WORKSHOP PANEL - HEALTHCARE

Renzo Dal Molin - Cairdac

Peter Zandbergen - Philips

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Where innovators meet & shape OUR DIGITAL FUTURE
2019

AGENDA

13.30 ECS-SRA 2020 Chapter HEALTH AND WELLBEING - Discussion and feedback
Peter Zandbergen; Renzo Dal Molin

13.45 Discussion on gaps
All / Audience

13.55 CSA HELoS
Françoise Charbit

14.10 ROUNDTABLE - Game changers for HEALTHCARE
Peter Zandbergen; Renzo Dal Molin; Olivier Horbowy; Françoise Charbit; Ronald Dekker

14.30 Close session

ECS-SRA Health and Wellbeing

- Only minor updates in 2020 version compared to 2019 version:
  - Alignment with Health.E Lighthouse on contents
  - Updates in timelines of activities and for market data

- Next slides show an overview of the 2020 ECS-SRA Chapter Health and Wellbeing

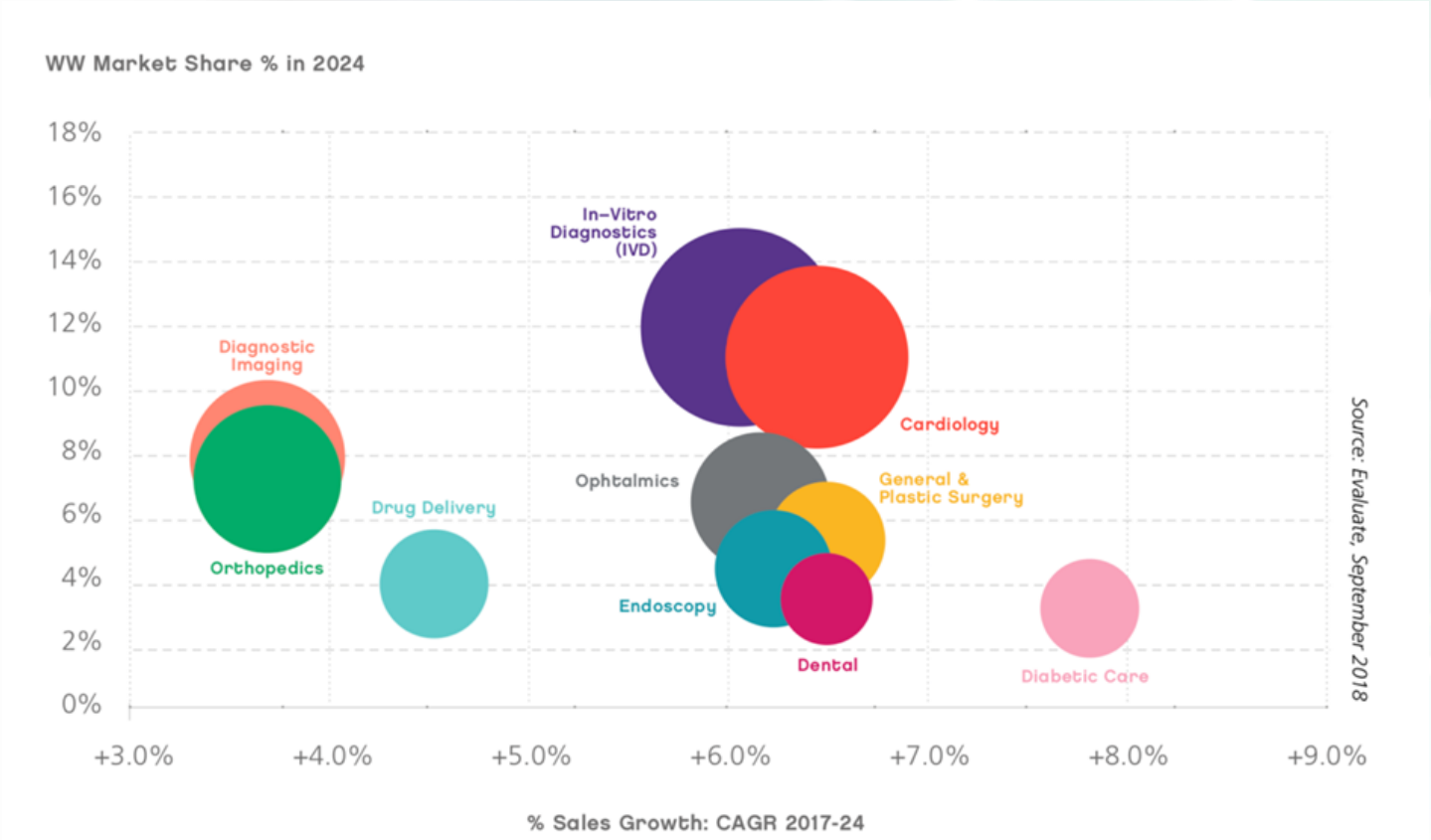
ECS-SRA Health and Wellbeing

- **In Europe, an average of 10% of GDP** is spent on healthcare
- Around **1% of GDP** is attributed to **medical technologies**

- Expenditure on medical technology per capita in Europe is at around EUR197 (weighted average)

- The European medical technology market has been growing on average by 4.6% per annum over the past 8 years

ECS-SRA Health and Wellbeing



ECS-SRA Health and Wellbeing

Game Changers

- **Wearable and remote sensing technologies**
  - These will allow patients and elderly to remain longer in their home environments and will move costly clinical trials out of the hospital
- **Bioelectronic medicines**
  - Small intelligent implantable devices to modulate the function of organs without the side effects of traditional chemical medicines to treat immune diseases, spinal cord disorders and even lifestyle disorders such as obesities, depression and hypertension
- **Smart minimal invasive instruments**
  - Replacing traditional surgery with less burden and risk for the patient and strongly reduced hospitalization. New X-ray free guidance technologies will guide these instruments relieving the burden to physicians and clinical staff
- **e-Health devices and applications**
  - Technical solutions, apps and AI appliances will replace standard physician consultations and guidance at a fraction of the costs. They will monitor people's lifestyle and help them to live healthier
- **Affordable point-of-care diagnostic tools**
