Creating a realistic digital roadmap:
Lessons learned from Cardiology

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Declaration of Interests

• Research grants administered by Imperial College London from Bayer, Boston Scientific, Abbott, and ResMed
• Consultancy and speaker fees from AstraZeneca, Servier, Novartis, Pfizer, Bayer, Medtronic, Boston Scientific, Abbott, Bristol Myers Squibb, Amgen, MSD.
• Non-Executive Director of NICE (2016-2020)
  • Chair, Digital Health Committee of the European Society of Cardiology
• Chief Physician-Scientist (Heart Failure) for AstraZeneca
What is the European Society of Cardiology?

• An independent, non-profit organisation of healthcare professionals who volunteer their time and expertise

• Represents >95,000 men and women in the field of cardiology from Europe, the Mediterranean Basin and beyond.

www.escardio.org
The ESC Community

The ESC is a global organisation that caters for all cardiovascular specialists.

Our diversity is our strength

100,000
scientists, clinicians,
nurses & allied
professions

57
National Cardiac
Societies
from Europe and the
Mediterranean basin

47
Affiliated Cardiac
Societies
from around
the globe

29
Subspecialty
Communities
The ESC’s role in fighting cardiovascular disease

The ESC acts in the interests of patients by providing cardiologists with the support and tools they need to deliver the best possible care. This not only means saving lives, but ensuring a good quality of life for the growing number of people living with cardiovascular disease.

The ESC does this by:

- Disseminating evidence-based, scientific knowledge through 15 scientific journals, numerous books and the world’s leading cardiovascular congress.
- Harmonising standards of care through their internationally respected ESC Clinical Practice Guidelines.
- Shaping heart health policy and regulation by fostering partnerships and providing scientific expertise and independent data.
- Providing a wealth of ESC scientific content, easily accessible on the ESC website, used by some 400,000 visitors each month.
Supporting our members

Improving members’ access to the latest science, best practices and networking

The ESC is a member organisation. Cardiologists and other healthcare professionals join the ESC and its subspecialty communities, to be part of a society that represents their interests within the health sector and gives them opportunities to network, access the latest science and use a broad array of services that support their ongoing professional development.

Healthcare professionals can choose ‘ESC Professional Membership’, ESC subspecialty memberships, or a combination of any memberships of their choice.
What we do
Leading congresses

Broad global reach and cutting-edge scientific programmes that change the way clinicians practice medicine

The ESC organises and co-organises 14 cardiology congresses.

Its award-winning flagship event, ESC Congress, is the largest and most influential cardiovascular assembly in the world, attracting more than 32,000 participants from some 150 countries each year. It is the pivotal event in the cardiology calendar, allowing healthcare professionals to keep up to date on the latest science while networking with their peers from different countries.
What we do
Robust research

Unbiased, real-life data that illustrate what is happening in cardiology today

The ESC’s key aims in this area include incubation, innovation, and management of world-class cardiovascular-related research programmes. It conducts research, drawing on expertise from ESC institutional members and international networks, including 21 Registries, involving 150,000 patients across 89 countries.*

The ‘ESC Atlas of Cardiology’ collates data from more than 40 healthcare realities. It highlights the gaps and inequalities in cardiovascular medicine today and is an invaluable tool in the ESC’s Advocacy programme.

The ESC is also a consortium partner in numerous EU funded research projects and provides grants to individuals to support excellence in research.

*As of July 2019
What we do

Advocating for heart health

Beyond science: Shaping an environment favourable to cardiovascular health

ESC Advocacy leverages the knowledge, network and influence of the cardiology profession to promote policy, regulation and research funding that advance cardiovascular science, support high quality healthcare, and encourage evidence-based decision making.

