ENRICH

EUROPEAN NETWORK OF RESEARCH AND INNOVATION CENTRES AND HUBS, USA

US Innovation Market Guide on eHealth

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Executive Summary

This market guide is a product of the ENRICH in the USA, which is the European Network of Research and Innovation Centers and Hubs. Promoted by the European Commission (EC) through Horizon 2020, ENRICH in the USA acts as a central contact point for European research and innovation actors seeking to grow and reinforce collaboration across the Atlantic. The mission of the Network is to provide standardized, as well as various tailor-made, research & innovation internationalization support services to European researchers and innovators to accelerate access to the United States (US) market and maximize chances of success.

This market guide provides relevant information on the US innovation and market landscape in regard to eHealth. eHealth is a leading innovation area in the European Union (EU) and US, as both regions are highly committed to introducing groundbreaking technology in the way healthcare is delivered. The EU and US aim to transform their healthcare systems from reactive and centered to more preventive, evidence-based and person-centered.

The Market guide identifies US key innovation hubs/facilitators and industry related centers, as well as the US main eHealth market opportunities and barriers. The Market guide also provides some key eHealth related networks and events and assesses the existing funding initiatives and programs at both federal and state level that promote eHealth innovation. Overall, this market guide aims to be an effective tool for EU research and business representatives in the eHealth related fields to gain knowledge on the US eHealth innovation and market landscapes, and therefore facilitate their initial approaches to establishing innovation and business collaborative activities with their US counterparts Figure 1.

Figure 1 - Initial Approaches for Establishing Collaborative Innovation and Business Activities

Importance of eHealth innovation to the EU and the US

The World Health Organization (WHO) defines eHealth as the "systematic application of information and communications technologies, computer science, and data to support informed decision-making

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by individuals, the health workforce, and health institutions, to strengthen resilience to disease and improve health and wellness for all”1. In parallel, according to the EC, eHealth refers to “tools and services that use information and communication technologies (ICT) to improve prevention, diagnosis, treatment, monitoring and management of health-related issues and to monitor and manage lifestyle habits that impact health. Digital health and care are innovative and can improve access to care and the quality of that care, as well as to increase the overall efficiency of the health sector”2.

The eHealth market has become a key market for accessing health information, as well as improving the process of gathering, managing, and using the information to make healthcare delivery processes more efficient3, 4. The progress in the eHealth industry is expected to result in the creation of several market opportunities related to the development of new innovative tools and services5. Thus, both the EU and US consider eHealth a rapidly developing and innovative market and are highly committed to encouraging the effective use of ICT to deliver better health services6. Therefore, cooperation among the public and private sector is key for the development and deployment of eHealth related technologies6

The EU recognizes the US as a strategic partner due to the level of development of its eHealth market. In December 2010, the US Department of Health, and Human Services (HHS) and the European Commission's Directorate-General for Communications Networks (DG CONNECT) signed a Memorandum of Understanding (MoU) for transatlantic cooperation on eHealth/Health IT7. The MoU aims to support an innovative collaboration between EU and US public and private sector entities to foster development, deployment, and use of eHealth ICT to improve healthcare delivery in both regions8.

Innovation ecosystem

The eHealth industry comprises a wide range of technologies, including mobile health apps, networked wearable devices, and telemedicine. The pervasiveness of the internet and smartphones, as well as the rising trend towards better lifestyles and enhanced well-being, have resulted in tremendous growth in this sector. The COVID-19 pandemic has also boosted expansion in the eHealth sector by increasing public access to healthcare and self-monitoring of health issues9. The US eHealth revenue has been steadily increased over the years. In 2023, the revenue for the US eHealth market is projected to hit

1https://iris.who.int/bitstream/handle/10665/260480/WHO-RHR-18.06-eng.pdf;jsessionid=82FE71E981CF4148E5961CD9CE61D2DD?sequence=1

2https://health.ec.europa.eu/ehealth-digital-health-and-care/overview_en

3https://www.linkedin.com/pulse/importance-ehealth-from-innovation-implementation-ethem-kamaci/

4https://www.focuscura.com/en/knowledge-development/blog/e-health-importance-usability-and-accessibility

5https://innovation-awards.nl/news/e-health/

6 https://www.euussciencetechnology.eu/themes/health

7https://digital-strategy.ec.europa.eu/hu/node/5057

8https://ec.europa.eu/health//sites/health/files/ehealth/docs/ev_20131119_co4_3_en.pdf

9 https://www.statista.com/outlook/dmo/digital-health/united-states#analyst-opinion

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$44.45 billion10 From 2023 to 2028, the US eHealth revenue is expected to show an annual growth rate (CAGR) of 8.54%, resulting in a projected market volume of $66.96 billion10.

When analyzing the US eHealth innovation ecosystem, the European SMEs should first identify the innovation hubs and facilitators of innovation that are most relevant for this sector. The innovation ecosystem is the term used to describe the numerous participants and resources that are needed for the innovation process11. Considering the multiplicity of actors that the innovation ecosystem encompasses, this market guide focuses on the identification of the leading eHealth innovation hubs, facilitators of innovation and industry-related centers. From the assessment of the US eHealth innovation and industry communities' landscape, it is clear there is a particular concentration of innovation hubs/facilitators and industry-related RDI centers in the states of California, Texas, Massachusetts, and New York.

Innovation hubs are ecosystems comprised of SMEs, large industries, startups, researchers, accelerators, and investors that aim to foster relationships between these entities and act as a bridge between research and market needs12. Currently, eHealth hubs are revolutionizing the future of healthcare in the US. Many companies and innovation facilitators focused on Big Data for Health, Electronic Health Record (EHR), Health Information Systems (HIS), mHealth and Telemedicine are establishing their activities in innovation hubs across the US.

Facilitators of innovation are responsible for supporting, promoting, and accelerating the innovation process. Business accelerators, incubators, science parks, and specialized consulting firms are considered facilitators of innovation, which play a very important role in the eHealth innovation process. In the US, numerous eHealth companies are early-stage businesses and therefore often require incubator and accelerator programs to attract seed and early-stage financing and accelerate their eHealth businesses13.

Industry-related RDI centers are entities that include businesses as members or partners. Since eHealth is a field deeply rooted in ICT and innovation, cooperation between researchers, industry members and innovation facilitators are crucial in fostering the advancement of new eHealth technologies and tools. In the US, most large companies in the Healthcare sector seem to primarily conduct RDI related to eHealth tools in-house and not through the establishment of partnerships with universities or/and academic entities14, 15. Therefore, most industry-related centers typically include members or partners of Small and Medium Enterprises (SMEs) in the healthcare sector, which are more dependent on the knowledge and technology from academic entities to develop new eHealth products.

10 https://www.statista.com/outlook/dmo/digital-health/united-states
[11]https://www.researchgate.net/publication/282122544_Innovation_Ecosystems_Implications_for_Innovation_Management
[12]http://americanjobsproject.us/system/innovation-ecosystem/
[13]https://www.fastcompany.com/3027636/4-major-benefits-of-startup-incubators
[14]https://www.prnewswire.com/news-releases/cvs-health-research-institute-study-shows-that-medication-reconciliation-programs-can-reduce-hospital-readmissions-300294934.html
[15]https://www.express-scripts.com/corporate/the-lab

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Market landscape

The US has one of the highest total healthcare expenditures in the world and, more importantly, it is the world-leading eHealth market. Although the US industry players from ICT areas have increased their investments in medical and health R&D in the past five years, there is still a short supply of trained health IT professionals in the country. As a result, the US has many opportunities for eHealth R&D and business. The opportunities seem to largely compensate for the barriers-to-entry. In order for commercialization in the US market, eHealth products need to be compliant with the US federal regulatory laws as well as with the country's multiple state laws.

Considering the size of the US eHealth market, there are states that can be considered leading regions from a market perspective. It seems that the final-end users of Big Data for Health, Electronic Health Record (EHR) and Health Information Systems (HIS) related products, which are clinics and hospitals, are especially concentrated in the states of California, Texas, New York, Florida, and Pennsylvania. In parallel, the final-end users of mHealth16 and Telemedicine17 products, which are the home health service providers, seem to be primarily located in the states of Florida, Missouri, California, Pennsylvania, and Tennessee.

Networks and events

The technologies associated with eHealth products are continuously changing and advancing quickly. Therefore, to be kept updated on the latest emerging innovations and market trends in the US eHealth sector, EU researchers and industry representatives are recommended to be in contact with the key US eHealth-related networks, as well as to attend US conferences and networking events focused in the eHealth field. A sample of the key eHealth-related networks and events are presented within the Market guide.

Initiatives and programs

In the US, eHealth innovation is highly supported by federal and state initiatives and programs that prioritize research areas that can lead to technological breakthroughs. Most medical and health R&D initiatives and programs are funded by federal agencies. In 2020, the Federal government invested a total of $61.5 billion (nearly €58.27 billion), with the National Institutes of Health (NIH) spending about $48.9 billion (nearly €46.33 billion) in medical and health R&D. In the same year, the state and local governmental agencies invested $2.1 billion (nearly €1.9 billion) in medical and health R&D activities18.

[16] mHealth can be defined as the use of mobile communication devices to deliver healthcare services.
[17] Telemedicine can be defined as the remote delivery of healthcare services over the telecommunications infrastructure.
[18] https://www.researchamerica.org/wp-content/uploads/2022/09/ResearchAmerica-Investment-Report.Final_.January-2022-1.pdf

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At the federal level, eHealth innovation is primarily supported by programs and initiatives from the US Department of Health and Human Services (HSS), the National Science Foundation (NSF) and the US Department of Defense. (DOD). Since each US state has independent authority to regulate and oversee the practice of medicine within its boundaries, only some states consider the integration of eHealth products in their healthcare systems as a priority. As a result, not all states have initiatives and programs aiming to promote eHealth innovation.

