NET4 Age-Friendly

Module
Digital Innovations and Implementation

Working Group 3

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

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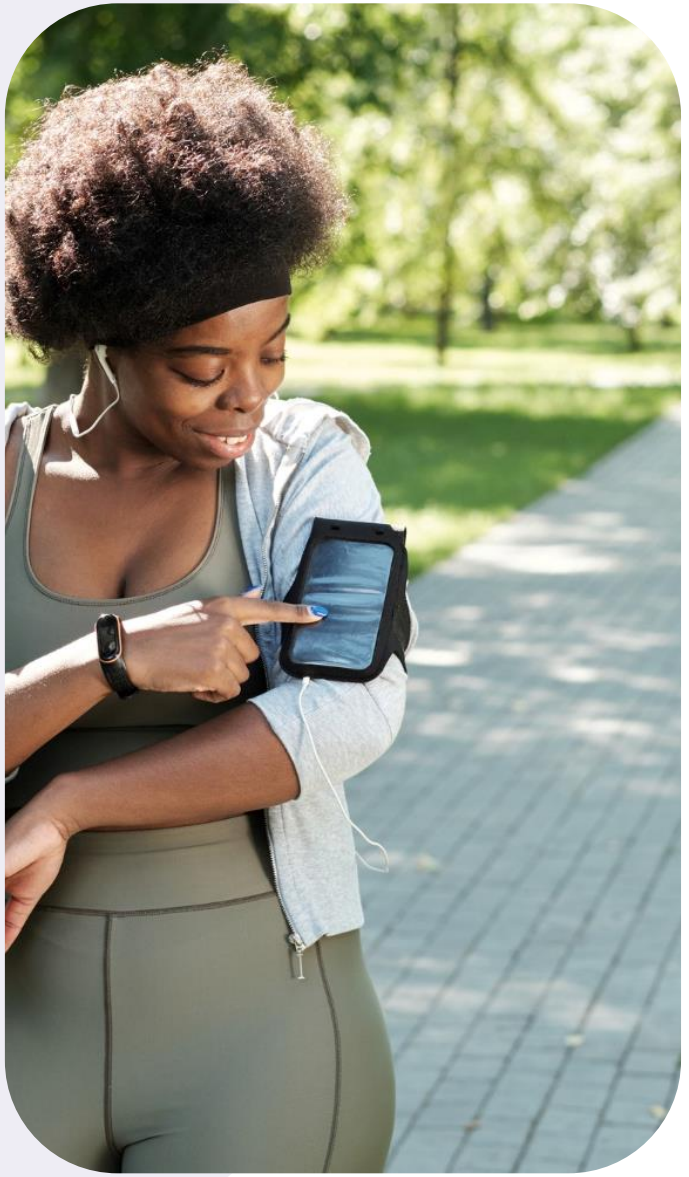

INTRO

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D8 - Final report on digital innovation and implementation

The primary objective of this report is to present the acquired synthesis of the existing knowledge in digital innovation and implementation of Smart Healthy Age-Friendly Environments (SHAFE) solutions, a critical assessment of practices, and recommendations for the future.

The objectives were achieved departing from a comprehensive desk research to address the background and challenges, define scope and purpose, identify target stakeholders, analyse the existing knowledge base, and augment it with new data.

https://www.net4age.eu/d8-final-report-digital-innovation-and-implementation

SHAFE digital solutions and large-scale uptake

The purpose of this module is to synthesize existing knowledge and to critically assess the practices of digital innovation and implementation, through:

A summary and presentation of the work presented in **D8 deliverable** available at https://www.net4age.eu/d8-final-report-digital-innovation-and-implementation

A **Knowledge Base of the State-of-the-Art**, available at https://www.net4age.eu/analysis-responses

An **integration of the Knowledge Base results** with the **SHAFE ontology**

An analysis of the potential **practical applications and uses** of the Knowledge Base

SOCIETAL CHALLENGE

SOCIETAL CHALLENGE

Societal challenges include an **ageing population**, increased **healthcare costs**, and growing **social isolation**. Technological solutions can mitigate these issues by improving access to healthcare, promoting social interaction, and creating more age-friendly environments.

NEEDS TO ADDRESS:

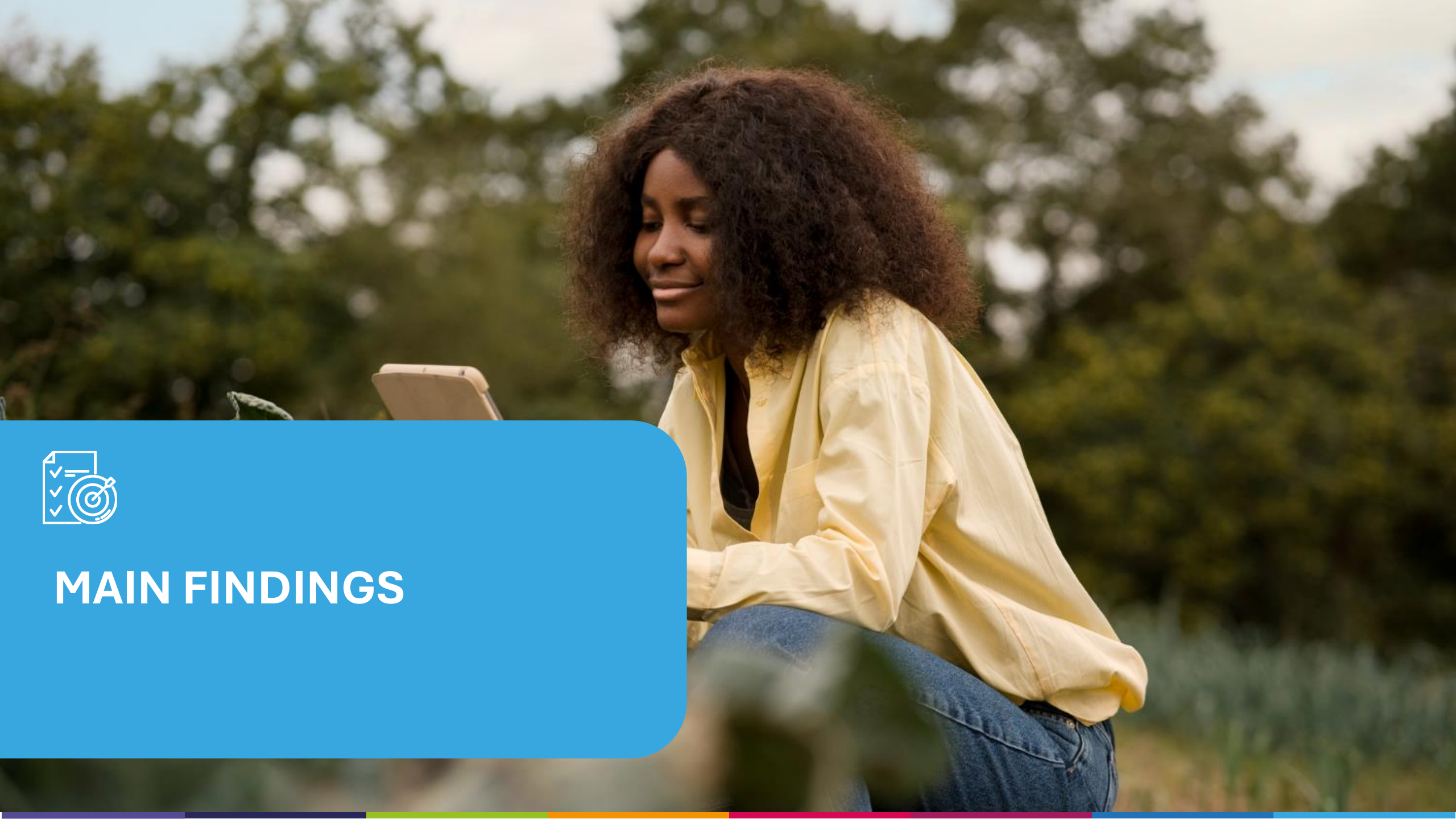
- Accessibility and inclusivity of healthcare
- Reduction of social isolation
- Promotion of age-friendly digital environments
- Enhanced education and digital literacy
- Ethical, privacy and cybersecurity considerations