  - Based on MEMS (ultra-sound) imaging devices and sensors assisted by AI interpretation will allow point of care workers to diagnose patients without the need for a hospital visit. It will bring advanced healthcare to remote and rural areas in developing countries
- **Organ-on-Chip**
  - New technologies on the interface between microfluidics, microfabrication and biology will result in improved models of organs and diseases that will help pharma developing safer and more effective medicines and will shorten the pharma innovation cycle

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Major Challenges

- Moving healthcare from hospitals into our homes and daily life, requiring preventive and patient centric care
- Restructuring healthcare delivery systems, from supply-driven to patient-oriented
- Engaging individuals more actively in their own health and wellbeing
- Ensuring affordable healthcare for the growing amount of chronic, lifestyle related diseases and an ageing population
- Developing platforms for wearables/implants, data analytics, artificial intelligence for precision medicine and personalised healthcare and wellbeing

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Moving healthcare from hospitals into our homes and daily life, requiring preventive and patient centric care (1/2)

- From products to integrated solutions and services
- Improved biomedical models of the health situation of healthcare customers, taking heterogeneous, longitudinal (image) data, context and population information into account
- Use large heterogeneous data from many sources to obtain precise information
- Ensure low-latency analysis and reasoning involving 2D, 3D and 4D images, and prompt delivery of precise results, also in situations with partial and imperfect data
- Longitudinal monitoring and data analysis of many patients applying AI techniques, leading to precise alarms only when needed
- Remote diagnosis and treatment delivery based on advanced user interaction models and collaboration models involving the healthcare customer and the healthcare practitioners
- Development of smart catheters used in (image guided) treatment and specialised operating theatres (e.g. Cathlabs)

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Moving healthcare from hospitals into our homes and daily life, requiring preventive and patient centric care (2/2)

