UNDERSTANDING THE TECHNOLOGY ECOSYSTEM FOR SENIOR LIVING & CARE

Ziegler

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INTRODUCTION

The COVID-19 pandemic has dramatically impacted nearly all aspects of the senior living and care ecosystem. Providers are altering operations to keep their communities safe, caregivers and staff are battling increased anxiety, residents are facing higher levels of isolation, and family members are searching for new ways to connect with loved ones. As these challenges mount, many market participants are relying on technology solutions to help combat the far-reaching effects of the virus. Telehealth solutions, for example, which can virtually connect residents to doctors and other providers, have surged in demand since the pandemic began. Remote monitoring and "smart home" technologies continue to rapidly gain traction, and engagement platforms that enable virtual communication between residents, staff, and loved ones are becoming the new norm. With this in mind, it is critical that senior living providers understand the scope of technologies available to their residents and staff. As such, we have developed this whitepaper to help educate senior living providers and define the array of relevant healthcare technology solutions available in today's market. Within this document, we will outline a number of key trends driving the growth of technology in the longevity economy and provide a high-level overview and explanation of key technology subsectors that are particularly relevant and/or emerging within the senior living market.

This whitepaper is the first document in what will be a series of technology-related publications from Ziegler. In fact, to help providers and operators better understand the ecosystem of technology available to the smart aging community, we expect to publish supplemental white papers over the next year that will review given technology subsectors in more depth and detail. These supplemental reports will, among other topics, explain the general product/service offerings within a given subsector, discus key trends impacting the sector, and list companies providing relevant and/or leading solutions.

KEY TRENDS DRIVING THE IMPORTANCE AND GROWTH OF TECHNOLOGY IN THE "SMART AGING" MARKET

As described below and on the following pages, a confluence of factors is driving the recent expansion of technology solutions and the need for providers in the smart aging community to effectively utilize technology.

COVID-19 has forced the smart aging industry to adjust the way it interacts with residents and delivers care

At the time of this writing, COVID-19 continues its surge throughout the country. While we do not yet know if, or when, the country will return to pre-COVID-19 levels of "normal," it is likely that many forms of medical care and social contact will need to be facilitated at a distance, to the extent possible, for the foreseeable future. Numerous technology solutions are well-suited for this new environment. For example:

- Telehealth offerings can virtually connect residents of all acuities to medical providers via video or phone, thereby helping residents receive routine or even high-acuity care (including behavioral health care) in a timely manner.

- Wearables, clinical sensors, personal emergency response systems (PERS), fall detection offerings, and other monitoring technologies allow residents and providers to track key health metrics in real-time from remote settings, and can help residents prevent adverse health events.

- To combat loneliness and social isolation, smart speakers, voice-first/voice assistant solutions, and other platforms that integrate Skype, FaceTime, or other communication methods are being deployed to help residents interact with both staff and loved ones from a distance. Many providers are also offering virtual community tours, and technology-enabled remote fitness solutions are helping residents remain active. Some of the most innovative providers are also exploring how robots, avatars, and other artificial intelligence software can help engage residents.

Importantly, each of these technologies has the ability to help residents effectively meet various medical and social needs without leaving their homes and with minimal in-person contact from family or staff.

Older adults are rapidly adopting, and gaining comfort with, modern technologies

There is little question that technology adoption amongst seniors has rapidly grown over the last several years. A 2019 study from Pew Research Center found that, "in 2000, 14% of those ages 65 and older were internet users; now 73% are. And while smartphone ownership was uncommon at all ages around the turn of the 21st century, now about half (53%) of people 65 and older are smartphone owners [1]." Adoption data for those specifically age 70 and above reveals similar trends: as shown in the graphs on the following page, a 2019 Link•age Connect survey found that both smartphone and tablet adoption have increased since 2016 for nearly every age cohort above 70[2][3]. Importantly, recent data also suggests that older cohorts of seniors do not just own smartphones and tablets, but also actually use them. As shown in AARP's December 2019, "2020 Tech and the 50+Survey" report, 88% of smartphone owners age 70 and older, and 61% of tablet owners age 70 and older use their respective devices daily[4]. We have not seen comparative usage data over time for wearables, home assistants/ smart speakers, and smart home technology for those 70 and above, but as those technologies become more familiar to aging seniors, we except similar patterns to emerge.