Although, there are several programs and initiatives at both federal and state level, it is important to note that the information related to funds and grants for European representatives is difficult to find. In most cases, the European research and business representatives interested in US eHealth initiatives and programs need to contact the program officers to know specific details about international eligibility.

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ENRICH in the USA Summary

ENRICH is the European Network of Research and Innovation Centers and Hubs. Started in April 2017, ENRICH in the USA is a H2020-funded initiative whose mission is to establish a Network of European Research and Innovation Centers and Hubs throughout the United States of America (USA). ENRICH in the USA acts as a central contact point for European research and innovation actors seeking to grow, reinforce collaboration, as well as find commercialization paths across the Atlantic. To do so, ENRICH in the USA is leveraging a network of vetted European and US Partners (entities - including "Ambassadors") and Experts (persons - including "Mentors") as defined below.

The Ambassadors are stakeholders (entities) already supporting R&I actors, and willing to join forces on outreach, funding, programs, and curriculums; this group includes Angel Networks, Venture Capital Firms, Corporate Investors, Corporate Open Innovation Teams, University Incubators, Equity-based accelerators, Clusters, Region, State and Country Government agencies and more. They can also support ENRICH in the USA via sponsorship (cash or in-kind).

Vetted by approved Ambassadors and the ENRICH in the USA team, Experts are individuals who are usually employees of Ambassadors with skills and industry experience. It includes Consultants/Service Providers (i.e., accountants, lawyers, etc.), Angel investors, as well as Mentors. Mentors are volunteering their time to support EU innovators (i.e., review pitches, collaterals, participation in meetings, etc.).

ENRICH in the USA targets to serve the following actors:

- Accelerators
- Businesses
- Clusters
- Entrepreneurs
- Funding Agencies
- Incubators
- Networks
- R&D institutes and labs
- Research managers and administrators
- Research Parks
- SME's
- Start-ups
- Universities
- University Associations

The ENRICH in the USA includes the following entities:

- **Two physical ENRICH in the USA Centers**:
  - **San Francisco Center** (managed by Temple University SBDC)
  - **Boston Center** (managed by Temple University SBDC)
- **Eight Associate Hubs across the US**, and plans to expand the ENRICH in the USA Network beyond these first five Hubs, over four years:
  - In **PA**: Temple University
  - In **VA**: George Mason University
  - In **CA**: California Polytechnic University or Cal Poly

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- In **CA**: UC Berkeley
- In **IN**: Purdue University
- In **MA**: Northeastern University
- In **CA**: Santa Clara University

The ENRICH in the USA Network is built on local US experience and strong existing ties between the EU and USA, while providing new researcher- and entrepreneur-serving capabilities which that address the resource gaps necessary to enable access for all EU Member States and Associated Countries. A variety of services are proposed for researchers and entrepreneurs engaged by the Network during the pilot phase, then the Centers' pilot activities will be evaluated to inevitably retain the initiative's most successful components to ensure a sustainable plan for ENRICH in the USA in the future.

Piloted services targeted various, commercially viable technology maturity levels, both research-oriented and market-oriented, besides research connection symposia, business matchmaking opportunities, working visits and innovation tours to US organizations to explore technology/product partnerships and/or business development middle/long term opportunities, pitching to potential investors, entrepreneurial boot camps, workspace access, hands-on business acceleration programs, and more will all be included.

ENRICH in the USA Consortium:

Coordinator: GAC Group (GAC), France

Partners:

> German Aerospace Center (DLR), Germany
> Temple University SBDC (Temple), USA
> European Business and Innovation Center Network (EBN), Brussels - Partner in Phase 1 (2017-2020)
> International Business Innovation Association (InBIA), USA - Partner in Phase 1 (2017-2020)
> European American Enterprise Council (EAEC), USA - Partner in Phase 1 (2017-2020)
> INTRASOFT International (INTRA), Luxembourg - Partner in Phase 1 (2017-2020)
> Sociedade Portuguesa de Inovação (SPI), Portugal
> Regional Center for Information and Scientific Development (RCISD), Hungary
> National Council of University Research Administrators (NCURA), USA

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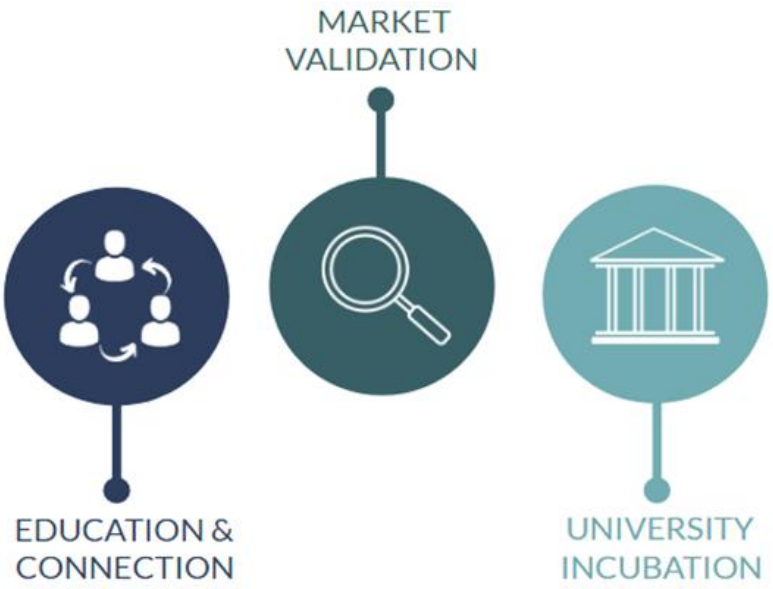

Figure 2 - ENRICH in the USA butterfly

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List of Abbreviations

Table 1 - List of Abbreviations

Abbreviation	Explanation
AAHAM	American Association of Healthcare Administrative Management
ACA	Affordable Care Act
AHCA	American Health Care Act
AHIC	American Health Information Community
AHN	Allegheny Health Network
AMIA	American Medical Informatics Association
ANIA	The American Nursing Informatics Association
ASHIM	American Society of Health Informatics Managers
ATA	American Telemedicine Association
BD2K	Big Data to Knowledge
CAH	Clinical Access Hospital
CETF	California Emerging Technology Fund
CHIP	Children's Health Insurance Program
CISE	Computer and Information Science and Engineering
CMCS	Centers for Medicaid and Children's Health Insurance Program services
CMS	Centers for Medicare & Medicaid Services
CTN	California Telehealth Network
DLR	Deutsches Zentrum für Luft- und Raumfahrt

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Abbreviation	Explanation
DOD	US Department of Defense
EAEC	European American Enterprise Council
EB TNGP	The Evidence-Based Tele-Emergency Network Grant Program
EBN	European Business and Innovation Centre Network
EC	European Commission
EHR	Electronic Health Record
EU	European Union
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FORHP	Federal Office of Rural Health Policy
GADPH	Georgia Department of Public Health
HCIA	Health Care Innovation Awards
HHS	US Department of Health and Human Services
HIMSS	Healthcare Information and Management Systems Society
HIPAA	Health Insurance Portability and Accountability Acat
HIS	Health Information Systems
HIT	Healthcare Information Technology
HRSA	Health Resources & Services Administration
InBIA	International Business Innovation Association
InTelMed	Informatics and Telehealth in Medicine
INTRA	INTRASOFT International

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Abbreviation	Explanation
IoT	Internet of Things
IT	Information Technology
I/UCRC	Industry/University Cooperative Research Center
I/UCRC-CAKE	NSF Industry/University Cooperative Research Center for Advanced Knowledge Enablement
JTMN	Joint Telemedicine Network
KOL	Key Opinion Leaders
mHealth	Mobile Health
MHCC	Maryland Health Care Commission
MoU	Memorandum of Understanding
MS	Member States
NCR	National Center Region
NCURA	National Council of University Research Administrators
NIH	National Institutes of Health
NSF	National Science Foundation
NYeC	New York eHealth Collaborative
PMI	Precision Medicine Initiative
QuBBD	Quantitative Approaches to Biomedical Big Data
RCISD	Regional Centre for Information and Scientific Development
RTP	Research Triangle Park
R&D	Research and Development

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Abbreviation	Explanation
RC	Research Commercialization
SCH	Smart and Connected Health
SDSC	San Diego SuperComputer Center
SIMs	State Innovation Models
SME	Small and Medium Enterprise
SPI	Sociedade Portuguesa de Inovação
STSI	Scripps Translational Science Institute
T2	The National Center for Telehealth & Technology
UC	University of California
UCSF	University of California, San Francisco
UNLV	University of Nevada, Las Vegas
UTMB	University of Texas Medical Branch
VAC	Value Analysis Committee
WHO	World Health Organization

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1 Introduction

This market guide, which has been developed in the context of the ENRICH in the USA network, aims to provide relevant information on the United States (US) landscape regarding the eHealth-related innovation ecosystem and market. It provides relevant information on the US eHealth innovation ecosystem and market, including the leading regions from an innovation and market perspective; the key innovation hubs/facilitators; a sample of the main research networks/ professional organizations; as well as important funding programs and initiatives at both federal and state levels.

The Market guide can be an effective source or tool for the European Union (EU) academic and industry communities to gain knowledge on the US related to eHealth fields and:

- To identify the US leading regions from an innovation and market perspectives;
- To identify potential approaches for developing collaborative partnerships with US facilitators of innovation and/or businesses;
- To identify relevant US networks and conferences that can be used as a conduit to meeting potential innovation and market partners; and
- To identify and assess the opportunity to access US funding programs related to eHealth in order to propose potential partnerships with US organizations.