- Development of active or passive implantable medical devices for chronic disorders currently not treated or treated by life-long pharmacy (e.g. stimulators for spinal cord disorders, depression, obesity, hypertension and immunomodulation)
- Development of surgical robots
- Development of novel regenerative medicine solutions
- Development of technologies such as smart body patches and monitoring implants for continuous monitoring, e.g. bringing clinical trials to the home
- Mutual coexistence between implants and mainstream diagnostic systems is a high priority research area stretching from basic electromagnetic compatibility aspects to communication protocols and harmonised cloud analysis interfacing
- Diagnostic imaging equipment with sufficient accuracy for active/passive implantable medical devices placement, preventing trial-and-error approach
- Development and industrialisation of radiation-free imaging and guidance technologies based on e.g. ultra-sound, optical shape sensing, or electromagnetic sensing

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Restructuring healthcare delivery systems, from supply-driven to patient-oriented (1/2)

- Holistic healthcare involving all imbalanced health situations of the patient
- Use of the (growing) whole body of medical knowledge during diagnosis, (image guided) treatment and monitoring
- EHR involving patient health models supporting precise communication between different care givers
- EHR involving health models that exactly describe the outcome heath values for the patients, both short and long term
- Transform large healthcare systems to optimise hospital workflow, automatically optimise diagnostic imaging and tracking of therapy results, enable preventive maintenance and generation of requirements and test cases for new generations of systems
- Predictable and repeatable outcome of diagnostic imaging. Current diagnostic imaging is often of a qualitative nature, meaning that comparison over time or with other patient cases is impossible
- Apply generic standards (e.g. industry 4.0) to diagnostic and therapy systems and use of big data principles to reduce cost of ownership

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Restructuring healthcare delivery systems, from supply-driven to patient-oriented (2/2)

- Create and apply biomedical models for AI based automation, visualisation and decision support, to get precise, quantified information of the person's health condition. This needs large amounts of images and other sensor data at many levels: from molecular imaging up to whole body imaging
- Less harmful and less expensive imaging modalities at several levels: from molecular imaging up to whole body imaging, in the prevention, diagnosis, therapy and monitoring phases
- Humanoid robots applying interpreted human body language and emotion in care delivery
- Robotics to improve treatments either in the operating room, minimal invasively inside the body, at general practitioners or at home
- 3D Printing and CNC (Computerised Numerical Control machining): printing implants and prosthetics for individuals, create patient-specific anatomical models, e.g. create powered exoskeleton to help paraplegics to walk again

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Engaging individuals more actively in their own health and wellbeing (1/1)

- Wearables or minimally invasive implants, Internet of Things, simple analysers for home use; reliable data collection and analysis – focus on input data quality assessment (we need to know whether we evaluate useful data or noise and artefacts); standardisation of calibration, process interoperability
- Devices or systems for utilising/extracting/sharing new knowledge in the most informative and efficient manner (e.g. vitality data, molecular profiling, biotechnology, diagnostics, ICT tools) in the most appropriate personalised setting (e.g. healthcare system, at home)
- Devices or systems for protecting and enforcing individual health-related information: ownership and secure storage of health data, data sharing with healthcare providers, and rendering real-time anonymity for wider data analytics Devices or systems improving security for executing transactions in healthcare and wellbeing, like blockchains to improve health or personal records exchanges and interact with stakeholders
- Devices or systems for integration of health and prevention ICT solutions in national health systems.

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Ensuring affordable healthcare for the growing amount of chronic, lifestyle related diseases and an ageing population (1/1)

- Wearables or minimally invasive implants, including new sensor systems for easier and more efficient measurement of physiological parameters, incl. posture, sitting position, physical activity, dynamics of walking, etc
- Devices or systems using biomedical models for better diagnostics, therapy and feedback to the patient for several chronic diseases e.g. musculoskeletal system and simulation of activity of muscle groups, joints, etc.
- Devices or systems using predictive models to anticipate the appearance of co-morbidities because of the evolution of chronic diseases
- Real-time location services with badges that can track patients, staff and medical devices, Environmental monitoring — for example, checking hand hygiene compliance. Mobile apps will replace traditional physician visits
- Devices and systems that improve drug adherence especially for expensive biological drug therapies

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Developing platforms for wearables/implants, data analytics, artificial intelligence for precision medicine and personalised healthcare and wellbeing (1/2)