While the findings above show positive adoption trends, gaps remain. The cost of some technologies remains high and adoption rates decline as income drops and age increases. There also appears to be some hesitancy amongst seniors to explore new or
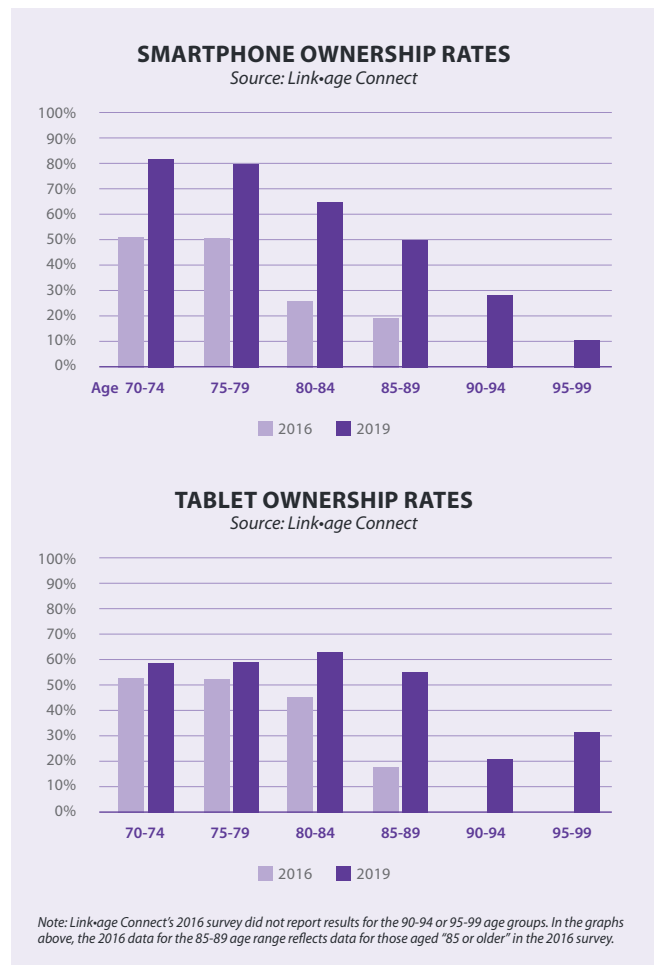
upgraded components of familiar devices. The 2019 Link•age Connect survey referenced earlier discovered that, "While the [survey] respondents report owning many of the common technologies today…they aren't as interested as their younger cohorts to get the latest and continue updating. In fact, most of our respondents reported having no interest in learning about new technologies…If the device works for them, they are more likely to keep it much longer." At the time of this writing, we have seen not comprehensive data around how COVID-19 has impacted technology adoption amongst seniors, but Ziegler observations and first-hand reports from providers and technology companies suggest that adoption levels have increased, out of necessity, during the COVID-19 pandemic. Regardless, smart aging operators will certainly need to consider these "gaps" and potential hurdles when exploring technology solutions for their communities.

