Community for Health and Independence

Opportunities for a UC Davis partnership to develop a community for healthy aging in the Sacramento Region

UC Davis Center for Healthcare Policy and Research

Joy Melnikow, MD, MPH

Shauna Durbin, MPH

Lauren Jansen, MD

Dominique Ritley, MPH

Meghan Weyrich, MPH

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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 healthcare through interdisciplinary, collaborative research. We contribute new knowledge about access, delivery, cost, quality, and outcomes related to health and healthcare.

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Executive Summary

UC Davis has an opportunity to engage in a public-private partnership with AKT Development Corporation (AKT) to develop a new, planned community focused on aging in place for vulnerable adults, including developmentally disabled adults – the Community for Health and Independence (CHI). This report provides a broad overview of how such a partnership relates to the UC Davis mission and factors important to UC Davis leadership decision-making. It includes a description of regional demographics, existing resources for older and vulnerable adults, examples of model communities, and an overview of research on use of technology, the built environment, and community-based interventions to facilitate aging in place. Finally, opportunities and challenges for research, education, and community partnership are discussed based on conversations with selected UC Davis faculty.

BOTTOM LINE
Evidence on effective methods and technologies to support community-based, healthy aging is minimal. With significant resource investment, UC Davis has a unique opportunity to develop and study cross-disciplinary, aging-in-place technologies and strategies through partnerships with industry, government agencies, foundations and sister academic institutions.

Community Location and Regional Demographics

The 2,000-acre CHI site is located about 25 miles east of Sacramento and south of Folsom and Highway 50. AKT projects about 500-700 homes in the initial building phase with a subsequent build-out to include 4,000-6,000 homes and residences. Ambulatory healthcare, parks, retail, transit, and community support services would be embedded in the development.

Our population continues to age in California and the Sacramento region. The adult population aged 60 years and older in the Sacramento region is projected to increase 78% by 2030 (588,000 to 1,045,000). Those turning 65 years between 2015 and 2019 are expected to live an average of 23.6 years with 4.5 years spent with one or more ADL limitations. Over 8,100 adults with intellectual and/or developmental disabilities live in Sacramento County of which 56% have an intellectual disability and 35% have an Autism spectrum disorder. Seventy-three percent of adults with ID have mild or moderate intellectual deficits and may be able to live independently. About 75% of young adults with I/DD live with their parent/guardian, however, as they and their parent's age, only 25% (aged 51-62 years) remain in their parent/guardian home.

Community Needs

Recent regional Community Health Needs Assessment reports identified a number of problems faced by older adults in the Sacramento region including the following needs:

- Quality, affordable housing suitable for aging in place
- Safe, reliable transportation
- Quality food nearby or home delivery meal services
- Senior-friendly recreation areas and pedestrian resources (e.g., sidewalks)
- Interventions to address social isolation and loneliness, depression, stress, anxiety, and increased risk of suicide
- More health professionals specializing in elder care
- Programs to address memory care, fall prevention, and elder abuse and neglect
- Facilitators to connect older adults with services

- Strategies to address rising costs of care outpacing fixed incomes
- Caregiver support programs (i.e., home nursing, transportation, and respite services)

For adults with I/DD, similar needs were identified in the reports, including access to safe and reliable transportation; more providers with disability-specific training; and interventions to address social isolation and depression.

Model Communities Supporting Healthy and Independent Living

A rapid environmental scan of the internet, scientific literature, and UC Davis faculty interviews did not identify any communities fully comparable to the proposed integrated vision of the CHI target populations, integrated technology, and built design. We identified examples of community models for older adults and independently living adults with I/DD, including examples of Cohousing, Villages, Naturally Occurring Retirement Communities, Continuing Care Retirement Communities and other community care sources for adults with I/DD. These models offer various aspects of design, technology, socialization, and research inspiration for the proposed CHI community. University partnerships with retirement communities may be on-site (university based), university-linked, or university affiliated. In one example, Oregon Health Sciences University partnered at the development stage with Mirabella, a retirement community in Portland where residents participate in research about technology supporting healthy aging.

Summary of Prior Research

We conducted a rapid review of the research evaluating the relationship between health outcomes and smart-home technologies, built environment designs, and community-based interventions. Although a large body of literature addressed the accuracy and acceptance of smart-home technologies, few studies examined impacts on health outcomes or healthcare utilization; most used weak study designs. Limited recent research with stronger methods suggests potential benefits of technology for sustaining aging in place and reducing caregiver burnout. In contrast, a large body of evidence supports the impact of the built environment and environmental design—particularly neighborhood walkability, pedestrian-friendly features, and easy access to nearby destinations, community services and recreational activities—with increased physical activity levels in older adults. Safe places to rest (e.g., benches, parks) are important for both older adults and persons with disabilities to increase physical activity. Many of these studies were cross-sectional and could not demonstrate causality of associations. Community-based interventions for older adults were shown in a small number of recent trials to improve functioning and independence, while reducing depression and social isolation.

Opportunities and Challenges

Partnership on the CHI project presents both opportunities and challenges for UC Davis. A community including innovative design, advanced technology, and access to appropriate care would likely meet strong demand. However, a durable public-private partnership would require careful negotiations with multiple stakeholders: AKT, potential builders, future residents, as well as local, regional, state and federal partners and regulators. Finally, the needs of UC Davis faculty, students, and UC Davis Health as a part of this partnership require further exploration.

A sustainable, shared, transparent process for such a partnership will be key to addressing as yet unforeseen challenges, including economic and political changes. If UC Davis chooses to

pursue a CHI partnership, mapping key decision points over the project's timeline would be a useful tool for managing risks associated with unforeseen events.

Research

There is an increasing imperative for research on aging given the rapid increase in the population of older adults and dearth of well-designed studies. We identified a clear need for longitudinal research on health outcomes related to strategies and interventions, including technology, to support aging in place. Research on the built environment and community interventions suggests improvements in health-related outcomes, but numerous gaps remain. Innovative research opportunities exist across multiple disciplines. UC Davis leadership in this area of research could positively impact the lives of individuals living in the community, as well as contributing to an essential body of knowledge. Partnering in the development of CHI could provide UC Davis researchers with opportunities to study interventions and outcomes of smart home and wearable technologies, built environment innovations, and community interventions. A longitudinal research relationship with community residents could provide a competitive advantage in proposals for federal and private research dollars. Developing an ongoing relationship with CHI residents may provide the foundation for UC Davis to establish a broad national presence in interdisciplinary aging research. Challenges to engaging with the community in a longitudinal research relationship, include addressing resident questions and concerns about informed consent to avoid the perception of the residents as "guinea pigs". Privacy protection concerns, especially related to in-home and wearable monitoring devices, must also be addressed.

Multiple evidence gaps offer UC Davis with many opportunities for research.

The possibility of establishing a longitudinal community research cohort could provide UC Davis with a strong competitive advantage for future research funding.

Education

Student training experiences and practicums could engage students at the undergraduate, graduate, and professional levels, support the community, and enhance student understanding of aging and disability. Faculty interviewed for this project in the Schools of Nursing and Medicine, Public Health Sciences, Human Ecology, and Design) all expressed enthusiasm and interest in exploring education and training opportunities. Other educational opportunities are possible for students in nutrition, sociology, engineering, and communication, among others. Student participation in research projects would contribute to the next generation of researchers in aging. Challenges in this area include defining and prioritizing educational opportunities and ensuring adequate student supervision.

Health Services

This report does not address the potential challenges and opportunities presented by providing UC Davis Health services on-site or via telehealth to the CHI community. UC Davis Health has an existing primary care clinic in nearby Folsom. Needs assessment and financial analysis are critical future components of initiating UC Davis Health services as part of CHI.

Community Partnerships

A public-private partnership between UC Davis and AKT will eventually involve multiple stakeholders at the local, regional, state and federal levels. A CHI partnership could enhance

perception of UC Davis as innovative and caring community partner participating in solutions to address persistent community needs and providing leadership in research on aging in place.

> *"We need to clearly define the goal of this partnership and know our exit strategies."*

Challenges to a sound partnership include assuring partnership duration as the development ownership transitions (from developer to homebuilders to homeowners). Local community concerns about the impacts of population growth and broader privacy protection concerns about in-home and wearable technology must be addressed. In the near future, careful exploration of this partnership opportunity with an emphasis on a stepwise agreement, transparency among all parties, and built-in exit strategies at future stages of the project would provide the best opportunity for success.

Conclusion

A successful CHI public-private partnership between UC Davis and AKT will involve investment of time and resources to define the potential model and to address financial, regulatory and political considerations. Under the ideal scenario, UC Davis faculty, students and partners would work with future community residents over many years to discover and disseminate effective strategies to enhance health and quality of life for aging and disabled adults. Research and education opportunities would begin in the community design phase and persist for the lifespan of the community. The possibility of establishing a longitudinal community research cohort could provide UC Davis with a strong competitive advantage for future research funding.

Despite some significant challenges, extensive potential opportunities for UC Davis in research, education, community partnership and community service deserve further in-depth exploration. The UC Davis Center for Healthcare Policy and Research provides a resource to UC Davis decision-makers for in-depth research, at their direction, on the many considerations briefly described here. Potential deliverables could include:

- In-depth review and analysis of existing model communities, including university-connected retirement communities. Site visits and interviews could explore successes and failures in community developments related to design, technology, and governance
- A conference convening futurists, model community representatives, experts in aging and disability, environmental/housing design, smart technology design, telehealth, and community interventions.
- Focus groups with target populations, their caregivers, and current area residents to better understand their needs and concerns related to healthy aging in place, community resources, and preferences for community design and governance.
- Formal public deliberation process with diverse stakeholders to define and prioritize community characteristics
- In-depth exploration of existing community governance models and formal academic-community partnership agreements
- Inventory of educational models engaging students in aging communities
- Economic analysis of specific design concepts/design elements that could influence health outcomes
- Needs assessment of potential on site and telehealth services

INTRODUCTION

This report provides key information to UC Davis decision-makers to assess the opportunity for a public-private partnership with AKT Development Corporation (AKT) to develop a healthy aging community: the Community for Health and Independence (CHI). We focus on potential contributions of this project to the educational, research, community, and healthcare missions of UC Davis. AKT has described CHI as a "planned, health-focused, community open to all but supportive of older adults; individuals with disabilities and other vulnerable populations." For purposes of this report, "vulnerable" is defined as low-income adults with multiple chronic conditions and/or developmental or intellectual disabilities such as autism or Down Syndrome. The vision of UC Davis partnership in this community includes contributions to design of the built environment, the inclusion of technology, as well as future implementation of health services and community interventions that will provide support and accessibility to people with disabilities and facilitate aging in place. The community would offer opportunities for longitudinal research with residents on the impact of these interventions on health outcomes, education and training of UC Davis students, and provision of healthcare services via technology.

This report was informed by a rapid environmental scan across four broad areas:

- Current and projected regional demographics for older adults and developmentally disabled adults, including vulnerable adults
- Examples of community models that include characteristics envisioned for CHI
- Scan of the scientific literature for evidence on effects of smart home technology, built environment characteristics and community interventions on health outcomes related to healthy aging
- UC Davis faculty input on perceived opportunities and challenges involved in the potential partnership

Development Plan

AKT has allocated 2,000 acres of undeveloped land southeast of the City of Folsom (south of Lincoln Hwy and east of Sunrise Blvd) for the Community for Health and Independence project (CHI). CHI is unique in its goal to support aging in place for medically vulnerable adults and adults with developmental disabilities; however, its universal design and amenities will make this all-inclusive community appealing to the general population as well.

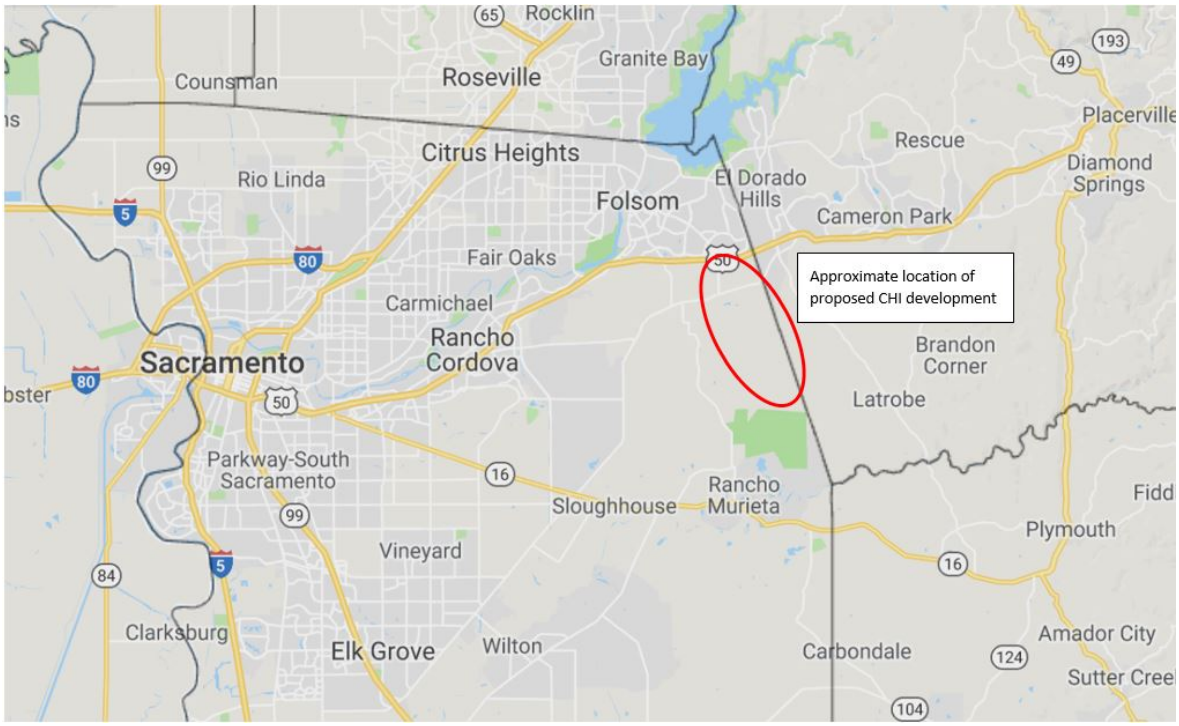
AKT proposes building 500-700 homes in the initial development phase with a full build-out of 4,000-6,000 units with retail (i.e., grocery and drug stores), parks, walking trails, nature conservancy sites, and facilities to promote socialization, exercise and recreation. Preliminary plans include single-family dwellings, possible multi-family units, and some affordable housing.

Preliminary plans also include developing healthcare-related services in the community such as a wellness center, medical clinic, and perhaps more advanced care facilities to support adults no longer able to live independently (e.g., memory care, assisted living, etc.). AKT is very interested in exploring the role of technology in promoting health and independence and seeks to integrate technology into the homes and throughout the development. AKT will seek regulatory approval for this project during the next few years.[i]

[i] Personal communication. Lou Vismara, AKT Investments Consultant. June 20, 2018.

Figure 1 shows the vicinity of the proposed CHI development. See **Appendix A** for more details about the CHI vision.

Figure 1. Project Location for the Community for Health and Independence



REGIONAL POPULATION AND SERVICES

To understand the viability of a development focused on supporting aging-in-place, we examined current and projected regional demographics to assess potential demand for such a community.

The following section describes baseline and forecasted information – when available – on common demographics, prevalence of key health conditions, community needs, and existing service resources. The data in each subsection comprise those related to the two primary demographic groups included in the community:

> (1) **Older adults**, aged 55 years and older.
>
> (2) **Adults with intellectual and developmental disabilities** (I/DD), defined by the California Department of Developmental Services as persons with persistent intellectual or adaptive deficits including epilepsy, cerebral palsy, autism spectrum disorder, general intellectual disabilities, and other nonspecified developmental disabilities with similar prognoses and treatment approaches as the other categories.[ii]

It should be noted that there is significant overlap between older adults and adults with I/DD with respect to age, health status, and health insurance type; however, there are also important distinctions in the challenges (i.e., health vulnerabilities, living support considerations) and opportunities (i.e., education, workforce development) faced by these groups. To understand the prevalence and needs of vulnerable adults in the region, we focused on the population of adults eligible for both Medi-Cal and Medicare (known as dual eligibles). Dual eligibles include low-income adults with long-term disabilities and low-income adults 65 years and older, many of whom have multiple chronic conditions. Both older adults and adults with I/DD are part of the dual eligible group.

Unless otherwise specified, the estimates and assessments provided in this report represent the Sacramento region, which includes the most likely counties from which this new development will draw residents: Sacramento, Placer, El Dorado, and Yolo counties. Details on sources for data in this section are found in **Appendix B**.

Demographic and Health Profile for Older Adults

In 2016, 26% of the population (588,000 persons) in the Sacramento region were aged 55 years or older. Among these older adults, about 17% (approximately 99,000) were dual eligibles.[2] **Table 1** provides a broad overview of population demographics for these two groups and describes selected variables associated with aging in place.

In general, older adults are more likely to be female, white, live in family households, and own their place of residence. In addition, almost a quarter of older adults in the Sacramento region are older than 75 years. About one quarter live alone; about a third are below 200% of the

[ii] Prior to the passage of Rosa's Law by Congress in 2010,1. National Archives and Records Administration. Change in Terminology: "Mental Retardation" to "Intellectual Disability". 2013; https://www.federalregister.gov/documents/2013/08/01/2013-18552/change-in-terminology-mental-retardation-to-intellectual-disability. Accessed July 27, 2018. individuals with intellectual disabilities—i.e., IQ of 70 or below—were characterized as having "mental retardation," which carried contemporary negative connotations; this law requires the adoption of the term "intellectual disability" in federal disability law and by state bodies enacting those laws.

federal poverty level (FPL),have "fair" or "poor" physical and oral health; one quarter are obese. Over half have at least one chronic condition or a physical, mental, or emotional disability that limits their ability to perform activities of daily living.

Older adults with dual Medicare and Medi-Cal eligibility are more likely to be male, have incomes below 200% FPL, and to have one or more physical, mental, or emotional disability. About one third of dual eligibles are aged 75 years or older, are current smokers, are obese, and exhibit "fair" or "poor" physical or oral health. See **Appendix B** for detailed demographic information on older adults and dual eligible adults.

Table 1. Characteristics of Older Adults and Dual Eligibles in the Sacramento Region, 2016

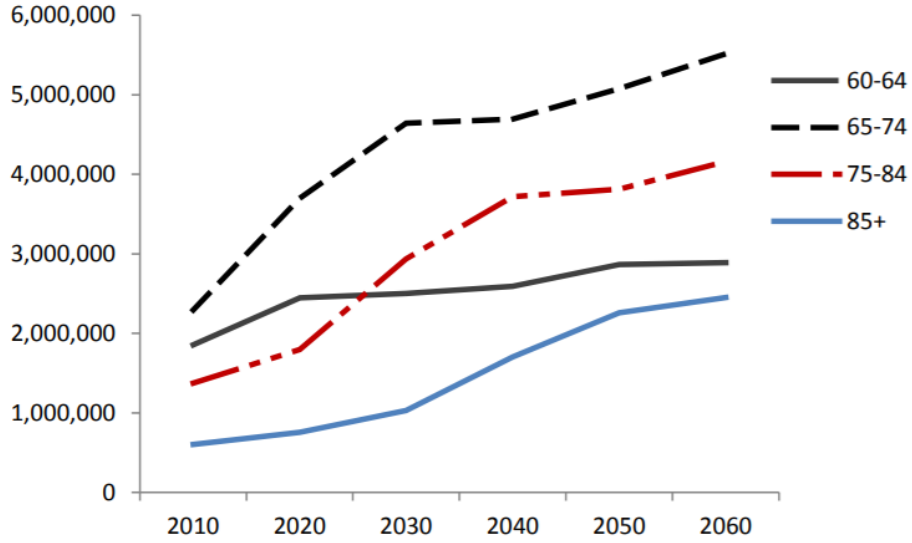
Characteristic	Older Adults (%)	Dual Eligibles (%)
Total estimated population (% of total population)	588,000 (26%)	99,000 (17%)
Age 75 and older	26.1	46.1
Male	42.6	55.8
White	72.1	50.7
Lives alone	25.6	--
Owns home	72.6	--
Less than 200% FPL	28.2	68.4
No usual source of health care	4.9	8.1
No dental insurance	28.3	41.2
General health status "fair" or "poor"	29.3	42.5
Has one or more physical, mental, or emotional disability	52.0	81.3
Has depression or exhibits serious mental distress	6.3	15.6
BMI 30 or greater	24.4	32.3
Current smoker	12.5	30.6
Has participated in binge drinking in past year	18.0	9.7
Condition of teeth is "fair" or "poor"	30.4	40.4

Source(s): 2016 California Health Interview Survey (CHIS; American Community Survey 5-Year Estimates, 2012-2016
Note: All data is from the 2016 CHIS, with the exception of the proportion of older adults and dual eligibles owning a home

Age Projections

The California Department on Aging (CDA) projects that adults aged 65 years and older will increase by an estimated 88% between 2016 and 2060.[3] The most growth will occur over the next 30 years as the "Baby Boomers" (persons born between 1946 and 1964) age. Adults aged 65 to 74 years will increase rapidly between 2010 and 2030, whereas adults aged 85 years and older will increase faster between 2030 and 2060[3] (**Figure 2**). Women live 4.8 years longer than men on average and will, therefore, account for an increasing proportion of the aging population in California, and the Sacramento region, over the coming decades.