- Smart, robust, secure and easy to use devices or systems (wearable or implantable and autonomous) for detection, diagnostic, therapy, through big data, artificial intelligence, machine learning, deep learning person-centred
- Multi-modal data fusion devices or systems: the generation of enormous amounts of data from different sources (e.g. vital signs from mobile apps, home monitoring, real-time sensors, imaging, genomic data, pharmaceutical data, and behavioural markers) brings valuable information to improve clinical decisions and to reveal entirely new approaches to treating diseases. But the fusion of multi-modal data poses several technical challenges related to modelling, data mining, interoperability, data share keeping privacy
- Scalable platforms able to support the automatic deployment and maintenance of applications for digital health, guaranteeing Service Level Agreements and Security for data
- Energy efficiency for medical wearables/implants: Improvement of energy consumption and battery life at device levels. Ability to deliver connected devices (wearable/implants) that are self-sustainable from an energy point of view for the full duration of a medical treatment (weeks, months or years)
- Sustainable, renewable or harvested long-term highly integrated energy sources or devices

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Developing platforms for wearables/implants, data analytics, artificial intelligence for precision medicine and personalised healthcare and wellbeing (2/2)

- Upgradability of medical wearables/implants: A wearable/implant must be able to adapt to several configurations in the function of the evolution of a disease and improvements in its treatment. The upgrade/downgrade must not imply obsolescence of the wearable/implant. Therefore, a supporting wearable infrastructure should support the possibility of running virtual devices that complement the processing power and storage embedded in wearables/implants
- Highly dependable (reliable, secure, safe, privacy supporting, easy to use, …) IoT platforms
- Devices or systems data with low-latency analysis performed with deterministic algorithms or deep learning that are able to deal with known levels of trust (both high and low) for precise presentation of the results to medical professionals and non-professionals
- Devices or systems based on cognitive computers providing support to professionals or non-professionals for healthcare or wellbeing

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CHAPTER 2 – HEALTH AND WELL-BEING

Leaders

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ECS SRA HEALTH

Healthcare Future

Renzo Dal Molin

Peter Zandbergen

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Megatrends for healthcare

- **Unprecedented surge in healthcare needs due to chronic diseases**
- **Healthcare is moving to value-based care to control spiraling costs and improve efficiency**
- **Stresses for collecting and sharing patient data so that care is coordinated and outcomes can be measured easily**
- **Consumerization of healthcare is opening the industry to new entrants and disruptors**
- **Value-based solutions, which not only lead to cost savings, but also to reduced, related health risks**

Healthcare Future

The future of health is expected to be driven by an omnipresent, proactive, and integrated system aimed at health and well-being, where transformational technologies (e.g., **artificial intelligence, digital therapeutics, cloud and app-enabled digital health capabilities, augmented and virtual reality**) are poised to play a significant role. New research for the medical-technology ("medtech") industry from **Deloitte** finds that these emerging technologies can result in a dramatic change to traditional medtech business models, opening up an opportunity for enhanced collaboration with consumer technology and digital health companies to transform the delivery of care

Source: Winning in the future of medtech Deloitte Sept 19

Healthcare Future

- Medtech companies that have **traditionally focused on developing hardware** (e.g., surgical equipment, joint replacements, diagnostic equipment, infusion pumps, pacemakers, etc.) are **shifting their focus to software and services, data collection, and advanced data analysis**.

Source: Winning in the future of medtech Deloitte Sept 19

Healthcare Future

- “In many ways, **data collected from the hardware** will be **more valuable than the hardware** itself,” the report said. “And 20 years from now, we expect that most of this **medical hardware will be commoditized**. What can set medtech companies apart from each other will be their ability to harness data gathered by their devices and use it to **improve well-being, anticipate health issues, and help patients change the day-to-day behaviors that affect their health**.”