Expected caregiver shortages and labor-related challenges will require operators to leverage technology in innovative ways
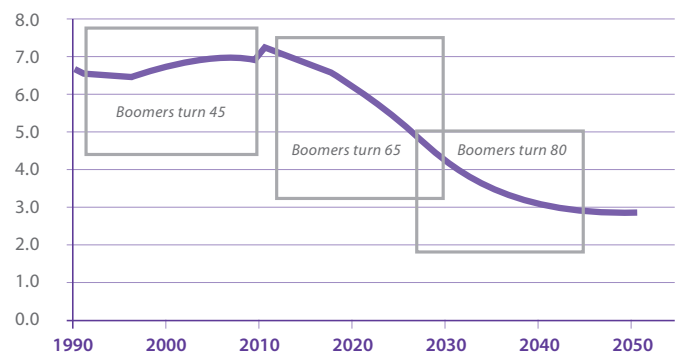
Labor-related challenges have concerned smart aging operators for several years, and at this point, most are likely familiar with the demographic trends fueling some of these worries: By 2030, every Baby Boomer will be age 65 or older, which means that one out of every five U.S. citizens will be of retirement age, and by 2035, people over age 65 will outnumber children for the first time in U.S. history [5]. Additionally, as shown in the chart below that was generated in 2013, the caregiver support ratio – which is used to estimate the availability of family caregivers over the next several decades – indicates that the number of available family caregivers will significantly decline in the coming years. The ratio, as defined by AARP, is "the number of potential family caregivers aged 45-64 for each person aged 80 and older" – those most in need of long-term services and support. In 2010, the caregiver support ratio was more than seven potential caregivers for every person in the "high risk" years of 80-plus; by 2030, the ratio is expected to fall to 4:1 and by 2050, the ratio is expected to reach 3:1 [6].

More aging adults and fewer family caregivers means that smart aging operators will likely need to expand their labor forces to meet increased demand; however, an array of hurdles confront smart aging leadership teams, including the following:

- Increased competition for labor pool
- Rising minimum wages in states & cities
- COVID-19-related labor shortages
- Caregiver burnout
- Stigmas of smart aging communities and other PR challenges post-COVID

SMARTPHONE OWNERSHIP RATES
Source: Link•age Connect

TABLET OWNERSHIP RATES
Source: Link•age Connect

Note: Link•age Connect's 2016 survey did not report results for the 90-94 or 95-99 age groups. In the graphs above, the 2016 data for the 85-89 age range reflects data for those aged "85 or older" in the 2016 survey.

CAREGIVER SUPPORT RATIO IN THE U.S.
Source: AARP Public Policy Institute

While technology will not remedy all workforce challenges, there are solutions that can assist employers in recruiting high-quality staff, reducing turnover, and engaging their workforces to promote retention, among other benefits. Additionally, some providers are beginning to explore how smart speakers, smart home technologies, wearable devices, and other technologies can potentially replace certain functions historically provided by direct care staff and other employees. Technologies are also being rapidly developed and deployed to mitigate the spread of COVID-19 and increase employee safety. Given the expected labor challenges that the sector may face for several years, it is important that smart aging providers become familiar with current technology offerings and explore the various ways they can help one's community.

Technology solutions are proving they can enhance care delivery and resident health

Perhaps the most basic yet important component of a technology solution is ensuring that it actually "works;" that it effectively helps mitigate the problem it intends to address. As shown below, numerous technology solutions have generated evidence proving that they can enhance care and improve health in multiple ways.

- Telehealth solutions that virtually connect residents to physicians and other caregivers have successfully reduced unnecessary hospital visits.

  - In 2019, **Third Eye Health** performed over 70,000 patient consults with a **treat in place rate of 94% and an average Return to Hospital reduction of 25% to 80%** across its customer base which includes post-acute care facilities[7].

  - **Curavi Health,** which merged into **Arkos Health** in July 2020, has provided telehealth services to post-acute long-term care facilities for approximately four years. The company has maintained a **94% treat-in-place rate** and performed ~60,000 remote consults since its founding [8].

- Numerous companies have created fall prediction/prevention technologies that are generating positive results.

  - **Virtusense,** an artificial intelligence company that is using proprietary technology to prevent falls, pressure injuries and provide proactive care, notes that its technology has **reduced falls in skilled nursing settings by as much as 79%** and **improved resident mobility by 85%**[9].