SOCIETAL CHALLENGE

One of the main challenges is to **optimally leverage digital tools to support smart and healthy living**.

- Addressing the challenges arising from the convergence of demographic challenges and digital innovations requires a **holistic and collaborative effort**.
- Promoting **inclusive** design, enhancing digital **literacy**, safeguarding **privacy**, and considering **ethical** implications are crucial steps.

By fostering a supportive environment and encouraging ongoing education, we can create a digitally inclusive landscape that enhances the overall societal wellbeing



MAIN FINDINGS

STATE OF THE ART

We performed a comprehensive **mapping of current digital solutions that enable SHAFE**, specifically for:

- Wellbeing and Quality of Life
- Healthcare delivery and prevention
- Independent living and age-friendly environments
- Ethical and privacy issues: health professional in a new role
- Efficiency and efficacy

WELLBEING AND QUALITY OF LIFE

- Digital tools that improve **mental and physical health** through personalized recommendations.
- Social engagement platforms that enhance **community involvement** and support networks.
- **Wearable devices** for continuous health monitoring, preventing adverse health events.

Digital platforms and wearables have enabled individuals to take proactive measures for their physical and mental well-being, fostering greater community involvement and offering tailored health monitoring.

HEALTHCARE DELIVERY AND PREVENTION

- **Telehealth services** providing remote medical consultations and preventive care.
- **AI-driven diagnostic tools** that help detect diseases early and recommend personalized treatments.
- **Health data platforms** that enable secure data sharing between citizens and healthcare providers.

eHealth tools: home telemonitoring, web / computer-based interventions, virtual reality tools, sensors.

Interactions include questionnaires, video recording or games.

Benefits: continuous insight into health status and variations, better decision making, and increasing healthcare accessibility; positive feedback gaining more clinical data improves AI based tools and knowledge base.

Commonly used for: mental illnesses, diabetes mellitus 1 / 2, stress, depression, anxiety, cancer, eating disorders, cardiovascular diseases, other chronic illnesses, sexually transmitted diseases, among others.

mHealth

The main categories of autonomic diagnostic applications in mHealth are:

1. symptoms checker platforms (variable accuracy)
2. applications using sensor data to screen health:
    a. embedded in smartphones
    b. external devices
    c. integrated into clothing as smart textiles
    d. placed under the skin

The technology spectra: Internet of Things (IoT), medical sensors, cryptography and security, cloud systems for data storage, Big Data for analysis.

HEALTHCARE DELIVERY AND PREVENTION

Main Barriers:

- Technology readiness and acceptance;
- Interoperability across systems;
- The cost of implementing e-health;
- Technical support namely to ensure security;
- Privacy of data storage and in data transmission.

Huge Potential for:

- Improvements in morbidity and mortality outcomes in specific scenarios.
- Data collected by mhealth apps can be used to recognize early signs of disease.
- Valuable for patients in low- and middle-income countries and in other regions where expert clinical advice is difficult to access.

INDEPENDENT LIVING AND AGE-FRIENDLY ENVIRONMENTS

Independent living refers to the degree to which people have the autonomy to control and lead their own lives, even if they do not do everything by themselves.

The integration of technology in creating age-friendly and assisted living has the potential to increase independence, as follows:

- Smart home technologies that assist people, namely older adults, people with disabilities among others, in living independently.
- Community-based platforms that offer social and recreational activities.
- Mobility solutions that enhance access to public spaces and reduce fall risks.

INDEPENDENT LIVING AND AGE-FRIENDLY ENVIRONMENTS

There are numerous European initiatives and projects promoting solutions to support independent living and age-friendly environments.

Offering ambient-assisted living services depends on multiple factors, commonly not related only to technology, but as well, among many, to economy related facilitators that influence network coverage, availability and affordability of ICT infrastructure, technology acceptance by Health and Care Professionals (HCP) and end users.

Identified EU projects for wellbeing in CORDIS and INNORADAR (by acronym)		
EU-WISE	BETTER AGEING	Smart4Health
EU-GENIE	IMANAGE CANCER	MENHIR
SOUND OF VISION	MY AIR COACH	GATEKEEPER
RICHARD	DECI	SmartEater
NEBIAS	NEPRHON+	MOBILIZE
ACTION	AALUIS	MindCare
SIMPLESKIN	CO-LIVING	LOCOMOTION
RECALL	CAPMOUSE	Smart-BEEjS
SIFORAGE	CONNECTED VITALITY	PaCE
EGOVISION4HEALTH	EXPRESS-TO- CONNECT	EMPOWER
OPTIFEL	FEARLESS	TIMELY
SIGNS FOR EUROPE	INCLUSION SOCIETY	TeleRehaB DSS
OTOSTEM	BD4QoL	ADLIFE
SOCIAL ROBOT	VITAL	R2D2
DISCIT	MDS-RIGHT	IN-4-AHA
VALUE-AGEING	DIAdIC	EUonQoL
SILVER	PreventIT	DynaMORE
TEC FOR LIFE	TeNDER	X-eHealth

INDEPENDENT LIVING AND AGE-FRIENDLY ENVIRONMENTS

Ambient Assisted Living (AAL) systems rely on event detection and real-time data processing for prompt interventions. Long periods of observation are required for detecting changes in habits and developing new models.