Therefore, it is the hope of the Market guide authors that the information is useful in assisting the EU research organizations and Small and Medium Enterprises (SMEs) in their efforts to develop stronger ties to the US eHealth innovation ecosystem and market.

Healthcare: eHealth

The World Health Organization (WHO) defines eHealth as the "systematic application of information and communications technologies, computer science, and data to support informed decision-making by individuals, the health workforce, and health institutions, to strengthen resilience to disease and improve health and wellness for all"[1]. In parallel, according to the EC, eHealth refers to "tools and services that use information and communication technologies (ICTs) to improve prevention, diagnosis, treatment, monitoring and management of health-related issues and to monitor and manage lifestyle habits that impact health. Digital health and care is innovative and can improve access to care and the quality of that care, as well as to increase the overall efficiency of the health sector"[2].

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The eHealth market aims to provide more efficient diagnosis, administration, remote care and monitoring, as well as cost-effective and wider healthcare delivery using advanced ICT[19, 20, 21]. Globally, the eHealth market has been growing which has resulted in an increasing introduction of groundbreaking transformations in healthcare delivery[22]. These transformations include new ways for accessing health information, as well as improving how that information is gathered, managed and used to improve the efficiency and cost-effectiveness of healthcare delivery processes[23, 24]. The progress in the eHealth industry is expected to create several market opportunities related to the development of new innovative tools and services.

The recent ICT developments, such as the emergence of the Big Data, Cloud and Internet of Things (IoT) technologies, were key drivers for the growth of the eHealth market. Those developments allow the improvement of existing eHealth products as well as the development of new eHealth products.

Currently, the eHealth market is highly complex and encompasses a wide variety of products. According to several studies, the main products in the eHealth market can be categorized as the following[25, 26, 27]:

- **Big Data for Health:** systems that collect high volumes of clinical, environmental and lifestyle information from single individuals to large cohorts, regarding their health and wellness status, at one or several time points[28];
- **Electronic Health Record (EHR):** digital version of a patient's paper chart. EHRs contain patients' clinical data, allow access to evidence-based tools that providers can use to make decisions about a patient's care and automate and streamline provider workflow[29];
- **Healthcare Information System (HIS):** an information system for processing data, information, and knowledge in healthcare environments. It can be defined as an integrated effort to collect, process, report, and use health information and knowledge to influence policymaking, program action, and research[30];
- **Mobile Health (mHealth):** mobile software and technology used for medical care, disease surveillance, treatment support, epidemic outbreak tracking and chronic disease management[31]; and

19http://www.grandviewresearch.com/press-release/global-e-health-market
20https://www.prnewswire.com/news-releases/global-e-health-market---by-application-type-region---trends-market-shares-forecasts-2015--2020-300147395.html
21https://ec.europa.eu/digital-single-market/en/news/report-identifies-challenges-and-trends-ehealth
22https://innovation-awards.nl/news/e-health/
23https://www.linkedin.com/pulse/importance-ehealth-from-innovation-implementation-ethem-kamaci/
24https://www.focuscura.com/en/knowledge-development/blog/e-health-importance-usability-and-accessibility
25https://www.fda.gov/medical-devices/digital-health-center-excellence/what-digital-health
26https://digital-strategy.ec.europa.eu/en/library/ehealth-adoption-primary-healthcare-eu-rise
27 https://www.ncbi.nlm.nih.gov/books/NBK470260/
28http://www.bdva.eu/sites/default/files/Big%20Data%20Technologies%20in%20Healthcare.pdf
29https://www.healthit.gov/faq/what-electronic-health-record-ehr
30https://link.springer.com/referenceworkentry/10.1007/978-1-4020-5614-7_1425
31http://searchhealthit.techtarget.com/definition/mHealth

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- **Telemedicine:** remote delivery of healthcare services, such as health assessments, consultations or prescriptions (E-prescribing), over telecommunication infrastructures[32].

Importance of eHealth market to the EU and US

The EU eHealth market is growing strongly, as the EU is highly committed to supporting its development. The EU eHealth revenue is expected to reach $14.02 billion in 2023[33]. From 2023 to 2028, the Europe eHealth revenue is expected to show an annual growth rate (CAGR) of 8.49%, resulting in a projected market volume of $21.07 billion (nearly €20.02 billion)[33]. As of 2023, Germany ($2.714 million, nearly €2,578 million)and the United Kingdom ($$1,804 million, nearly €1,714 million) are among the leading contributors to the world eHealth market[34, 35].

The increasing pressure from healthcare systems of the EU Member States (MS) to change the way healthcare is delivered has led to the development of the Digital Single Market Strategy. This Digital Single Market Strategy aims to boost the competitiveness of the eHealth industry, among others, through improving interoperability and standardization. By ensuring effective communication and connections between digital components, supply chains, industry and service sectors, communities, public services and authorities, it encourages the development of new eHealth technologies and the expansion of the eHealth industry[36,37]

Therefore, to support the growth of the eHealth market, the EU has defined a set of actions to support its MS developing cross-border eHealth services and to foster the deployment of Telemedicine, as well as to develop guidelines on the security, safety and interoperability of mHealth apps[38]. These actions are expected to generate competitive advantages to the EU eHealth market and stimulate its global growth.

The EU recognizes the US as a strategic partner due to the level of development of its eHealth market. Currently, both the EU and the US are highly committed to encouraging effective use of ICT to deliver better health services that could lead to more efficient health promotion and disease prevention[39]. As a result, in December 2010, the US Department of Health and Human Services (HHS) and the European Commission's DG CONNECT signed a Memorandum of Understanding (MoU) for promoting transatlantic cooperation on eHealth/Health IT[40]. In 2015, DG CONNECT and HHS released the updated Roadmap of specific MoU actions, which has been guiding activities focusing on:

1. Advancing eHealth/Health IT Interoperability,

[32]http://searchhealthit.techtarget.com/definition/telemedicine
33 https://www.statista.com/outlook/dmo/digital-health/digital-treatment-care/europe?currency=usd
[34]https://www.statista.com/outlook/dmo/digital-health/digital-treatment-care/germany?currency=usd
35 https://www.statista.com/outlook/dmo/digital-health/digital-treatment-care/united-kingdom?currency=usd
36 https://ec.europa.eu/commission/presscorner/api/files/attachment/8210/DSM_communication.pdf
[37]https://ec.europa.eu/health//sites/health/files/ehealth/docs/2016_ehealthleaflet_vertical_en.pdf
[38]https://eufordigital.eu/wp-content/uploads/2021/03/Common-Guidelines-for-eHealth-Harmonisation-and-Interoperability.pdf
[39]https://oncprojectracking.healthit.gov/wiki/display/TechLabSC/EU-US+eHealth+Cooperation+Initiative
[40]https://2009-2017.state.gov/p/eur/rls/or/2016/260929.htm

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2. eHealth/Health IT Workforce Development, and
3. Supporting Transatlantic eHealth/Health IT Innovation Ecosystems[41].

Overall, as the EU and the US consider eHealth innovation and market a priority from both academic and business perspectives, the cooperation among public and private sector entities from both regions is perceived as key for the development and deployment of technologies crucial for the market growth[42].

41 https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=12123
42https://digital-strategy.ec.europa.eu/en/news/european-union-and-united-states-america-strengthen-cooperation-research-artificial-intelligence

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2 US innovation ecosystem

The US is the world's leading country in terms of R&D investment, with a total spending on R&D in 2022 of $791.9 billion[43], which represents roughly 3.4% of its Gross Domestic Product (GDP) of $23.32 trillion[44]. The R&D programs are mainly supported by industry ($587.7 billion, nearly €553.44 billion, in 2021), the Federal government ($153.3 billion, nearly €144.36 billion, in 2021), academia ($24.1 billion, nearly €22.7 billion, in 2021), the non-Federal government ($5.9 billion, nearly €5.59 billion, in 2021), and non-profit organizations ($21.0 billion, nearly €19.78 billion, in 2021). Moreover, according to the latest data available, in 2021, the US R&D investment made up 41% of the global R&D expenditure[43,45,46,47,48]

In 2020, the US annual medical and health R&D expenditure amounted to $245.1 billion (nearly €232.90 billion), an 11.1% increase from 2019[49]. In 2020, industry accounted for 66% of the total investment in the US medical and health R&D ($1$161.8 billion, nearly €152.37?? billion). T The Federal government investment accounted for 25% of all US medical and health R&D at $61.5 billion, with the National Institutes of Health (NIH) alone accounting for 20% ($48.9 billion, nearly €46.05 billion) of all such investment in 2020. In terms of funding for medical and health R&D, the NIH is second only to the biopharmaceutical sector[49].

The US eHealth revenue has been steadily increased over the years. In 2023, the revenue for the US eHealth market is projected to hit $44.45 billion. From 2023 to 2028, the US eHealth revenue is expected to show an annual growth rate (CAGR) of 8.54%, resulting in a projected market volume of $66.96 billion[10]. The high growth rate of the eHealth market is likely due to the widespread use of the internet and smartphones, with the shifting tendency towards healthier lifestyles and increased well-being. In addition, the COVID-19 pandemic has boosted expansion in the eHealth sector by increasing public access to healthcare and self-monitoring of health issues[9].

The innovation ecosystem is the term used to describe the numerous participants and resources that are needed for the innovation process[50]. These stakeholders include researchers, universities, venture capitalists, industry companies, SMEs, startups, accelerators, incubators and investors. Considering the multiplicity of actors that the innovation ecosystem encompasses, this market guide focuses on the leading eHealth Innovation Hubs, the facilitators of innovation and the industry-related R&D centers to identify the US regions that most contribute to the eHealth innovation process.

