 300 Residents, Mix of Independent Living, Assisted Living, Skilled Nursing, Memory Care, and Rehabilitation	• Computer Room • Convenience Store • Game Room • Health and Wellness Centers • Ice Cream Shop • Library • Lounge Areas • Pharmacy, Medical, and Dental Services • Trails for Walking • Transportation to Off-Site Areas • Worship Center

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
Mt. San Antonio Gardens (Pomona, CA, USA)	Suburban	Age Restricted (60+)	• 31 Acres • Mix of Single-Family Homes, Cottages, Apartments and Suites, Memory Care Studios, Skilled Nursing, and 2 Green House Homes (10 Residents in Each) for 287 Total Homes • Approximately 500 residents	• Intimate setting emphasizing comfort and livability • Grad Student Residencies for Intergenerational Interactions • Gardens • University Collaboration (Intergenerational Interaction and University Classes for residents)
St. John's Village (Woodland, CA, USA)	Suburban	Older Adults	• 14 Acres • Mix of 13 Individual Cottages, 14 Apartments, 64 Personal and Memory Care Rooms • 150 Residents	• Administration Building • Chapel • Facility Maintenance • Gardens • Hair Salon • Library • Memory Care • Outdoor Exercise Space • Putting Green
DEMENTIA CARE COMMUNITIES (DEMENTIA VILLAGES)				
De Hogeweyk Village (Weesp, Netherlands)	Urban	People Affected by Dementia	• One Facility with 23 Shared Homes • 152 Residents	• Activity Center • Cafe • Community Center • Intimate setting emphasizing comfort and livability • Hair Salon • Hardware Store • Outpatient Care Unit • Restaurant • Safe Paths • Supermarket • Theatre
Gradmann Haus (Stuttgart, Germany)	Urban	People Affected by Dementia	• One Facility of 25 Rooms and 18 • Apartments	• Café • Courtyard Garden • Day Centre • Dining Space • Looped Hallways
The Village (Langley BC, Canada)	Suburban	People Affected by Dementia	• 5 Acres • 6 Single Story Shared Cottages with Individual Doors	• Central Main Street/ Pathway • Community Center with General Store, Café and Bistro, Salon, and Spa • Farm with Farm animals • Games Lawn • Sensory Gardens • Village Center with Store • Walking Paths with no dead ends

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
Village Landais (Dax, France)	Suburban	People Affected by Dementia	• 12.3 Acres • 16 Shared Homes • 120 residents	• Auditorium • Café-Restaurant • Common Dining Area • Day Care Unit • Gardens • Hairdresser • Library • Parks with Sensory Gardens • Supermarket • Walking Paths
COHOUSING COMMUNITIES				
Heartwood Commons (Tulsa, OK, USA) *Proposed*	Suburban	Age Restricted	• 4.8 acres • 41 Single Story Homes	• Bike Storage • Centralized Community Green Space • Common House with Kitchen, Activity Spaces, Outdoor Living Space, Guest Rooms • Community Dog Park, Gardens, Shed, Workshop • Greenhouse • Walking Paths
Marmalade Lane (Cambridge, UK)	Suburban	Intergenerational	• 1 Acre • 42 Single-Family Homes and Apart-ments	• Car-Free Lane • Common House with Playroom, Guestroom, Laundry Facilities, and Meeting Room • Gardens • Near Education and Employment Hubs • Near Transportation • Parking along Property Perimeter • Workshop and Gym
New Ground (High Barnett, UK)	Urban	Age and Gender Restricted	• 2.1 Acres • 25 Apartments (11 1-Bedrooms, 11 2-Bedrooms, and 3 3-Bedrooms) • 26 Women (ages 50+)	• Central Garden • Central Lobby • Courtyard • Garage • Guest Rooms • Kitchen/ Dining Area • Laundry and Drying Space near Courtyard • Meeting Room • Near Transportation, Shops, Health Facilities, and Restaurants
Village Hearth (Durham, NC, USA)	Suburban	Age Restricted (55+) for those identifying as and friends/ allies of LGBTQ	• 10 Acres, 29 Single Story Cottages	• Art Studio • Central Green Space • Common House (with homes clustered around it) • Dog Park • Workshop