Figure 2. California Age Growth Projections, 2010-2060



Source: California State Plan on Aging 2017-2021, California Department on Aging

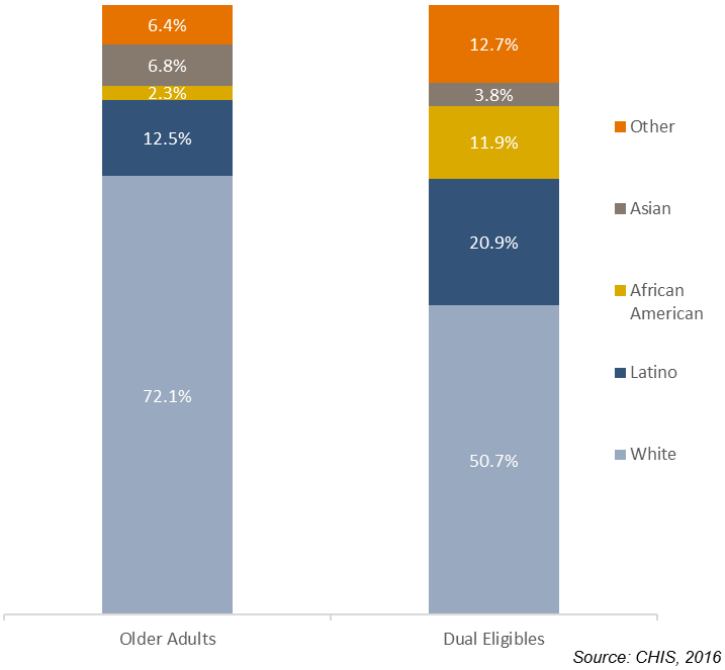
In the Sacramento region, CDA estimates that the population of adults aged 60 years and older will increase 78% by 2030, accounting for an estimated additional 460,000 adults in this age group. The number of adults aged 85 years and older in the Sacramento region is expected to increase at a similar rate (76%) between 2010 and 2030; however, El Dorado and Placer counties are projected to experience higher rates of growth among this age group (109% and 104%, respectively) .[3] The high projected growth among persons 85 years and older may have a significant impact on housing and care support needs since 36% of this population has incomes below 200% of FPL and is more likely to require medical and housing subsidies.[3]

Race/Ethnicity

In 2016, the majority of older adults in the greater Sacramento region were white (72%); Latinos were the next largest group, accounting for 12.5% of adults aged 55 years and older. In contrast, racial/ethnic minorities accounted for 48.3% of the Sacramento-area dual eligible subgroup (**Figure 3**).[2]

Statewide projections show a gradual shift towards greater racial/ethnic diversity among older adults. By 2035, ethnic minorities will account for the majority of persons aged 55 and older, with the largest growth occurring among Latinos and Asians.[4]

Figure 3. Racial/Ethnic Composition of Older Adults and Dual Eligibles, Sacramento Region, 2016

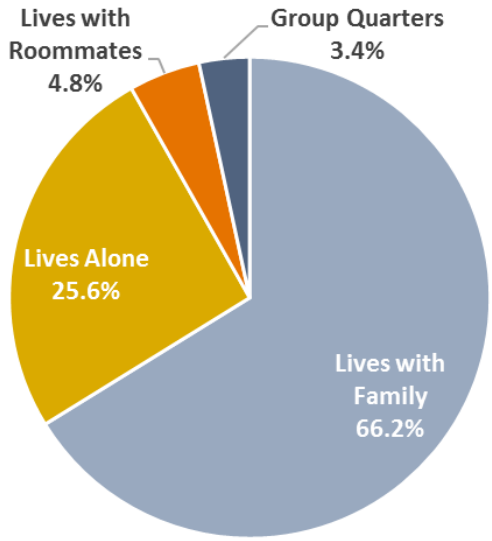


Source: CHIS, 2016

Place of Residence and Living Arrangement

The distribution of household types for adults aged 65 years and older in Sacramento County is based on five-year estimates from the American Community Survey. Two-thirds of older adults live with family members (i.e., spouses, children, parents, extended family) and 26% live alone in single-person households; less than 10% of older adults live with nonfamily roommates or in group homes (**Figure 4**).[5]

Figure 4. Distribution of Household Type for Older Adults, Sacramento County, 2012-2016



Source: ACS, 2011-2016

Most older adults in Sacramento County own their residence (73%); 27% are renters.[5] Among renter households in Sacramento, over half (60%) are "rent burdened," meaning that they pay 30% or more of their gross monthly income in rent.[5]

In the coming decade, family structures are projected to change in ways that will impact the housing and care needs of older adults. By 2030, older adults will be more likely to be living alone as the proportion of divorced/separated and widowed persons over the age of 65 is expected to increase relative to married people.[6] Moreover, because of their longer life expectancy, over 40% of women aged 65 and older in California are widowed (and more likely to live alone) compared to only 10% of men.[3] 20% of

older adults (aged 65 years and older) will be childless in 2030 (as compared with 12% in 2012) and more likely to need nonfamily sources of support care as they age.[6]

Healthcare Access and Utilization

Usual Source of Care. Fifteen percent of adults, persons with disabilities, and dual eligible enrollees in the Sacramento region reported having no usual source of healthcare or listed the emergency room as their primary provider in the 2016 California Health Interview Survey (CHIS). In contrast, older adults were more likely to have a usual source of care, with only an estimated 5.8% unable to identify a usual source of care.[2]

Disability and Activities of Daily Living

Fifty-two percent of older adults (306,000 persons) and 81% (81,000 persons) of dual eligible enrollees in the Sacramento region reported having some form of physical, mental, or emotional disability in 2016.[2] In addition, census-based estimates of disability type indicate that ambulatory-related difficulties requiring wheelchairs, canes, or other movement assistance are the most common disability, affecting 26% of people aged 65 years and older in Sacramento County. Housing alterations will be needed to accommodate these limitations.

About 20% of older adults have independent-living-related disabilities that may require nontraditional housing solutions, such as group homes or housing with integrated support services. Projection data from the California Department of Social Services indicates that the number of seniors requiring in-home support services will double by 2030.[4,5] Whereas the prevalence of all disabilities increases with age, the relative distribution of disability type is similar throughout the aging process.

Ambulatory-related difficulties requiring wheelchairs, canes, or other movement assistance are the most common disability, affecting 26% of people aged 65 years and older, in Sacramento County. The number of seniors requiring in-home support services is projected to double by 2030. The number of older adults California living with ADL or IADL limitations will nearly triple by 2060, with almost two-thirds of the senior disability population having two or more limitations by that year.

The disabilities described above are often referred to as limitations in Activities of Daily Living (ADLs). ADLs encompass routine, personal care such as bathing, eating, or dressing. Instrumental Activities of Daily Living (IADLs) include more complex tasks associated with independent living such as financial management, shopping, and travel outside of the home.[7] The California Legislative Analyst's Office (LAO) has predicted the number of older adults in California living with ADL or IADL limitations will nearly triple by 2060, with almost two-thirds of the population of seniors with at least one disability having two or more limitations by that year.[7] California adults turning age 65 years between 2015 and 2019 are projected to live, on average, for another 23.6 years, during which they will spend 4.5 years with one or more

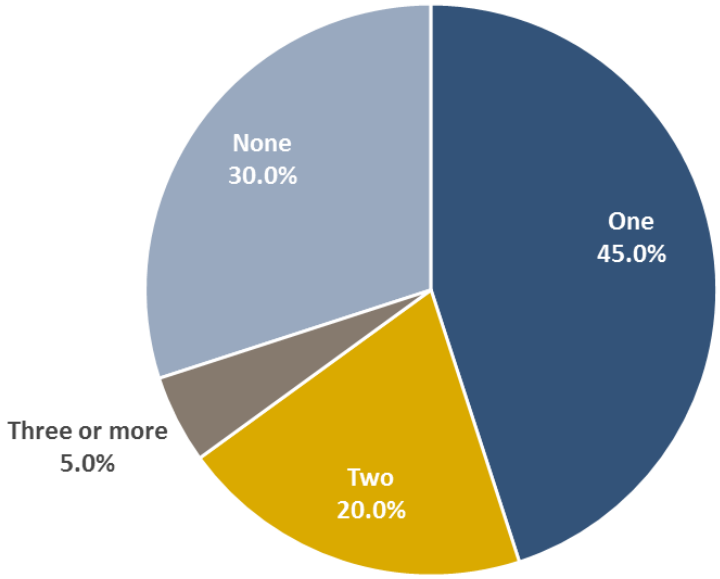
ADL/IADL limitation(s).[7] See **Appendix B** for a complete description of gender- and race-stratified ADL/IADL projections.

Chronic Conditions

The prevalence of chronic health conditions is higher among older adults: 70% of adults aged 65 years and older in California have at least one chronic health condition (**Figure 5**) compared with 26% of adults aged 18 to 39 years and 45% of adults aged 40 to 64 years.[8] Given the anticipated increase in numbers of older adults in the coming decades, expansions in housing and health care supports will be needed to accommodate the rising burden of chronic health conditions throughout the state.

The three most prevalent chronic health conditions for Medicare enrollees in Sacramento County are hypertension, diabetes; and arthritis (47%; 25% and 24% respectively). About 20% have heart disease.[9]

Figure 5. Chronic Conditions among Older Adults (aged 65 years and older), Sacramento Region, 2012



Source: CHCF, 2015

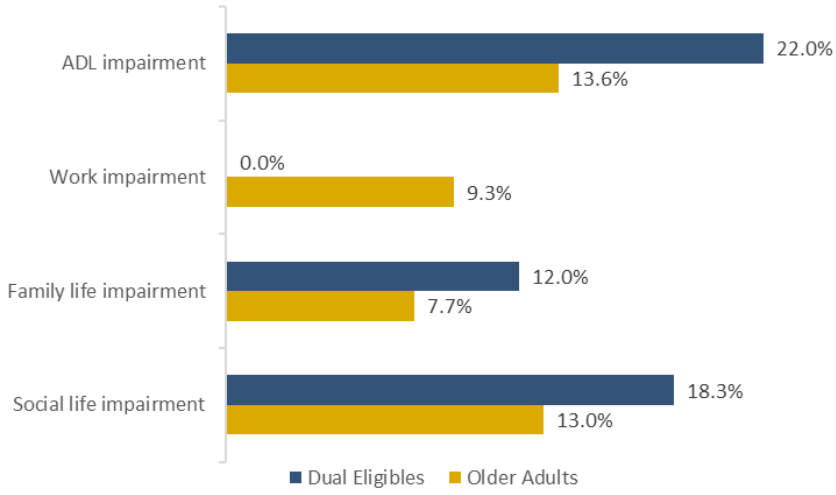
Age-stratified 5-year incidence rate trends for Sacramento County indicate that older adults have a higher burden of cancer. The pooled incidence of cancer from 2011 to 2015 among adults younger than age 50 years was 96.4 cases/100,000 persons as compared with 1,327.6/100,000 persons for adults 50 years and older (averaging 5,725 cases/year).[10] Sacramento County had the 11th highest all-cancer incidence rate for this age group out of 58 counties statewide.

Sacramento County had the 11th highest all-cancer incidence rate among 58 counties statewide for adults aged 50 years and older.

Mental Health Outcomes

About 15% of Sacramento County Medicare enrollees had depression in 2015 and almost 5% had schizophrenia or another psychotic disorder diagnosis.[9]

Figure 6. Impairments due to Mental Health Status for Older Adults and Dual Eligibles, Sacramento Region, 2016



Source: CHIS, 2016

Chronic depression and other long-term mental disorders are often associated with social and occupational disruptions as well as ADL/IADL limitations. In the broader Sacramento region in 2016 (**Figure 6**), 12% of older adults and 7.7% of dual eligibles for Medicare and Medi-Cal reported disruptions in their family life due to their mental health status, and nearly 10% of older adults reported a diminished ability to perform their job functions because of poor mental health. Twenty-two percent of dual eligibles reported impairments in ADLs due to psychological distress (**Figure 6**).[2]

Health Behaviors

- **13.8% of older adults and 29.7% of dual eligible reported that fresh fruits and vegetables are sometimes or never affordable in their neighborhood.**
- **69% of the region's older adults and 81% of dual eligibles reported that they did not regularly walk for transportation, fun, or exercise.**

Smoking, poor diet, and physical inactivity are important contributors to morbidity and mortality and are often associated with chronic health conditions. In 2016, 12.5% of older adults and 30.6% of dual eligible persons in the Sacramento region self-identified as current smokers.[2] About one-half of older adults (45.5%) and almost 60% of dual eligibles have lifetime histories of smoking. There are few age-stratified data available regarding the dietary habits of persons in the Sacramento region; however, proxy measures of the food environment in the Sacramento region showed that about 20% of older adults and dual eligibles consume fast food more than twice a week. 5% of older adults and 9% of dual eligibles consumed soda more than twice a week.[2] In contrast, 13.8% of older adults and 29.7% of dual eligible reported that fresh fruits and vegetables are sometimes or never affordable in their neighborhood.[2] Almost a quarter of older adults (24.4%) and a third of dual eligibles (32.3%) had a reported BMI indicating obesity (i.e., 30 or greater). Finally, 69% of the region's older adults and 81% of dual eligible persons reported that they did not regularly walk for transportation, fun, or exercise.[2]

Demographic and Health Profile for Adults with Intellectual and Developmental Disabilities

Demographic information for adults with intellectual and developmental disabilities (I/DD) presented in this section is based on data from the March 2018 Client Master File (CMF) maintained by the California Department of Developmental Services (DDS). The CMF is updated quarterly and is the primary source of demographic information for Californians with intellectual and developmental disabilities. CMF data are available at the state and county level, as well as for the 21 regional center service areas.

Estimates presented in this section are specific to Sacramento County. Sacramento County accounts for almost 65% of the Alta California Regional Center (ACRC)[iii] client base and is therefore most likely to supply the majority of residents in the CHI community. When possible, the data in this report are presented for adults aged 18 years and older; however, the majority of the data available in the CMF include all ages.

Adults with I/DD are more likely to be male, non-white, and live in the home of their parents or guardians; about 20% of Sacramento County adults with I/DD have a chronic medical condition, need support to walk, require special care equipment, or exhibit one or more severe behaviors.

Table 2 presents a broad overview of population demographics for persons with intellectual or developmental disabilities (I/DD) in Sacramento County and describes some of the aging-in-place challenges for this group. In general, adults with I/DD are more likely to be male, non-white, and live in the home of their parents or guardians. In addition, about 20% of Sacramento County individuals with I/DD have a chronic medical condition, need support to walk, require special care equipment (e.g., feeding tubes), or exhibit one or more severe behaviors such as running away or physical aggression. Many also have vision or hearing problems that impact their ability to interact with their community. See **Appendix B** for more detailed demographic information on persons with I/DD.

[iii] One of 21 Centers in California, Alta California Regional Center is a non-profit corporation working under contract with the State of California, Department of Developmental Services, to provide services to persons, aged three years and above, with a developmental disability pursuant to the Lanterman Act who live in the greater Sacramento region.

Table 2. Individuals with Intellectual and/or Developmental Disabilities, Sacramento County, 2018

Characteristic	
Total population with I/DD	13,523
Adults 18 years and older with I/DD	8,134
Adults 62 years and older with I/DD	627
Male (%)	64.5
White (%)	42.2
Lives with parent or guardian (%)	72.9
Severe or profound intellectual deficits (%)	7.4
Exhibits severe behaviors (e.g., aggression, self-injurious behavior, etc.) (%)	19.1
One or more chronic medical conditions (e.g., diabetes) (%)	21.1
Both I/DD and a diagnosed mental health disorder (%)	13.1
Unable to walk without support (%)	19.4
Requires special health care interventions (e.g., feeding tubes, mobility aids, DME, etc.) (%)	20.3
Dependent on medical technology (%)	7.0
Vision Problems (%)	9.5
Hearing Problems (%)	4.0
Both Vision and Hearing Problems (%)	1.5

Source: California Department of Developmental Services, 2018
Key: I/DD=intellectual and/or developmental disability; DME=durable medical equipment

Age

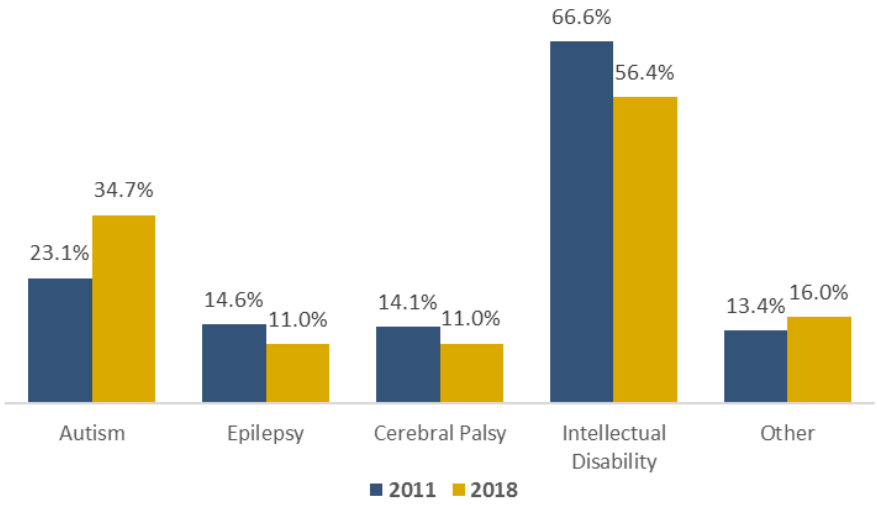
As of March 2018, there were 8,134 adults aged 18 years and older with I/DD receiving services from the DDS regional center in Sacramento County, accounting for 60% of all individuals with I/DD countywide. The majority of adults with I/DD (80%) are aged 18 to 51 years; less than 10% are aged 62 years or older.[11] Over the past ten years, the I/DD population in California has aged. The increase in average age is primarily due to large increases among adults with I/DD aged 18 to 31 years since 2009.[12]

Gender

In 2018, individuals with I/DD in Sacramento County were disproportionately male, accounting for almost two-thirds of the total I/DD population. This distribution is reflective of a widening gap between males and females that has been observed over the past ten years, both at the county level and statewide. In 2007, about 60% of individuals with I/DD in Sacramento County were male; in 2018 males accounted for almost 65%. DDS primarily attributes the growing gender imbalance to the increasing number of individuals with autism spectrum disorder (ASD), a population that is approximately 80% male.[11,12]

Disability Type

Figure 7. Distribution of Disability Type by Diagnosis, 2011 vs 2018



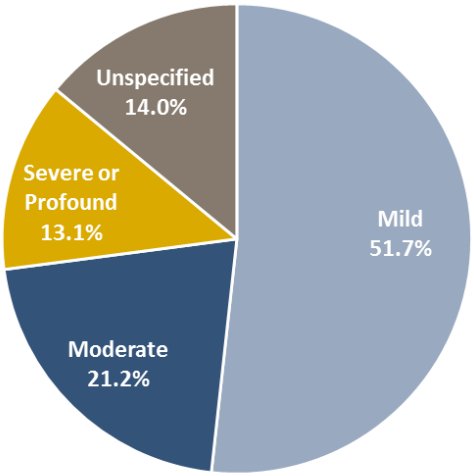
Source: DDS Fact Book, 2018

DDS recognizes five major I/DD categories: autism spectrum disorder (ASD), epilepsy, cerebral palsy, intellectual disability (i.e., IQ below 70), and other non-specified developmental disabilities. Individuals may have more than one diagnosis.