Interdisciplinary competencies are essential for designing, installing, and ensuring the acceptability and functionality of AAL systems.

Key Components:

- Real-Time Processing: ensures timely interventions while minimizing false alarms.
- Long-Term Observation: essential for detecting changes and adapting systems to user needs.
- Interdisciplinary Approach: involves healthcare professionals, geriatricians, psychologists, and technology experts working together.

ETHICAL AND PRIVACY ISSUES: health professional in a new role

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Secure data platforms

Ethical considerations

Training programs

Dignity and autonomy

Collaboration

1. Secure data platforms that maintain privacy while enabling effective health data sharing.
2. Ethical considerations and frameworks guiding the use of A.I. and automation in healthcare.
3. Training programs to help professionals navigate emerging digital health roles and prioritizing wellbeing in technology design.
4. Balancing technology use with dignity and autonomy, especially for use in more vulnerable situations.
5. Collaboration among developers, healthcare professionals, policymakers, and community organizations is key to supporting the wellbeing of the ageing population

EFFICIENCY AND EFFICACY

There are multiple ways in which digital health offers improvement in efficiency and efficacy of healthcare.

KEY COMPONENTS:

1. **Streamlined Workflows:** digital tools that automate routine tasks, allowing healthcare professionals to focus more on patient care.
2. **Reduced Administrative Burdens:** tools that minimize paperwork and administrative tasks, leading to time savings and cost reductions.
3. **Increased Connectivity: t**echnologies that enhance communication and information sharing among healthcare providers, patients, and caregivers

EFFICIENCY AND EFFICACY

1. **Digital tools that streamline healthcare workflows, reducing administrative burdens**

Digital tools are reshaping the healthcare sector by enhancing both organizational efficiency and patient care. These innovative technologies offer potential for increased connectivity. However, they present some persistent challenges, namely with social isolation remaining a significant issue to address.

2. **AI-based predictive models that identify at-risk populations for targeted interventions**

Artificial Intelligence (AI) offers significant benefits, such as improved decision-making, productivity gains, and optimized resource management. AI and Machine Learning (ML) algorithms can exploit the vast amounts of data from Electronic Health Records (EHRs) to uncover new knowledge

3. **Interoperable systems that link healthcare services, social care, and built environments**

Integrating healthcare with social care and built environments ensures a comprehensive integration that considers not only medical conditions but also the lifestyle, needs, and goals of individuals. Key Points:

- Holistic Approach: linking different sectors provides comprehensive care for various aspects of a person's life.
- Improved Outcomes: interoperable systems enhance the quality of care by ensuring all relevant information is accessible to healthcare providers.
- User-Centric Design: systems are designed to meet the needs of patients, caregivers, and healthcare providers.

SHAFE IN PRACTICE

PROJECTS AND PRACTICES IMPLEMENTING DIGITAL SOLUTIONS

An online, searchable collection of digital tools and resources, categorised under either of the following categories:

- Best Practices
- Case Studies
- Data Sets
- Development
- Projects
- Standards
- Taxonomies
- User Experience
- Others

http://www.net4age.eu/knowledge-base

NET4 Knowledge base

Developed by NET4Age Working Group 3 members, this tool provides a **comprehensive repository of knowledge** that enables users to **explore some digital innovation examples related to SHAFE**.

For the preliminary organisation and collection of knowledge, there was a clear option of valuing this aspect of **practicality** in detriment of strict and formal queries and keywords.

- SHAFE Ontology Terms
- Category
- Keywords
- Resulting matches to the search terms above are displayed, allowing the user to view the in-depth analysis of the entry.
- Integrated SHAFE Ontology to provide a standardized structure and methodology for knowledge aggregation and analysis.

EXAMPLES OF RELEVANT PROJECTS & INITIATIVES

- **MENHIR**: identify early signs of mental health issues through natural language processing .
- **Smart4Health**: health data platform to empower citizens and professionals in managing health data.
- **GATEKEEPER**: Utilizing AI to improve predictive healthcare and personalized services.
- **Smart-BEEjS**: Community engagement and empowerment through energy solutions.
- **PaCE:** A system that helps older adults remain socially active by offering personalized guidance to local events, activities, and virtual interactions, thus reducing social isolation.
- **EMPOWER:** A digital solution that empowers diabetic patients to better self-manage their condition through personalized monitoring and AI-driven recommendations.
- **MindCare:** Focused on providing digital mental health solutions, this project uses mobile applications and AI-based analytics to offer proactive care to individuals at risk of mental health conditions.
- **TeleRehaB DSS:** A tele-rehabilitation decision support system that assists in the remote monitoring and rehabilitation of patients recovering from surgery or injury.
- **SmartEater:** A nutritional platform that helps individuals make better dietary decisions through AI-based recommendations and monitoring of eating habits.
- **LOCOMOTION:** Promotes active aging and mobility by offering digital fitness programs and remote coaching, designed to reduce fall risks and improve overall health.

SHAFE PEOPLE

WHO IS AFFECTED? THE SHAFE FAMILY

A family consisting of a pregnant woman, a baby, a pre-teen, an adolescent, a 40-year-old man, and grandparents, one of whom is dealing with a disability.

This multi-generational family provides a comprehensive view of how digital solutions can benefit people across various life stages.