  - Real-time fall detection using **SafelyYou's** artificial intelligence-enabled video recording **reduced the need for emergency services by 80% in dementia care facilities,** according to research results published in 2019 in *The American Journal of Managed Care* [10].

- Platforms and devices that enable remote/in-home resident monitoring have become increasingly popular over the last decade. Some of these monitoring solutions focus on specific chronic conditions (i.e. diabetes, cardiac care) while others offer solutions that monitor vital signs or other, broader measures of health. A number of these solutions have published evidence on their effectiveness, and while there are too many companies to list in this document, notable offerings include those from **BioIntelliSense, Blue Willow Systems/Philips, BlueStar Senior Tech, Cosan Group, Foresite Healthcare, Sensico Systems, Sentrics, Stay Smart Care, Vigil Health Solutions, VitalTech,** and many others.

- Several companies have recently released innovative technologies in an effort to protect resident and staff health by mitigating the spread of COVID-19.

  - **CarePredict,** a developer of machine learning-driven wearables and aging-in-place solutions for seniors, launched its PinPoint toolset in March 2020, which offers contact tracing, location tracing, path tracing, and room traffic tools for smart aging communities.

  - **Accushield** has integrated multiple new features into its sign-in kiosk/visitor management system including COVID-19 screening questions and an integrated touchless temperature capture feature that allows communities to record the body temperature of every staff member, visitor, and third-party caregiver that enters a facility.

OVERVIEW OF KEY "SMART AGING" TECHNOLOGY SUBSECTORS

Within the overall smart aging market, there are countless subsectors of technology solutions, some of which are newer to the market while others have existed for a number of years yet continue to mature and evolve in sophistication. Many subsectors deliver their technologies in unique ways that can be dependent on the intended user base. For example, some technology-enabled solutions are "device-centric" and/or can be physically worn 24/7, others enable real-time connectivity to caregivers through smartphones or tablets, and some are "platform-based" solutions that build and license software which can quickly capture, analyze and present data from disparate sources. The breadth of solutions is vast, but the paragraphs below highlight the key subsectors that Ziegler feels senior living providers should be particularly attuned to, and as part of that discussion, we have included representative examples of solutions within each subcategory. As noted earlier, we expect to publish supplemental white papers over the next several months that will provide a deeper-dive of many of the subsectors listed below.

KEY "SMART AGING" TECHNOLOGY SUBSECTORS

- TELEHEALTH SOLUTIONS
- COMMUNICATION & ENGAGEMENT SOLUTIONS
- WORKFORCE SOLUTIONS
- BRAIN FITNESS / COGNITIVE CARE SOLUTIONS
- RESIDENT MONITORING, SAFETY, AND FALL SOLUTIONS
- CARE COORDINATION SOLUTIONS
- SMART HOME TECHNOLOGY

TELEHEALTH SOLUTIONS

Social distancing requirements, pandemic-related provider shortages, and recent legislative developments have dramatically increased telehealth's utilization over the last several months and transformed telehealth from a "nice to have" to a "must have" feature in smart aging communities. While the telehealth sector is vast and includes numerous use cases, many of the most common "resident-facing" telehealth offerings are those that virtually connect residents of all acuities to medical providers via video or phone, day or night. These types of solutions not only help residents receive care rapidly, but also allow providers to remotely monitor residents with mild COVID-19 or other symptoms, enable provider-to-provider consultation, enhance a community's after-hours provider coverage, and help residents receive routine or even higher-risk care (including behavioral health care) from the comfort of one's home. Given the recent dramatic increase in demand for telehealth, it is likely that providers and residents who have become accustomed to the ease and efficacy of telehealth will want to continue using these solutions once the pandemic ends, and while it is anticipated that reimbursement for telehealth services will continue in some form following the pandemic, it is unclear what exactly that will entail. At the time of this writing, Congress and CMS have not yet ruled on future reimbursement policies, yet federal and state governments are under increasing pressure from lawmakers, providers, and industry groups to permanently expand telehealth coverage to ensure that individuals of all ages and acuities can easily access affordable virtual care in any location and on any device.