Currently, over half of the I/DD population in Sacramento County has a diagnosis of intellectual disability and over one third have an ASD diagnosis (**Figure 7**).[11]

Over 70% of individuals with an intellectual disability in Sacramento County have mild or moderate intellectual deficits (**Figure 8**) and are likely able to communicate, practice self-care, socialize, and may be able to live independently. According to DDS trend data, the percentage of persons with profound, severe, or moderate intellectual disabilities has declined since 2007.[12]

Figure 8. Distribution of Intellectual Disability Severity



Source: DDS, 2018

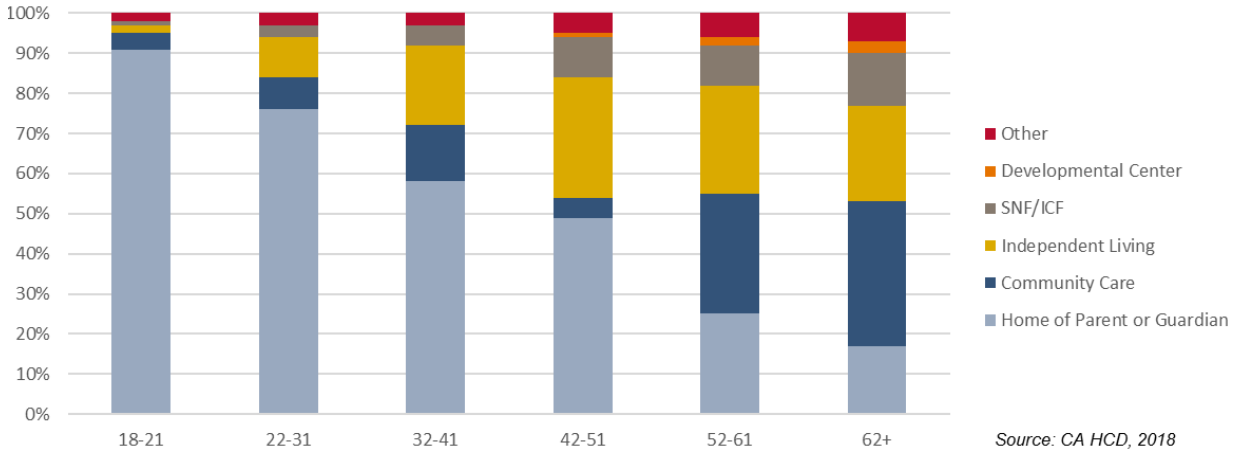
Residence Type

In Sacramento County, most individuals (72.9%) with I/DD live in the home of their parent or guardian, about 10% live in community care settings (i.e., foster homes, group homes, and adult residential centers); almost 15% reside in an independent living setting. A much smaller proportion live in institutional healthcare settings, such as skilled nursing or intermediate care facilities (SNF/ICF), hospitals, correctional institutions, rehabilitation centers, and psychiatric treatment facilities (**Appendix B**).[11]

The proportion of adults in California with I/DD who live in the home of their caregivers decreases as this population ages; adults with I/DD aged 62 years and older predominantly reside in community care and independent living settings as compared with younger adults.

Although age-stratified residence data are not available for Sacramento County, statewide data (**Figure 9)** indicate that adults with I/DD aged 18 and older are still most likely to live in the home of their parent(s) or guardian(s), and slightly less than a third of adults with I/DD live in community and independent living settings. The proportion of adults in California with I/DD who live in the home of their caregivers decreases as this population ages. Persons with I/DD aged 62 years and older predominantly reside in community care and independent living settings as compared with younger adults (aged 18-31 years) with I/DD who mostly live in the home of a parent or guardian.[4]

Figure 9. Distribution of Residence Type by Age Group of Adults with I/DD in California, 2016



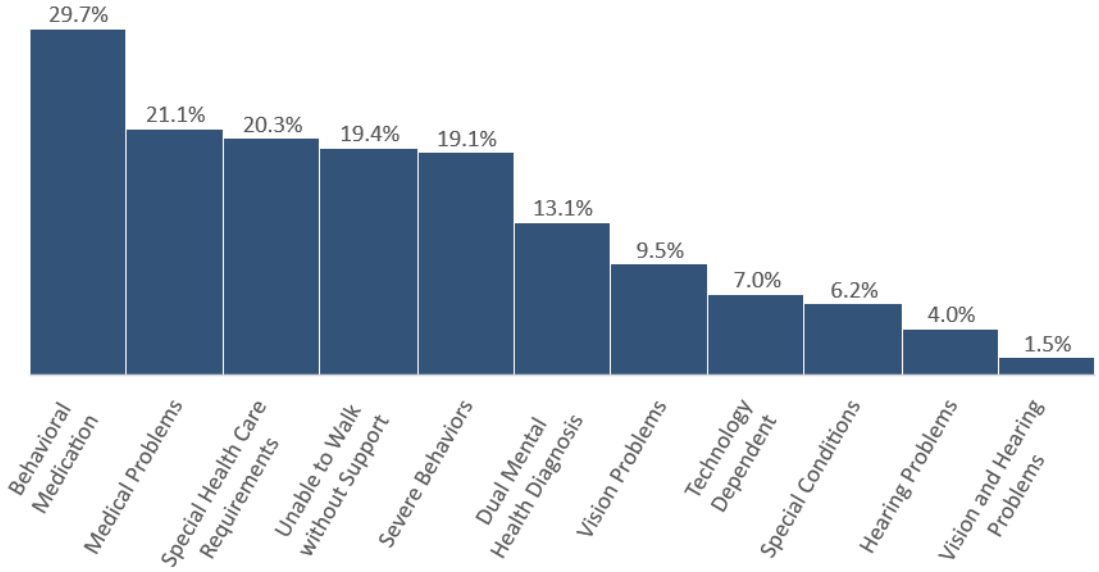
Race and Ethnicity

Overall estimates show that almost 60% of persons with I/DD in the Sacramento region are racial and ethnic minorities, who are primarily African American or Hispanic.[11] Adults with I/DD are mostly white as compared with minors with I/DD who are mostly Hispanic. Ten-year trend data show that, since 2007, adults with I/DD have become proportionally less white; in particular, Hispanic, Asian, and Black adult I/DD populations have increased by 79%, 67%, and 50% respectively.[12]

Health Challenges

Adults with I/DD experience a range of behavioral and physical health challenges that impact their ability to socialize and live independently. As shown in **Figure 10**, almost 30% of persons with I/DD in Sacramento County take behavior-modifying drugs to control maladaptive behaviors such as hyperactivity, aggression, self-injurious behavior, and poor impulse control. In addition, about 20% of Sacramento-area adults with I/DD have one or more chronic medical problem(s) (e.g., diabetes, heart disease, substance use disorders), require special health care interventions (e.g., feeding tubes, mobility aids, frequent repositioning), are unable to walk without support, or exhibit severe or aggressive behaviors that require supervision and, often, chemical control. Almost 15% of individuals with I/DD have a dual mental health diagnosis such as depression or anxiety.

Figure 10. Common Health Challenges among Adults with I/DD in Sacramento County, 2018



Source: DDS, 2018

Community Needs in the Sacramento Region

To understand the broad health and wellness challenges facing older adults and adults with disabilities in the greater Sacramento region, we conducted a targeted scan of health needs assessments performed by local area nonprofit hospitals and abstracted information regarding the health needs and challenges facing older adults and persons with disabilities. Community health needs assessments (CHNAs) are large-scale evaluations of a hospital's service intended to identify health challenges and vulnerable populations, describe important local and social forces that shape the health and well-being of the local communities, and inventory local health resources to address health needs and disparities. All nonprofit hospitals are required by the Patient Protection and Affordable Care Act (ACA) to conduct a CHNA every three years; the most recent CHNAs were completed in 2016.

Community Environment

Stakeholders and survey respondents identified the need to create interventions and supportive programs specific to older adults that address the following challenges:

- **Community crime**
- **Lack of quality, affordable housing suitable for aging in place**
- **Limited access to safe, reliable transportation**
- **Lack of quality food nearby or home delivery meal services**
- **Poor air quality and exposure to pollution**
- **Lack of senior-friendly recreation areas and pedestrian resources (e.g., sidewalks) to promote active lifestyles.**

Health Needs for Older Adults

Mental Health. Mental health concerns were the most commonly cited challenges for older adults in the Sacramento region. Overall, the 2016 CHNA identified three primary mental health challenges:

- Social isolation and loneliness, particularly in rural areas
- High rates of depression, stress, and anxiety
- Increased risk of suicide

Health Care Access. Important workforce and structural gaps in access to quality health care for older adults in the Sacramento region were identified, including:

- Needs for health professionals with specialized training for elder care, especially for mental health and specialty services
- Rising costs of care outpacing fixed senior incomes
- Facilitators to connect older adults with needed assessment and screening services

Caregiver Support. Deficits in caregiver support were identified in several communities included in the 2016 CHNA. Specific caregiver supports included:

- Home nursing support;
- Transportation
- Respite services

Aging-Related Health Concerns. In addition to the challenges discussed above, stakeholders identified several community needs for aging-related health challenges:

- Fall prevention programs
- Improved access to memory care for older adults with Alzheimer's disease and dementia
- Elder abuse/neglect awareness and prevention initiatives

Health Needs for Adults with Intellectual and Developmental Disabilities

Although adults with disabilities, including intellectual and/or developmental disabilities, were identified as a vulnerable population for the collaborative CHNA of greater Sacramento, information regarding specific health and wellness challenges facing this community was much more limited than for older adults.

Needs identified for adults with I/DD in the 2016 CHNA were access to safe and reliable transportation, mental health and healthcare access to providers with disability-specific training, and interventions to address social isolation and depression.

Sacramento Regional Resources and Services

There are a number of community-based resources in Folsom and the greater Sacramento area that provide services to support older adults and adults with disabilities. The following is a summary of the healthcare and community services serving the two target populations.

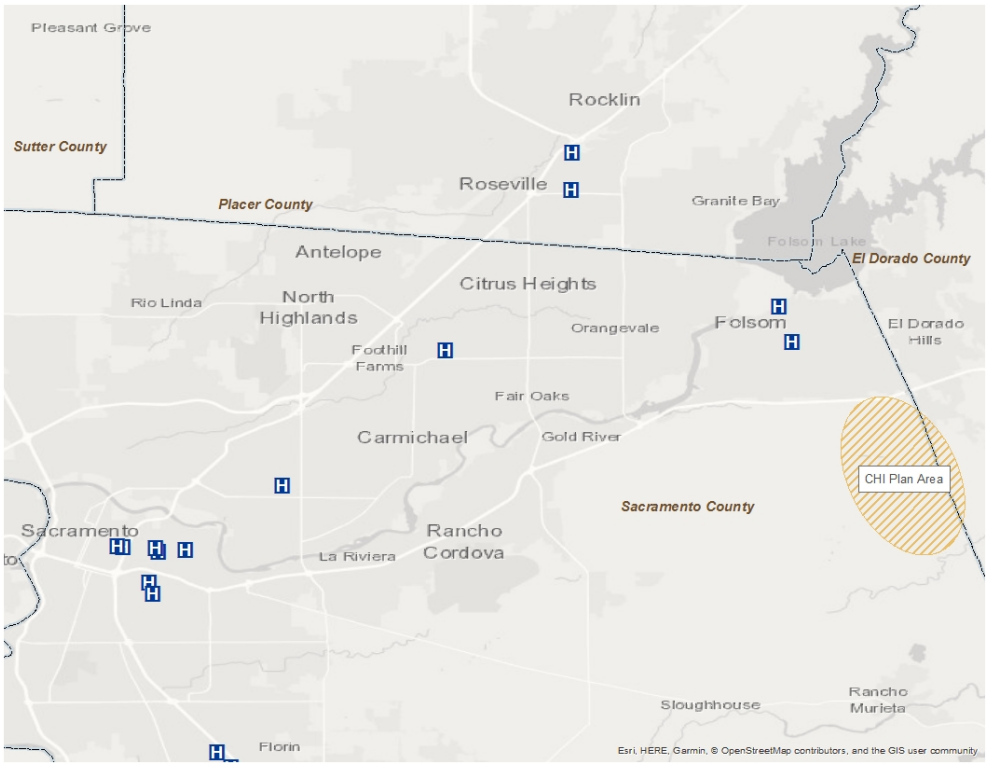
Healthcare Services

There are numerous healthcare services located in Folsom. UC Davis, Sutter, Dignity Health, and Kaiser have primary and specialty care clinics in Folsom. The only hospital serving the community within the Folsom city limits is Mercy Hospital of Folsom, which is a 106-bed facility with an emergency department and inpatient and outpatient medical and surgery services, as well as an intensive care unit (ICU), and physical therapy and respiratory care services.[13]

There are six additional hospitals serving the greater Sacramento area (**Figure 11**): Kaiser Sacramento Medical Center (287-bed facility); Kaiser Roseville Medical Center (340-bed facility); Mercy San Juan Medical Center (370-bed facility); Mercy General Hospital (419-bed facility); Sutter Medical Center (523-bed facility); and UC Davis Medical Center (627-bed facility).[13] All of these facilities offer emergency services; Mercy San Juan is a Level II Trauma Center and UC Davis is a Level I Trauma Center. All include an intensive care unit (ICU), and

Kaiser Sacramento, Mercy San Juan, and UC Davis offer a Cardiac Care Unit. Mercy General and UC Davis also have rehabilitation centers.[13] For additional details about these facilities, please refer to **Appendix C**.

Figure 11. Hospitals Serving Folsom and the Greater Sacramento Area



Within the greater Folsom/Sacramento area, there are three acute psychiatric hospitals[iv] (Sierra Vista Hospital, Sutter Center for Psychiatry, Heritage Oaks Hospital) and four licensed psychiatric health facilities[v] (Sacramento Mental Health Treatment Center; Crestwood Psychiatric Health Facility in Sacramento and Carmichael; and Telecare Psychiatric Health Facility in Roseville).

Our brief scan identified at least eight facilities offering physical or occupational therapy in Folsom (one specifically focused on children). We also identified at least 12 home health services in the greater Folsom area (including Rancho Cordova, Citrus Heights and Sacramento). Some of these programs also coordinate respite care and/or hospice services.

[iv] Acute Psychiatric Hospitals (APH) are defined by California Health and Safety Code Section 1250(b) as "a health facility having a duly constituted governing body with overall administrative and professional responsibility and an organized medical staff that provides 24-hour inpatient care for persons with mental health disorders or other patients referred to in Division 5 (commencing with Section 5000) or Division 6 (commencing with Section 6000) of the Welfare and Institutions Code, including the following basic services: medical, nursing, rehabilitative, pharmacy, and dietary services.

[v] Psychiatric Health Facilities (PHF) provide acute, short-term psychiatric care in a non-hospital setting. They are defined by California Health and Safety Code Section 1250.2 as a facility providing a "distinct type of service to psychiatric patients in a 24-hour acute inpatient setting" consisting of "structured outpatient services (commonly referred to as SOPS) consisting of morning, afternoon, or full daytime organized programs, not exceeding 10 hours, for acute daytime care for patients admitted to the facility."

Two programs – Home Instead Senior Care and Interim Healthcare – offer other services such as transportation or meal services.

Community Resources for Older Adults

Within the greater Folsom/Sacramento area, we identified at least six adult day centers/senior centers (defined as groups with a designated facility and wide-ranging services and programs, and not general community centers offering some senior services). Additionally, we identified several other organizations providing support and services to older adults.

Senior Centers and Adult Day Centers. The closest senior centers to the CHI community would be the Folsom Senior Center, the El Dorado Hills Senior Day Center and the Rancho Cordova Adult Day Health Care Center. Other centers serving the broader Sacramento area include the Eskaton Adult Day Health Center in Carmichael, Triple R Adult Day Program and ACC Senior Services, both in Sacramento. Services provided by each center vary but may include health screening, health education, meal provision, social activities, exercise classes, respite care. Adult Day health centers provide supervised adult day care. For additional details about these centers and their services/programs, see to **Appendix C**.

Other Community Services and Resources. In the greater Sacramento area, numerous other organizations provide support and services to older adults. *Meals on Wheels* delivers meals to seniors aged 60 years and older in Sacramento County and Western Placer County who are homebound, and provides hot noontime meals to seniors during the week at select senior centers.[14] *Seniors Helping Seniors*, based in Sacramento, provides in-home care volunteer services to empower seniors to continue living independently, including companionship, light housekeeping, shopping, cooking, personal care, and medication reminders.[15] The *Senior Community Service Employment Program* provides low-income adults age 55 years and older community service opportunities to improve participants' skills.[16] For additional details about local, regional and national organizations supporting older adults, see **Appendix C**.

Community Resources for Individuals with Developmental Disabilities

In California, services for adults with intellectual and developmental disabilities (I/DD) are primarily coordinated through regional centers, which contract with the California Department of Developmental Services to help persons with developmental disabilities across a client's lifespan.[17] The services provided by the Alta California Regional Center (ACRC) for the Sacramento region are summarized below and presented in greater detail in **Appendix C**. Additionally, the regional office of the California State Council on Developmental Disabilities also provides resources.[18]

Day Services for I/DD. Adult day programs provide supervisory services and training programs for adults with I/DD including self-advocacy, self-care, community integration, or employment training. Adult day programs range from large, group activity centers to tailored, individual training services.

Our scan identified two ACRC-approved vendors of adult day services: the *Odyssey Learning Center* (Folsom) is a licensed behavior management and educational program that provides training in transitional day skills to adults with autism spectrum disorder who are between the ages of 18 to 22 years; and the *El Dorado County Senior Day Care Program* (also described in the section above on *Community Resources for Older Adults*). It provides limited day-time care services for adults with dementia and "other chronic conditions," including persons with developmental and intellectual disabilities. Since services at these two facilities are targeted to younger (aged 22 years and younger) and older adults (aged 60 years and older), adult day services for middle-aged adults with I/DD would require travel outside of their community; additional services are available in Roseville, Rancho Cordova, Placerville, and Sacramento.

Since services at these two facilities are targeted to younger (aged 22 years and younger) and older adults (aged 60 years and older), middle-aged adults with I/DD may need to travel outside of their community to participate in adult day services; additional services in are available in Roseville, Rancho Cordova, Placerville. and Sacramento.

Housing and Residential Services. Housing and residential services for adults with I/DD are comprised of training programs on living skills, residential care communities, and in-home support services such as respite for caregivers and support with activities of daily living for adults with I/DD living independently.

Our scan identified two vendors providing housing or residential care services to adults with I/DD in the Folsom/El Dorado Hills area. Located in Sacramento, *United Cerebral Palsy of Sacramento and Northern California* provides in-home respite care services for caregivers of adults with any developmental disability within Sacramento and El Dorado counties, particularly for low- to middle-income persons. For adults with I/DD aged 18 to 22 years, the *Odyssey Learning Center* provides training in transitional skills for independent living. We did not identify any vendors located in Folsom or El Dorado hills that offered in-home living support services. *Summit Therapeutic Services,* located in Rancho Cordova, offers supportive services for adults with I/DD and their employees may travel to meet clients where they are in the community after a referral from ACRC. Our scan did not identify any residential care communities for adults with I/DD in Folsom or El Dorado Hills, but we did identify some in nearby communities like Fair Oaks, Shingle Springs, Rancho Cordova, and Sacramento.

In addition, Housing Now, is an advocacy group with a local coalition of consumers, providers, developers, and property managers that seek to create affordable, accessible housing for people with developmental disabilities.[19]

Applied Behavioral Analysis Services. Applied Behavioral Analysis (ABA) is a blanket term that describes a suite of behavioral interventions that use evidence-based techniques to teach desired interaction skills while reducing maladaptive behaviors. These services can be delivered as caregiver training or direct interventions with adults with I/DD and commonly target self-care, functional communication, daily living skills, and safety awareness.[17]

Although our scan identified several ABA providers for *children* with I/DD in the Folsom-El Dorado Hills area, only one provider offered ABA services to *adults* with I/DD. *1st Step, Inc.* provides ABA-related training to clients and caregivers. These services are available either on-site, at 1st Step, Inc.'s Cameron Park location, or in a client's home. Additional ABA services providers are located in Fair Oaks, Roseville, and Sacramento.

Work and Employment Services. Work and employment programs sponsored by ACRC focus on helping adults with I/DD engage in paid employment. Employment services can range from participation in structured work activity programs to group and individual services in collaboration with the Department of Rehabilitation. Our scan of ACRC's provider directory did not identify any providers offering work opportunities or employment training for adults with I/DD in the Folsom and El Dorado Hills communities. The closest providers are in Roseville and Sacramento.

EXAMPLES OF MODEL COMMUNITIES

Healthy aging and aging-in-place community models range from conventional, apartment complexes ("affordable housing") with few amenities that generally serve low-income, older adults, to sophisticated, expensive communities with extensive services that generally cater to younger, wealthier retirees. To date, our rapid environmental scan using the internet, literature, and UC Davis faculty interviews identified no communities paralleling the combined vision of the AKT development in terms of target population, integrated technology, and built design. The following summary divides examples of community models between those for older adults and those designed for adults with intellectual or developmental disabilities (I/DD). **Appendix D** provides further details about these sample communities designed for older adults or adults with developmental disabilities.

Our rapid environmental scan identified no communities paralleling the complete vision of the CHI development in terms of target population, integrated technology, and built design.

Communities Designed for Aging in Place

This section provides a framework of common types of model communities for healthy aging in place.[20,21] These models are not necessarily mutually exclusive. Examples of existing communities (with hyperlinks) are presented for each model type. While the current CHI concept does not replicate any of these existing models, they provide useful examples to stimulate the design of CHI.

Cohousing

A 2016 report by the American Institutes for Research (AIR) summarized research regarding three types of housing.[20] Cohousing, is a form of collaborative housing designed and operated by residents "…to emphasize social contact among community members while preserving and respecting individual privacy."[22] Extensive common facilities such as open spaces, playgrounds, and a common house with a large dining room and kitchen support the private homes in the development.[23] The owners co-design and oversee the community build, which fosters shared ownership of the entire community. According to AIR, research about cohousing communities is descriptive or qualitative in nature and lacks quantitative analysis or failure analysis. AIR concluded that cohousing promotes sustainable urban development and solves practical problems for community members. Although most cohousing communities are multigenerational, there is a growing interest in "elder-intentional" communities", which add amenities, social engagement and other support services through shared activities and resources.