How can they be supported? Some examples:

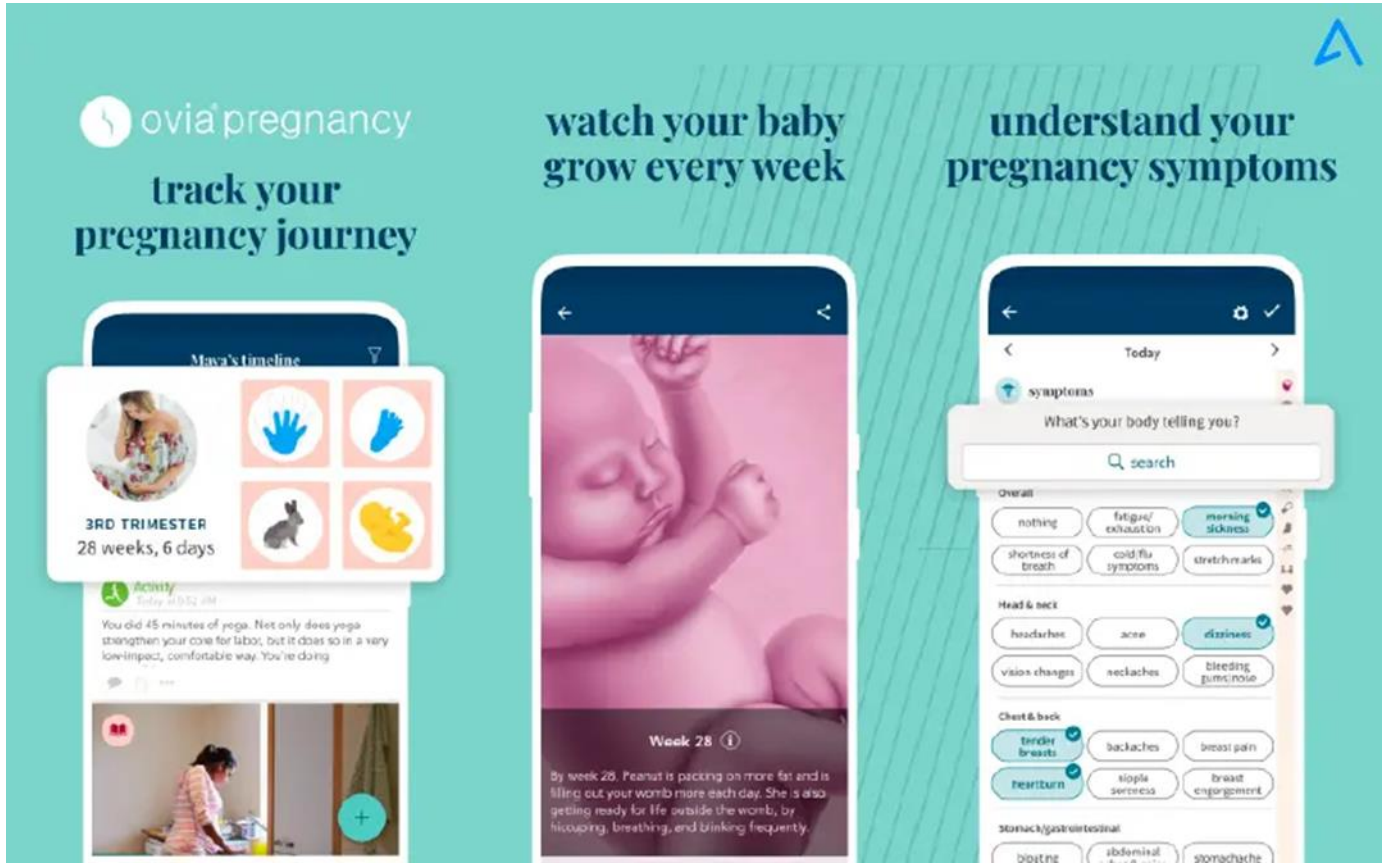
- **Pregnant Woman**: access to personalized healthcare via telehealth and maternity apps.
- **Baby & Pre-Teen Child**: remote pediatric consultations and education tools can enhance their well-being.
- **Adolescent**: mental health apps and community forums can support their social development.
- **40-Year-Old Man**: wearable devices and apps can aid in managing work-life balance and health.
- **Grandparents**: monitoring devices, social platforms, and home care support enable independent living.

MATCHING PEOPLE WITH TOOLS

Family Member	Pregnant Woman	Baby & Pre-Teen Child	Adolescent	40-Year-Old Man	Grandparents
Potential Goal	Enable monitoring of maternal and fetal health, providing alerts and data to healthcare providers.	Ensure continuous healthcare access and support early childhood development through educational apps and health monitoring.	Provide mental health support, peer interaction, and access to educational resources.	Encourage a healthy lifestyle and facilitate remote healthcare access.	Ensure safety and health monitoring, support independent living, and enhance social interaction.
Example	**Ovia Pregnancy:** For tracking pregnancy and accessing health resources. **Babylon Health:** For remote health consultations and prenatal care.	**ABCmouse:** For interactive learning tailored to young children. **Owlet Smart Sock:** For monitoring a baby's vital signs.	**BetterHelp:** mental health counseling. **Kooth:** anonymous peer support and counseling. **Khan Academy:** comprehensive educational resources.	**Apple Watch:** For fitness and health tracking. **MyFitnessPal:** For personalized health and nutrition plans. **Teladoc:** For remote healthcare consultations.	**GrandPad**: For simplified social interaction. **Lively Mobile Plus:** For emergency monitoring and health tracking. **Google Nest:** For home automation and safety.