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
VILLAGE HOUSING COMMUNITIES				
Derwenthorpe York (North Yorkshire, UK)	Suburban	Intergenerational	• 540 Single Family Homes	• Car Parking Behind Houses • Central Square • Cycling and Walking Routes • Main Road • Near Drugstore, Dentist, Doctors, Gym, Library, Nurseries, Post Office, Schools, Supermarket, Vets, and Transportation • Playground • Pond • Recreational Areas • Street Facing Homes for "Eyes on the Street" Security • Winter Gardens
Drommehagen (Drobak, Norway) *Proposed*	Suburban	Intergenerational	• 3 Acres • 22 Apartments and Townhomes	• Below Ground Multi-Story Car Parking • Courtyard • Front Street which expands into city • Permeable to the Outside Community • Public Square • Underground Car Parking
Grow Community (Bainbridge Island, WA, USA)	Suburban	Intergenerational	• 22 Single Family Homes, Apartments and Townhomes for a Total of 131 Homes	• Community Center • Shared Gardens and Green Space • Sustainable Home Features (Solar Panel, built with renewable materials, energy efficient appliances and home) • 5-minute Community
Share Kanazawa (Ishikawa Prefecture, Japan)	Rural	Intergenerational and Children with Special Needs	• 8.9 Acres • 32 Units for Older Adults and 30 Units for Youth • 40 Adults (60+), 32 Youth with Special Needs, and 8 University Students	• Alpaca Farm • Art Studio • Beer Garden • Café • Bath House • Integrated Pathways connect to outer community • Kitchen Studio • Main Hall/ Building • Massage Salon • Restaurant • Shared Laundry • Sports Facility • Store • Vegetable Gardens
Shell Cove (Dawlish, UK) *Closed*	Suburban	Age Restricted	• 35 Apartments and Cottages	• Clifftop Path Network • Common House and Lounge • Gardens • Private Beach • Seaside

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
The Village of Hope (Clearfield County, PA, USA)	Rural	Intergenerational	• 23 Acres • 51 Minka Homes	• Adult Day Service • Café and Restaurant • Car Free Roads and Trails • Central Green Space • Chronic Care Management Services and Support • Community Arts and Theatre Space • Community Farming Space • Grocery Store • Health Clinic • Multi-Sensory Snoezelen Spaces • Pedestrian Walking Paths • Pharmacy Services • Telehealth and Wellness Technology • Village Hall
COMMUNITIES FOR INDIVIDUALS WITH INTELLECTUAL AND DEVELOPMENTAL DISABILITIES				
Coastal Haven (Santa Cruz, CA, USA) *Proposed*	Suburban/ Urban	Individuals with I/DD	• 6.7 Acres • 9 shared Single-Family Homes, a garage/ visitor space, and one historic house	• Common Walkway • Outdoor common spaces outside homes • Pedestrian-friendly spaces • Proximity to essential services (namely, three hospitals, transportation, retail, cultural attractions, and a greenbelt) • Satellite parking to optimize pedestrian spaces • Shared Garage • Use of pocket neighborhoods around third places, such as outdoor common spaces with dining areas and front porches • Working Farm
First Place Phoenix (Phoenix, AZ, USA)	Urban	Individuals with I/DD	• 4-Story Building • 55 1- or 2-Bedroom Apartments • 79 Residents	• Community Center • Health & Wellness Center • Proximity to medical centers, pharmacy, library, Universities, grocery store, and cultural attractions • Teaching Kitchen
Independence Landing (Tallahassee, FL, USA) *Proposed*	Suburban	Individuals with I/DD	• 72 available spots in apartment-style units	• Adjacent 42-acre city park • Proximity to walking and biking trails • Proximity to golf and tennis courts • Proximity to transportation (city bus) • Access to essential services (namely, medical offices, restaurants, pharmacies, and grocery stores) • Lifelong Learning opportunities from local colleges
Noah Homes (Spring Valley, CA, USA)	Suburban	Individuals with I/DD	• 11 Acres • 10 Units (8 Residential Single-Family Homes where residents may share a room and 2 Memory Care Homes) • 90 Residents including 20 in Memory Care Homes	• "Infinity Paths" to prevent residents from getting lost/ confused • Community Center • Gardens • Playgrounds