Cohousing architects McCamant & Durrett have built 24 cohousing communities across the U.S., many of which are focused on aging-in-place. Communities average around 25 private homes and share common indoor/outdoor spaces for cooking, activities, and guest stays. The communities provide socialization and support, but not long term health care. Cohousing supporters assert that having close neighbors may reduce the need for skilled care. Neighbors drive debilitated neighbors to appointments, walk dogs, cook, or pick up medications. Advocates also note that cohousing is a more affordable model than other senior

Cohousing communities typically limit the number of units/residents to enable a successful self-governing process.[24] According to research by Glass and Choi, cohousing communities in the US and Denmark average 8-30 units/community as compared with Sweden, which averages 17-90 units/community.[25] This model exists at Glacier Circle in Davis, CA, one of the first self-planned elder housing developments in the U.S.[26,27] Its eight units house 12 residents who also rent a studio apartment (below market value) to an on-site nurse. The Phoenix Commons site in Oakland, CA, offers 41 recently built units with a universal design to promote wellness and aging in place for adults aged 55 years and older.[28]

Both multigenerational and elder cohousing communities are considering how to provide more health-related support, including how to house caregivers in communal space or in the guest rooms of an individual's unit.[29] Unlike developer-driven projects or naturally occurring retirement communities, cohousing residents design an environment that reflects their needs. The process may take 2.5 to 3 years to complete and involves building relationships with potential co-residents even before the physical land is identified. Developers may guide the planning process, but the residents determine the community's mission and character.

Villages

Villages are virtual (rather than built) communities that are membership-driven, grassroots organizations, run by volunteers and paid staff who provide services in members' homes and connect them with affordable services in the community.[26] Villages are used most often by middle to upper-middle income residents. A monthly fee (averages $40/mo) supports the coordination of volunteer services already provided through government entities, nonprofit organizations, local businesses and professionals. Examples of service referrals include transportation services (i.e., errands, appointments), in-home support (i.e., technical assistance, basic maintenance, hospital-home transition, pet walking, meal preparation), and social support (i.e., daily check-ins, event notices, presentations, book/game clubs). The Village-to-Village Network estimates there are 205 operating and 150 forming villages in the United States.

Locally, the Sierra Foothills Village, serving parts of Nevada County, is in development and will launch membership services in 2018.[30] They describe themselves as "a locally governed, non-profit membership organization that can help people age in place." Washington Area Villages Exchange (WAVE) is a much larger version with designated village liaisons who take an active role in developing villages.[21]

Marin Villages is an example of a well-established village that uses a hub-spoke organization wherein a board of directors and several staff (to match members with volunteers) maximize economies of scale to serve seven local villages in Marin County.

Research indicates that Villages create "a sense of purpose for retirees and [facilitate] awareness of and access to services…that reduces the risk of social isolation."[20] However, challenges to village sustainability remain due to the reliance on a predominantly volunteer system, increased integrated care needs as members develop disabilities, and potential income barriers for many seniors. Research gaps in village effectiveness identified by AIR "include potential nonresponse bias that influences diversity findings; lack of longitudinal studies; reliance on self-reported data; and uncertainty about the effectiveness of villages on more frail and vulnerable individuals." In more recent studies of village models by Graham et al. (2017), village members perceived greater levels of social connection, as well as improved quality of life that they linked to their

membership in their village. Members also reported feeling more empowered to seek and receive the help they needed to remain in their current homes in the future.[31]

Livable Communities or Naturally Occurring Retirement Communities (NORC)

The World Health Organization (WHO) defines a naturally occurring retirement community (NORC) as a "multidisciplinary partnership [that] helps to create or increase access to needed services for communities that have naturally high concentrations of older individuals" (in which at least 40% of the population exceeds age 60).[20] WHO identified 54 U.S. cities that meet the definition and AARP identified 108 communities in the U.S. meeting similar criteria ("livable communities"). NORCs conduct a needs analysis of the local community. Through surveys, interviews, and focus groups, non-profits gather information about residents' needs for food, housing, healthcare, transportation, and socialization and design programs to fit their needs.[26]

> *"One thing we learned is that whatever you think the residents need, you can't create and impose it upon them...The philosophy of 'if you build it they will come' doesn't work because in all our wisdom we can't develop a program unless the inhabitants want it."*
>
> *Ellen Miller, PhD*
> *Executive Director*
> *University of Indianapolis Center for Aging and Community*

Probably the most well-known NORC in California is located in downtown San Francisco and served by On Lok, which coordinates and provides medical and social services to frail elderly aging in their homes. Their housing program includes three buildings in the Chinatown-North Beach neighborhood. The national Program for All-Inclusive Care for the Elderly (PACE), a certified Medicare program, was developed from the On Lok model to support independent living for older persons.[32] Sutter SeniorCare PACE provides support to frail elderly in Sacramento County.[33]

Ellen Miller at the University of Indianapolis noted that resident participation is critical to the successful design and adoption of community resources.[26] Many organizations offer support to communities seeking to become more livable (e.g., Partners for Livable Communities, Smart Growth America, Walkable and Livable Communities Institute, AARP, Grantmakers in Aging, and Community Innovations for Aging in Place [CIAIP]). They often focus on a particular vantage point, such as transportation, environment and walkability, accessibility for the disabled, or architectural design, when designating communities. New York funds 31 designated NORCs administered by non-profits.[34,35] Support services (house cleaning, transportation, social work, social activities, etc.) are provided for residents in NORC apartment buildings or housing communities, or through designated NORC retirement communities in low-rise buildings or single-/multi-family homes. New Yorkers eligible for services must be at least 60 years old and reside in a NORC.

According to AIR, there is very limited research on the success of livable communities/NORCs, which are heterogeneous in design and their specified interventions and goals.

Continuing Care Retirement Communities/Life Plan Community

The most commonly known continuing care retirement communities (CCRC), are generally described as communities for "active retirees" aged 55 years and older, many of which offer stepped-care levels as disabilities increase for residents. Most examples of existing university partnerships involve CCRCs. These communities, such as Eskaton or Del Webb, typically provide single-family housing with clubhouse-type amenities and social activities for residents.

St. John's Retirement Village in Woodland, California is a local, continuing care retirement community that offers free housing to students willing to work 10 hours/week with residents and employs a registered nurse. UC Davis has developed a relationship with this CCRC.[vi] The Villages, near Orlando, Florida, is the fastest growing age-restricted community in the U.S.[36] There are 115,000 residents living in one of 10 community development districts across 36 square miles and 9 million square feet of commercial space. In addition to typical CCRC recreational amenities, The Villages designated three subdivisions for families; a project with Voyage Auto that is piloting an autonomous (driverless) taxi service in one district; and an Enrichment Academy for lifelong learning opportunities.[37]

Smart home technology appears to be less important than the common recreational CCRC amenities. Our scan found a few CCRCs that are experimenting with technology, such as Front Porch[38], which partners in developing housing options for seniors and people diagnosed with chronic mental illness. Its Center for Innovation and Wellbeing partners with tech companies to test products that might improve physical and emotional well-being. Their website shares case studies and survey results regarding technologies such as touch screens for intellectual stimulation, virtual reality, telehealth, assistive listening devices ("hearables for all"), and pet robots.

Del Webb and Monroe Lodge in Sacramento are local examples of communities that are starting to make smart sensor technology available to residents, but these are the exception rather than the rule.[39,40] Technologies are either experimental or optional, such as Alexa/Siri/Google Home devices that can assist with remote control of thermostats, garage/door locks, and motion sensor lights. Oakfield Estates (Milwaukie, OR), a memory care community, discusses its use of technology to monitor, engage and improve resident freedom as well as enhance caregiving processes.[41]

Unique Retirement Community: Mirabella Portland

This urban retirement community not only offers aging-in-place options to older adults, but also the opportunity to participate in research conducted by faculty at Oregon Health and Sciences University. The aging-in-place research, led by Dr. Jeffrey Kaye, uses wireless technology to track the research participants' activity such as sleep, walking pace, medication use, and weight in their own home. These data points are used to study the effectiveness and desirability of various technologies and to inform behavioral research.

Commencing in 2008, OHSU partnered with Intel and Pacific Retirement Services (PRS) to develop a unique community that promotes healthy aging, lifelong learning and research activities. PRS, a non-profit housing developer, has 24 affordable housing communities and 10 "signature" communities including the forthcoming Mirabella ASU, which markets research activities as part of its amenities. PRS also owns the University Retirement Community in Davis, CA.

Finally, there are models of academic partnerships with CCRCs across the US.[42] The Mirabella CCRC in Portland Oregon partnered with Oregon Health Sciences to study aging-in-place technology (see box). OHSU houses ORCATECH, which developed a computing platform to continuously collect data from passive home technology to study healthy aging.[43] Georgia Tech Aware Home Research Initiative has a

[vi] Personal communication. T. Stoltz, Director, Business Development and International Affiliations, UC Davis Health, August 1, 2018.

"laboratory" apartment at the Wesley Woods Towers in Atlanta, GA to test aging-in-place technology in such areas as fall detection, safety, mobility, and reminder prompts.[44] This satellite lab connects with the larger "Aware Home" laboratory (5,040 sq/ft) that facilitates research in an "authentic home" setting. MIT and University of Florida have similar home-like laboratories for study of the effects of technology on aging and independence.[45,46] See **Appendix D** for more information about these and other communities.

Examples of Community Support Services Facilitating Aging in Place

Two regional social service agencies embedded in affordable senior housing communities provide residential services to support aging in place. Rolling Oaks Housing in Rocklin, CA is a NORC-type community that provides affordable housing for 87 residents.[vii] The apartments are modest with low/no technology, but the community does have a federally-funded registered nurse available 20 hours per week to help with health prevention and maintenance and a social services director to coordinate community engagement. Rolling Oaks recently partnered with the UC Davis School of Nursing, with support from a federal grant, to have student nurse trainees help residents identify health goals, act as medical advocates, and track residents' physical and mental health outcomes.

LifeSTEPS[viii] is a non-profit organization that creates care plans and coordinates government, community and health care services in low-income senior housing communities. USA Properties Fund, a developer that builds and retains ownership of many affordable senior communities, works closely with LifeSTEPS to support senior residents' aging in place. There is great need for affordable senior housing (defined as no more than 30% of income devoted to housing). The USA Properties[ix] senior housing portfolio has a 99% occupancy rate; half of the occupants are dual eligibles. There is little to no technology in the residences, and LifeSTEPS relies on co-residents, social service directors, and property managers to identify needs among a building's residents.

Communities for Adults with Intellectual and Developmental Disabilities (I/DD)

The Department of Developmental Services uses a person-centered approach to identify where a person with I/DD will live based on the types of services and supports desired and needed. These services are provided through the 21 regional centers across California. Categories of domiciles range from independent living programs (vendored by regional centers) and supported living services for adults living in their own homes to a gradient of institutional settings such as adult residential facilities, community care facilities, and intermediate care facilities.[47]

There is disagreement within the community of adults with developmental disabilities and their families and providers regarding the most appropriate housing models. Some endorse housing exclusively devoted to persons with developmental disabilities to ensure resident safety, comfort, and the ability to provide special adaptations useful to a particular population. Others, concerned about "warehousing" and isolating adults with I/DD, advocate for integrated housing with typically-developed adults. The California Supported Living Network advocates for the provision of "supported living services," a person-centered model that assists adults with I/DD

[vii] Personal communication. P. Galloway, Resident Wellness Director, Rolling Oaks Senior Housing, May 29, 2018.
[viii] Personal communication. M. Chillemi, Director of Aging and Education Services, LifeSTEPS, June 5, 2018.
[ix] Personal communication. G. Brown, President/CEO, USA Properties Fund, June 5, 2018.

with independent living. A previous court decision (Olmstead) strongly supports housing policy focused on community integration.[48]

Numerous federal and state regulations for housing adults with I/DD, some of which overlap with rules for senior housing, determine client access to funding for housing and in-home support. Specifically, the Centers for Medicare and Medicaid Programs (CMS) implemented guidance for each state to further define standards under which Medicaid Home and Community-Based Services (HCBS) are provided.[49] It is an outcome-based guidance that clearly removes traditional institutional qualities from the setting and targets quality of experience rather than a specific location or physical characteristics. To receive HCBS funding, all settings must provide:

a) community integration (residents have services and employment opportunities that are also available to/used by the greater community);
b) choice and control of personal resources and setting (i.e., private living units in residential facilities) including non-disability-specific settings; and
c) within the setting, a guarantee to an individual's right to privacy, respect, dignity, and freedom from restraint.

> *"The Built Environment and Community Integration: A Review of States' Olmstead Plans is a good document regarding important components for residential settings that are designed for the needs of people with disabilities. It states that, 'Housing policy actions should encourage housing that is dispersed throughout the community, spatially as well as demographically and economically; coordinated with the transportation infrastructure, as well as the employment, education, services, and recreation infrastructure of the community; in close proximity to the public facilities of the community; and designed to accessible standards rather than modified. To be specific and measurable, housing policy actions may refer to proximity in terms of walkable, a term used in the planning fields to indicate that accessing low-order destinations does not require the use of a private vehicle, and that the environment is conducive to pedestrianism. For individuals with disabilities, being conducive to pedestrianism requires that the environment is physically accessible, as well as safe and comfortable.'"*
>
> *-UC Davis Researcher*

Examples of independent living options for adults with I/DD include David Wright Apartments (Pittsburgh PA), a 42-unit apartment complex providing affordable housing for persons with autism as well as typically developed persons.[50] Financed primarily through federal tax credits and public and private funding, people with autism are given preference for housing in half of the units. The building has a community room, quiet lounge, exercise room, and an office for a nonprofit human services agency staff member to work on site 25-40 hours per week.[51] The Sweetwater Spectrum housing pilot project (Sonoma, CA) provides four 4-bedroom homes for 16 residents and accepts persons anywhere along the autism spectrum[52]; this setting does not meet affordable housing standards at $40,000 per resident/year, although it does offer subsidies to about one-third of residents.[53] Sweetwater provides a design handbook for communities interested in replicating their model.

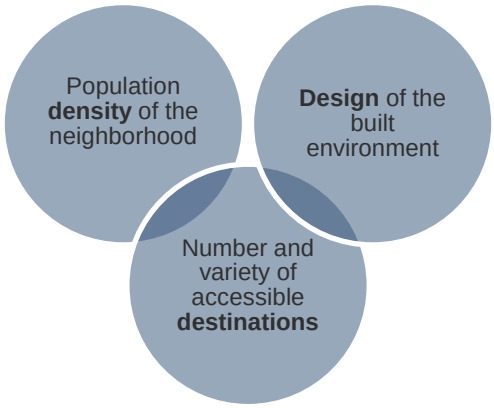
RAPID LITERATURE SCAN: APPROACHES SUPPORTING AGING IN PLACE

Based on the intention of the CHI community to incorporate advanced technology, built-environment design features, and community-based interventions to support healthy, independent living and aging in place, we conducted a rapid literature scan to identify published research on the effectiveness of these interventions to improve health and quality-of-life outcomes. We focused our scan on smart home technologies, built environment designs, and comprehensive community-based interventions designed to promote aging in place.

"Smart homes" are defined as a special kind of home or residence equipped with technological devices, such as sensors or controls, which are integrated into the infrastructure of the home and intended to monitor the inhabitant(s) to improve their experience at home.[54] Technology to support aging in place generally serves one of two purposes: (1) to prevent, postpone, and or detect early outcomes that threaten independence (e.g., sensors to detect falls) or (2) to promote independence and maintain outcomes or health status (e.g., chronic disease management or medication reminder systems).[55,56]

The Centers for Disease Control and Prevention (CDC) defines **the built environment** as the "buildings, roads, utilities, homes, fixtures, parks and all other man-made entities that form the physical characteristics of a community."[57] The built environment has been described as having three dimensions – density, design and destinations (**Figure 12**). These dimensions interact to either promote, or inhibit, physical activity and "active travel" within a community. Built environment considerations are also important for accommodating disabilities through design modifications (e.g., wider doors, ramps, or other wheelchair-accessible modifications, improved signage for individuals with cognitive impairment, visual cues such as pavement color or texture to identify home neighborhood, etc.).

Figure 12. Dimensions of the Built Environment



Source: Eisenberg (2017)

Finally, **community interventions** involve organized provision of support services to meet needs older and disabled adults in their home or local environment.

Methods

We conducted a two-phase rapid review of the published literature, based on the following guiding questions:

1. Are smart-home technologies effective in helping older adults or adults with disabilities to live independently?
2. Are community-based interventions (e.g., those delivered at a community center or via home visits) effective in helping older adults or adults with disabilities to live independently?
3. What features of the built environment, or community design elements, help older adults or those with disabilities to live independently?

In the first phase, we performed a "review of reviews;" we searched PubMed from 2005 to the present to identify existing systematic reviews applicable to these questions. In the second phase, we searched PubMed from 2015 to the present to identify recently published primary research studies (randomized controlled trials, cohort studies, or cross-sectional studies) not included in the reviews. Detailed methods are presented in **Appendix E.**

Smart Home Technologies

We reviewed six recently published systematic reviews that were investigating the types of technologies used to monitor individuals in the home environment, and the effect of these monitoring tools on health outcomes.[54,56,58-61] Four of the reviews included older adults (typically aged 60 years and older) while the others included adults of all ages. While there were a high number of randomized trials identified in the reviews, the study outcomes primarily focused on device accuracy or technology acceptance; very few studies reported on short-term health outcomes and no studies reported on longer-term outcomes such as healthcare utilization or costs. Liu et al. (2016) reported that 66% of their included studies (32/48 studies) found that smart homes and home health-monitoring technologies showed advantages compared to no monitoring or other types of interventions. Limited numbers of research trials identified positive impacts of technologies on health outcomes, such as cognitive status and activities of daily living. One trial found that technology only used to track and/or measure biometric data alone did not affect health status. All reviews concluded that this area of research is still in its early stages. Additional findings of these reviews are presented in detail in **Appendix E.**

Our review of studies published since 2015 identified several studies of sensors in homes that showed benefits to users. Rantz et al. (2015) found that residents of TigerPlace (a housing development in Missouri) living in dwellings outfitted with non-wearable sensors that automatically reported health changes were able to reside there 1.7 years longer than residents living without the aid of sensors.[62] Lyons et al. (2015) showed that home sensors detected "behavior signatures" that could predict increased risk of needing to transition to a higher level of care.[63] Dupuy et al. (2017) demonstrated that "ambient assisted living technology" – consisting of sensors and two tablet computers in the home – helped frail older adults maintain their functional skills and reduced progression of caregiver burnout.[64]

Built Environment Designs

We reviewed five recently published systematic reviews assessing the impact of the built environment on health outcomes – primarily impacts on physical activity or active travel. The majority of these studies were cross-sectional. The reviews generally found strong evidence that walkability and access to destinations/services/recreational activities were all positively

associated with total physical activity among older adults. The reviews also noted positive associations with access to public transit and pedestrian-friendly features (such as well-maintained walking paths or sidewalks).

Eisenberg et al. (2017) reviewed studies assessing the impacts of the built environment on individuals with disabilities (hearing, vision, cognitive, ambulatory, self-care or difficulties with independent living). The review found that most studies identified numerous barriers to physical activity among persons with disabilities (e.g., uneven sidewalks, inadequate lighting, stop light timing, etc.), and noted that the built environment can increase the effect of having a disability on physical activity. For example, someone with a disability may not choose to walk at night due to inadequate lighting, but the presence of facilitators, such as benches or street lamps, can promote walking.[65]

A literature scan of individual studies from 2015 to present added to the evidence that modifications to the built environment can promote health. Clarke et al. (2015) found that community centers and closer proximity to public transit were linked to slower cognitive decline.[66] Van Holle et al. (2016) found that in highly walkable neighborhoods with a favorable social environment, residents walked more for transportation, watched less TV, and were less sedentary.[67]

Community-based Interventions

Community-based interventions can also help keep older adults healthy and aging in place. A study of the CAPABLE program -- a home-based care program that used an inter-professional team consisting of a handyman, registered nurse, and occupational therapist to help residents achieve their self-identified functional goals, found that after five months, physical functioning and ADLs had improved in 49% of residents and difficulties with IADLs had decreased in 65%. Depression also improved in 53% of residents.[68] ElderHelp Concierge Club evaluated the effect of both professional and volunteer services to help participants with various tasks including driving, shopping, housework, and pet care. Participants in the program achieved increased travel outside the home and better access to healthcare. They experienced decreased social isolation, home hazards, and falls. Perhaps most importantly, participants increasingly felt confident that they could remain in their own homes because they felt able to get the assistance they needed to do so.[69]

> *…a home-based care model to help residents achieve their self-identified functional goals improved physical functioning and ADLs for 49% of residents and difficulties with IADLs had decreased for 65%.*
>
> *Szanton et al. (2016) describing the CAPABLE program*

Conclusions about the Strength of Evidence

In summary, research to date suggests that the built environment, targeted in-home technology, and community-based interventions have strong potential to improve health and aging in place. However, our review identify limited numbers of studies with strong research designs focused on relevant health outcomes. A UC Davis partnership with CHI involving longitudinal research could make critical discoveries and advance knowledge about interventions to enhance health and quality of life for aging and disabled adults.

UC DAVIS FACULTY PERSPECTIVES ON PARTNERSHIP POTENTIAL

To consider the potential opportunities and challenges of the CHI project in relation to the mission of UC Davis, we conducted interviews with UC Davis faculty across multiple disciplines.

Generally, there was strong interest in research and education opportunities once faculty concerns and questions were acknowledged.