WHO IS AFFECTED? THE SHAFE FAMILY

Pregnant Woman- Ovia Pregnancy

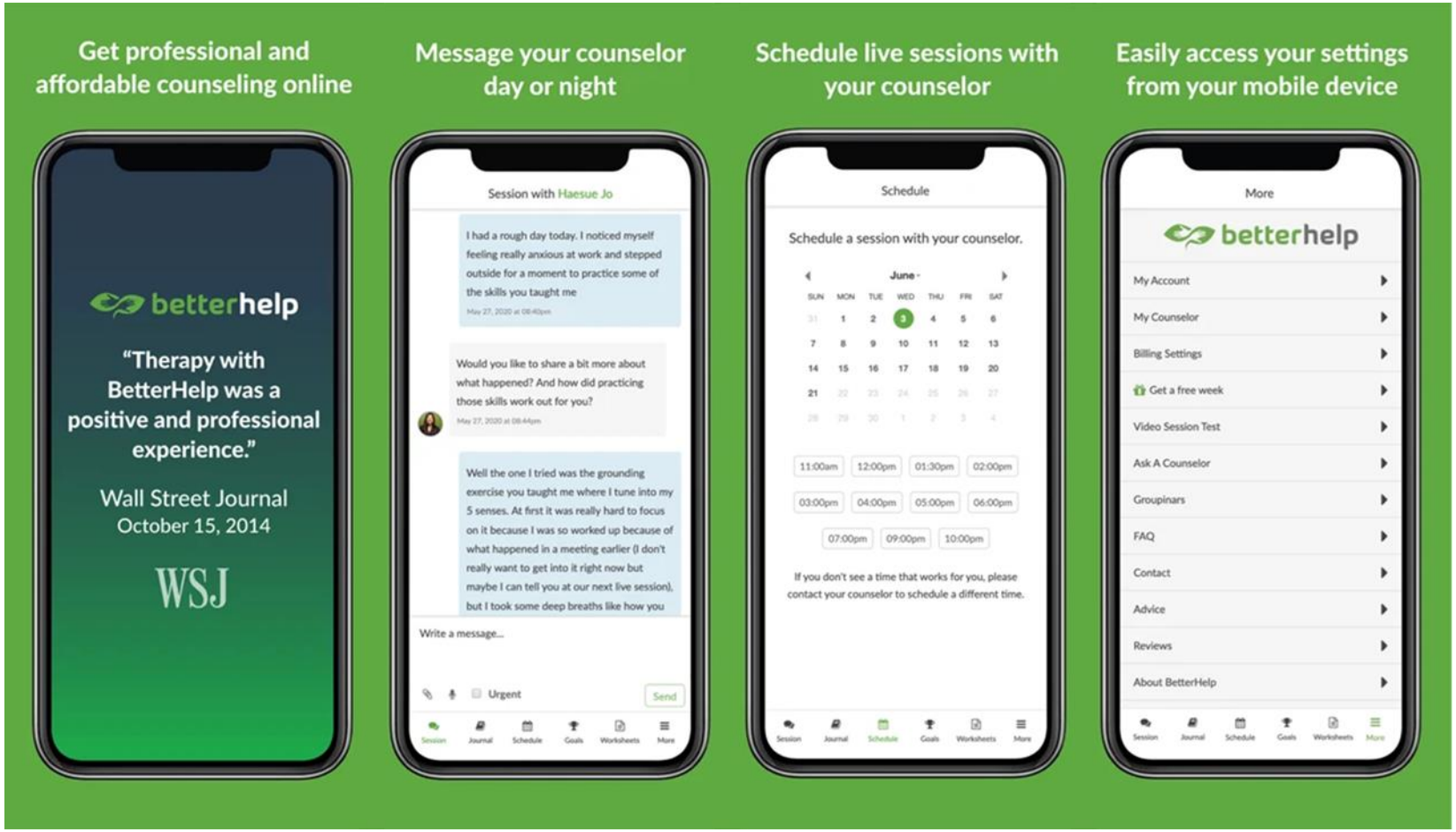


WHO IS AFFECTED? THE SHAFE FAMILY

Baby & Pre-Teen Child - Owlet Smart Sock

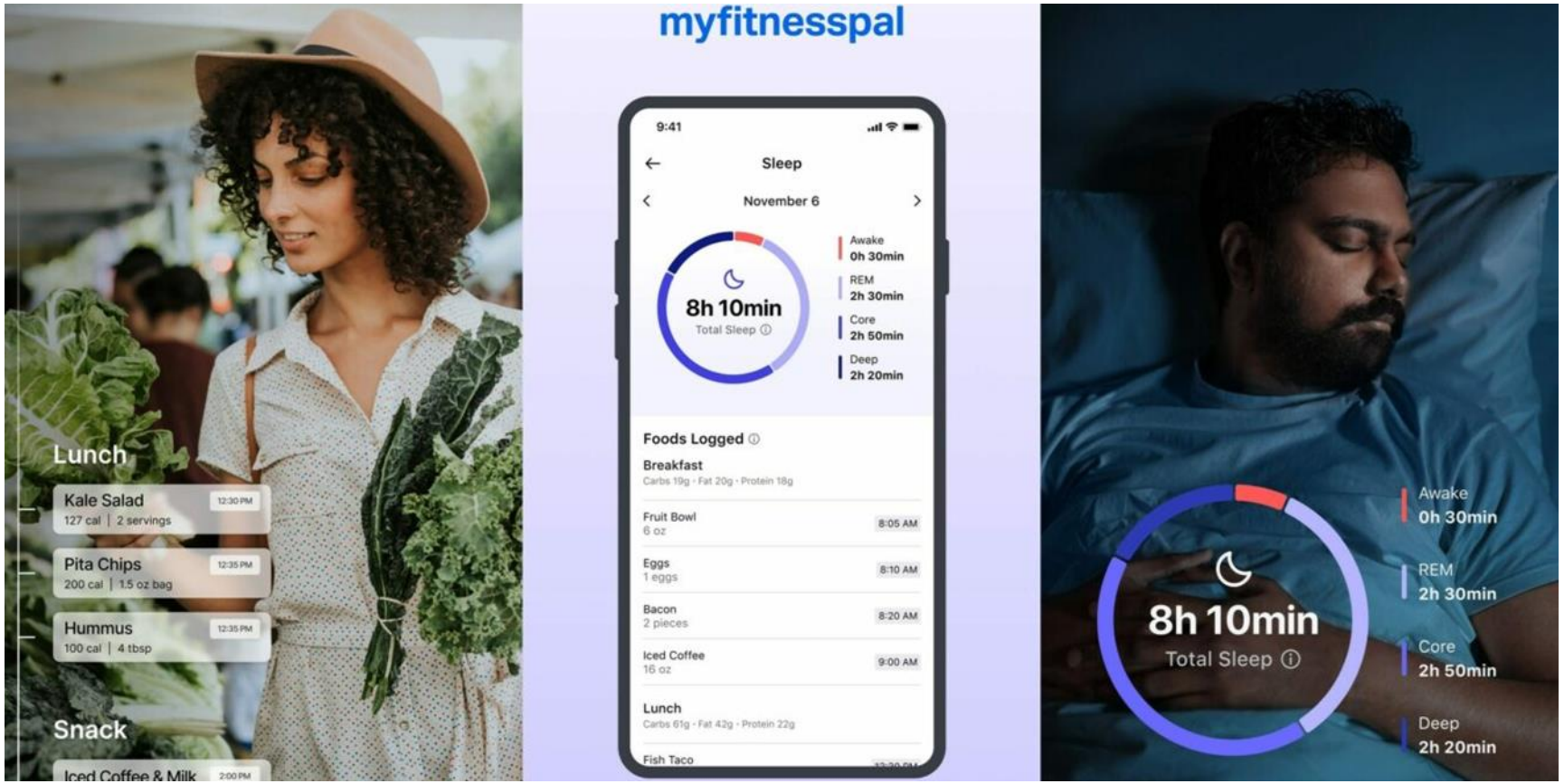
WHO IS AFFECTED? THE SHAFE FAMILY

Adolescent - BetterHelp



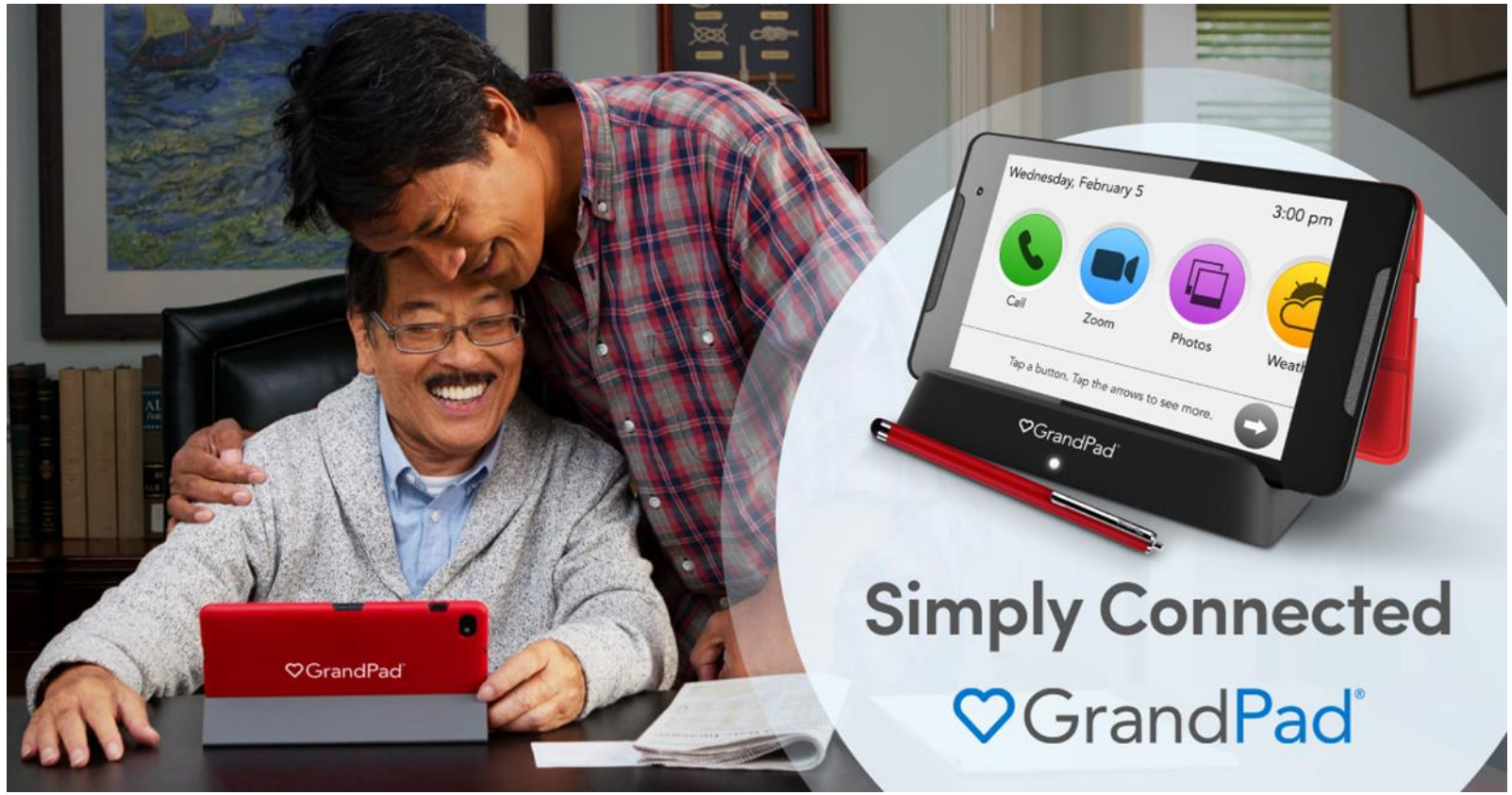
WHO IS AFFECTED? THE SHAFE FAMILY

40-Year-Old Man - My Fitness Pal



WHO IS AFFECTED? THE SHAFE FAMILY

Grandparents - Grandpad



WHO IS AFFECTED? HEALTH & CARE PROFESSIONALS