43 https://ncses.nsf.gov/pubs/nsf23320#:~:text=U.S.%20Total%20R%26D&text=The%20three%20years%20leading%20to,%2C%20respectively%20(table%202).
44 https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=US
45 https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm
46 https://www.statista.com/statistics/732247/worldwide-research-and-development-gross-expenditure-top-countries/
47 https://fas.org/sgp/crs/misc/R44307.pdf
48 https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=US
49 https://www.researchamerica.org/wp-content/uploads/2022/09/ResearchAmerica-Investment-Report.Final_.January-2022-1.pdf
50https://www.researchgate.net/publication/282122544_Innovation_Ecosystems_Implications_for_Innovation_Management

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When analyzing the US eHealth innovation ecosystem, the EU academic and industry communities should first identify the innovation hubs/facilitators and industry related R&D centers that are most relevant for this sector. The assessment of the US eHealth innovation landscape, which comprises these key innovation actors, allows EU research organizations and SMEs to identify relevant US eHealth research and industry organizations that often develop multi-partner collaborative partnerships to advance eHealth technology.

2.1. Innovation Hubs

Innovation hubs is a physical space that create an environment for innovation and productive connections that influence the success of SMEs, large industries, startups, researchers, accelerators and investors and promote the translation of new ideas into products, processes and services[51]. Innovation hubs foster relationships among these entities and act as a bridge between the research activities and the market needs. Thus, a successful innovation hub promotes R&D activities, facilitates the development of new technologies and incubates early-stage companies[52]The US is home to some of the world's most recognized innovation hubs. The San Francisco Bay Area is internationally recognized for its world-class high-tech companies and numerous highly innovative startups. This innovation hub promotes world-leading technological trends as well as important advances in technology[53]. However, in recent years, Boston and New York have also emerged as world-leading innovation hubs due to their combination of funding with highly talented professionals, which can lead to important innovation breakthroughs[54,55].

Currently, the eHealth hubs are revolutionizing the future of Healthcare sector in the US. Many companies and innovation facilitators focused on Big Data for Health, EHR, HIS, mHealth and Telemedicine are establishing their activities in innovation hubs across the US. Therefore, the eHealth innovation hubs support the exchange of knowledge, foster the development of new technologies, facilitate capital attraction and promote research-industry partnerships that can lead to breakthroughs in the sector.

According to several studies, the US major innovation hubs for eHealth are primarily located in the San Francisco Bay Area, New York, Boston and Los Angeles metropolitan areas[56, 57, 58, 59, 60]. The companies

[51]https://ec.europa.eu/digital-single-market/en/blog/digital-innovation-hubs-ict-2015 https://www.innovationquarter.com/articles/what-is-an-innovation-hub/#:~:text=An%20innovation%20hub%20is%20a,industry%2Dchanging%20products%20and%20services.
[52]http://americanjobsproject.us/system/innovation-ecosystem/
[53] https://medium.com/@RussellMoopa/silicon-valley-innovation-hub-of-the-world-1925278c6289
[54] https://www.forbes.com/sites/noahkirsch/2016/10/18/why-boston-is-the-next-hub-for-innovation/#75ab33693d6a
[55] https://www.crowdspring.com/blog/startups-entrepreneurs-best-startup-cities-us/
[56]https://www.beckershospitalreview.com/digital-transformation/top-4-us-digital-health-hubs.html
[57] https://arkenea.com/blog/best-cities-for-healthcare-startups/
[58]https://healthtransformer.co/the-great-recalibration-2022-health-innovation-funding-dropped-by-50-yoy-yet-were-as-optimistic-cf13989b670f
[59]https://www.beckershospitalreview.com/healthcare-information-technology/thriving-outside-of-silicon-valley-9-other-digital-health-startup-hubs-to-know.html
[60] https://www.startupblink.com/blog/best-cities-for-startups-in-2023/

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of these four areas concentrate high levels of investment in eHealth Research, Development and Innovation (RDI), and also have the highest number of eHealth startups in the country, which demonstrates the potential to attract investment and promote innovation.[61,62].

Important eHealth hubs have also emerged in Chicago, Minneapolis, Salt Lake City, Austin and Denver metropolitan areas (listed by innovation rating). Currently, these areas are highly committed to invest in the development of the required infrastructure to host eHealth companies and support new ideas, technologies and tools related to eHealth products[59.]

The eHealth innovation hubs identified in this section, and listed by innovation rating, have been selected based on different sources[59,63, 64, 65,66]. The identified hubs are focused on at least one of the five areas: Big data for Health, EHR, HIS, mHealth and Telemedicine. Figure 3 presents an overview of the US leading Innovation hubs in the eHealth-related fields.

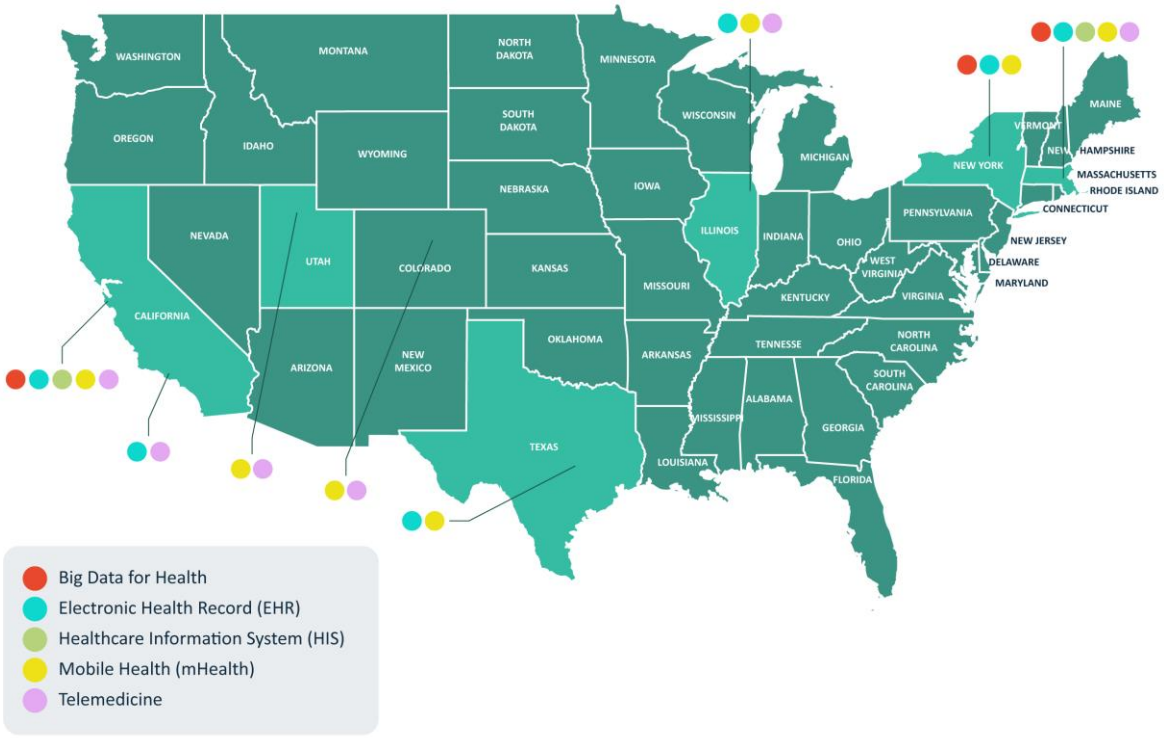

Figure 3 - US Mapping of the leading Innovation Hubs focused on eHealth-related products

[61] https://moove-it.com/most-developed-healthtech-countries#contact
[62]https://rockhealth.com/reports/digital-health-2015-midyear/#geographies
[63]https://www.drugdiscoverytrends.com/emerging-biotech-hubs-north-america/#:~:text=While%20traditional%20hubs%20like%20Boston,its%20biomanufacturing%20and%20robotics%20expertise.
[64] https://rockhealth.com/reports/2017-midyear-funding-review-a-record-breaking-first-half/
[65] http://fortune.com/2017/04/20/digital-health-revolution/
[66]https://www.forbes.com/sites/noahkirsch/2016/10/18/why-boston-is-the-next-hub-for-innovation/#4a9669933d6a

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Los Angeles, California

Areas: Telemedicine, EHR

Los Angeles has built a reputation for health innovations advances in the city. The biotech startups in the region received more federal research funding from NIH than any county in the state $1.9 billion. Academics Institutions such as UCLA and the new health entrepreneurs are attracting investors, providers and payors to create an eHealth ecosystem providing an environment of collaboration and technological advancement in the city[67]. The digital health sector in Los Angeles accounts for 20% of the health workers in the state of California, this sector generated in economic activity $98.8 billion in 2020[68].

The city also has its own Silicon Valley known as Silicon Beach, which is becoming an innovation ecosystem for healthcare delivery nationwide. Los Angeles ranks third in the U.S. in technology graduates, with 38,500 technology graduates in the last five years combined with the Los Angeles health-tech scene that comprises more than 180 startups. Technology and health find Los Angeles one of the best destinations for innovation in eHealth, creating a perfect ecosystem that ensures sustainable growth over time[69].