Source: Winning in the future of medtech Deloitte Sept 19

Source: Five Megatrends Driving the Future of Medical Devices,' a 30-minute webinar presented by Director of Design and Innovation Strategy, Ryan Chen, and Design Strategist, Anat Mooreville, PhD

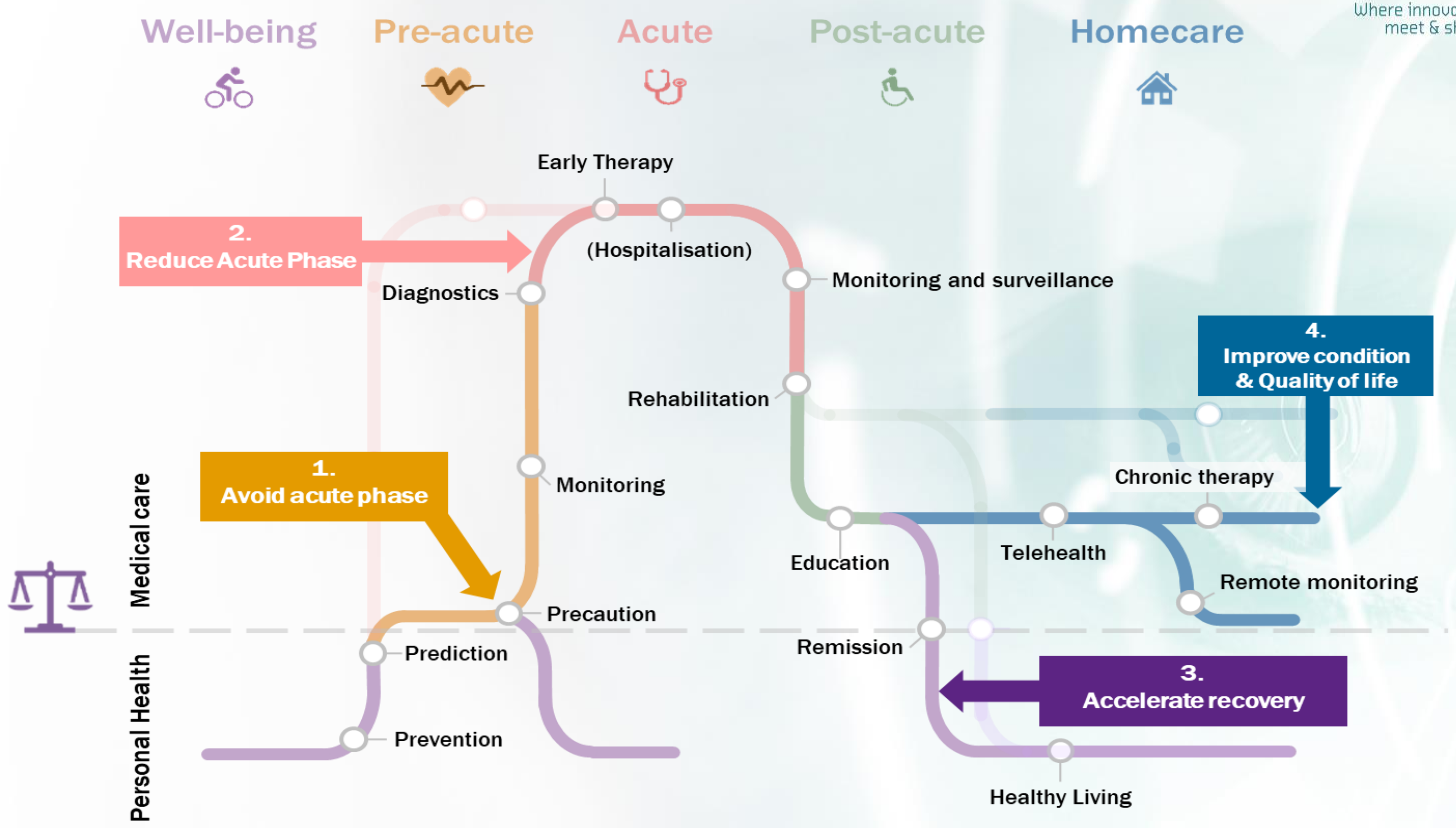
MEGA SHIFT in HEALTHCARE

- Shift #1: Health + Wellness
  - More proactive and preventive mindset, and this paradigm is focused on enhancing our well-being and health in all areas of life practically all of the time, whether we're tracking our steps, calories, or minutes meditating.
- Shift #2: Empathic Care
  - Empathic Care, healing is about being able to live your life the way you want to, and being able to achieve meaningful and functional goals
- Shift #3: Data-Informed Personalization
  - Data-Informed Personalization, the treatment is targeted to you. It's based on an aggregation of personal and big data, including genomics, preference and lifestyle data, and even social determinant factors. It can be iterative and is optimized to be given at the right time to be most effective.