For all other information please contact:

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“There is a new and rapidly changing healthcare landscape, where digital technologies are becoming increasingly **normalized into the everyday delivery of healthcare.**”
e-Health: a position statement of the European Society of Cardiology

Martin R. Cowie, Jeroen Bax, Nico Bruinsing, John G. F. Cleland, Friedrich Koehler, Marek Malik, Fausto Pinto, Enno van der Velde, and Panos Vardas

Table I The domains of e-health, involving healthcare administration and support, education, healthcare delivery, and research

1. Telemedicine and telecare (including disease management services, remote patient monitoring, teleconsultations, and homecare)
2. Clinical information systems (electronic medical records, decision support and monitoring of clinical and institutional practice)
3. Integrated regional and national information networks and associated e-referrals and e-prescribing
4. Disease registries and other non-clinical systems used for education, public health, patient/disease-related behaviour, and healthcare management
5. ‘Mobile’ health (m-health) including mobile applications (‘Apps’): medical and public health practice supported by mobile technologies delivering health information, screening patients, monitoring physiological signs, providing direct care and education (sometimes considered part of telemedicine, but increasingly less medicalized)
6. ‘Personalized’ health (p-health): wearable or implantable micro- and nano-technologies with sensors and/or therapy delivery devices to help facilitate health and social care decision making and delivery (including fall detectors, implantable insulin pumps, defibrillator vests, etc.).
7. ‘Big Data’—large-scale integration and analysis of heterogeneous data sources, usually of high volume (amount of data), velocity (speed of data in and out), and variety (range of data types and sources), ideally linked at the individual person level to provide a more holistic view of a patient/individual and shed light on social and environmental factors that may influence health.
The covid19 pandemic has accelerated DH adoption

• 2020 was the year of the “tech-celleration”
• Investment in digital health boomed, particularly for on-demand healthcare services and remote care
• Telemedicine went mainstream
• Digital health became truly global
• Apps and wearables challenged interaction with HCPs
• Regulators increasingly approved AI for medical uses
• Virtual events replaced in-person events
A digital “fingerprint” of our patients
The complexity of medicine now exceeds the human mind.
ML to the rescue…

- If designed, validated and implemented appropriately, ML will HELP in acquiring, interpreting and synthesizing healthcare data from multiple sources and putting it at our fingertips....."like an expert subspecialist to call upon for every patient and for every clinical situation"....

Quer G et al. JACC 2021; 77: 300-13
TABLE 3  Select FDA-Cleared Machine Learning Products for Cardiology

<table>
<thead>
<tr>
<th>Company</th>
<th>Product</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>AliveCor</td>
<td>AliveCor Heart Monitor</td>
<td>Atrial fibrillation detection</td>
</tr>
<tr>
<td>Apple</td>
<td>Apple Watch</td>
<td>Atrial fibrillation detection</td>
</tr>
<tr>
<td>Arterys</td>
<td>CardioDL</td>
<td>CMR measurement</td>
</tr>
<tr>
<td>Caption Health</td>
<td>EchoMD AutoEF, Guidance</td>
<td>Echocardiogram LVEF measurement, guidance</td>
</tr>
<tr>
<td>Canon</td>
<td>Advanced Intelligent Clear-IQ Engine (AiCE)*</td>
<td>General biomedical image denoising</td>
</tr>
<tr>
<td>Eko Devices</td>
<td>Eko Analysis Software</td>
<td>Audiogram interpretation</td>
</tr>
<tr>
<td>FitBit</td>
<td>ECG App</td>
<td>Atrial fibrillation detection</td>
</tr>
<tr>
<td>PhysioQ</td>
<td>Heart Rhythm and Respiration Module</td>
<td>ECG, vital signs, cardiac function</td>
</tr>
<tr>
<td>Qompium</td>
<td>FibriCheck</td>
<td>Atrial fibrillation detection</td>
</tr>
<tr>
<td>Shenzhen Carewell Electronics</td>
<td>AI-ECG Platform &amp; Tracker</td>
<td>ECG interpretation</td>
</tr>
<tr>
<td>Subtle Medical</td>
<td>SubtlePET,* SubtleMR*</td>
<td>General biomedical image denoising</td>
</tr>
<tr>
<td>Ultronics</td>
<td>EchoGo Core</td>
<td>Echocardiogram measurements</td>
</tr>
<tr>
<td>Zebra Medical Vision</td>
<td>HealthCCS</td>
<td>Coronary calcium score</td>
</tr>
</tbody>
</table>

*These products are not specifically cardiovascular, but provide general tools for image denoising.
CMR = cardiac magnetic resonance imaging; ECG = electrocardiogram; LVEF = left ventricular ejection fraction.