San Francisco Bay, California

Areas: Big Data for Health**,** EHR, HIS, mHealth, and Telemedicine

The San Francisco Bay Area is home to one of the world's most developed and dynamic eHealth ecosystems. In 2022, the San Francisco Bay Area received over $2 billion in NIH funding[70]. The San Francisco Bay area also attracted private investments due to the presence of some organizations in the Healthcare sector, namely Kaiser Permanente and Dignity Health, which have been investing in their own innovation centers to promote the development and deployment of new eHealth technologies and devices[71]. In 2016, this area received venture capital investment valuing $839 million (nearly €755 million)[72]. The Bay Area's healthcare industry has consolidated over the past 20 years and is now dominated by four systems: Kaiser Permanente, Stanford Health Care, University of California, San Francisco Medical Center (UCSF), and Sutter Health[73]. Smaller systems, like John Muir Health and El Camino Health, are ideal partners for larger systems looking to increase market share since they play significant roles in geographic submarkets. The Bay Area also comprises some of the country's most

67https://healthtransformer.co/the-bright-minds-of-los-angeles-emerging-healthtech-hub-3ec2255fa14a
68https://www.discoverlosangeles.com/sites/default/files/2022-04/2021BiocomCaliforniaEIR_LosAngelesCounty.pdf
69https://www.forbes.com/sites/forbeslacouncil/2018/10/19/why-digital-health-is-a-sector-to-watch-in-los-angeles/?sh=7719ce9846ae
70 https://www.cbre.com/press-releases/cbre-report-san-francisco-bay-area-among-the-top-three-fastest-growing-life-sciences-markets-in-2022
71https://www.bizjournals.com/sanfrancisco/slideshow/2016/12/23/7-hottest-bay-area-digital-health-companies-2016.html
72https://www.tfhc.nl/agenda/digital-health-mission-silicon-valleybay-area/
73 https://www.chcf.org/wp-content/uploads/2021/04/RegionalMarketAlmanac2020BayArea.pdf

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innovative eHealth startups[73,74]. The high demand for eHealth products has attracted numerous startups focused on EHR[75], Telemedicine[76], mHealth[77], Healthcare Information Systems[78] and Big Data for Health.

ENRICH in the USA Soft Landing Hubs: Initial contact points for California

Through the ENRICH J-1 Soft Landing Programs, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the eHealth domain.

ENRICH in the USA has some Soft-Landing Hubs located near the California industry cluster. These soft-landing hubs help SMEs to venture into North America, through a low-cost strategy and temporary visa. All the tools are provided, to conduct proof of concept tests, to connect with new strategic partners and potential clients, to revamp your product development, research, and intellectual property strategy within the U.S. market. Soft-landing hubs also ease access to local funding opportunities and grants to support research and commercialization efforts. Through the ENRICH J-1 Soft Landing Programs, interested participants can access Incubators/Innovation Centers of Universities dedicated to R&I in the eHealth domain, namely: CalPoly University – CIE, Citris Foundry at UC Berkeley, Galvanize – San Francisco and Santa Clara University.

CalPoly University – CIE

Cal Poly is a highly rated public university located in San Luis Obispo, California. It is one of two polytechnical universities in California, with the other located in Pomona. It is a large institution with an enrollment of 19,685 undergraduate students.

Admission is competitive as the Cal Poly acceptance rate is 28%. The university has six colleges that offer 65 undergraduate degrees and 39 Master's degrees. Popular majors include Business, Mechanical Engineering, and Biology. Cal Poly was ranked 115 out of 650 in a list of the best colleges in America by Forbes in 2019.

The CIE HotHouse is a community space created through the efforts of Cal Poly, the city and county of San Luis Obispo, the business community, and the Cal Poly Center for Innovation and Entrepreneurship (CIE). It is an off-campus location that houses CIE programs. The goal of the HotHouse is to support students and community members as they work to create new innovations and start business ventures.

Citris Foundry at UC Berkeley

74 https://spdload.com/blog/healthcare-startups-in-san-francisco/
[75]https://datamagazine.co.uk/23-most-innovative-electronic-health-record-ehr-startups-companies-san-francisco/
[76]https://www.builtinsf.com/companies/type/telehealth-companies
[77]https://wellfound.com/startups/l/san-francisco/mobile-health
[78]https://wellfound.com/startups/l/san-francisco/health-care-information-technology

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The University of California, Berkeley is a public land-grant research university in Berkeley, California. Established in 1868 as the University of California, it is the state's first land-grant university and the first campus of the University of California system. Its fourteen colleges and schools offer over 350 degree-programs and enroll some 31,000 undergraduate and 12,000 graduate students. Berkeley is ranked among the world's top universities by major educational publications.

When it comes to Research, from expeditions to Egypt in the late 1800s to stem cell research and artificial intelligence today, Berkeley has been at the forefront of research throughout its history. Here students can work side-by-side with Nobel Laureates, Fields medal winners, Fulbright Scholars, and MacArthur fellows.

Uniquely situated across multiple UC campuses, the CITRIS Foundry is ideally positioned to help new generations of innovators and entrepreneurs bridge the gap from lab to market and actualize rigorous, validated solutions to society's biggest challenges. The Foundry's Incubator offers guidance, education, and a home-base to de-risk entrepreneurship for early-stage founders, especially supporting those who have been historically marginalized, allowing innovators to confidently identify pathways to success and reach the next stage of development and investment for their emerging technology venture.

CITRIS FOUNDRY is part of CITRIS as one of its programs. Citris Banatao Institute departments focus on health research, energy, robots, policy lab, and enterprise innovation represented by Citris Foundry.

Galvanize – San Francisco

Galvanize helps to build and scale companies or projects with a custom co-working solution. Companies can get access to mentors, workshops, talent, and resources.

- Upskill & train teams: With custom curriculums, businesses can upskill their technical talent and accelerate business growth.
- Hire bootcamp graduates: At no cost, Galvanize's partnerships team connects organizations with job-ready software engineering talent graduating from their coding bootcamps.
- Hire trained veterans: As a VA VET TEC Preferred Provider, Galvanize matches talented, job-ready Veterans to open roles.
- Access corporate resources: Galvanize has the resources to help companies upskill or reskill their organizations, find efficiencies, and onboard talents.

Santa Clara University

Santa Clara University (SCU) is partnering with tech companies to bring smart solutions to its campus. Thus, in 2017 USC have adopted smart parking technology (which includes sensors to keep track of open spaces in parking garages; up to the minute information about the status of parking spaces), but also a system that detects pedestrians crossing the streets and automatically activates warning lights.

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Additionally, SCU has been working towards energy savings, to the extent that photovoltaics, solar thermal systems, and wind turbines have been gradually installed on the campus as part of the Green Power Program, a program that aims to prevent the emission of over 21,545 tons of carbon dioxide each year and at the same time provide smart energy solutions to the campus.

Boston, Massachusetts

Areas: Big Data for Health, EHR, HIS, mHealth and Telemedicine

Boston is home to a large network of leading universities, research centers, teaching hospitals, startups, venture capital firms, accelerators and incubators, which cooperate within the same innovation ecosystem[79] and are focused on developing solutions on Big Data Analysis[80], EHR[81], HIS[82] mHealth[83] and Telemedicine[84]. The Massachusetts Digital Health Cluster brings together 350 health technology actors, creating a unique eHealth innovation hub with several assets, from digital health accelerators to piloting environments[85].

In January 2016, a coalition of leaders including Massachusetts Governor Charlie Baker, Boston Mayor Marty Walsh, and industry executives announced the Massachusetts Digital Healthcare Initiative, which is considered a key opportunity to capture private investment[86]. This initiative is expected to bring together public, private, academic, and healthcare leaders to build a stronger and more innovative eHealth ecosystem. Moreover, several private industry-led initiatives have been announced to foster the development of new technologies for the market[87]. The Massachusetts ecosystem provides a unique market opportunity where Massachusetts stakeholders can invest time and resources to drive the growth and differentiation of their eHealth ventures: access to data and patients, accessing, building and attracting talent. This will create many new opportunities for the Boston´s workforce and will likely result in the emergence of new, innovative digital health companies that will have the power to transform healthcare.[88]

[79] https://www2.deloitte.com/content/dam/Deloitte/us/Documents/life-sciences-health-care/new-roads-healthcare-pov.pdf
[80]https://www.forbes.com/sites/petercohan/2012/06/08/five-reasons-massachusetts-to-lead-big-data-market/#51b2a83e5798
[81] https://medcitynews.com/2017/08/boston-transformed-powerful-digital-health-ecosystem/?_hsenc=p2ANqtz-9hf1_2SNx8NaIDA7e6xCXe1CiapK2qT4Cbpk3vYChm9j67kwjB1daDgE0wzN4AXFTd7WvWlfnaJWukcUzJArhw9JkqiQ&_hsmi=54967768
[82] https://lightit.io/blog/bostons-top-accelerators-for-digital-health-startups-2022/
[83]http://bostonstartups.net/startups/mobile_health
[84]http://www.massgeneral.org/telehealth/
[85]http://massdigitalhealth.org/why-massachusetts
[86]https://medcitynews.com/2017/08/boston-transformed-powerful-digital-health-ecosystem/
[87] https://mehi.masstech.org/news/massachusetts-launches-comprehensive-digital-health-initiative
[88] https://www.massbio.org/wp-content/uploads/2020/03/MassBio-Digital-Health-Report_Feb-2019_FINAL.pdf

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ENRICH in the USA Soft Landing Hubs: Initial contact points for Massachusetts

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Northeastern University and its Innovation Campus at Burlington, Massachusetts (ICBM)

Northeastern University's unique, customizable research-partnership model offers co-location of industry, government, and Northeastern research laboratories and access to university faculty and PhD students. They also provide joint project planning and management to speed progress toward goals, flexible IP policies that benefit all participants, customized training and educational programs to give teams a competitive edge, expertise in areas that include novel materials and devices; manufacturing; national security, cybersecurity, and intelligence; drug analysis and testing; structural testing of materials and designs; large-structure design and testing; and data analytics, systems modeling, and network science. Additionally, they maintain rigorous, ITAR-compliant protocols and practices in a secure environment and have a venture creation center with a wet lab, recently tripled in square footage to accommodate 40 companies.