Professional carers providing or coordinating healthcare and social services in hospitals, primary care centers, rehabilitation centers, and more.

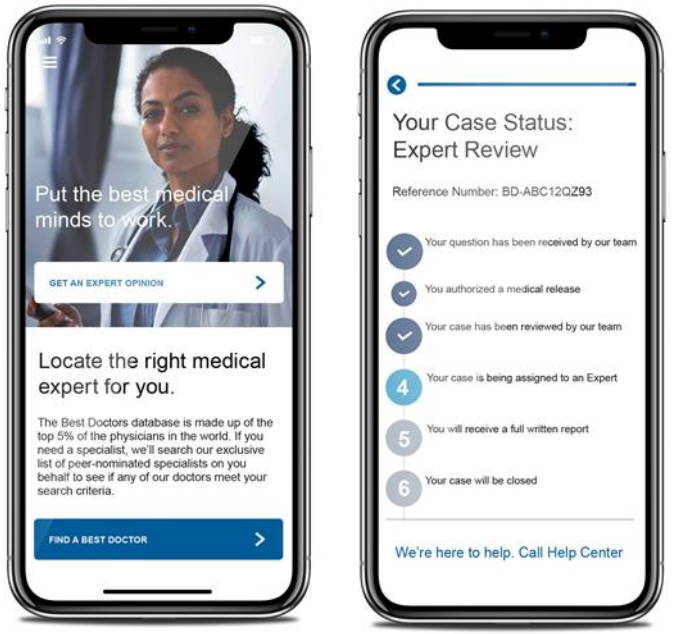
How can they be supported? Some examples:

- **Integrated Systems**: tools for patient data sharing improve workflow and diagnosis.
- **Telehealth**: remote consultations and monitoring enhance reach and efficiency.
- **Training**: digital platforms for training staff in emerging health technologies.