Sample Companies

Avera eCARE®   CORSTRATA   FOREFRONT TELECARE

THIRD EYE HEALTH   Total Triage A Care·XM™ COMPANY

COMMUNICATION & ENGAGEMENT SOLUTIONS

At the highest level, communication and engagement solutions in the smart aging sector help foster relationships amongst residents, their families, and staff – an objective that is particularly important in the era of COVID-19. These solutions have rapidly evolved over the last several years and often serve multiple purposes, including: (i) helping providers communicate developments/updates around resident activities, dining menus, and other announcements to current and prospective residents; (ii) enabling and encouraging resident-to-resident interaction, thereby increasing social connectivity and reducing isolation; and (iii) allowing residents to more easily connect with family members and loved ones via video or messaging. Many communication and engagement solutions are accessible using smartphones, tablets, or televisions, and some technology providers have developed voice-enabled commands that integrate with smart speakers or other smart home technologies. Additionally, a number of technology providers in this sector are continually enhancing their product by adding new modules or "plug-ins" via acquisitions or partnerships with other technology providers (i.e. integration with telehealth and/or remote monitoring solutions, addition of brain-fitness modules, or the ability to create video clips and life stories to enhance engagement).

Sample Companies

WORKFORCE SOLUTIONS

As explained on prior pages, staff recruitment, retention, and engagement are common pain points amongst many smart aging operators, particularly in the era of COVID-19; as such, technology providers are addressing these labor-related challenges from numerous angles. For example, some technology providers have developed "employee-facing" solutions designed to directly benefit staff, such as offerings that provide same-day access to earned wages or those that enable caregivers to find open work shifts "on demand." Alternatively, there are a number of solutions designed more for smart aging management teams such as technologies that leverage algorithms and analytics to identify successful job applicants, solutions that help organizations improve their scheduling and timekeeping practices, as well as technologies that enhance employee training, credentialing, and compliance. While this subsector is becoming increasingly crowded, there are emerging "winners" who are proving with data and use cases that they can help smart aging providers mitigate the numerous labor-related challenges mentioned earlier.

Sample Companies

BRAIN FITNESS / COGNITIVE CARE SOLUTIONS

After the age of 65, one's risk of developing dementia doubles approximately every five years[11], and 50% of primary care physicians believe the medical profession is not ready for the growing number of people with Alzheimer's and other dementias[12]. Given these and other related trends, dementia has become an increasingly larger part of the healthcare conversation, and technologies designed to prevent or help mitigate memory impairment have emerged. A number of these "brain fitness" offerings are web-based platforms that provide cognitive exercises which residents can use on their own, while other solutions offer more structured group programs or platforms for staff to utilize when caring for older adults with memory impairment. Many smart aging providers have integrated these solutions into programming and services for those with and without a diagnosis of dementia, and when utilized correctly, these technologies can not only help mitigate memory impairment, but are often seen as helpful in improving the overall health and quality of life for residents.

Sample Companies

RESIDENT MONITORING, SAFETY, AND FALL SOLUTIONS

The terms "in-home monitoring," "remote monitoring," "safety solutions" and "fall detection solutions" are becoming increasingly difficult to distinguish. In general, most safety, monitoring, and fall solutions use digital/ wearable technologies to record a resident's health data and automatically alert providers in real-time when readings exceed predefined parameters, and/or allow residents to rapidly call for help in the case of self-identified emergencies. The scope and sophistication of solutions in this subsector is vast and addresses a range of acuities. Representative solutions include, among other offerings: (i) PERS solutions which, with the release and adoption of smartphones, smartwatches, and the emergence of artificial intelligence, have dramatically evolved from the historical "I've fallen and I can't get up" pendants; (ii) other wearable devices that monitor, record, and analyze in real-time health metrics such temperature, heart rate, pulse oximetry, etc.; (iii) "intelligent sensors" and other devices that are placed throughout the home to track resident movement and vital signs; and (iv) technology-enabled solutions that facilitate daily virtual "check-ins" to identify and monitor concerns in real-time. Additionally, because elderly falls often generate adverse health and economic consequences, a related market for wearable fall prevention / gait-related technologies has rapidly developed. While there are certainly companies who solely offer fall prevention solutions, it is also common to see fall prevention technologies "bundled" or included as features in other safety and monitoring offerings. Overall, the technologies in this subsector are critical in prevention efforts aimed at keeping older adults independent as long as possible, particularly in the era of COVID-19.