NAME (LOCATION)	LOCATION TYPE	TARGETED POPULATION	LAND AREA, NUMBER OF UNITS, TYPE OF UNITS, AND NUMBER OF RESIDENTS*	UNIQUE LAND USE FEATURES
Ravenswood Village (UK)	Suburban	Individuals with I/DD	• 120 Acres • 12 Residential Care Homes (including 5 self-contained apartments around a shared living space) • 111 Residents	• Hydrotherapy Pool • Outdoor Spaces • Stables • Units available for those preferring certain environments (e.g., south-facing windows for more light; north-facing for less light; closer or further location from communal space for preferred level of socialization and activity).[282]
Sweetwater Spectrum (Sonoma, CA, USA)	Urban	Individuals with I/DD	• 2.79 Acres, Shared 4-Bedroom Homes with Common Areas	• Community Center with Gym Space, Library, Kitchen, and Media Room • Greenhouse • Therapy Pool and Hot Tubs • 1.25 Acre Farms
The Village (Los Angeles, CA, USA)	Urban	Individuals with I/DD	• High Rise with 60 Apartments	• Common Rooms • Retail Space • Rooftop Garden (Resident and Broader Community Use)

Appendix D: Example of Local Planning Parameters for Land Use Planning

Excerpts from the Folsom General Plan provides an example of local planning parameters in which developers must operate. This particular example demonstrates the priorities of a local community relating to greening and quality of life.

I. Folsom General Plan 2035:[199]

1. **Land Use: blobdload.aspx (folsom.ca.us)**

   a. **Growth and Change**

   Goal LU1.1

   Retain and enhance Folsom's quality of life, unique identity, and sense of community while continuing to grow and change.

   LU 1.1.7 Concentrated Development

   Allow project applicants to concentrate the proposed development on a portion of the site through the clustering 2-12 Adopted August 28, 2018 of buildings to encourage the preservation of open spaces, cultural resources, and natural features of the landscape.

   LU 1.1.8 Preserve Natural Assets

   Maintain the existing natural vegetation, landscape features, open space, and viewsheds in the design of new developments.

   LU 1.1.10 Network of Open Space

   Ensure designated open space is connected whenever feasible with the larger community and regional network of natural systems, recreational assets, and viewsheds.

   LU 1.1.14 Promote Resiliency

   Continue to collaborate with nonprofit organizations, neighborhood groups, and other community organizations, as well as upstream, neighboring, and regional groups to effectively partner on and promote the issues relating to air quality, renewable energy systems, sustainable land use, adaptation, and the reduction of greenhouse gas (GHG) emissions.

   b. **Residential Neighborhoods**

   Goal LU6.1

   Allow for a variety of housing types and mix of uses that provide choices for Folsom residents, create complete and livable neighborhoods, and encourage walking and biking.

   LU 6.1.4 Open Space in Residential Developments

   Require open space in each residential development except the following: developments located within a Specific Plan Area that has already dedicated open space, on multifamily parcels of less than 10 acres and, or parcels of less than 20 acres for single family uses surrounded by existing development. Open space includes parklands, common areas, landscaped areas, paths and trails, and plazas. Open space does not include areas devoted to vehicle parking, streets, and landscaped streetscapes. To achieve the open space guidelines, a developer may be allowed to group the homes at smaller lot sizes around shared open space features, as long as the average gross density does not increase.

   LU 6.1.6 Senior and Convalescent Housing

   Encourage the development of independent living, assisted living, and convalescent housing facilities that provide health care for seniors. Proposed facilities shall be evaluated based on the location and impacts on services and neighboring properties, and not on a density basis. Independent living facilities should be located in walkable

environments to improve the health and access of residents.

LU 6.1.10 Enhanced Walking and Biking
Where volume-to-capacity analysis demonstrates that bike lanes and pedestrian improvements can be included in the public right-of-way, encourage opportunities to promote walking and biking in existing suburban neighborhoods through improvements such as: introducing new pedestrian and bicycle connections; adding bike lanes and designating and signing bike routes; narrowing streets where they are overly wide; introducing planting strips and street trees between the curb and sidewalk; or introducing appropriate traffic-calming improvements.

c. Community Design
Goal LU 9.1
Encourage community design that results in a distinctive, high-quality built environment with a character that creates memorable places and enriches the quality of life of Folsom's residents.