WHO IS AFFECTED? HEALTH & CARE PROFESSIONALS

Training - Laerdal Medical

Telemedicine - Teladoc



WHO IS AFFECTED? POLICY MAKERS

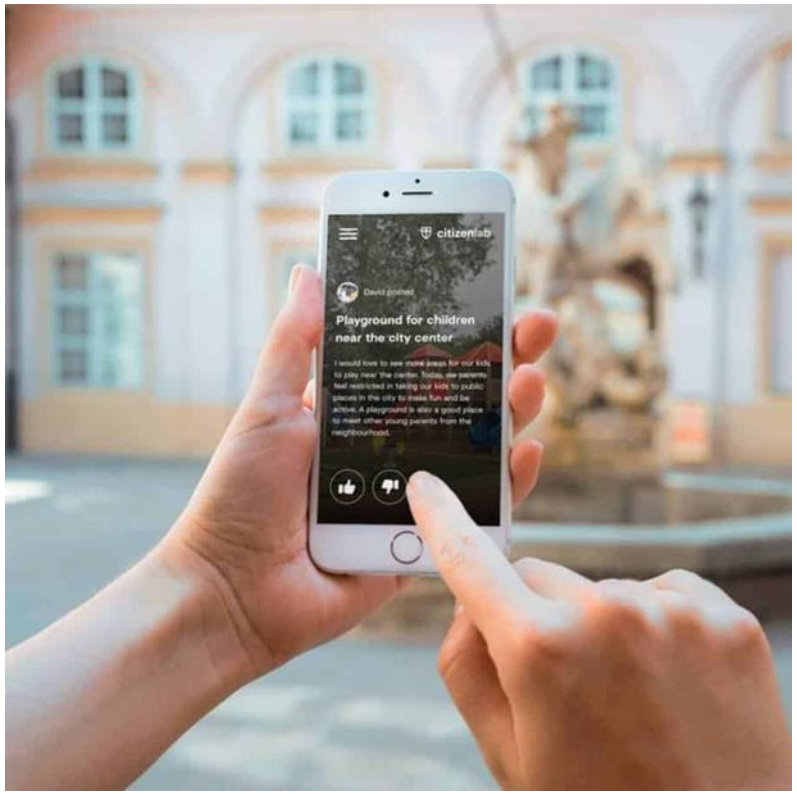
Decision-makers at local, regional, national, and international levels responsible for public policies and funding related to urban regeneration, smart cities, integrated care, and more.

How can they be supported? Some examples:

- **Funding Frameworks**: Policies that support inclusive digital health and social services.
- **Cross-Sector Collaboration**: Encourage collaboration across departments for integrated, people-centered care.
- **Public Awareness**: Campaigns that promote the benefits of digital health to all ages.

WHO IS AFFECTED? POLICY MAKERS

Public Awareness – Citizen Lab



Grant Management - Fluxx

WHO IS AFFECTED? ACADEMIA and R&I

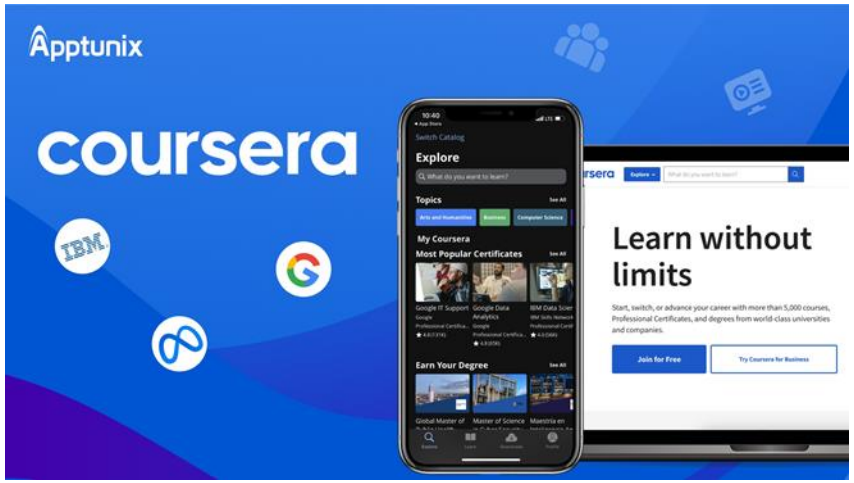
Researchers, students, and professors working in social sciences, technology, health, urban planning, and community engagement.

How can they be supported? Some examples:

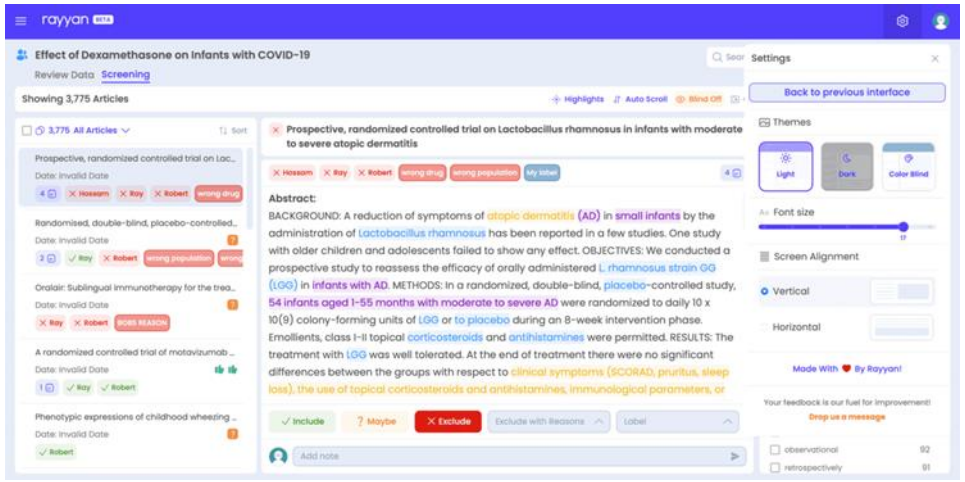
- **Collaborative Research**: foster multidisciplinary partnerships for holistic solutions.
- **Curriculum Development**: create educational programs focused on digital health technology and ethics.
- **Policy Impact**: use evidence-based research to shape digital health policies.

WHO IS AFFECTED? ACADEMIA and R&I

Curriculum Development – Coursera



Collaborative Research – Rayyan



WHO IS AFFECTED? PRACTIONERS

Practitioners across domains involved in designing, implementing, and maintaining SHAFE environments.