Sample Companies   BEST BUY.   PHILIPS   VirtuSense *Transforming Healthcare with AI*   VitalTech

CARE COORDINATION SOLUTIONS

Care coordination technologies generally strive to enable or improve communication between physicians, caregivers, residents, and family members so that all relevant parties have the same insight into a resident's wellbeing and can appropriately collaborate on critical decisions. These solutions are particularly relevant for aging residents battling chronic conditions, as many of these individuals see multiple doctors, take multiple medications, and are often under the false assumption that all members of their care team have the same information. While some of these solutions can overlap with the "communication and engagement" offerings described on the prior page, the spectrum of solutions in this subsector is vast. For example, some create technology platforms that connect and facilitate communication amongst various parties (including physicians), some offer alert-type solutions that tell providers or loved ones when a resident transitions to care locations of varying acuities, while others are designed to help educate families on how to better care for and support their aging loved one. If designed properly, these solutions can align providers, improve resident health, prevent unnecessary medical procedures or hospital admissions, and provide peace of mind to family members and loved ones.

Sample Companies   Ai AUDACIOUS INQUIRY   naviHealth   PATIENTPING   PointRight   SENIORLINK

SMART HOME TECHNOLOGY

Over the last several years, voice-activated and smart home technologies have become more prevalent. Niche solutions for the smart aging sector have evolved as well, particularly within independent and assisted living communities. We believe there are two primary groups of companies within this subsector: technology-focused organizations that develop smart home devices (i.e. Amazon, Google, Nest, Samsung, etc.), and organizations such as K4Connect that provide "smart home ecosystems" and/or enable connectivity to, and integration with, smart home devices. On the device front, smart home offerings have grown to the point where smart solutions are currently available for nearly every room in one's house, including smart door locks and security systems that monitor entrance activity, smart doorbells with video surveillance, speakers, and microphones, smart stoves with automatic shut-offs, remote access smart thermostats, and smart light switches with voice command features. These devices, when synched to smart home "hubs" or integrated more broadly with smart speakers, can dramatically improve an individual's ability to age independently by increasing one's safety, convenience, and comfort. These platforms have also elevated operational efficiencies within various senior living communities.

Sample Companies   amazon   K4 CONNECT *Life. Connected.*   SAMSUNG SmartThings

While the subsectors described on the prior pages are those to which we feel smart aging providers should be particularly attuned in today's environment, there are many other technologies that play important roles in smart aging and should not be overlooked. For example, electronic medical record platforms are foundational to many smart aging providers and have greatly evolved over the last 10-20 years; technology-enabled medication management/compliance solutions are quickly gaining popularity, especially amongst polypharmacy residents and their families; and many fitness and physical wellness solutions are incorporating technology to improve their usability and their capability to collect and interpret relevant health data.

Additionally, there are a handful of "next wave" technologies that will likely impact the smart aging landscape in numerous ways. Various forms of robotics are being piloted in communities across the country as means to reduce isolation, supplement staff shortages, fill medications, and disinfect common areas during COVID-19, among other examples. Similarly, multiple smart aging providers are exploring how virtual reality (VR) can improve their communities, whether it be utilizing VR to improve staff training (through companies such as Embodied Labs), using VR to enhance staff and resident communication, or stimulating and helping residents overcome isolation through VR-powered immersive travel experiences. We also expect to see continued expansion of voice-activated solutions and artificial intelligence and would not be surprised if Amazon, Apple, or other large tech-focused conglomerates "formally" enter the smart aging sector in a disruptive fashion. The future of technology in smart aging is incredibly exciting, but it is important to note that the solutions described herein cannot be properly implemented without the technological infrastructure needed to support community-wide offerings. As such, it is critical that providers continue to understand their technology infrastructures and invest in offerings and improvements that provide the appropriate bandwidth and Wi-Fi services needed to serve all residents.