In May-June 2018, we interviewed 11 UC Davis faculty in the areas of Alzheimer's research, nursing/caregiving, design, urban planning, technology, and developmental behavioral health. Interviews generated strategies for overcoming barriers and challenges, and proposals for a wide variety of research topics (**Appendix F** lists interviewed faculty).

Generally, there was strong interest in research and education opportunities once faculty concerns and questions were acknowledged. Faculty generally agreed that partnering on the development of CHI offers numerous possibilities for innovative research, education, and community engagement. See **Appendix G** for a full list of initial ideas.

The most common questions raised by faculty focused on the viability of a UC Davis-developer partnership, feasibility of a long-term relationship with community, and the effectiveness of a technology-oriented community to facilitate healthy aging. Key themes emerging from these conversations are described below.

Unique Study Design Opportunity

"Could this be a 'Framingham' opportunity?"
-Two UC Davis faculty

Some faculty noted that this is a rare opportunity to design a community-based cohort (Framingham[x]-like) that would allow multiple studies of longitudinal cross-disciplinary outcomes. Such a setting could improve UC Davis' competitiveness for federal research funding.

Several faculty mentioned the potential for application of rapid-design techniques. For example, UC Davis could leverage the work at the co-design lab at the School of Nursing or leverage the rapid prototype design methods available through the Department of Design on the Davis campus. Other faculty members suggested embedding community-based lab(s) in the CHI. Opportunities to study the impact of nutritional interventions to improve fruit and vegetable intake, community gardens, home care or community interventions involving nursing, pharmacy, or physical therapy, and community delivery of interventions for smoking cessation and problem drinking were also mentioned.

Several faculty mentioned the potential for application of rapid-prototype design techniques.

[x] The Framingham Heart Study was started in 1948 in Framingham, Massachusetts to determine causes of heart disease and stroke. This longitudinal study, which enrolled its third familial generation of participants in 2002, identified primary risk factors for cardiovascular disease (e.g., high blood pressure, smoking, obesity, cholesterol, etc.). *Source*: https://www.framinghamheartstudy.org/fhs-about/history/

Important Characteristics for Community/Resident Success

Faculty noted the importance of an intergenerational community, and availability of affordable housing for clinicians, workforce, and students. Many faculty emphasized that attributes of a successful community include an environmental design to promote walking and social interaction and the need to address high summer temperatures, location remote from urban services, transportation access, social inclusion, integration of target populations, need for family and paid caregiver housing, and potential alienation from the higher-income Folsom/El Dorado Hills community.

Regarding technology, some observed that producing modular-based living units and appliance-based technology rather than hard wiring a home would avoid problems with rapid technology obsolescence. Several raised concerns about resident privacy and resident aptitude for technology. A few commented on the need to avoid "novelty technology" and that technology should be used judiciously to improve health outcomes.

Faculty noted professional and public concern about "warehousing" vulnerable populations while others noted unique supervision needs of vulnerable populations would allow such a community to be safer and improve the delivery of support services. Although there was disagreement about the effectiveness of segregated housing, most agreed that adults with degenerative and developmental conditions are compatible across some service-support needs. Concern was expressed about the prevalence of individuals with behavioral problems in the potential community. Faculty noted that adults with intellectual and developmental disabilities are aging as well and would benefit from similar universal design supports used for the general aging adult population.

Managing UC Davis-AKT/CHI Partnership

Several faculty members expressed concern about the success and longevity of a public-private partnership between UC Davis and the developer and/or the community. Questions included:

- How could UC Davis sustain access to the community once the developer is no longer associated with the land?
- What can UC Davis do to initiate and maintain resident participation in research and education projects?
- What happens if unforeseen economic, political, or social challenges arise during the project design and build?

Faculty cited examples like the dissolution of a large public-private partnership with Penn State following an unrelated scandal that affected the university's reputation, and the impact of economic recession on the abandonment of more costly developmental design features emphasizing sidewalks and large porches. Another faculty member mentioned that mixed-use zoning is often difficult to achieve.

Some suggestions for overcoming these types of challenges included:

- Clear and careful negotiation of a public-private partnership agreement with defined exit strategies for UC Davis as the project progresses;
- Negotiating a well-defined community governance model as part of the partnership agreement,

> *"…a resident advisory committee could be established as part of governance of the community to advise UC Davis."*

including a resident advisory committee (similar to grant requirements of the federal Patient-Centered Outcomes Research Institute) to advise UC Davis;
- Establishing a community-based ethics consultation group to integrate the larger community's needs and facilitate group discussion about research participation or concerns such as balancing adult protection, privacy, and autonomy;
- Designing marketing materials for home sales to emphasize the UC Davis partnership to improve resident awareness of research and education opportunities.

Research and Education Opportunities

UC Davis faculty suggested a variety of research questions that could be explored with the CHI (see **Appendix G** for the list of specific research and education ideas). For example, UC Davis researchers could explore the effects of rapidly produced, resident-guided prototypes or design strategies for community and residences and study comparative outcomes of variations in the built environment features of neighboring home clusters. Other ideas included studying effects of in-home monitoring and technology for personal use on short- and long-term clinical and mental health outcomes (including caregivers) across conditions and interventions, and effectiveness of various care-giving or technological interventions. See **Appendix H** for a list of other available resources and laboratories specific to aging-in-place research.

Example R.1.
Use a rapid prototype technique to incorporate patient/caregiver input into design of home or community to learn whether design improves social interaction and reduces loneliness among older adults.

Example R.2.
What is the optimal built environment that enables adults with developmental disabilities to thrive?

Example R.3.
How can we use sensor technology to improve function and quality of life instead of simply monitoring someone?

Faculty also suggested educational and training opportunities for undergraduate, graduate, nursing, and medical students. (See *Examples of Model Communities* section for examples of how communities integrate students into support roles in exchange for subsidized housing.)

Example E.1
Engage Public Health Sciences MPH students in CHI projects for required a 300-hour practicum; Students in the

UCD Health Informatics Master's Degree program could participate in CHI research projects.

Example E.2.
Undergraduate, graduate, nursing, and medical students could interact with residents in their homes or community settings to learn about resident needs, participate in research projects and to deliver supervised services. Local community college students could be engaged in teams with UC Davis students.

Example E.3.
The School of Nursing co-design lab could use their rapid-design prototyping to improve home design and caregiving strategies.

One faculty member pointed out the opportunity to coordinate and leverage CHI research and education opportunities with future public-private innovation partnerships established through Aggie Square.

Additionally, the Central Valley has no major academic gerontological research presence. There is an increasing need for research on aging given the expected rapid increase in the population of older adults. Developing an ongoing relationship with CHI residents may provide the foundation for UC Davis to establish its own gerontology research center. Other UC

partnerships may be forged with existing centers of research such as UCLA's GeroNET (a multi-center health and aging services core), UCSF's Older American Independence Center (funded by the National Institute of Aging), or the UCSD Stein Institute for Research on Aging.

CONCLUSIONS

The potential public-private partnership between UC Davis and AKT Development on the CHI community presents many potential challenges and opportunities for UC Davis. Under the ideal scenario, UC Davis faculty, students and partners would work with the future community residents over many years to discover and disseminate effective strategies to enhance health and quality of life for aging and disabled adults. Research and education opportunities would begin in the community design phase and persist for the lifespan of the community. The possibility of establishing a longitudinal community research cohort could provide UC Davis with a strong competitive advantage for future research funding and perhaps the foundation for UC Davis to establish a broad national presence in interdisciplinary aging research. Community residents would benefit from evidence-based design and ongoing community and home-based services provided through UC Davis and UC Davis Health. A CHI partnership could also enhance perception of UC Davis as an innovative and caring community partner participating in solutions addressing persistent community needs. Likely public concerns about "experimentation" on CHI residents and about technology adversely affecting privacy should be addressed prospectively.

The possibility of establishing a longitudinal community research cohort could provide UC Davis with a strong competitive advantage for future research funding.

Student training experiences and practicums could engage students at the undergraduate, graduate, and professional levels, support the community, and enhance student understanding of aging and disability. Faculty interviewed for this project in the Schools of Nursing and Medicine, Public Health Sciences, Human Ecology, and Design) all expressed enthusiasm and interest in exploring education and training opportunities. Other educational opportunities are possible for students in nutrition, sociology, engineering, and communication, among others. Student participation in research projects would contribute to the next generation of researchers in aging. Challenges in this area include defining and prioritizing educational opportunities and ensuring adequate student supervision.

This report does not address the potential challenges and opportunities presented by providing UC Health services on site or via telehealth to the CHI community. UC Davis Health has an existing primary care clinic in nearby Folsom. Needs assessment and financial analysis are critical future components of initiating UC Davis Health services as part of CHI.

Our region is unprepared for the projected growth of the population of older adults through 2060. This trend clearly supports a growing need for housing, especially affordable housing, designed for the needs of older and disabled adults as well as expanded access to medical and mental healthcare focused on older and disabled adults. A community incorporating innovative design, advanced technology, and access to appropriate care would likely experience strong demand. However, any public-private partnership requires careful negotiations with multiple stakeholders; this one would need to involve AKT developers, potential builders, future residents, and take into consideration the needs of UC Davis faculty and students, UC Davis Health, as well as stakeholders at the local regional state and national levels. The existing community in the Folsom area has concerns about population growth that will need to be addressed. A process would need to be developed to establish engagement longitudinally with

A public-private partnership would require careful negotiations with multiple stakeholders.

future residents for research and education. The Mirabella Portland retirement community is a promising example of a public-private partnership between Oregon Health Sciences University and a private development firm that supports research and education for aging in place; lessons learned from this partnership could be useful to UC Davis going forward. UC Davis could explore other successful university partnerships with CCRCs, including PRS (University Retirement Community-Davis), which is partnering with Arizona State University in a new development currently under construction, and seek out examples of failed partnerships to better define potential pitfalls.

The CHI planning and building process is projected to take 5 to 10 years, requiring an ongoing and adaptive relationship between partners. A sustainable, transparent, stepwise process for establishing and maintaining such a partnership will be key to addressing unforeseen challenges, including economic and political changes. If UC Davis pursues a partnership with AKT, mapping key decision points over the project's timeline would be a useful tool for managing risks associated with unforeseen events. UC Davis has experience partnering with developers for building student and faculty housing that may be applicable to this potential partnership (i.e., West Village, Davis, CA).

> *"We need to clearly define the goal of this partnership and know our exit strategies."*

We identified many potential advantages for UC Davis to collaborating on the development of the Community for Health and Independence with AKT Development, Inc. Despite some significant challenges, further in-depth exploration is warranted to address outstanding questions, clarify opportunities, and identify potential solutions.

The *Center for Healthcare Policy and Research* provides a resource to UC Davis decision-makers for in-depth research, at their direction, on the many considerations briefly described here. Potential deliverables could include:

- **In-depth review and analysis of existing model communities, including university-connected retirement communities. Site visits and interviews could explore successes and failures in community developments related to design, technology, and governance**
- **A conference to convene futurists, model community representatives, experts in aging and disability, environmental/housing design, smart technology design, telehealth, and community interventions.**
- **Focus groups with target populations, their caregivers, and current area residents to better understand their needs and concerns related to healthy aging in place, community resources, and preferences for community design and governance.**
- **Formal public deliberation process with diverse stakeholders to define and prioritize community characteristics**
- **In-depth exploration of existing community governance models and formal academic-community partnership agreements**
- **Inventory of educational models engaging students in aging communities**
- **Economic analysis of specific design concepts/design elements that could influence health outcomes**
- **Needs assessment of potential on site and telehealth services**

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Appendix A. Description of the Community for Health and Independence (CHI) Project

AKT Investments/ Development Inc. provided the following description. The vision for the Community for Health and Independence (CHI) development includes the following concepts:

- All homes will be of the highest quality; include universal design; and offer state-of-the-art conveniences that will promote health and independence.
- Technology, with a focus on healthcare, will be integrated within all residences and throughout the entire development.
- Technology will be supported by on-site healthcare facilities and other ancillary services/supports.
- The community will establish and promote the following values:
  - ➢ The importance of an active and healthy lifestyle for individuals of all ages and abilities across the lifespan.
  - ➢ The importance of the sense of neighborhood and community.
  - ➢ A development that provides secure movement.
  - ➢ An environment that is safe.
  - ➢ A community designed for mobility and not commuting (i.e. beautiful walkways, restricted traffic, innovative vehicles, and other assistive devices).
  - ➢ A community that encourages social interaction.
  - ➢ A development project for people who love life and value independence.

A "Master Plan" will establish an incremental plan to achieve the vision stated above. As discussed, AKT proposes an initial community comprised of about 500 homes. The majority of these residences would consist of single-family dwellings, with a possible inclusion of some multi-family units. Affordable housing will be included. The Project will not be age-restricted. Current plans call for the Project to be inclusive, "market-driven", and have no specific limitations or restrictions for occupancy. In other words, individuals will "self-select" in determining whether the Project is a good fit for their lifestyle.

The CHI project would include these additional resources/facilities:

- Healthcare-related facilities (i.e., medical clinic, wellness center, physical and occupational therapy center(s), nutritional center, etc.). The Project would not include a hospital, emergency room, or other in-patient facilities.
- Facilities to promote/support social events and social interactions, exercise, and recreation (i.e., community center).
- Retail facilities such as grocery stores, drugstores, and possibly a small shopping center(s).
- Parks, walking trails, and nature conservancy sites.
- (Possibly) facilities to support the needs of older/vulnerable adults who can no longer live in their initial CHI homes, such as a limited number of facilities/residences for assisted living, memory care and skilled nursing.

The Project will include the necessary resources and infrastructure to ensure that the requisite technologies, informatics, and data analysis capabilities are effectively integrated throughout the community. The final Master Plan will be based on a needs assessment and the expertise and guidance of UC Davis and other stakeholders.

Appendix B. Demographics - Detailed Tables

Baseline data in this section are derived primarily from the 2016 California Health Interview Survey (CHIS). CHIS is a statewide, yearly telephone survey that covers a range of health-related topics including information about respondents' health status and conditions, health access, utilization of health services, and health behaviors. The data are available at the state and county level. When relevant, trend data are also presented.

Demographic projection data for indicators such as age, income, and cultural considerations are from the California State Plan on Aging, 2017-2021, which is compiled by the California Department of Aging and includes age- and county-stratified population growth projections out to the year 2060. General disability and activities of daily living (ADL) impairment projections are based on an analysis of disability among California's senior population published by California's Legislative Analyst Office.[7] Data on housing trends and independent living considerations for older adults in California are primarily from a report by the California Department of Housing and Community Development.[4]

Table B1. Older Adults and Medi-Cal–Medicare (Dual) Enrollees in the Sacramento Region, Selected Demographics, 2016

Demographic	All Older Adults	Those Enrolled in Both Medicare and Medi-Cal
Number in Total Population	588,000	99,000
DEMOGRAPHIC CONTEXT	**% (n)**	**% (n)**
Gender[(a)]		
Male	42.6%	55.8% (55,000)
Female	57.4% (338,000)	44.2% (44,000)
Age[(a)]		
18-54 years	--	22.4% (22,000)
55-64 years	44.5% (262,000)	14.9% (15,000)
65-74 years	29.4% (173,000)	26.9% (27,000)
75+ years	26.1% (154,000)	35.7% (36,000)
Race/Ethnicity[(a)]		
White	72.1% (424,000)	50.7% (50,000)
Latino	12.5% (73,000)	20.9% (21,000)
African American	2.3% (13,000)	11.9% (12,000)
Asian	6.8% (40,000)	3.8% (4,000)
Other	6.4% (37,000)	12.7% (13,000)
Poverty		
Income <200% FPL[(a)]	28.2% (165,000)	68.4% (68,000)
Not able to afford enough food	50.5%	46.5%
Currently Receiving SSI	22.3%	51.4%
Place of Residence		
Living Arrangement[(b)]		
Lives with family	66.2%	--
Lives with roommates	4.8%	--
Lives alone	25.6%	--
Lives in group quarters	3.4%	--

Demographic	All Older Adults	Those Enrolled in Both Medicare and Medi-Cal
Ownership[b]		
Owns	73.0%	--
Rents	27.0%	--
Geography[a]		
Urban	84.4% (496,000)	91.5% (91,000)
Rural	15.6% (92,000)	8.5% (8,000)
HEALTHCARE ACCESS AND UTILIZATION	**% (n)**	**% (n)**
Insurance Type[a]		
Uninsured	3.7%	--
Medicare	42.7%	--
Medicaid	9.3%	--
Medicare and Medicaid	13.1%	100.0%
Private	31.2%	--
Other Healthcare Access Measures[a]		
No usual source of health care	4.9% (29,000)	8.1% (8,000)
Delayed medical care in past year	8.4% (49,000)	10% (10,000)
No dental insurance	28.3% (166,000)	41.2% (41,000)
HEALTH STATUS AND OUTCOMES	**% (n)**	**% (n)**
General Health Status[a]		
Excellent or Very Good	41.5%	23.5%
Good	29.3%	34.0%
Fair or Poor	29.3%	42.5%
Disability and Activities of Daily Living (ADLs)		
Physical, mental, or emotional disability[a]		
Yes	52.0% (306,000)	81.3% (81,000)
No	48.0% (282,000)	18.7% (19,000)
Disability Type[b]		
Hearing Difficulty	15.9%	--
Vision Difficulty	6.9%	--
Cognitive Difficulty	11.6%	--
Ambulatory Difficulty	25.9%	--
Self-Care Difficulty	11.7%	--
Independent Living Difficulty	20.1%	--
Average years after 65 with ADL limitations[c]		
All adults age 65+	4.5	--
Females	5.3	--
Males	3.7	--
Whites	3.6	--
Hispanics	5.8	--
Other Races	5.6	--

Demographic	All Older Adults	Those Enrolled in Both Medicare and Medi-Cal
Chronic Conditions		
Number of chronic conditions[d]		
None	58.7%	--
One	29.0%	--
Two	10.4%	--
Three or more	1.9%	--
Condition Prevalence[e]		
Alzheimer's/Dementia	8.3%	--
Arthritis	24.3%	--
Asthma	8.1%	--
COPD	9.4%	--
Diabetes	24.8%	--
Heart Disease	19.6%	--
Hypertension	47.2%	--
Osteoporosis	5.5%	--
Stroke	3.7%	--
Cancer Incidence (All Sites)[f]		--
Age <50 years	96.4 per 100,000	
Age >=50 years	1,327.6 per 100,000	
Other Physical Health Outcomes		
Fell more than once in past year[g]	9.8%	10.5%
Needed medical care due to falls	47.5%	79.8%
Changed daily routine due to falls	30.7%	48.0%
Obesity (BMI>=30) [a]	24.4%	32.3% (32,000)
Condition of teeth[a]		
Excellent or Good	65.6%	48.2%
Fair or Poor	30.4%	40.4%
Has no natural teeth	4.0%	11.4%
Mental Health Outcomes[a]		
Serious psychological distress in the past year	6.3% (36,000)	15.6% (15,000)
Avoided social activities due to mental health	13.0%	22.1%
Missed work due to mental health	85.5%	88.7%
Family life impairment due to mental health	7.7%	12.0%
Unable to do household chores due to mental health	13.6%	22.0%
Has considered committing suicide	7.3%	15.0%
HEALTH BEHAVIORS[a]	**% (n)**	**% (n)**
Smoking		
Current Smoker	12.5% (73,000)	30.6% (30,000)
Physical Activity		

Demographic	All Older Adults	Those Enrolled in Both Medicare and Medi-Cal
Regular walking in the past week	31.2%	18.6%
Diet		
Fast food two or more times/week	20.1%	20.8%
Fresh fruit/vegetables sometimes/never affordable in neighborhood	13.8%	29.7%

Key: FPL=Federal Poverty Level; ADL=Activities of Daily Living; COPD=Chronic Obstructive Pulmonary Disorder; BMI=Body Mass Index
[a] 2016 California Health Interview Survey
[b] 2012-2016 American Community Survey 5-year Estimates; older adults defined as age 65+ (n=189,264)
[c] Legislative Analyst's Office Report, 2016 (https://lao.ca.gov/reports/2016/3509/disability-long-term-outlook-112816.pdf); older adults defined as age 65+
[d] California Health Care Foundation, 2015 (https://www.chcf.org/publication/californians-with-the-top-chronic-conditions-11-million-and-counting/); estimates for the four-county Sacramento Region (i.e., El Dorado, Placer, Sacramento, Yolo)
[e] CMS Interactive Atlas of Chronic Conditions, 2016 (https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/Interactive_Atlas.html); rates presented for Sacramento County Medicare fee-for-service beneficiaries only (n=101,227)
[f] National Cancer Institute State Cancer Profiles, All Cancer Sites, 2011-2015 (https://statecancerprofiles.cancer.gov/incidencerates/index.php?stateFIPS=06&cancer=001&race=00&sex=0&age=136&type=incd&sortVariableName=rate&sortOrder=default#results); incidence reported for Sacramento County adults age 50 and older
[g] 2012 California Health Interview Survey (older adults, n=504,000; dual eligibles, n=64,000)

Table B2. Adults with Intellectual and Developmental Disabilities (I/DD), Selected Demographics, 2018