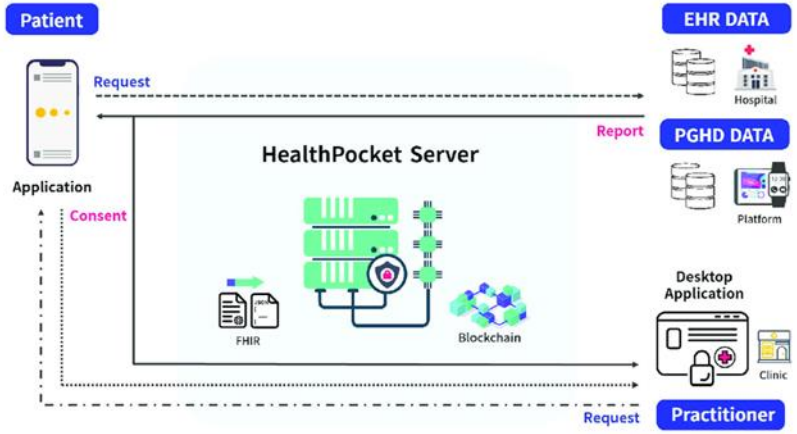
How can they be supported? Some examples:

- **User-Centered Design**: Prioritize universal design principles in all environments.
- **Technology Integration**: Ensure interoperability between health, social care, and built environments.
- **Inclusive Solutions**: Design with the needs of people with disabilities and the elderly in mind.

WHO IS AFFECTED? ACADEMIA and R&I

User-Centred Design – VisioCreate

Technology Integration – FHIR standards



WHO IS AFFECTED? IMPLEMENTATION ACTORS

Real estate promoters, AI developers, tech SMEs, and architecture offices creating residential, rehabilitation, and public spaces.

How can they be supported? Some examples:

- **Sustainable Models**: Develop services that align with the principles of sustainability and inclusivity.

- **Business Opportunities**: Invest in technologies that improve people's lives while creating new market
- opportunities.

- **Accessible Infrastructure**: Design residential and public spaces with digital health tools.

WHO IS AFFECTED? IMPLEMENTATION TEAMS

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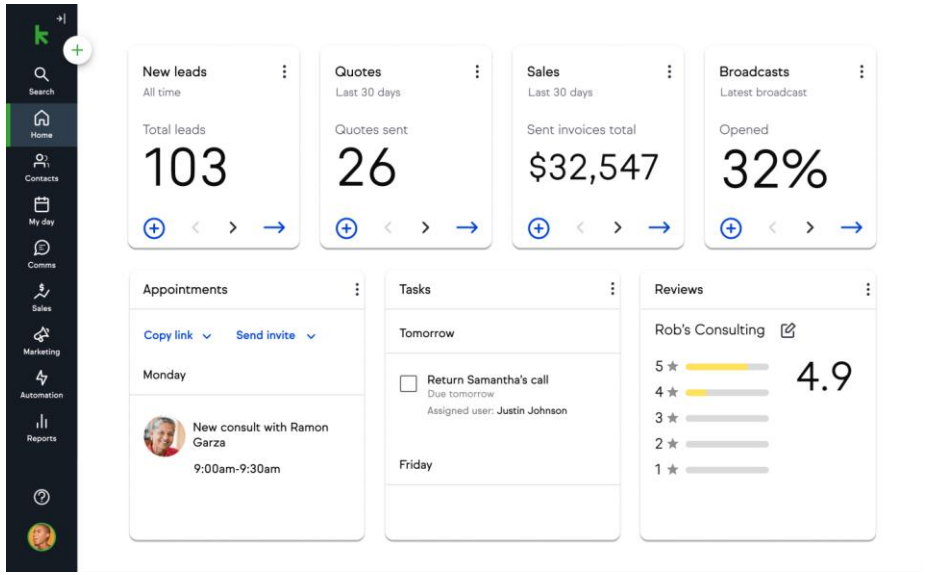
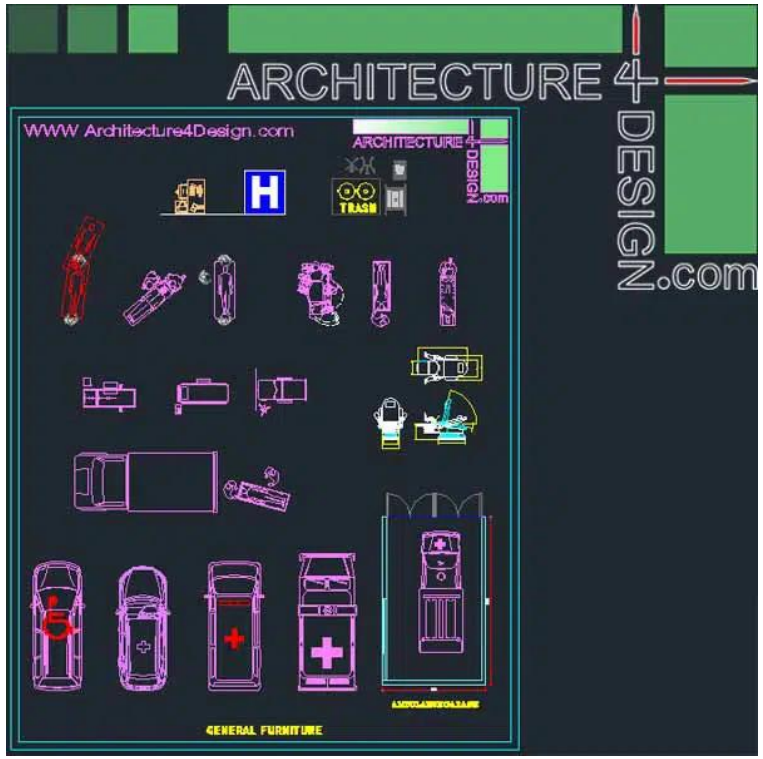
Sustainable Models – LEED



Accessible Infrastructure - AutoCAD



LOOKING AT THE FUTURE

LOOKING AT THE FUTURE

NEEDS

More research into inclusive, age-friendly digital solutions.

Address gaps in digital literacy and access.

RESPONSIBILITY

Policymakers: implement inclusive frameworks.

Tech Developers: design with accessibility in mind.

Community Groups: support digital literacy initiatives.

Healthcare Providers: integrate SHAFE into daily practice.

MODULE INFORMATION

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THE END!

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