CONCLUDING THOUGHTS & A CALL TO ACTION

The COVID-19 crisis, for all of its pain and suffering, has been a catalyst to push senior living and care into a more modern and digital era. When this pandemic passes, many forms of technology descried herein will be considered the "new norm" and will continue to serve as vital tools throughout the smart aging ecosystem. As such, it is critical that smart aging operators gain clarity on the array of technology offerings in the market. For many years, Ziegler and others have been touting the abundant possibilities that technology can bring to the senior living and care sector. There will always be those first to step out and adopt new technologies, but collectively as a sector, we need to move off the sidelines and lead the way with advancing solutions in the smart aging space. No one knows the needs of older adults better or what gaps exist for providers where technologies could assist. We encourage senior living providers, entrepreneurs and funding sources to work together to elevate the visibility of the power of technology in the care and housing for older adults.

Ziegler is highly committed to playing a leadership role in this movement. Ziegler provides research, thought leadership and investment banking services related to smart aging and technology, as evidenced by our numerous investment banking platforms and our Ziegler Link•age Funds which have raised over $60 million in capital commitments to help companies build technologies and services that will shape the future of healthcare, aging, and learning. Additionally, Ziegler frequently partners with industry groups such as LeadingAge CAST to conduct primary research on technology adoption and spending in senior living and care. Ziegler looks forward to offering insights in future supplemental white papers and will be closely watching as the technology landscape continues to evolve at unprecedented speed.

EDITORIAL COMMENTS

While we recognize there are numerous, unique care settings that serve aging adults of varying acuities (independent living, assisted living, skilled nursing, etc.), we have used the umbrella term "smart aging" within this paper to reference: 1) the numerous care and seniors housing settings that primarily serve consumers age 65 and above; 2) the leadership and staff at those settings; 3) the residents within those settings; and 4) the various caregivers (family members, loved ones, etc.) that communicate with those residents.

Additionally, the listing of companies in this document is not intended to be fully inclusive and does not represent endorsement of a particular company, solution or platform. Finally, some of the companies mentioned in this report include companies in which Ziegler holds a financial interest

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Prior to joining Ziegler as a research assistant in 2018, Clayton was a vice president in Raymond James' healthcare investment banking group where he advised healthcare services and technology clients on a variety of transactions including sell-side and buy-side acquisitions, mergers, joint ventures, as well as public and private financing transactions. Earlier in his career, Clayton served as an investment banker at Shattuck Hammond Partners, which was acquired by Morgan Keegan.

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Lisa McCracken joined the senior living team at Ziegler in July 2013. As a director of senior living research and development, her primary focus is concentrated on conducting industry research and trend analyses for educative purposes in the form of presentation modules, newsletters, and research publications. In addition to providing support to several senior living bankers, she also facilitates the Ziegler CFO Hotline , an electronic interchange of information among CFOs of senior living providers, and coordinates Ziegler's multiple senior living educational initiatives and conferences.

Prior to joining Ziegler, Lisa most recently served as president of Holleran, a national senior living research and consulting firm. Her tenure with Holleran lasted more than 13 years, where she also previously served as managing partner and vice president of research. Lisa's expertise is in conducting research in the not-for-profit senior living sector, writing white papers and articles on various industry topics, and presenting research findings to providers and experts in the field. She is a seasoned lecturer, facilitator and researcher with more than 20 years of experience in senior living and care. Lisa has served on various state, regional and national workgroups such as the LeadingAge.

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