Demographic	California	Alta California Regional Center[a]	Sacramento County
Total Population with I/DD (served by DDS)	276,263 (100%)	20,631 (100%)	13,523 (100%)
Age 18+ Population	162,274 (59%)	12,247 (59%)	8,134 (60%)
Age 62+ Population	12,459 (4.5%)	922 (4.5%)	627 (4.6%)
DEMOGRAPHIC CONTEXT	**%**	**%**	**%**
Gender			
Male	65.21%	64.40%	64.48%
Female	34.79%	35.60%	35.52%
Race/Ethnicity			
White	33.77%	49.81%	42.22%
Latino	37.93%	16.02%	16.35%
African American	9.50%	12.46%	16.91%
Asian	6.89%	6.88%	8.47%
Other	11.91%	12.71%	13.74%
Diagnosis Type (% with disability – persons may have more than one type)			
Autism	37.28%	35.26%	34.67%
Epilepsy	14.05%	10.68%	10.99%
Cerebral Palsy	12.96%	10.98%	11.04%
Intellectual Disability	60.57%	55.35%	56.40%
Other Developmental Disabilities	10.23%	16.53%	16.01%
Severity of Intellectual Disability			
No ID	39.43%	44.65%	43.60%
Mild ID	32.10%	28.67%	29.18%
Moderate	12.64%	11.82%	11.95%
Severe	5.20%	4.98%	5.41%
Profound	3.05%	1.79%	1.96%
Unspecified	7.58%	8.09%	7.91%
Primary Language, English			
Yes	75.47%	88.68%	86.98%
No	24.53%	11.32%	13.02%
Residence Type			
Home of Parent or Guardian	77.05%	74.10%	72.90%
Community Care	9.65%	9.77%	10.91%
Independent Living	9.44%	13.60%	13.97%
Intermediate Care Center	2.53%	1.15%	1.07%
Developmental Center	0.21%	0.21%	0%
Skilled Nursing Facility	0.40%	0.48%	0.41%
Other	0.72%	0.68%	0.73%

Demographic	California	Alta California Regional Center[a]	Sacramento County
HEALTH AND BEHAVIORAL STATUS	**%**	**%**	**%**
Severe Behaviors[b]			
No	80.63%	81.00%	80.90%
Yes	19.37%	19.00%	19.10%
Medical Problems[c]			
No	76.35%	78.86%	78.87%
Yes	23.65%	21.14%	21.13%
Special Conditions or Behaviors[d]			
None	94.24%	93.79%	93.83%
One	3.39%	3.75%	3.75%
Two	1.38%	1.53%	1.49%
More	0.98%	0.94%	0.92%
Dual Diagnosis[e]			
No	88.67%	87.33%	86.87%
Yes	11.33%	12.67%	13.13%
Takes Behavioral Medication[f]			
No	82.05%	70.00%	70.32%
Yes	17.95%	30.00%	29.68%
Unable to Walk Without Support			
No	79.52%	81.14%	80.56%
Yes	20.48%	18.86%	19.44%
Special Health Care Requirements[g]			
No	80.32%	79.78%	79.69%
Yes	19.68%	20.22%	20.31%
Technology Dependent[h]			
No	94.78%	92.89%	93.03%
Yes	5.22%	7.11%	6.97%
Vision Problems			
No	89.55%	89.79%	90.47%
Yes	10.45%	10.21%	9.53%
Hearing Problems			
No	94.74%	96.10%	96.01%
Yes	5.26%	3.90%	3.99%
Both Vision and Hearing Problems			
No	97.88%	98.50%	98.47%
Yes	2.12%	1.50%	1.53%
EVALUATION SCALE AVERAGES **Range: 1 (disabled) to 5 (able)**			
Practical Independence	4.28	4.31	4.30
Personal and Social Skills	3.26	3.30	3.28

Demographic	California	Alta California Regional Center[a]	Sacramento County
Challenging Behavior	4.18	4.20	4.19
Social Integration	3.55	3.78	3.77
Well-Being	4.62	4.62	4.62

Key: DDS=California Department of Disability Services; I/DD=Intellectual and Developmental Disability; ID=Intellectual Disability
Note: Data reported within Demographic Context, Health and Behavioral Status and Evaluation Scale Averages represent the total population with I/DD in California served by DDS

[a] Alta California Regional Center serves the following 10 counties: Alpine, Colusa, El Dorado, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, and Yuba.
[b] Severe Behaviors include aggression, frequency of self-injurious behavior, severity of self-injurious behavior, smearing of feces, destruction of property, running or wandering away, reaction to frustration, and temper tantrums.
[c] Medical problems include the presence of chronic medical conditions that limit or impede the individual or impact the provision of service. Such conditions include, but are not limited to, diabetes mellitus, congenital heart disease, hepatitis, hypertension, and upper respiratory infections.
[d] Conditions or behaviors that affect the individual's placement in a suitable living arrangement or day program, including inappropriate sexual behavior, assaultive behaviors, attempted suicide, habitual acts of theft, vandalism or property destruction, conviction of substance abuse or alcohol-abuse related offenses, recent history of abusing drugs or alcohol, history of habitual lying, or behaviors that could result or have resulted in fire setting.
[e] Dual Diagnoses include individuals having both a developmental disability and a mental disorder (as defined in the DSM-IV).
[f] Behavior-modifying drugs are prescribed for maladaptive behavior, which includes hyperactivity, self-injurious behavior, aggression, and poor impulse control as well as behaviors or symptoms associated with psychiatric diagnoses.
[g] Special Health Care Requirements include individuals requiring special treatments such as feeding or mobility aids, equipment, or positioning on an on-going basis.
[h] Individuals who for life support depend daily on a mechanism or device such as ostomy care, catheter, apnea monitor, tracheostomy, suctioning, inhalation therapy, oxygen, respirator, nasal gastric tube/gastrostomy, or parenteral equipment.

Appendix C. Sacramento Regional Resources and Services

Table C1. Greater Sacramento Hospitals – Facility Details

Facility Name	Beds	Emergency Services	ICU	CCU	Rehab Center	Other Services	
Mercy Hospital of Folsom	106	✓ (basic)	✓		✓	-Labor & delivery -Nuclear medicine -Physical therapy -Respiratory care services	
Mercy San Juan Hospital	370	✓ (Level II trauma center)	✓	✓		-Ambulatory surgery -Cardiac catheterization lab -Cardiovascular surgery -Labor & delivery -Neonatal ICU	-Nuclear medicine -Pediatric (in patient) -Physical therapy -Respiratory care services
Mercy General Hospital	419	✓ (basic)	✓		✓	-Ambulatory surgery -Cardiac catheterization lab -Electrophysiology (out patient) -Nuclear medicine -Occupational therapy	-Physical therapy -Radiation therapy -Respiratory care services -Social services -Speech pathology
Kaiser Foundation Hospital – Roseville	340	✓ (basic)	✓			-Ambulatory surgery -Audiology -Cardiac catheterization lab -Labor & delivery -Neonatal ICU -Nuclear medicine	-Occupational therapy -Pediatric (in patient) -Physical therapy -Respiratory care services -Social services -Speech pathology
Kaiser Foundation Hospital – Sacramento	287	✓ (basic)	✓	✓		-Ambulatory surgery -Cardiac catheterization lab -Nuclear medicine -Occupational therapy	-Physical therapy -Respiratory care services -Social services
Sutter Medical Center, Sacramento	523	✓ (basic)	✓			-Ambulatory surgery -Cardiac rehabilitation -Labor & delivery -Neonatal ICU -Nuclear medicine -Pediatric (inpatient)	-Occupational therapy -Pediatric (inpatient) -Physical therapy -Radiation therapy -Respiratory care services -Social services
University of California, Davis Medicine Center	627	✓ (Level I trauma center)	✓	✓	✓	-Ambulatory surgery -Audiology -Burn unit -Cardiovascular surgery	-Occupational therapy -Pediatric (in patient) -Physical therapy -Plastic surgery

Facility Name	Beds	Emergency Services	ICU	CCU	Rehab Center	Other Services	
						-Chronic dialysis clinic -Dental service -Labor & delivery -Neonatal ICU -Nuclear medicine	-Radiation therapy -Rental transplant -Respiratory care services -Social services -Speech pathology

Source: Office of Statewide Health Planning and Development (OSHPD) ALIRTS Facility Look-Up (https://alirts.oshpd.ca.gov/AdvSearch.aspx)

Table C2. Community Services in Folsom & the Greater Sacramento Area

Provider (Location)	Service Description
Adult Day Centers/Senior Centers	
Folsom Senior Center (Folsom)	Provides activities and programs for adults ages 55+. The center includes a Senior Lounge and two activities rooms, as well as books, puzzles, games, and organized activities. No membership fee.
El Dorado Hills Senior Day Center (El Dorado Hills)	Provides a warm, nurturing and friendly setting, offering a world of activity for body, mind and spirit; helping adults remain active and involved in the world around them. Friendships blossom while participants enjoy activities designed to add meaning to their lives, improve mental and physical function, and increase their sense of worth. The Centers give families peace of mind and a break from caregiving responsibilities. Senior Day Care also provides supportive services, resources, education and respite care for family members who are taking care of those with dementia and other chronic health issues. Daily rate is $58/day; frequency discounts available.
Rancho Cordova Adult Day Health Care Center (Rancho Cordova)	Serves frail elderly persons and impaired adults ages 18 years and older with health problems, Alzheimer's disease, chronic illnesses, or physical disabilities who are able to continue to live in the community while receiving professional services in a group setting. Accepts adults with Medi-Cal who are under managed care.
Eskaton Adult Day Health Center (Carmichael)	Provides nursing, personal care, therapy, social services and activities; available 5 days per week and covered by Medi-Cal where eligible.
ACC Senior Services (Sacramento)	Promotes the general welfare and enhances the quality of life for our community by identifying, developing, and providing culturally sensitive health and social services for older adults.
Triple R Adult Day Program (Sacramento)	Specializes in care for people with mild to severe memory loss (dementia) and provides a variety of care, including physical assistance with mobility issues and maintaining/developing a sense of overall wellbeing for the participant.
Meal Services	
Meals on Wheels	Meals on Wheels provides home-delivered meals to eligible homebound seniors, as well as at 22 *All Seasons Café* locations in Sacramento County. ACC Senior Services coordinates the Meals on Wheels program in Sacramento and West Placer Counties.
Folsom Senior Center (Folsom)	Meals on Wheels (offered through ACC Senior Services) serves hot lunches to seniors ages 60+ Monday-Friday at the Folsom Senior Center.
El Dorado Hills Adult Day Center (El Dorado Hills)	Provides a hot noon meal and two snacks.
Rancho Cordova Adult Day Health Care Center (Rancho Cordova)	Provides two meals a day; special meals are available for those with chronic diseases (high blood pressure, diabetes, high cholesterol).
Health/Healthcare Services	
Folsom Senior Center (Folsom)	• Blood pressure screenings (provided by Mercy Hospital) • Medicare Help (offered by the Health Insurance Counseling and Advocacy Program [HICAP] • Diabetes Academy (offered by Novo Nordisk)
El Dorado Hills Senior Day Center (El Dorado Hills)	• Physical therapy evaluation and maintenance program • Nursing consultations and oversight • Medication assistance

Provider (Location)	Service Description
Rancho Cordova Adult Day Health Care Center (Rancho Cordova)	• Medical and nursing services – all participants are assigned an individual nurse who is responsible for: monitoring the patient (BP, glucose), communicating with their physician, assisting with mobilization, providing medication assistance. • Social workers – all participants are assigned a social worker who is responsible for: assessing their needs, helping them choose their insurances, troubleshooting problems, and helping the participant with scheduling appointments. • Physical therapy • Dietician • Massage therapy
ACC Senior Services (Sacramento)	• Health and wellness classes (first aid, balance/mobility, fall prevention, self-defense) • Diabetes education and self-management • Advanced medical directives workshop
Social/Exercise Activities & Classes	
Folsom Senior Center (Folsom)	• Senior day trips • Senior dances • Games (bridge, bingo) • Book club • Group and individual exercise programs • AARP driver safety • Music lessons (guitar, bluegrass) • Retirement, estate, and advanced planning • Technology classes (iphone, android) • Art classes (clay)
El Dorado Hills Senior Day Center (El Dorado Hills)	• Live music and dancing • Senior field trips and outings • Group and individual exercise programs • Modified sports (bowling, volleyball, shuffleboard) • Art classes (crafts, ceramics, painting)
Rancho Cordova Adult Day Health Care Center (Rancho Cordova)	• Live music and entertainment • Group and individual exercise programs • Games (bingo, pool)
ACC Senior Services (Sacramento)	• Social clubs and excursions • Arts and culture • Cooking demonstrations • Dance classes • Language classes • Technology classes (MS office, internet/social media, etc.) • Group and individual exercise programs

Provider (Location)	Service Description
	• AARP mature driver course
Transportation Services	
El Dorado Hills Senior Day Center (El Dorado Hills)	Curb-to-curb transportation
Rancho Cordova Adult Day Health Care Center (Rancho Cordova)	Curb-to-curb transportation
Seniors Helping Seniors (Sacramento)	Escorts to appointments, events, and for running errands.
ACC Senior Services (Sacramento)	• ACC Rides provides door-to-door transportation service to Meals on Wheels café sites, senior centers, medical/dental appointments, grocery shopping, field trips and for other errands. • Workshops on learning to use regional transit bus and rail
Home/Housing Services	
Seniors Helping Seniors (Sacramento)	Provides in-home care services to empower seniors to continue to live independently. Services offered include companionship, light housekeeping, shopping/cooking, assistance with personal care, and medication reminders.
ACC Senior Services (Sacramento)	• Telecommunications Education and Assistance in Multiple-Languages (TEAM; provided by ACC Senior Services) assists seniors in understanding their phone bills or resolving complaints with their phone company. • Community Help and Awareness of Natural Gas and Electricity Services (CHANGES; provided by ACC Senior Services) assists seniors in understanding their PG&E bill and resolving issues with PG&E. • Classes (crime prevention; internet safety; scams and schemes) • AARP HomeFit Workshops, which show seniors simple do-it-yourself repairs • Home inspections
Employment Services	
Senior Community Service Employment Program (SCSEP)	Administered by ACC Senior Services, SCSEP provides low-income adults ages 55 years and older community service through Host Agencies while also improving participant's skills to help them find unsubsidized employment.
Caregiver Support	
Folsom Senior Center (Folsom)	• Dementia Caregiver Support Group (offered by the Alzheimer's Association) • Parkinson's Support (offered by the Parkinson's Association of Northern California) • Meaningful Moments: Techniques for Dementia Care (offered by Empire Ranch Alzheimer's Special Care Center)
Seniors Helping Seniors (Sacramento)	Works with family caregivers for those with dementia and Alzheimer's to recognize caregiver burnout, manage difficult behaviors, and help caregivers recognize different stages of these conditions. Also offers overnight stays and 24-hour care if needed.
ACC Senior Services (Sacramento)	• Bridge to Healthy Families seeks to improve access to comprehensive support services for family caregivers and care receivers, through care assessments and home safety checks, care consultations and caregiver support, support groups and educational programs.

Provider (Location)	Service Description
	• Friendly Visitors (part of Legacy Corps, an AmeriCorp program) provides family caregivers with an opportunity to take a break; Friendly Visitors go into the family home and serve as companions to older adults or family members with disabilities. • Support groups for dementia, Alzheimer's, and Parkinson's
Regional/National Resources	
Area 4 Agency on Aging	Serving Nevada, Placer, Sacramento, Sierra, Sutter, Yolo and Yuba Counties and is an Aging and Disability Resources Center (ADRCs), acting as a single point of entry into long-term services and support systems for older adults, people with disabilities, caregivers, veterans and families.
Alzheimer's Association of Northern California and Northern Nevada	Serving communities in northern California and northern Nevada, this chapter provides support, education, training and other resources to increase knowledge about and to support those facing Alzheimer's disease and other dementias.
California Health Advocates (Sacramento)	Non-profit organization focused on Medicare advocacy and education in California.
Del Oro Caregiver Resource Center (Citrus Heights)	Private, non-profit agency serving family and individuals which provides care for brain-impaired adults and frail elderly.
Health Insurance Counseling and Advocacy Program (HICAP) of Northern California (West Sacramento)	Provides counseling and advocacy services for Medicare beneficiaries residing in El Dorado, Nevada, Placer, Sacramento, San Joaquin, Sierra, Sutter, Yolo and Yuba Counties.
Senior Legal Hotline (Sacramento)	Special program within Legal Services of Northern California, providing legal help to seniors and dependents.

Table C3. Services for Adults with Disabilities in Folsom & the Greater Sacramento Area

Type of Service	Service Description	Number of Providers
Adult Day Services *Day Programs provide training for adult clients in at least one of the following areas: self-advocacy, self-care, community integration, or employment training. Some Day Programs have a specific focus, such as volunteer work, art, or literacy.*		
Activity Centers	Day programs that typically serve adults who have acquired most basic self-care skills, have some ability to interact with others, are able to make their needs known, and are able to respond to instructions. Activity Center programs focus on the development and maintenance of the functional skills required for self-advocacy, community integration, and employment.	1 (Roseville)
Behavior Management Program	Community-based day programs that serve adults with severe behavior disorders and/or dual diagnoses who, because of their behavior problems, are not eligible for any other community-based day programs.	1 (Odyssey Learning Center; Roseville)
Community Activity Support Services	Time-limited, community- based adult services, which may have a program emphasis on serving consumers with very specialized needs (e.g., transitional housing, wraparound service, etc.).	1 (Sacramento)
Community Integration Training Programs	Community-based (not licensed sites) day programs that may have a program emphasis on serving clients with a very specialized need or who have not been successfully served in a typical day program.	1 (Rancho Cordova)
Adult Day Care/ Adult Day Health Centers	Provide nonmedical care and supervision to adults 18 years of age or older on less than a 24-hour per day basis.	2 (El Dorado County Senior Day Center; Placerville)
Work and Employment Services *Programs focused on helping adult clients to achieve the goal of paid employment. Employment services can range from participation in structured work activity programs and competitive employment, to providing supported employment group and individual services in collaboration with the Department of Rehabilitation.*		
Work Activity Programs	Programs include but are not limited to Work Activity centers or settings that provide support to clients engaged in paid work.	1 (Roseville)
Transportation Services		
Public Transit		3 operators • Sac RT (Gold Line) • Folsom Stage (within Folsom) • El Dorado Transit (commuter routes from Placerville through Sac along Hwy 50)

Type of Service	Service Description	Number of Providers
Paratransit	Special transportation services for people with disabilities, often provided as a supplement to fixed-route bus and rail systems by public transit agencies.	3 operators • Dial-A-Ride (Folsom) • RT's ADA Connection in Folsom (Sac) • El Dorado Transit (Placerville to Sac)
Ride Share Companies		3 operators • RT SmaRT ride (only in downtown Folsom, but expanding) • Uber (including uberXL and uberSUV) • Lyft (including Lyft Plus)
Applied Behavioral Analysis Services *ABA services is a general term used to describe programs that utilize Applied Behavioral Analysis, which consists of evidence-based techniques for teaching skills and reducing problematic behaviors.*		
Adaptive Skills Training	AST programs are designed to target adaptive skills by training the client's family members/caregivers how to effectively assess, teach and generalize skills. Examples of commonly targeted skills in AST programs include self-care, functional communication, daily living skills and safety awareness.	2 (1st Step ABA, Cameron Park; Fair Oaks)
Behavior Parent Training	Training includes familiarizing family members/caregivers, in a group setting, with the principles of applied behavior analysis (ABA). Training will also include information on tracking and taking data on behaviors, analyzing the function of a behavior and more.	1 (Roseville)
Behavior Intervention Services	BIS provides family members/caregivers with the training and intervention strategies necessary to manage and modify difficult behaviors, while teaching functionally related replacement skills.	1 (Roseville)
Socialization Skills Training	SST is a behavior service that promotes the development of interpersonal and communication skills necessary for successful interactions within home, community and peer group settings.	1 (Sacramento)
Housing Services		
Independent Living Skills	ILS services are provided to clients who are interested in increasing their independence in their natural environment while residing in their own home or in their family's home, or while residing in a care home with a goal of moving out within six months. This community-based program provides instruction in functional skills to adult clients over a period of two years with the goal of increasing the independence of the client.	1 (Shingle Springs)
Supported Living Services	SLS is a service like ILS, but is provided to clients who require on-going training and support to live in their own home. The duration of the services are provided based on an on-going assessment of need.	1 (Rancho Cordova)

Type of Service	Service Description	Number of Providers
Family Home Agency	A Family Home Agency (FHA) approves individual family homes and then offers the opportunity for up to two adult individuals with developmental disabilities per home, to reside with a family and share in the interaction and responsibilities of being part of a family.	1 (Sacramento)
Residential Services	Some adult clients would like to live somewhere other than in the home of their family, but need on-going support to remain safe and healthy. These homes are called care homes and provide meals, supervision or some level of protective oversight and can provide reminders to take medications; staff cannot directly administer medication.	1 (Fair Oaks)
Respite Care Services	Respite services are designed to give caregivers a break from the care and supervision of the client. Respite is not meant to be used as day care or regular babysitting, but as intermittent or regularly-scheduled short-term breaks to allow parents/caregivers to refresh themselves and return to caring for the client. Respite care can occur in or out of a client's home.	2 (UCP of Sacramento and Northern California; Fair Oaks)