MEGA SHIFT in HEALTHCARE

- Shift #4: Anytime Anywhere
  - In Anytime, Anywhere, rather than revolve around the doctor, the time and location of care revolves around the consumer, not unlike how Amazon has made purchasing anything an anytime, anywhere proposition. And we can see this in the spread of telehealth, minute clinics, and apps. Shift #2: Empathic Care
- Shift #5: Seamless Integration
  - Seamless Integration, it takes into account the entire patient experience: the physical and digital, quantitative and qualitative data, and moves easily between prevention and management – similar to the blood glucose monitors and apps I talked about previously. And it’s also this consumer desire to have a single solution rather than toggle between multiple products and companies.

Continuum of Healthcare



https://nobel-project.eu/

ECS-SRA Health and Wellbeing

- Discussion and feedback on ECS-SRA **2020** Chapter on Health and Wellbeing Chapter

- **2021** version is foreseen to involve a major update

- Feel free to contribute in shaping the Health and Wellbeing **2021** update!!

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HELoS project

Françoise Charbit CEA

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Objective

- What are the emerging and future opportunities for ECS-based solutions in healthcare?
- Adoption of open technology platforms for the development and microfabrication of electronic components and systems (ECS) for applications in healthcare

Futurs Health Products

HELoS is built on 3 pillars

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Identify Emerging Medical Domains

Opportunities for ECS
Gaps in ECS SRA

Forming a Sustainable Community

Identify projects and stakeholders
Connect to EU initiatives and RTOs

Disseminate the Open Technology Platform concept

Accelerate innovation in medical devices

Implementation of HELoS

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VISION

Workshop 1

Grenoble
May 7 2020
(CEA)

Translate emerging healthcare needs and trends into ECS opportunities

STRATEGY

Workshop 2

March 2021
(IMEC)

Implementation aspects of OTP for medical devices

DISSEMINATION

Workshop 3

November 2021
(TUD, Fraunhofer)

Public communication of the Health.E roadmap to stakeholders

White papers

Emerging medical domains: priorities & recommendations

Networking and project cluster support

Our reference projects

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ECSEL Joint Undertaking

InForMed

POSITION II

EUREKA
innovation across borders

ASTON!SH
Advancing Smart Optical Imaging and Sensing for Health

SCOTT
Secure Connected Trustable Things

Penta

ULIMPIA
ULTRA-SOUND BODY PATCHES

ITEA 3

Disperse

HORIZON 2020

VOSTARS

BIOCDx

MADiA
MAgnetic DIagnostic Assay for neurodegenerative diseases

SOLUS

ORCHID
organ-on-chip in development

Other identified projects: HoliFAB (microfluidics), EnSO (Energy for Smart Object)
Photonics pilot lines PIXAPP, PIX4LIFE, MIRPHAB
Printed, flexible electronics pilot lines InSCOPE, PI-SCALE

SC1 Health projects involving new components and devices

How to be in HELoS network?

- Gaps in the roadmap – Health & Well-being
- Have your say: your input is important
  - Emerging opportunities for ECS in health and well-being applications
  - Projects and stakeholders to be included in our community
  - Open Technology Platforms
  - Related issues (standards, regulation, competition…)
  - Ideas to support Health.E Lighthouse

- Answer to our questionnaire
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Contribute to new Strategic Research Agendas for relevant PPPs in the new FP Horizon Europe

Interaction with future Health PPP

Public consultation until 25 November 2019 euhealthppp.org/consultation

Electronic Components and Systems already play a major role in healthcare products

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Thank you!

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