LU 9.1.6
Community beautification encourage the landscaping of public rights-of-way and planting of street trees to beautify Folsom consistent with water-wise policies

2. Natural and Cultural Resources:

a. Natural Resource Conservation
Goal NCR 1.1
Protect and enhance Folsom's natural resources for current and future residents.

NCR 1.1.4 Native and Drought Tolerant Vegetation
Encourage new developments to plant native vegetation, including that which is important to Native American lifeways and values, and drought tolerant species and prohibit the use of invasive plants.

NCR 1.1.5 New Open Space
Continue to acquire strategically located open space areas for passive and active recreational uses when such parcels of open space value become available and feasible funding sources are identified to sustain the ongoing maintenance expenses.

NCR 1.1.6 Consolidate Parcels
Encourage landowners to consolidate identified habitats, open space, and park lands between separately owned development projects and individually owned properties, when feasible.

NCR 1.1.8 Planting in New Development
Require the planting of street trees, parking lot canopy trees, screening trees, and other amenity trees and landscaping in all new development, consistent with City landscaping development guidelines, to minimize the heat island effect. Planting strips must be large enough to accommodate a large tree canopy and allow for healthy root growth.

NCR 1.1.9 Public Awareness
Encourage and support development projects and programs that enhance public appreciation and awareness of the natural environment.

b. Scenic Resources
Goal NCR 2.1
Allow residents to enjoy views of the hills, lakes, river, and habitats that make Folsom such a beautiful place to live.

NCR 2.1.1 Maintain Scenic Corridors
The City shall protect views along identified scenic corridors.

NCR 2.1.2 Complementary Development
Through the planned development permit process, require new development to be located and designed to visually complement the natural environment along Folsom Lake, the American River, nearby hillsides, and major creek corridors such as Humbug, Willow, Alder, and Hinkle.

3. Parks and Recreation:

Park Development and Maintenance Goal PR1.1

Develop and maintain quality parks that support the diverse needs of the community.

PR 1.1.1 Parks and Recreation Master Plan

Maintain and continue to implement a Parks and Recreation Master Plan to carry out the goals and policies of this General Plan.

PR 1.1.2 Complete System

Develop and maintain a robust system of parks, recreation facilities, and open space areas throughout Folsom that provide opportunities for both passive and active recreation.

PR 1.1.3 Park Design

Develop well-designed parks that enrich and delight park users through innovative and context appropriate design.

PR 1.1.4 Park Acreage Service Level Goal

Strive to develop and maintain a minimum of five acres of neighborhood and community parks and other recreational facilities/sites per 1,000 population.

PR 1.1.5 Bicycle and Pedestrian Plan Consistency

Require parks and recreation facilities be consistent with Folsom's Bikeway Master Plan and Pedestrian Master Plan and connect to the bikeway system whenever possible.

PR 1.1.7 Universal Access

Require new parks and open spaces be easily accessible to the public, including providing disabled access.

PR 1.1.8 Shade and Hydration

Ensure water fountains, trees, pavilions, arbors, and canopies are provided in Folsom's parks and playgrounds, as well as along bike paths, trails, and other active transportation corridors, where appropriate and feasible, to provide important safeguards on hot days.

PR 1.1.9 Water-Wise Landscaping

Employ low water use landscaping in the development of City parks.

PR 1.1.10 Appropriate Land for Parks

Land accepted for parks shall not be constrained by drainage, slopes, easements, regulated species/habitats, dense natural vegetation, and/or structures that limit the full recreational use.

PR 1.1.11 Parkland Acreage

Do not accept easements and designated open space/natural areas as parkland acreage. These areas may be used for parkland; but shall not be credited as parkland under the parkland dedication ordinance.

PR 1.1.12 Neighborhood Parks

Strive to ensure all neighborhoods, new and established, have parks that serve as community focal points.

PR 1.1.13 Community Gardens

Encourage community gardens consistent with the Parks and Recreation Master Plan.

PR 1.1.14 Parkways

Encourage the development of parkways and greenbelts to connect the citywide parks system.