New York City, New York

Areas: Big Data for Health, EHR and mHealth

New York is often seen as a hub for the Ad Tech, Fin Tech, E-commerce and Fashion sectors; however, in recent years this metropolitan area has also turned into a leading eHealth hub[89]. The eHealth sector has emerged as one of the fastest growing of New York City's innovation ecosystem. This metropolitan area has been attracting important eHealth related tech companies, startups, accelerators and incubators. New York is one of the leading cities in the development of new therapies and medical devices, supported by the biotechnology incubators that stimulate and fuel their growth to save more

[89]https://www.cbinsights.com/research/new-york-digital-health-funding/

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lives. New York State is an ideal location for life science incubators because it uniquely benefits from world-class academic and research communities that are also a source of technological innovation. New York Medical College's Valhalla campus, offers shared offices and fully equipped laboratories at an affordable price that allows small-cap startups to access world-class resources.[90].

New York is highly focused on EHR implementation. In 2010, the Centers for Medicare and & Medicaid Services (CMS) launched the Medicare and Medicaid EHR Incentive Programs. The primary goal of the Initiative is to foster the adoption, implementation and upgrading of certified EHR technology to support the development of new eHealth solutions[91]. In 2016, the New York eHealth Collaborative (NYeC), a not-for-profit organization working in partnership with the New York State Department of eHealth, was launched to improve healthcare delivery for all New Yorkers through EHR implementation[92]. Moreover, organizations in the Health sector, such as Kaiser Permanente, have implemented EHR systems and are developing Big Data analysis systems in order to develop new eHealth solutions[93].

Chicago, Illinois

Areas: HER, mHealth and Telemedicine

Chicago is considered a major player in ICT and is home to a leading innovation ecosystem. In recent years, the Chicago metropolitan area has been investing in eHealth innovation, especially due to the establishment of highly innovative eHealth startups, accelerators and incubators[94]. Currently, Chicago is home to the headquarters of the American Medical Association, the American Hospital Association and the Healthcare Information and Management Systems Society[95].

The Chicago metropolitan area also comprises numerous recognized teaching hospitals and research centers focused on the development of new eHealth technologies[96]. The University of Chicago Medicine invites collaboration with eHealth startups and established businesses eager to test and implement new ideas at various stages of development[97,98]. The University of Chicago is also highly focused on activities that involve the RDI of mHealth[99] and support the implementation of EHR systems[100,101,102]. Furthermore, MATTER, a leading digital health accelerator based in Chicago, hosts the

[90] https://esd.ny.gov/esd-media-center/esd-blog/nys-life-science-incubators-life-saving-innovations??tid%5B0%5D=476&page=1&?utm_source=facebook&utm_medium=social&utm_content=DRI%20-%20A&utm_campaign=B2B%20Blogs&tid%5B%5D=481
[91]https://www.health.ny.gov/health_care/medicaid/redesign/ehr/overview.htm
[92]https://www.nyehealth.org/about/
[93]https://conferences.oreilly.com/strata/strata-ny-2016/public/schedule/detail/52015
94 https://www.builtinchicago.org/companies/type/healthtech-companies
95 https://matter.health/uploads/hc3_whitepaper_digital.pdf
96https://insightpd.com/accelerator/how-we-help/growing-chicago-health-tech-ecosystem/
97 https://hdsi.uchicago.edu/innovation/
98http://news.medill.northwestern.edu/chicago/chicago-start-ups-embrace-digital-health/
99https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4034376/
101https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4454095/
102http://hospitalist.uchicago.edu/sites/newhospitalist.uchicago.edu/files/uploads/usingepic.pdf

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AMA Interactive Lab, where entrepreneurs and physicians cooperate on developing new technologies for the sector [59,103].

Minneapolis, Minnesota

Areas: EHR, mHealth and Telemedicine

Throughout the state of Minnesota, the number of health tech startups, which have been contributing to the development of a highly innovative eHealth ecosystem, has been significantly increasing during the past ten years[104]. In 2019, Minnesota also produced its first unicorn startup, which is from the health tech sector. Moreover, the top 10 most funded health tech startups in Minnesota have received a combined VC funding of over $2.4 billion[105].

In the state of Minnesota, the metropolitan area of Minneapolis has been particularly recognized as a Healthcare hub. This area is home to important industry players, such as Medtronic, UnitedHealth Group and the Mayo Clinic. It has been attracting innovative eHealth startups focused on mobile apps and telemedicine. Leading universities, research centers, startups, accelerators and incubators related to the eHealth sector are also located in Minneapolis. As a result of the presence of recognized research and industry communities focused in eHealth RDI in Minneapolis, some public-private partnerships have led to the development of new web-based EHR tools[106].

Salt Lake City, Utah

Areas: mHealth and Telemedicine

Salt Lake City is one of the youngest and most entrepreneurial cities in the US, and has been emerging as an eHealth innovation hub. This metropolitan area benefits from the influx of young entrepreneurs, which has brought in more startup activity and capital venture opportunities. ,TheSalt Lake City's population grow around 1% per year in the last 5 years and generated over 19,000 new job opportunities[107].

Currently, Salt Lake City is home to leading eHealth startups, accelerators and incubators, such as Orca Health (mHealth) and TruClinic (telemedicine)[108], and has become a leading area for Digital Health initiatives[59]. This metropolitan area includes two leading eHealth actors, Intermountain Healthcare and the University of Utah Health and Sciences, which are highly focused on the development of new eHealth technologies.

104http://www.modernhealthcare.com/article/20170401/TRANSFORMATION04/170329898
105https://www.bizjournals.com/twincities/inno/stories/news/2020/06/22/minnesotas-top-funded-health-tech-startups.html
[106]https://medcitynews.com/2017/10/celebrating-highlighting-digital-health-innovation-midwest/?rf=1b
[107]https://www.freeenterprise.com/salt-lake-city-brimming-with-innovation/
[108]http://salt-lake-city.startups-list.com/

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Austin, Texas

Areas: EHR and mHealth

Austin is positioning itself to become a leading eHealth hub. In 2022, Austin received $491 million in eHealth investment funding, ranking the sixth among US metropolitan areas. New startups and entrepreneurs are being attracted to this area due to the low price of real estate and the need for a healthier community[59].

Health Tech Austin gathers leaders in eHealth from Texas and beyond to host healthcare conferences, networking events and competitions[109]. Austin is also home to leading EHR startups, such as Xelpha Health[110].

Denver, Colorado

Areas: Telemedicine and mHealth

Denver is home to an established entrepreneurial eHealth ecosystem. The Office of eHealth Innovation (OeHI), based in Denver, regulates health IT governance and advances health equity in Colorado[111]. The OeHI is the State-Designated Entity for all Health IT strategy, policy, and funding coordination across public and private sector partners. To modernize Colorado's healthcare systems and ensure the streamlining of public and private efforts in the healthcare industry, the Health IT Roadmap was created[112]. It outlines how to use digital tools and services to support the health of all people in Colorado.

Denver is home to numerous eHealth startups, including Alto Pharmacy and DispatchHealth[113]. A notable organization in Denver is Catalyst HTI, a real estate development that brings together important eHealth stakeholders, such as private enterprises (startups to Fortune 20), governments, academics, non-profit organizations, healthcare providers and payers to develop cutting-edge eHealth innovations[114].Relevant academic players in the eHealth sector, such as the Health Administration Research Consortium (HARC)[115], are highly focused on making Denver a recognized hub for eHealth. Denver is expected to attract new startups in the eHealth sector, developing new technologies to be integrated in eHealth products.

109 http://www.healthtechaustin.com/
110https://www.simform.com/blog/healthtech-in-austin/
111 https://oehi.colorado.gov/
112 https://oehi.colorado.gov/2021-colorado-health-it-roadmap
113 https://www.builtincolorado.com/healthcare-technology/healthcare-startups-colorado
114 http://www.catalysthealthtech.com
115 https://business.ucdenver.edu/centers-programs/health-administration-research-consortium-harc

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2.2 Innovation facilitators

The US economy is deeply grounded on innovation as a source of economic growth[116]. Public and private programs support the development of an entrepreneurial ecosystem, which is based on flexibility, diversity, creativity and novelty[117]. In the US, facilitators of innovation are responsible for supporting, promoting and accelerating the innovation process. Business accelerators, incubators, science parks and specialized consulting firms are considered facilitators of innovation, as they play a very important role in the eHealth innovation process.

Accelerators support early-stage innovative companies through programs that offer education, mentorship, access to capital and investment, office space and supply chain resources during a fixed period[118]. During the accelerating process, early-stage companies are often grouped with other early-stage financing organizations, such as incubators, angel investors and seed-stage venture capitalists to attract investment[119]. Incubators support early-stage innovative companies with a nurturing environment and often provide affordable working spaces, shared offices and services, management training, marketing support and access to finance. Overall, incubators support early-stage innovative companies reducing their costs and growing their businesses faster[120,121].

Science parks are areas, often created or supported by a college or university, where companies involved in scientific work and new technology are located[122]. Science parks are catalyzers for innovation and promote university-business collaborations, which are likely to lead to important advances in technology. In addition, science parks provide an ecosystem that supports early-stage businesses' incubation and acceleration[123].

As eHealth is a recent sector that is highly grounded in ICT advancements, numerous eHealth companies are often early-stage businesses that require incubator and accelerator programs to attract seed and early-stage financing to accelerate their businesses[124]. Considering the intrinsic connection between eHealth and ICT, science parks also play an important role in the development and deployment of innovative eHealth technologies.