Appendix D. Examples of Communities with Unique Aging-in-Place Characteristics

Community Name/Location	Characteristics	Description	Community Model	Website
California Communities				
Carlsbad by the Sea San Diego, CA	Technology test site	Front Porch Center for Innovation and Wellbeing conducted a pilot study with 15 Amazon Echos and compatible smart thermostats and electric plugs to study acceptability and user adaptability. Study found high satisfaction among users with limited mobility and sight. Use has expanded to about half of the residents. Other compatible applications (Ask Marvee/Ask My Buddy) for family members and caregivers are being explored.	CCRC	http://carlsbadbythesea.org/ http://fpciw.org/story/amazon-alexa-voice-activated-model-engagement-world-possibilities/
St. John's Village Woodland, CA	Students in residence	CCRC students have free housing and work 10hr per week with residents; nurses live there too.	CCRC	http://sjrv.org/
On Lok San Francisco, CA	National leader of quality care for frail elderly	On Lok program pioneered the model of care: Program of All-inclusive Care for the Elderly (PACE), which is a certified Medicare program replicated throughout the US. Program supports in-home aging of frail and low-income elderly with coordinated medical care, nutrition, senior services, adult day health center and Alzheimer's program. Transportation services provided for care and adult day health center.	NORC	https://onloklifeways.org/services/
Rolling Oaks Senior Apartments Rocklin, CA	Nurse education and training	One of 40 Housing and Urban Development grantees in the region for affordable aging-in-place. A federally-funded registered nurse helps with health prevention and maintenance 20 hours per week and a social services director coordinates community engagement. UC Davis BIMSON partnered with Rolling Oaks to have student nurse trainees help residents identify health goals, act as medical advocates, and track residents' physical and mental health outcomes. Funded through an I-WISH federal HUD grant. To date, of the 87 residents, 18 are participating in the I-WISH program.	NORC	https://www.voa.org/housing_properties/rolling-oaks
U.S. Communities				

Community Name/Location	Characteristics	Description	Community Model	Website
Oatfield Estates Milwaukie, OR **Blue Horizon** Enterprise, OR	Built environment (dementia focused) Technology	Retirement communities that emphasize the importance of home design to improve quality of life for adults with dementia. Technology was developed and tested at Oatfield Estates for nine years before rolling out the caregiving and prevention technology to other facilities like Blue Horizon. Residents wear tracking pendants and data are used by staff and families for immediate assistance and health monitoring. Example: resident walks into kitchen alone and an email alert is sent to staff, but if a caregiver is already present, no alert is sent. Residents can use a smart phone picture to recall a staff name. Sleep patterns are monitored as well.	CCRC	http://www.elitecare.com/locations/milwaukie-oatfield-estates/ https://www.wired.com/2001/11/aging/ https://seniorhousingnews.com/2009/07/15/portlands-curotek-technology-brings-a-new-way-to-care-for-alzheimers-residents-at-blue-horizon/
Lantern Chagrin Falls, OH	Built environment	A memory care facility with interior design that mimics a 1950s streetscape with tiny homes and porches, overlooking a golf course. Lighting changes from day to night. Lantern finds that this familiar setting reduces anxiety, anger and depression.	CCRC	https://www.countryliving.com/life/a39630/nursing-home-tiny-houses/
Albert Lea, Minnesota	Intergenerational living Built environment	Part of the Blue Zones Project, this pilot project town adopted characteristics of communities that had long life spans due to healthy living (Ikaria Greece, Okinawa Japan, Nicoya Cost Rica, Loma Linda California, Sardinia Italy). The community targeted tobacco use, healthy eating, built environment, and citizen and employer engagement to improve quality of life and longevity.	NORC	https://albertlea.bluezonesproject.com/
Beach Cities, California	Public-private partnership Community health and wellness Built environment	Part of the Blue Zones Project, this Los Angeles community is designing the “Healthy Living Campus” which provides preventive care to all residents and will build housing for older adults who can no longer live independently but want to remain in their town. Overseen by Beach Cities Health District, a preventive health service agency that provides health and wellness services to all ages. This “aging-in-place” facility will have providers from several health systems on site (i.e., UCLA, Torrence Memorial, Providence) that serve the broad population as well as geriatric social workers and dementia care staff for older adults.	NORC/CCRC	http://www.bchd.org/HealthyLivingCampus

Community Name/Location	Characteristics	Description	Community Model	Website
Mirabella Portland, OR	Academic-private partnership Research site Technology	A continuing care retirement community that collaborates with an OHSU-Intel partnership to research technology that supports aging in place. Residents giving informed consent have sensors throughout the apartment that passively record activity. Based on marketing materials, its target population is wealthier, well-educated, active retirees who enjoy an urban setting and wish to age-in-place. It offers independent living, assisted living, memory care, and short- and long-term skilled nursing services for acute or extended nursing care needs.	CCRC	https://www.youtube.com/watch?v=hXCLQKvHLY4 http://katu.com/news/local/ohsu-study-monitors-seniors-in-effort-to-allow-them-and-others-to-age-in-place https://www.oregonlive.com/living/index.ssf/2012/12/mirabella_portland_takes_boome.html
The Villages Orlando, FL	Technology Lifelong learning	There are 115,000 residents living in one of 10 community development districts across 36 square miles and 9 million square feet of commercial space. In addition to typical CCRC recreational amenities, The Villages designated three subdivisions for families; a project with Voyage Auto that is piloting an autonomous (driverless) taxi service in one district; and an Enrichment Academy for lifelong learning opportunities.	CCRC	https://www.thevillages.com/index.html
Wesley Woods Towers Atlanta, GA	Technology Academic partnership	Located near Emory University, this complex partners with Georgia Tech's Aware Home Research Initiative (see Appendix H) wherein a single apartment in the retirement community is designated as a research lab to study how technology impacts health, wellbeing, entertainment and sustainability for the aging population.	CCRC	http://www.wesleywoods.org/wesley-woods-towers/amenities-services.html http://www.awarehome.gatech.edu/drupal/?q=content/about-ahri
Judson Manor Cleveland, OH	Students in residence Lifelong learning	Cleveland Institutes of Art and Music students live in residence and give performances, assist staff therapists, and socialize with residents (one wrote a biographic account of residents). JM has partnership with Case Western Reserve University to provide learning events and cultural activities close by at University Circle.	CCRC	https://www.judsonsmartliving.org/judson-manor/ https://www.judsonsmartliving.org/about/intergenerational-programs/
Western Home Communities Iowa	Students in residence	University of Northern Iowa. WHC provides university students with subsidized housing ($150 rent and 15 meals/week) for 10-15 hrs/week of engagement/activities with senior residents. Some students are gerontology or leisure, youth and human services majors.	CCRC	https://www.csmonitor.com/World/Making-a-difference/Change-Agent/2016/0614/At-senior-living-facilities-students-in-residence-programs-catch-on

Community Name/Location	Characteristics	Description	Community Model	Website
International Communities				
Hogewey, Weesp, Netherlands	Built environment	Serves about 150 people with moderate to severe Alzheimer's Disease in 23 residential units that house 6-8 people per unit. It is a closed village setting where residents are able to safely explore and wander outside, eat with friends at a restaurant, grocery shop, or visit a barbershop or theater. Other villagers are geriatric nurses, social workers and caregivers who are trained to support the residents.	CCRC	https://www.alzheimers.net/2013-08-07/dementia-village/ https://www.youtube.com/watch?v=LwiOBlyWpko https://hogeweyk.dementiavillage.com/en/kenniscentrum/ https://www.cnn.com/2013/07/11/world/europe/wus-holland-dementia-village/index.html
Lyon Catholic University, France	Students in residence	The ESDES inter-generations association aims to put international students in contact with older people or families who want to offer lodging in return for their presence in their home and help with some everyday chores.	NORC	http://www.ucly.fr/en/esdes-inter-generations-38902.kjsp
One Roof, Two Generations, Lyon, France	Students in residence	12 city-owned senior independent living residences (1,000 apartments) with 100 subsidized apartments set aside on the top floor of the residences for college students in exchange for their socializing with the senior residents. Students help with shopping, cooking, and socialize with senior residents.	CCRC	https://www.aarp.org/livable-communities/network-age-friendly-communities/info-2015/domain-3-intergenerational-housing-lyon-france.html https://www.expat-agency-lyon.com/english/international-students-lyon/students-accomodation-lyon/intergeneration-home-sharing-in-lyon/
Saxion University, Deventer, Netherlands	Students in residence	Residential and Care Center Humanitas—Six students (to 160 seniors) stay in vacant rooms for free in exchange for 30 hrs per month teaching residents social media, skyping, and graffiti art, and keeping residents company when they are sick.	CCRC	https://www.pbs.org/newshour/world/dutch-retirement-home-offers-rent-free-housing-students-one-condition https://www.citylab.com/equity/2015/10/the-nursing-home-thats-also-a-dorm/408424/
Geel, Belgium	Community-based care for persons with cognitive disabilities or mental disorders	250 people with serious mental disorders or cognitive disabilities board with residents of Geel. This has been a community-based support system for 700 years. Households receive a small stipend for their caregiving.	NA	https://www.npr.org/sections/health-shots/2016/07/01/484083305/for-centuries-a-small-town-has-embraced-strangers-with-mental-illness

Community Name/Location	Characteristics	Description	Community Model	Website
Japan	Community-based care for persons with cognitive disabilities	The Japanese government, in 2005, developed a community-focused policy of supporting people with dementia including awareness-raising; challenging the stigma associated with dementia; and training volunteer supporters for people with dementia (4 million people had been trained by 2012). European governments and NGOs have developed 'dementia-friendly community' initiatives based on the Japanese experience. Germany and Belgium are following suit.	NA	https://ec.europa.eu/eip/ageing/sites/eipaha/files/results_attachments/mapping_dfcs_across_europe_final.pdf
Quayside Toronto, Canada	Technology	Sidewalk Labs, a subsidiary of Alphabet, which owns Google, will pilot a tech-laden community on 12 acres in Toronto. Plans are for energy-efficient pre-fab buildings, mixed use within buildings (i.e., offices, apartments, and distillery). Robots deliver packages/pick up garbage. Target cycling, walking, mass transit and self-driving cars. Sensors in the community will collect data on noise, air pollution, human/vehicular movement, toilet sink water use, etc.	NA	https://www.nytimes.com/2017/12/29/world/canada/google-toronto-city-future.html

Abbreviations: CCRC= continuing care retirement communities; NORC=naturally occurring retirement community

Appendix E. Rapid Evidence Review - Detailed Methods & Results

Table E1. Inclusion/Exclusion Criteria

	Inclusion Criteria	Exclusion Criteria
Population	Older adults (≥55) or adults with a physical, developmental, intellectual, or sensory disability	
Setting	Homes, residences, or communities within countries categorized as "Very High" on the Human Development Index (as defined by the United Nations Development Programme)*	Countries not categorized as "Very High" on the Human Development Index
Interventions	**Smart home technologies** (e.g., sensors, devices incorporated into the residential structure) **Remote monitoring technologies** (e.g., sensors, devices typically worn by an individual or manually used on a daily basis) **Telehealth interventions** **Built environment** (e.g., street light design, green space) **Community personnel interventions** (e.g., interventions delivered in a community center, home visits by a nurse, neighborhood health kiosks)	
Comparisons		
Outcomes	**Health outcomes** (e.g., changes in BP, weight, falls) **Healthcare utilization** (e.g., ED visits, hospitalizations) **Health behaviors** (e.g., physical activity, diet) **Social interactions** **Quality of life** **Adverse effects/harms** (e.g., sensor false-alarms) **Technology acceptance**	
Study designs	Randomized, controlled trials; cohort studies; cross-sectional studies; systematic reviews (of included study designs); meta-analyses	Other study designs
Study quality	Good- and fair-quality studies	Poor-quality studies
Language	English	Non-English
Timeframe	Review of reviews: 2005 – present Reviews of recent primary research: 2015 to present	Published before indicated search dates

**"Very High" HDI countries: Andorra; Argentina; Australia; Austria; Bahrain; Belgium; Brunei Darussalam; Canada; Chile; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hong Kong; Hungary; Iceland; Ireland; Israel; Italy; Japan; Korea (Republic of); Kuwait; Latvia; Liechtenstein; Lithuania; Luxembourg; Malta; Montenegro; Netherlands; New Zealand; Norway; Poland; Portugal; Qatar; Romania; Russian Federation; Saudi Arabia; Singapore; Slovakia; Slovenia; Spain; Sweden; Switzerland; United Arab Emirates; United Kingdom; United States*

Table E2. Rapid Evidence Review – Detailed Findings for Smart Home Technology (Review of Reviews)

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
Vegesna (2017)[61] **1/2005 – 9/2015**	Adults	• Smartphone/PDA • Wearable devices • Biosensor • Computerized systems • Multi-component interventions	• 62 studies included; 44 were RCTs • 12 studies used smartphone/PDAs, 11 studied wearable devices, 7 studied biosensors, 6 studies included computerized systems and 26 studies comprised multiple technologies • Majority of studies included a feedback loop where a physician or nurse collected and provided feedback to the patient regarding the remotely captured data • Most studies were descriptive, and only reported that most health outcomes were "positive" • Only a few studies reported cost outcomes – tended to be neutral or cost-saving compared with control group	• Limited research on patient activation and costs • Future research should explore long-term healthcare utilization and costs in various patient populations such as those with chronic disease
Liu (2016)[54] **1/2010 – 10/2014**	Adults ≥60 years requiring continuous care (including permanent monitoring) and who have activities of daily living (ADL) limitations	Home health monitoring technologies: • physiological • functional and emergency detection/ response • safety monitoring/ assistance • security monitoring/ assistance • social interaction monitoring/ assistance • cognitive and sensory assistance	• 48 studies included; largest proportion were RCTs (19%) or feasibility studies (15%) • Nearly half (48%) were conducted in the US • Most studies looked at technology acceptance (40%) or clinical outcomes (33%); only 2% looked at economic outcomes • 66% of studies found that smart homes and home health-monitoring showed advantages over no monitoring or other types of interventions • 1 good quality RCT found that older adults maintained physical/cognitive status and ADL function and mobility when this tech was used • 1 good quality RCT found that older adults with chronic illness and comorbid depression had reduced symptoms and	• None of the included studies used theories that helped explain intent to use or usage behaviors; employing a theoretical framework would help researchers achieve better understanding about the reasons why older adults accept or reject home health tech • Lack of studies examining cost-effectiveness or studying technology costs or sustainable reimbursement models • Limited follow-up (mean f/u across studies was 0.92 years)

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
			numbers of post-discharge ED visits due to tech use • 1 good quality RCT found that use of tech to measure/track biometric data by itself did not improve or reduce the decline in frailty status • Pre-post control study found that fall detectors did not reduce fear of falling or number of falls. However, older adults using the tech did report improvements in safety, independence and confidence • Older adults were more accepting of the technology if they believed that it would allow them to stay in their home and age in place; however, overall level of readiness was low	
Peetoom (2015)[60] **1995 – 2012**	Independently living older adults	Monitoring technologies addressing in-home detection of ADLs, significant events (falls) or changes in health status	• 141 studies included • Five main groups of monitoring tech identified: o In-home passive infrared motion sensors o Body-worn sensors o Video monitoring o Pressure sensors o Sound recognition • Research on passive infrared sensors, body-worn sensors, and sound recognition primarily focused on accuracy rates. Improvements in outcomes, efficiency, cost, etc. were rarely reported • Research on video monitoring was mainly used to detect ADL activities, and to recognize posture or postural transitions or to detect falls/events • Research on pressure sensors looked at length of transfer time (sit-to-stand, stand-to-sit)	• Research is in its infancy • Need studies of the usability, functionality and effects of these technologies in real-life settings, and development of "intelligent" algorithms for the analysis and interpretation of the data collected by these systems
Reeder (2013)[56]	Adults ages ≥60 years	• E-health • Health monitoring	• 31 studies included	• 28 studies were deemed emerging or having promising evidence. Even the

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
1/1980 – 10/2011		• Telemedicine • Telehealth • Home-based health technology • Gerontechnology • Gerotechnology	• 58% of studies were classified as emerging, 32% were promising, and 10% were effective (first tier) evidence • Novel health indicators from the effective and promising studies were related to monitoring activity patterns and changes in activity patterns to detect cognitive and physical health status changes • Effective studies described monitored activities that included fall detection, bed occupancy, motion detection, seizure detection, and medication reminders • 87% of studies had an activity-sensing component and 29% had a physiological sensing component. 42% of studies had a safety-monitoring component and 13% had security features for intruder detection • Most studies used passive infrared sensors	three studies classified as effective had limitations (attrition, non-randomized comparison groups, use of historical control) • Need for research based on theoretical frameworks and models • Need for targeted, meaningful indicators in home-based telemonitoring systems • Developing ways to use data from couples or families is important issue
Demiris (2008)[58] **1/1980 – 10/2007**	Elderly adults	Technologies integrated into residential infrastructures	• 21 studies included • Most studies (71%) include functional monitoring or safety monitoring (67%) • Studies did not report impacts on clinical outcomes	• Relatively less focus on technologies that monitor and/or facilitate social interaction • None of the project publications presented evidence of the effects on health outcomes (earlier disease, illness, injury detection, intervention, etc.). • No research included acute episodes requiring ED visits or a possible delay/prevention of nursing home visits • Research agenda for smart homes must include development of an ethical framework for their design and implementation • Further research is needed to address eligibility criteria and user characteristics or clinical conditions that may be more suitable for smart home interventions
Martin (2008)[59] **1/1982 –**	Adults ages ≥18 years with physical	• Social alarms	All four preliminarily included articles were excluded for methodology and design reasons	• Lack of well-designed studies; need to investigate all aspects of the intervention

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
3/2007	disability, cognitive impairment or learning disability who are living at home	• Electronic assistive devices • Telecare social alert platforms • Environmental control systems • Automated home environments • "Ubiquitous homes" (internal and external networks allowing interactive & "remove" control of systems, as well as access to services and information)	1. Hopps 2006 – intervention was a telemedicine application aiming to provide nursing contacts beyond those available under traditional care 2. Jutai 2000 – electronic aids to daily living for young adults with progressive neuromuscular conditions; was a site-control added after study design 3. Sixsmith 2000 – evaluation of an intelligent home monitoring system, applying multi-method approach 4. Vincent 2006 – uncontrolled and not an interrupted time series analysis	(impacts on service users, service providers and organizational processes) • Need for (international) consistency in describing and reporting on technology-enabled interventions • Need more research into adoption of these technologies (high abandonment rates)

Abbreviations: ADL=actives of daily living; ED=emergency department; PDA=personal digital assistant; RCT=randomized controlled trial

Table E3. Rapid Evidence Review – Detailed Findings for Smart Home Technology (Primary Evidence)

Author (Year)	Study Design Location	Aim	Population	Intervention Description	Findings
Dupuy et al. (2017)[64]	Cohort France	Assess the benefits of a multi-task ambient assisted living (AAL) technology platform for both frail older adults and professional caregivers	Frail older adults living at home with their caregivers	"HomeAssist" uses a tablet+app design to provide assistance in three needs domains (everyday activities, safety, and social participation). Sensors were placed in different parts of the home to monitor ADLs. The tablet reminded users of appointments or events, and allowed the user to use video telephoning and collaborative gaming apps to increase social participation. To prevent falls, users were provided with a light path (a sensor detected when a bedside light turns out and illuminates a light path). Sensors were also placed on doors and alerts were triggered if a door was left open and unattended; electronic appliances were similarly monitored.	Caregiver estimates about everyday functioning of equipped patients was unchanged across time, but decreased for control participants. After 6-months, the equipped patients saw a reduction of self-reported objective burden compared to the control group.
Lyons et al. (2015)[63]	Cohort U.S. (Oregon)	Assess the effectiveness of continuous monitoring platforms to detect early or prodromal cognitive decline in older adults living in community settings	Residents age 70+ living alone or with a spouse/partner (not as a caregiver), without impairment based on Mini-Mental State Exam or Clinical Dementia Rating scale, and average health on examination who agreed to have sensors installed	Participant's homes were outfitted with sensors (passive motion sensors and wireless magnetic sensors); personal computers also served as another type of sensor (time spent, mouse movements). Based on specific research needs, some homes received additional sensors (medication trackers, phone monitors, wireless scale).	Sensors were able to detect "behavior signatures" that could predict increased risk of needing to transition to a higher level of care.
Rantz et al. (2015)[62]	Cohort U.S. (Missouri)	Compare length of stay (LOS) of residents living with embedded sensor systems and automated health alerts	Residents of TigerPlace[a] between March 2010 and December 2014 who lived with sensors in addition to usual care	Residents voluntarily chose to live with the sensor systems embedded in their apartments. Care coordinators received health alerts and followed up as appropriate with early assessments	Residents living with sensors were able to reside at TigerPlace 1.7 years longer than those without. Residents without sensors were able to reside at TigerPlace 2.6 years, versus the national median of 1.8

Author (Year)	Study Design Location	Aim	Population	Intervention Description	Findings
			(IG) versus residents who did not (CG)	and interventions to resolve potential health changes.	years, which may be due to the RN care coordination model at TigerPlace. Potential savings of living at TigerPlace with sensors versus nursing home estimated at $30,000 per person.