II. Folsom Sustainability Action Plan, Goal 6, Urban Forestry/Heat Island[200]

III. Folsom Tree Resources

Folsom tree permit and guidelines[368]

Folsom Master Tree List[369]

Tree Facts and Information[370]

Tree Preservation Ordinance[371]

Tree Permit Guidelines, Tree Work Permit Application, and Tree Removal Permit Application[201]

Appendix E: Untested Sidewalk Designs

Gamache et al. conducted a systematic review of 41 studies evaluating pedestrian infrastructure designs that accommodate individuals with motor, visual and hearing disabilities. Based on their findings, they proposed an untested sidewalk and curb cut design.

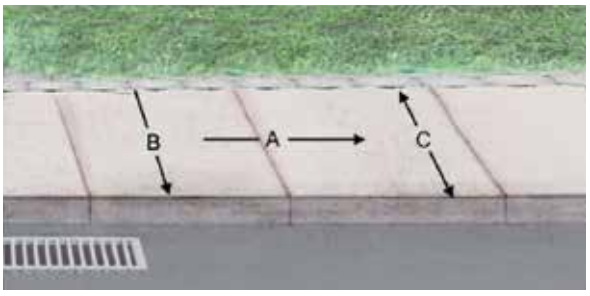
- **Slope (A):** slope should be minimized as much as possible. When slopes are present (for example, at the beginning of a driveway), a visual/tactile indicator should be included.
- **Cross-slope (B):** cross-slope should be minimized as much as possible.
- **Width (C):** sidewalk width should be maximized with a minimum 5-foot width.
- Surface materials should be nonslip, stable, and unobstructive to all types of mobility devices (e.g., scooters, walkers, and wheelchairs). This could include asphalt, concrete, and/or stabilized/compacted decomposed granite, however, materials such as brick, cobblestone, sand, or gravel should be avoided.[372]

Curbs and Curb Cuts

Curb cuts are an example of an accessibility feature that is crucial to facilitating walkability and pedestrian safety and comfort.[73,93,373] They are especially important for individuals with vision or mobility challenges, or pain from injury or arthritis who could not otherwise confidently step down from a standard curb height.[374] Several studies identified challenges with the standard curb cut design and areas where it could be improved. Gamache et al propose the following untested curb cut design (Figure 19b).

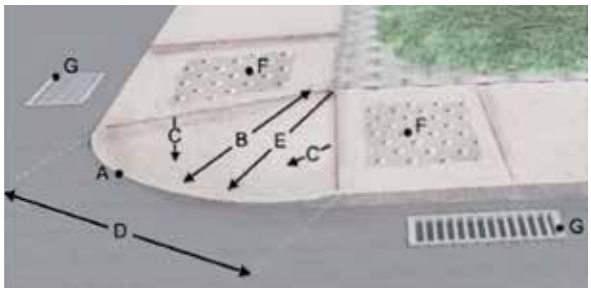
- **Lip (A):** should meet road level.
- **Slope (B):** should be built at an angle equal to or less than 4.8° at a rate of 1-inch rise for every 12-inch length (1:12).[89]
- **Cross-slope (C):** should be built at an angle equal to or less than 2.9° at a rate of 1-inch rise for every 20-inch length (1:12).
- **Width (D):** greater than or equal to 39 inches, enough to ensure adequate passage for wheelchair users.[372]
- **Depth (E):** 39 to 59 inches
- **Signage (F):** Painted, non-slip, tactile paving on both sides of the curb cut, located before a change in slope.
- **Drainage Grates (G):** Located on both sides of the curb cut for adequate drainage and reduce puddling. Grates should not include any large gaps that can trap walkers or other mobility devices. Because flat, even surfaces were frequently cited for their importance, an extension of the sidewalk could be placed behind the curb cut, for those who do not wish to cross at that intersection to comfortably navigate around. Ensuring that the curb is accessible for all mobility devices and uses a non-slip surface is also highly important.[95] To increase navigability and support safety, curb cuts should be made available at all corners.[93]

FIGURE 24A
Proposed sidewalk design



Source: Gamache, 2019

FIGURE 24B
Proposed curb cut design



Source: Gamache, 2019

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