Furthermore, specialized consulting firms can act as important facilitators of innovation. These firms provide services that help startups to promote the creation of strategic partnerships, to promote research and technology transfer, and to foster entrepreneurship. Moreover, specialized consulting

[116] https://www.uschamberfoundation.org/enterprisingstates/assets/files/Executive-Summary-OL.pdf
[117]https://www.researchgate.net/publication/266392166_A_Review_of_the_Entrepreneurial_Ecosystem_and_the_Entrepreneurial_Society_in_the_United_States_An_Exploration_with_Global_Entrepreneurship_Monitor_Dataset
[118]https://smallbiztrends.com/2016/08/business-accelerator-differ-incubator.html
[119]https://hbr.org/2016/03/what-startup-accelerators-really-do
[120] https://documents1.worldbank.org/curated/pt/717091562157862660/pdf/BIM-Module-1-Business-Incubation-Definitions-and-Principles.pdf
[121] https://www.british-business-bank.co.uk/finance-hub/what-is-a-business-incubator/
[122]https://dictionary.cambridge.org/dictionary/english/science-park
[123] https://www.iasp.ws/our-industry/definitions
[124]https://www.fastcompany.com/3027636/4-major-benefits-of-startup-incubators

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firms play a crucial role in applying their entrepreneurial approach, business experience, and fundamental scientific knowledge to support technology advances for the benefit of eHealth startups.

Based on desk research, this Market guide identifies eight leading facilitators of innovation in the eHealth sector, which are not focused in a specific eHealth related field.

Healthbox, Chicago

Healthbox is a business accelerator founded in 2011. Currently, Healthbox is one of the first healthcare-focused accelerator programs in the US**.** Healthbox hosts an annual Chicago Studio, which is a five-day program focused on advancing digital health solutions for early-stage companies with a product-ready prototype or a product in the market. This program provides early-stage companies the opportunity to meet healthcare leaders and network with start-up founders from other US regions.

www.healthbox.com/

Blueprint Health, New York

Blueprint Health is a community of healthcare information technology (HIT) entrepreneurs that support early-stage eHealth companies to raise capital, define their markets, gain customers and refine their sales pitch. Each year Blueprint Health invests $20,000 (nearly €18,830) in 20 healthcare IT companies. Blueprint Health has programs that last a period of three months, which include marketing and sales consulting, customer development, and assistance with fundraising.

www.blueprinthealth.org/

Rock Health, San Francisco

Rock Health is a venture fund dedicated to the development of new mobile technologies for the Health sector. Rock Health supports early-stage companies through fundraising, go-to-market planning, customer and business development and marketing and communications training. Rock Health has also partnerships with leading Healthcare entities, such as Blue Shield of California, Kaiser Permanente and Sanofi.

www.rockhealth.com/

Dreamit Health, Philadelphia

Dreamit is a startup accelerator that operates a seed-focused venture capital firm. It is focused on providing startups with access to investors, customers and a large network of resources. Dreamit also provides a framework for the startups' growth and development, which ends with a two-week roadshow to raise financing.

www.dreamit.com/

MATTER, Chicago

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MATTER is a Healthcare innovation incubator that brings together Healthcare and Life Sciences entrepreneurs, innovators and industry leaders. MATTER comprises: the AMA Interaction Studio, that replicates an outpatient environment where entrepreneurs and physicians collaborate; the Shop for entrepreneurs to build and test medical device prototyping; and the Simulation Stage for promoting a high-acuity simulation environment.
www.matter.health/about/

New York Digital Health Accelerator, New York
The New York Digital Health Accelerator, which has been established by the New York eHealth Collaborative and the Partnership Fund of New York City in 2013, consists of an annual program for early-stage companies that have developed advanced technology products for healthcare organizations. 27 companies have already completed the New York Digital Health Innovation Lab Program. This completion resulted in a fundraising of over $250 million (nearly €235 million) and in the creation of over 240 positions.
http://digitalhealth.nyc/

Health Wildcatters, Dallas
Health Wildcatters is a mentor-driven seed accelerator that aims to support Healthcare entrepreneurs and startups through a 12-week program with an initial seed investment between $30,000 (nearly €28,250) and $380,000 (nearly €357,850). Since 2013, 42 early-stage companies have completed this accelerator program and raised $23 million (nearly €21 million) to accelerate their businesses.
www.healthwildcatters.com/

Research Triangle Park (RTP), Durham County
RTP is the largest science park in the US and one of the largest in the world. It is home to more than 200 companies and over 50,000 people with expertise in fields such as Biotechnology, Chemistry, Environmental Science, Medical Science, Micro-electronics, and Telecommunication. Each year, industry invests about $296 million (nearly €278.75 million) in R&D at the region's universities.
www.rtp.org/about-us/

2.3. Industry related RDI centers

eHealth is a recent area and deeply grounded on ICT and innovation. The cooperation among researchers, industry members and innovation facilitators is crucial to foster the advancement of new eHealth related technologies and tools. In the US, numerous industry related centers have emerged as a result of the country's highly innovative ecosystem and strong entrepreneurial spirit.

Most large companies in the Healthcare sector seem to simply conduct the R&D of eHealth tools in house, and not through the establishment of partnerships with universities and other academic organizations. For example, the CVS Health and the Express Scripts have established their own

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Research Institutes for the development of new eHealth tools, the CVS Health Research Institute and The Express Scripts Technology & Innovation Center, respectively[125,126,127,128]. Therefore, most industry related R&D centers typically include as members or partners SMEs in the Healthcare sector, which are more dependent on the knowledge and technology from research organizations than the large companies to develop new eHealth products.

Some of the Industry related RDI centers are highlighted in Table 2. These centers have been selected through desk research. Even though some of the identified centers are not located in the innovation hubs previously mentioned (e.g., Industry/University Cooperative Research Center for Advanced Knowledge Enablement), these represent important contributors to the eHealth innovation ecosystem.

[125] https://www.express-scripts.com/corporate/the-lab
[126]https://www.prnewswire.com/news-releases/cvs-health-research-institute-study-shows-that-medication-reconciliation-programs-can-reduce-hospital-readmissions-300294934.html
[127]https://www.cvshealth.com/health-care-redefined/digital-innovation.html
[128]http://lab.express-scripts.com/

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Table 2 - A sample of Industry connected RDI Centers in the eHealth related fields

Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
Center for Health Organization Transformation, Industry/University Cooperative Research Center (I/UCRC)	Texas A&M University Georgia Institute of Technology PennState The University of Alabama at Birmingham Florida Atlantic University University of Washington University of Louisville	Main Line Health (US)[129]	College Station, Texas Atlanta, Georgia	HIS	https://iucrc.nsf.gov/centers/center-for-health-organization-and-transformation/
Center for Digital Health Innovation at University of California, San Francisco	University of California, San Francisco	General Electric (US)[130] Gordon and Betty Moore Foundation (US)[132] Rock Health (US) [132] Salesforce (UK) [132] Samsung Strategy and Innovation Center (US) [132] Vital Connect (US) [132] Voalte (US) [132]	San Francisco, California	HIS, mHealth	http://centerfordigitalhealthinnovation.org/

[129]https://iucrc.nsf.gov/centers/center-for-health-organization-and-transformation/
[130] http://centerfordigitalhealthinnovation.org/about-us/

Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
Center for Digital Health, Stanford University	Stanford University	Apple (US)[131]	Stanford, California	Big Data for Health, mHealth	http://med.stanford.edu/cdh.html
Division of Digital Medicine, Scripps Translational Science Institute (STSI)	The Scripps Research Institute Scripps San Diego Supercomputer Center (SDSC)	Aetna (US)[132] IRhythm (US)[134] Janssen, Johnson & Johnson (US)[134] NeuroMetrix (US)[134] Oura (Finland)[134] Philips (Netherlands)[134] Qualcomm (US)[134] Scanadu (US)[134] Spire (United Kingdom)[134] Walgreens (US)[134]	La Jolla, California	Big Data for Health, EHR, mHealth, Telemedicine	https://stsiweb.org/translational_research/digital_medicine/

[131] http://www.mobihealthnews.com/content/stanford-medicine-launches-center-digital-health
[132]https://www.stsiweb.org/about/research-collaborators/

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Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
Informatics and Telehealth in Medicine (InTelMed), Industry/University Cooperative Research Center (I/UCRC)	University of Arizona University of Pittsburgh	NASA[133] Breault, Inc[134]	Tucson, Arizona Pittsburgh, Pennsylvania	Telemedicine	https://intelmed.arizona.edu/
Massachusetts eHealth Institute		MEDIC@LPS (France)[135] MEDfx (United Kingdom)[136] eClinical Works (US)[136]	Boston, Massachusetts	EHR, HIS	https://mehi.masstech.org/

[133] https://govtribe.com/award/federal-contract-award/definitive-contract-80nssc19c0130
134 https://www.nsf.gov/awardsearch/showAward?AWD_ID=1430062
[135]http://mehi.masstech.org/news/masstech-forms-strategic-alliance-french-health-technology-organization
[136]http://masstech.org/press-releases/massachusetts-ehealth-institute-awards-vendor-grants-advance-accelerate-health

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Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
Medstar Institute for Innovation	Mid-Atlantic Telehealth Resource Center (US)[137]	American Telemedicine Association (US)[137] Cleveland Clinic (US)[144] Kaiser Permanente Center for Total Health (US) [144] Microsoft Research (US) [144] Telcare (US) [144]	Washington, DC	HIS, Telemedicine	https://mi2.medstarhealth.org/#q={}
NSF Industry/University Cooperative Research Center for Advanced Knowledge Enablement (I/UCRC-CAKE)	Florida International University Florida Atlantic University	AventuSoft [138] Eyecast[138] LexisNexis [138] [139] [138] OP Solutions [138]	Miami, Florida Boca Raton, Florida	HIS	https://iucrc.nsf.gov/centers/center-for-advanced-knowledge-enablement/