Abbreviations: ADL = activities of daily living; CG = control group; IG = intervention group

(a) TigerPlace (Sinclair Home Care) is a home care agency operated by the University of Missouri Sinclair School of Nursing and provides routine assessment, wellness activities, social work services, exercise classes, health promotion activities, and veterinary services. Registered nurses on staff are on-call 24/7 to assist with triaging any emergencies and operate a wellness clinic.

Table E4. Rapid Evidence Review – Detailed Findings for Built Environmental Design (Review of Reviews)

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
Barnett (2017)[70] **1/2000 – 9/2016**	Older adults (studies with mean age ≥65 years)	• Built environment • Neighborhood environment	• 100 studies identified • 94% were cross-sectional studies • 46% set in N. America (36% USA) and 22% in Europe • Strong evidence that neighborhood walkability, overall access to destinations, services, and recreational activities, and crime-related personal safety were positively associated with older adults total physical activity (PA) • Perceptions of crime-related personal safety, access to/availability of recreational facilities, parks/open space, greenery and aesthetically pleasing scenery and destination diversity (land-use mix) were all positively (significantly) associated with perceived total PA, but not objective total PA • Strong evidence supported the role of greenery and aesthetically pleasing scenery on levels of total PA • Findings show that perceptions of crime have more influence on behavior (e.g., leaving the house) than objective crime rates	• Better understanding of fear of crime and assessment of the emotional rather than cognitive responses to crime; moderators of the relationship between PA and safety • Future research would benefit from assessing and adjusting for residential self-selection to account for biases at the individual level • Longitudinal and quasi-experimental studies are needed to establish causal relationships between PA and BE
Cerin (2017)[71] **1/2000 – 9/2016**	Older adults (with mean age ≥65 years)	• Built environment • Neighborhood environment	• 42 studies assessing built environment impacts on active travel (walking or cycling to a destination – incidental PA, goal of AT is to reach a destination, not accumulate PA) • All were cross-sectional studies • 43% were set in N. America and 21% in Europe • Positive associations with total walking for transport were found for residential density/urbanization, walkability, street	• Longitudinal and quasi-experimental studies are needed to establish causal relationships between BE and active transport • Address selection/sampling bias • Most studies use self-report of AT – studies would benefit from GPS-enabled logging

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
			connectivity, overall access to destinations/services, land use mix, pedestrian-friendly features, and access to several types of destinations • Littering/vandalism/decay was negatively associated with total walking for transport • Public transport stops, shops/commercial destinations, and parks/open spaces/rec facilities were the most consistent correlates with AT • Good access to public transport is particularly important to older adults who do not live in destination-rich neighborhoods and have limited/no access to private travel options • Pedestrian-friendly features such as well-maintained footpaths and indoor places for walking were positively associated with total and within-neighborhood walking • Older adults considered the presence, quality and pedestrian-friendliness of footpaths as the most important test of micro-environmental features encouraging walking • Having safe places for rest (benches/siting facilities) is important	
Besser (2017)[72] **2/1989 – 3/2016**	Community-dwelling adults aged ≥45 years	• Built environment • Neighborhood environment	• 25 studies identified • Lower neighborhood SES was associated with worse cognition. Cognition improved when living in a neighborhood with a greater % of adults ≥65 years • Two studies found that neighborhoods in poor condition (deteriorating public spaces) were associated with accelerated cognition decline, but those lacking pedestrian facilities were not • Three studies found that increased distance to community resources and the presence of a community center (but not	• Studies need to use sampling weights or propensity scores to reduce selection bias and use multiple imputation to address bias due to missing data • Studies need to effectively measure and control for individual characteristics that are likely associated with neighborhood characteristics and cognition to reduce residual confounding • Need better ways to define neighborhoods than census tracts • Need better neighborhood measures, and need to collect data re: the

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
			presence of recreation centers and institutions) was associated with better cognition • 4/5 studies found that individual-level SES modified the association between neighborhood social environment and cognition • Two studies found that low SES and living in a low SES neighborhood negatively impacted cognition; two other studies found that the association was strongest when personal SES did not match neighborhood SES	neighborhoods at the same time as data re: cognition • Studies need to account for longer term neighborhood exposures that may be more important than late-life neighborhood exposures • Studies need to address regional context and the potential influence of nearby neighborhoods and comparability across regions • Studies should use more specific cognitive tests than the mini-mental state exam (MMSE)
Eisenberg (2017)[65] **1/1990 – 1/2015**	Persons with disabilities (hearing, vision, cognitive, ambulatory, self-care or independent living difficulties)	• Built environment • Neighborhood environment	• 14 studies identified • 10/14 conducted in US • All looked at ambulatory disabilities; 4 with visual, 3 with cognitive and 2 with hearing difficulties • Most barriers to PA fell into "design" categories: physical barriers (uneven sidewalks, inadequate lighting, barriers on paths), temporal barriers (stop light timing, maintenance re: snow and rain puddles), and behaviors of other people (pressure to keep up with pace of others, crowded sidewalks, fear of motorists) • Built environment can increase the effect of having a disability on PA – for example, due to low sense of safety and security, people would not walk at night or, alternatively, having facilitators present (benches, good lighting) promoted walking	• Lack of studies on people with non-ambulatory disabilities, particularly sensory and cognitive disabilities • Most studies were of older adults – need to include a more generalizable population of people with disabilities • Studies need to assess not only whether an environmental facilitator is present but the quality of the facilitator (sidewalk presence vs. condition)
Vaughan (2016)[73] **1/2001 – 2/2014**	Adults > 55 years	• Built environment • Neighborhood environment	• 12 studies identified • 11/12 studies were cross-sectional (one longitudinal) • 4/5 studies found significant associations between walkability measures and community participation	• Wide variability in assessment methods of the environment – need for consistent measurement approaches • Need study designs to better measure the causality of associations

Author (Year) Search Dates	Population	Included Interventions	Findings	Research Gaps/Limitations
			• 6/7 studies showed a positive relationship between land-use diversity and community participation, particularly the number of community members participating • 4/4 studies found significant associations between living with or near friends and community participation • 5/7 studies found significant associations between perceived social support and participation • 5/6 studies measuring “neighborliness” found significant positive associations • 2/5 studies found significant association between transportation and participation but they were conducted with more physically limited or older populations than the other studies • Mixed associations were found in relation to civil protection services, likely due to differences in setting (i.e. in urban samples crime was significantly associated with participation) • Effects found between community participation and neighborliness, perceived social support, land-use diversity, street connectivity/walkability, civil protection services, and transportation services were small to moderate	

Abbreviations: AT=active travel; BE=built environment; PA=physical activity; SES=socioeconomic status

Table E5. Rapid Evidence Review – Detailed Findings for Built Environmental Design (Primary Evidence)

Author (Year)	Study Design Location	Aim	Population	Intervention Description	Findings
Van Holle et al. (2016)[67]	Cohort Belgium	Examine associations between neighborhood social factors and physical activity (PA) and sedentary behavior (SB) in older adults	431 community-dwelling adults ≥65 years	Participants were visited twice by a trained interviewer and wore an accelerometer in between two visits for seven consecutive days. The first visit assessed self-reported physical functioning, physical activity and TV viewing. The second visit consisted of collecting the accelerometer and an interview assessing sociodemograhics and the neighborhood social environment	Increased frequency of social interaction with neighbors was associated with higher levels of self-report walking for both transportation and recreation. Social interactions with neighbors was also negatively associated with overall sedentary behavior and television viewing. Diverse neighborhood social composition was also associated with higher levels of self-report walking.
Clark et al. (2015)[66]	Cohort U.S. (Chicago)	Investigate whether resource-rich neighborhoods can act as a source of cognitive reserve by stemming declines in cognitive function with age	6,518 adults ≥65 years who participated in the Chicago Health and Aging Project	Based on data collected from 1993-2011 (including medical history, lifestyle factors, demographic/psychosocial characteristics, as well as standardized tests of physical and cognitive function), a three-level growth curve model was constructed to examine the role of individual and neighborhood factors no trajectories of cognitive function	Residing in a neighborhood with community resources, proximity to public transport, and public spaces in good condition were associated with slower rates of cognitive decline.

Table E6. Rapid Evidence Review – Detailed Findings for Community-based Interventions (Primary Evidence)

Author (Year)	Study Design Location	Aim	Population	Intervention Description	Findings
Szanton et al (2016)[68]	Cohort U.S. (Maryland)	Assess whether an interprofessional team can reduce the impact of disability among low-income older adults by addressing individual capacities and the home environment	281 adults ≥65 years who were dually eligible for Medicare and Medicaid, and who reporting having at least some difficulty in performing an average of 4 or 8 ADLs. Participants had to be living in a house, and not be cognitively impaired, receiving skilled home health services or been hospitalized ≥4 times in the previous year	The Community Aging in Place, Advancing Better Living for Elders (CAPABLE) program uses an interprofessional team consisting of an occupational therapist, an RN and a handyman to help participants achieve self-set goals, such as providing assistive devices and making home repairs/modifications to enable participants to navigate their homes more easily and safely	After five months, 75% of participants saw improved performance of ADL; participants also saw improvements in performance of IADLs, such as shopping or medication management. Depressive symptoms improved in over half (53%) of participants.
Scharlach et al. (2015)[69]	Cohort U.S. (San Diego)	Examine an innovative program model that integrates various program components (a comprehensive assessment, differential service intensity, consumer involvement, and use of non-professional support services) and its potential benefits for low-income elderly participants	Adults ≥60 years without severe cognitive impairment or mental illness participating in ElderHelp's "Concierge Club" (CC)	ElderHelp of San Diego's "Concierage Club" is a service organization (requiring membership fee), providing a variety of services, including information/referral services, transportation services, home assessments, and volunteer support services (grocery shopping, housekeeping, home maintenance, financial advocacy, pet care, etc.), care management, and financial assistance.	A significant number of participants reported feeling very confident that they could get the help they needed to age-in-place. The majority of participants reported that accomplishing tasks (shopping, pet care) had become easier since joining CC. Participants were more likely to report leaving their homes or getting to the places they needed to go.

Abbreviations: ADL=activities of daily living; IADL=instrumental activities of daily living; RN=registered nurse

Appendix F. UC Davis Faculty-Stakeholder Interviewees

Name	Title	Department/Organization
UC Davis Researcher		
Diana Cassady, MPH, DrPH	Associate Professor/Director, MPH Program	Department of Public Health Sciences
Sharon Demeter, MA, MS, RN, CNM	Assistant Clinical Professor/Assistant Director, Master's Entry Program in Nursing	Betty Irene Moore School of Nursing
Charles DiCarli, MD	Professor/Director, Alzheimer's Disease Center	Department of Neurology/Alzheimer's Disease Center
Robin Hansen, MD	Professor and Chief of Developmental-Behavioral Pediatrics/Director of Clinical Programs	Department of Pediatrics/MIND Institute - Center for Excellence in Developmental Disabilities
Terri Harvath, PhD, RN, FAAN	Executive Associate Dean/Director, Family Caregiving Institute	Betty Irene Moore School of Nursing - Family Caregiving Institute
Kathy Kim, PhD, MPH, MBA	Assistant Professor	Betty Irene Moore School of Nursing - Center for Future Tech in Cancer Care
Tom Maiorana, MFA	Assistant Professor	Department of Design
Michael Rios, PhD, MCP, MArch	Associate Professor	Department of Human Ecology
Steve Ruder, BA	Coordinator	Transition Through Adulthood Projects, MIND Institute
Marjorie Solomon, PhD	Professor	Department of Psychiatry and Behavioral Sciences/MIND Institute
Susan Verba, MFA	Associate Professor	Department of Design
Community Resources		
Meredith Chillemi	Director	Aging and Education Services, LifeSTEPS
Geoffrey Brown	President/CEO	USA Properties Fund
Pamela Galloway	Resident Wellness Director	Volunteers of America Northern California & Northern Nevada, Rolling Oaks Senior Housing
Chris Callahan, MD	Director	Indiana University Center for Aging Research

Appendix G. Potential Topics for Research in Conjunction with CHI Project

Potential Topics for Research with the CHI Project (suggested by one or more UC Davis faculty)					
		Research Category			
		Clinical Outcomes	Mental/ Emotional Health (Quality of Life)	Technology	Design
1	Use a design lens to guide investigation of complex geographic, economic, and policy questions from multi-stakeholder perspectives				■
	Use a design ethnography approach to study the community				■
2	Workshop with stakeholders/end users: categorize stakeholders' "critical constraints vs. constraints that can be relaxed" by identifying key questions, building prototypes/simulations to quickly learn about their flexible/nonflexible constraints			■	■
3	What is it about this environment that promotes or impedes activity (technology, intentional emotional support, etc.)? Questions can be artificially provocative/controversial to quickly identify barriers and facilitators.		■	■	■
4	Short term: rapid prototype lab could develop prototypes for testing and stakeholder feedback including patient/family/caregiver input into design (home and community)			■	■
5	Long term: a larger on-site community design lab by phases of development with models at scale			■	■
6	What new caregiving interventions can nursing develop to improve population health?	■	■	■	■
7	A longitudinal cohort would allow study of the onset of caregiving in the study and the roles of multiple (congruent/cascading) caregivers as individuals age	■	■	■	■
8	What would the outcomes be for a community that integrates young mothers needing help with babysitting and an older population that might benefit from that relationship?	■	■		
9	What interventions would improve the quality of end-of-life care?	■	■		
10	Is regular exercise protective of falls (improves balance/strength)? How much? How often? What kind?	■			
11	What role can technology and other interventions play in mitigating loneliness?		■	■	
12	How can community design improve social interaction and reduce loneliness among older and disabled adults?		■		■
13	What kinds of social connections improve clinical and emotional health? What are the effects on intermediate outcomes (i.e., medication adherence, less depression, fewer clinic visits, lower blood pressure/fewer meds, etc.) and long-term outcomes (i.e., hospitalizations, living independently, stroke, etc.)?	■	■		

	Potential Topics for Research with the CHI Project (suggested by one or more UC Davis faculty)				
14	Study obesity among intellectually/developmentally disabled	■	■		
15	How can we use artificial intelligence to manage the potentially large volume of surveillance data from monitors in smart homes?			■	
16	The smart home movement is currently monitoring-focused, but how can you make it smart enough to enable a resident do what they want to do rather than be monitored? How can technology help people become/stay connected with people they want to be connected with?		■	■	
17	What was the positive social connectivity aspect of Twitter that diminished over time (and why)? How can that feature/characteristic be recaptured to help with social isolation? (Early evidence demonstrated that Twitter yielded high quality social connectivity.)		■	■	
18	Video connectivity is also demonstrated to help with improved relationships –further study of what works, what doesn't, and why would be useful.		■	■	
19	Proximity sensors (CITRIS project by Sanjay Joshi in the UC Davis Department of Engineering) experimented with more interactive sensors that enabled/supported people with email etc. instead of simply monitoring them. How can we use that sensor technology to improve function and quality of life?		■		
20	How to keep up with rapid technology development and prevent planned smart homes from becoming obsolete by the time they are built?			■	
21	Study the effectiveness of built environment design/characteristics at CHI (i.e., signs with high contrast to improve readability, improved lighting, color-coded pavements by neighborhood, etc.)	■	■	■	■
22	Conduct trials of innovative in-home or community-based technologies at CHI	■	■	■	■
23	Test home-based modes of care delivery and healthy lifestyle interventions in the community	■	■	■	■
24	School of Nursing has a co-design lab where nurses, patients, and caregivers actively participate in design. How can we integrate a similar rapid-prototype lab in the community?		■	■	
25	Using data collected in the community and applying machine-learning dynamic algorithms has potential to improve researcher learning more quickly.			■	
26	What role does (whole food, supplemental) nutrition play in healthy aging?	■	■		
27	What is the optimal built environment that helps adults with developmental disabilities thrive?		■	■	■
General Research Questions and Strategies					
28	Are there research opportunities associated with CHI PCORI-eligible projects?	■	■	■	■
29	Interventions could occur in parts of CHI as compared with a control population in same location.	■	■	■	■

Potential Topics for Research with the CHI Project (suggested by one or more UC Davis faculty)					
30	Review literature for gaps in aging research and use the community to answer these questions.	■	■	■	■
31	Study similarities and differences between populations with developmental vs. degenerative disorders—what are the best practices for addressing overlapping or different challenges for these cohorts?	■	■	■	■

Appendix H. Resources and Laboratories for Research on Aging in Place

Resources and Laboratories for Research on Aging-in-Place: Examples of Smart Home Technology Demonstrations		
University of Florida	University of Florida Gator Tech Smart House. Principal Investigator, Sumi Helal, PhD, uses a 2,500 sq/ft home as an experimental laboratory and live-in trial environment to test technology and systems developed in the Mobile and Pervasive Computing Laboratory. Specifically, Dr. Helal and his research team have been conducting research and development activities designed to assist older persons and individuals with special needs in maximizing independence and maintaining a high quality of life. Testing includes: floor sensors, microwave-based meal prep assistance, a "cognitive assistant" to assist older adults with mild dementia in overcoming difficulties in carrying out basic daily activities by means of reminders, orientation, and context-sensitive triggering. Uses "attention capture" and "anywhere multimedia cueing" to help remind resident to take medication, about an appointment, to feed a pet, etc. Monitor temperature; smart microwave reads directions, measure of sleep quality, sensor on toilet handle as assist to adults with strength or dexterity deficits.	https://www.cise.ufl.edu/~helal/gt.htm#1 https://www.cise.ufl.edu/~helal/pervasive-applications.htm#1 https://www.youtube.com/watch?v=q2hB83F5EII
Georgia Tech	The Aware Home Research Initiative (AHRI) supports a 5000 sq/ft residential laboratory for research about technology that supports aging in place and caregivers of children with autism or other developmental disabilities. Also includes an offsite lab in one apartment at Wesley Woods Towers retirement community in Atlanta where studies with residents can be conducted. Technologies designed to detect falls, monitor safety and mobility, and provide reminder prompts are tested. HomeLab is an AHRI resource comprised of research volunteers aged 50 years and older who are willing to test products in their own homes.	http://www.awarehome.gatech.edu/drupal/?q=content/about-ahri
Oregon Health Sciences University	The Life Lab consists of a population of community-dwelling individuals who have agreed to participate on an ongoing basis in research on technology-based health monitoring, interventions, and support of independent aging. Members of the Life Lab have the ORCATECH (Oregon Center for Aging & Technology) platform installed in their homes and participate in studies ranging from testing new technology to longitudinal behavioral research studies (with other academic and industry partners like Intel).	https://www.ohsu.edu/xd/research/centers-institutes/orcatech/tech/life-lab.cfm https://www.commonwealthfund.org/publications/newsletter/2016/dec/focus-using-technology-find-blind-spots-care-elderly

Resources and Laboratories for Research on Aging-in-Place: Examples of Smart Home Technology Demonstrations		
	The Collaborative Aging Research using Technology (CART) Initiative is a new multi-site, nation-wide project that uses technology and big data to facilitate the independence and health of older adults who are a part of diverse communities. Developed in partnership among the University of Miami, Rush University and OHSU and funded by the National Institutes of Health and the Department of Veterans Affairs, the Initiative is initially using the ORCATECH Life Lab platform on a scale of 240 homes with the aim of expanding the network to 10,000 homes across the U.S. in several years.	https://www.nia.nih.gov/news/nih-initiative-tests-home-technology-help-older-adults-age-place https://www.ohsu.edu/xd/research/centers-institutes/orcatech/tech/The-CART-Initiative.cfm https://www.ohsu.edu/xd/research/centers-institutes/orcatech/tech/rite.cfm
MIT	PlaceLab designed the "House_n," a residential laboratory to test innovative applications and materials to improve quality of life in a home environment. Study volunteers occupy the home for varying lengths of time to test new technologies related to physical activity, home energy, entertainment, communications and learning. Data collected from sensors in the home or on wearables are downloaded off site and require no researcher interaction with volunteers.	http://web.mit.edu/cron/group/house_n/index.html http://web.mit.edu/cron/group/house_n/placelab.html
Organizations Focused on Aging-in-Place Innovation		
LeadingAge	LeadingAge is a non-profit focused on education, advocacy and applied research on aging issues. Its members and partners represent government agencies, businesses, foundations, consumer groups and researchers. It houses the **Center for Aging Services Technologies (CAST)** (focused on "the development, evaluation and adoption of emerging technologies that can improve the aging experience") and the **Center for Affordable Housing Plus** (focused on the "development, adoption and support of innovative affordable housing solutions that enable low- and modest-income seniors to age safely and successfully in their homes and communities").	http://www.leadingage.org/cast/about
Grantmakers in Aging	A non-profit organization of philanthropies committed "to improving the experience of aging." It has documented community innovations and built environments that are age-friendly and facilitates partnerships and funding to create sustainable age-friendly communities. It also houses a database for communities designated as age-friendly.	https://www.giaging.org/

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Director
Joy Melnikow, MD, MPH
Professor, Family & Community Medicine
jamelnikow@ucadavis.edu

Associate Director
Jeffrey Hoch, PhD
Professor, Public Health Sciences

Administrative Manager
Monica Steinhart

Contact Us:
Telephone: 916-734-2818

Website: www.ucdmc.ucdavis.edu/chpr