Quer G et al. JACC 2021; 77: 300-13
But what about the downsides?

Ethical and Regulatory Concerns
- Biases
- Lack of transparency
- Privacy concerns with the data used for training AI models
- Safety and liability issues with AI applications in clinical environments
- Does it work in real life?

“…automation won’t replace physicians, but those using automation will replace those that don’t.”

J Am Med Inform Assoc 2020; 27: 491–497
https://doi.org/10.1093/jamia/ocz192
The roadmap

• Set up the Digital Health Committee to co-ordinate a strategic approach across the ESC
  • Educate members about DH
  • Support evidence-based implementation
  • Advocacy for standards & best practice
  • Stakeholder engagement to ensure co-design & appropriate evaluation of DH tools
  • Foster DH research in CV disease
Listening to our members needs

Asteggiano R et al. Eur Heart J Digit Health 2021 [https://doi.org/10.1093/ehjdh/ztab032]

Knowledge about Digital Health

- Expert: 14.1%
- Fair: 57.4%
- Low: 25.9%
- None: 2.5%

Daily exposure to Digital Health

- mHealth: Never 17.1%, Very frequent 22.7%
- pHealth: Never 19.5%, Very frequent 23.2%
- Telemedicine and telecare: Never 19.5%, Very frequent 23.2%
- Clinical information systems: Never 17.5%, Very frequent 33.8%

[Diagram showing percentage of responses for different categories of Digital Health exposure]
Barriers and Solutions...


**BARRIERS**
- Stakeholder resistance to adopt digital health based care:
  - Lack of patient motivation and digital health literacy skills
  - Lack of healthcare provider belief in digital health care
- Legal, ethical & technical barriers:
  - Mobile data privacy, security & liability concerns
  - Lack of interoperability
- Other barriers:
  - Lack of health economical evaluations
  - Lack of reimbursement

**SOLUTIONS**
- Stakeholder resistance to adopt digital health based care:
  - Establish patient digital health education programs
  - Redesign contemporary workflow models
- Legal, ethical & technical barriers:
  - Establish European-wide digital health certification programs
  - Assure compliance to applicable digital health directives
  - Assure interoperability of digital health services
- Other barriers:
  - Encourage economical evaluations of digital health based care
  - Inform health insurance industry & policy makers
  - Stimulate digital health related knowledge & experience sharing

**How to deploy digital health based care in Europe?**

ESC e-Cardiology Working Group Position Paper: Overcoming challenges in digital health implementation in cardiovascular medicine
Digital Health Activities @ESC

FROM a Summit 2019

TO a Digital event 2020

TO launch of a new journal
Digital Health Week 2020: 3 Themes

A. Devices & mobile applications in cardiology
   What works in 2020?

B. Artificial intelligence & Big Data in cardiology
   Evidence & perspectives in 2020

C. Telemonitoring & remote/teleconsultations
   Integrating advances into daily practice
European Heart Journal - Digital Health

Goals:

– To become the preferred Digital Health journal in Cardiology
– Open access
– First issue Nov 2020, with 4 issues per year
– Accepted papers published immediately on-line

– Aim: PubMed central 12 months ✓
– Aim: Medline inclusion 18 months
– Aim: Impact factor 3 years

– Editor-in-Chief: Nico Bruining, NL

https://academic.oup.com/ehjdh
Advocacy & Best practice
Being part of the conversation
The best way to predict the future is to create it.