[137] https://mi2.medstarhealth.org/hub/alliances-and-collaboration/#q={}
[138]http://www.cse.fau.edu/~hari/doc/cake_booklet.pdf

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Industry Connected RDI Center	Examples of Academic Partners/Members	Examples of Industry Partners/Members	Location	Fields	Internet link
Samsung Strategy and Innovation Center	-	Samsung Semiconductor[140] Samsung Catalyst HARMAN	San Francisco, California	Big Data for Health, mHealth	http://www.samsung.com/us/ssic/innovation/digital-health/ https://news.samsung.com/us/samsung-in-america
Telemedicine & Advanced Technology Research Center	United States Army	Irving Burton Associates (US)[141]	Frederick, Maryland Fort Gordon, Georgia	EHR, mHealth, Telemedicine	https://www.tatrc.org/www/

[140] https://news.samsung.com/us/samsung-in-america
[141] http://blog.executivebiz.com/2017/09/irving-burton-associates-to-support-army-health-it-research-programs/

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3 US market landscape

In the US, the Healthcare Industry has a significantly high impact on the country economy. The US is one of the world leading countries in terms of healthcare expenditure. The US annual Healthcare spending in 2018 was $3.6 trillion (nearly €3.3 trillion), while in 2021 it reached $4.3 trillion (nearly €4.05 trillion), or $12,914 (nearly €12,161) per person. Such values represent a year on year growth in the expenditure, with the most recent increase of 4.6% as compared to 2017. Moreover, the Healthcare spending in 2021 accounted for 18.3% of the US GDP[142].

The Affordable Care Act (ACA), which was passed in 2010, paved the way to the growth of the eHealth market and created new market opportunities. ACA was legislated to improve quality, lower costs, and increase the geographical coverage of eHealth[143]. Under this health reform, mobile medical apps and telemedicine programs became increasingly important in the new patient-focused ecosystem[144].

Currently, the US Government is highly committed to increase the country's healthcare coverage, efficiency, and quality, without increasing the respective costs. Since the eHealth market is considered a tool for cost containment in the Healthcare sector by both private and public sectors, several regulatory acts have been passed focused on the implementation of eHealth products in the US healthcare systems. Among these, it should be highlighted the American Health Care Act (AHCA), which is expected to replace ACA, aims at reducing costs associated with the US healthcare delivery systems and processes[145].

Due to the size of the US market and the complexity of the eHealth sector, this Market guide identifies the US leading regions for these areas based on the geographical concentration of clinics, hospitals and home health services, as well as the key considerations to be taken into account by EU businesses interested in accessing the US eHealth market.

3.1. Market overview

The US is the world leading eHealth market, as it is the country in the world that generates more revenues from the commercialization of eHealth related products and services. According to the data from 2017, in 2018, the US eHealth market was expected to reach a value of $3.8 billion (nearly €3.4 billion), followed by China ($1.8 billion, nearly €1.6 billion) and Germany ($652 million, nearly €587 million)[146]. Most recent data, from 2019, confirms the US maintained its position as a world leading eHealth market, in terms of market value[147]. The US also represents one of the most developed

[142] https://www.cms.gov/data-research/statistics-trends-and-reports/national-health-expenditure-data/nhe-fact-sheet
[143] https://www.ama-assn.org/delivering-care/patient-support-advocacy/understanding-affordable-care-act#:~:text=The%20Affordable%20Care%20Act%20(ACA,a%20better%20health%20care%20system.
[144]https://www.thelundreport.org/content/mobile-medical-applications-and-affordable-care-act
[145]https://www.forbes.com/sites/sciencebiz/2017/03/24/how-the-american-health-care-act-could-affect-digital-health/#1af702113f1d
[146]https://www.statista.com/outlook/hmo/digital-health/digital-treatment-care/worldwide?currency=usd
[147] https://www.industryarc.com/Report/16930/ehealth-market.html

healthcare markets globally, as well as one of the healthcare markets in the world that invests more in ICT[148].

The US eHealth market is dominated by key segments such as the Big Data for Health, EHR, HIS, mHealth and Telemedicine. It is forecasted for 2024 a profit of $72 billion (around €68 billion) for MedTech, and $28 billion (around €26 billion) for Healthcare IT[149]. In 2016, the Big Data for Health segment accounted for nearly 7% of the eHealth market share. It is also forecasted to increase $34.3 billion till 2022, primarily due to the increasing use of personalized medicine and the expansion of IOT and wearable devices in the health sector[150,151]. Overall, the North America market is expected to represent the largest healthcare analytics market by 2021, as it is predicted to experience a Compound Annual Growth Rate (CAGR) of 29% between 2020 and 2025[152].

In 2017, the EHR market segment was expected to continue dominating the overall eHealth market, with over 25% of the market share. The high and growing demand for advanced electronic healthcare systems alongside technological advancements in the field of HIT are considered the key factors for the growth of this market in the US. The US demand for EHR by many developed healthcare facilities is particularly influenced by the increasing necessity of remote monitoring of geriatric patients[153,154].

In 2016, the North America market was the largest HIS market in the world. Between 2016 and 2022, the US HIS market segment is expected to grow at a CAGR of 7.2%, mostly due to the strong need for quality diagnostics, easy access of data to healthcare professionals and reduction of healthcare errors[155,156]. Similarly, the EHR market segment, the growth of geriatric population in the US has also been a key driver for the increasing demand for HIS products[157].

In 2017, the global mHealth market segment was expected to reach a value around $25.4 billion (nearly, €22.8 billion)[158]. In North America, the mHealth market amounted to $1.8 billion (nearly €1.6 billion) in 2016 and is forecasted to reach $19.4 billion (nearly €17.5 billion) by 2021, as it is estimated experience a CAGR of 40.8% between 2016 and 2021[159]. The growth of the US mHealth market could be particularly explained by the increasing use of smartphones, robust penetration of 4G networks, increasing necessity to manage chronic diseases (due to the population aging) and required increase in the cost-effectiveness of the healthcare delivery[160] .

[148]http://www.rncos.com/Market-Analysis-Reports/US-e-health-Market-Analysis-IM344.htm
[149] https://www.discoveryaba.com/statistics/healthcare-industry
[150]http://www.businesswire.com/news/home/20160728005733/en/Big-Data-Analytics-Healthcare-Market-2016-2021--
[151]https://healthitanalytics.com/news/big-data-analytics-to-bring-billions-in-healthcare-market-growth
[152]https://www.marketdataforecast.com/market-reports/north-america-healthcare-analytics-market
[153]http://www.grandviewresearch.com/industry-analysis/e-health-market
[154]http://www.grandviewresearch.com/industry-analysis/electronic-health-records-ehr-market
[155]http://www.businesswire.com/news/home/20170428006135/en/Global-Healthcare-Information-Systems-Market-Research-Analysis
[156]https://www.prnewswire.com/news-releases/healthcare-information-systems-market---global--north-america-industry-analysis-size-share-growth-trends-and-forecast-2016---2024-300491214.html
[157]https://www.transparencymarketresearch.com/healthcare-information-system.html
[158]https://www.statista.com/statistics/295771/mhealth-global-market-size/
[159]https://www.mordorintelligence.com/industry-reports/north-america-mobile-health-market
[160]https://www.prnewswire.com/news-releases/mobile-health-apps--solutions-market-worth-207-billion-by-2018-235402841.html

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The US Telemedicine market segment reemerged in the last few years due to the increasing healthcare costs. This segment was forecasted to grow at a CAGR of 29% from 2016 to 2021[161]. Several reforms in the US healthcare delivery could contribute to the expected growing use of Telemedicine products. The reforms include: the potential establishment of the AHCA, the increasing technological advancements and the growing awareness among citizens regarding the benefits of telemedicine[162]. Additionally, Telemedicine seems to have potential for widespread adoption, especially as a prescription refill option for chronically ill users, with the market forecasted to grow and reach the $22 billion (€20.7 billion) in 2025[163].

3.2. Leading regions

Considering the size of the US eHealth market, there are states that can be considered leading regions from a market perspective. As stated earlier, eHealth comprises several products and services. Consequently, the US leading regions for the eHealth market were identified by analyzing two main market targets: clinics and hospitals; and home health services' providers.

The geographical concentration of clinics, hospitals and home health services was identified based on the Standard Industrial Classification (SIC) codes. The SIC codes are four-digit numerical codes assigned by the US government to business establishments to identify the primary business of an establishment. Thus, the SIC codes facilitate the collection and analysis of information as well as promote the standardization, comparability, and presentation of statistical data[164]. Considering the US eHealth market, this market guide used three different SIC codes: SIC 801104 (clinics), SIC 806202 (hospitals) and SIC 808201[165] (home health services).

In this context, both clinics and hospitals were the main target markets for businesses commercializing Big Data for Health, EHR and HIS products; whereas the home health services were considered to be the main target market for the mHealth and Telemedicine products. Thus, the regions with a higher concentration of clinics, hospitals and home health services' providers seem to represent important market opportunities for businesses providing eHealth products. Among those regions, there are three states which particularly stand out: California, New York and Texas.

[161] https://store.frost.com/growth-opportunities-in-the-us-telehealth-market-forecast-to-2021.html
[162] https://www.prnewswire.com/news-releases/us-telemedicine-market-to-cross--13-billion-by-2021-pharmaion-consultants-report-568841771.html
[163] https://www.zippia.com/advice/us-healthcare-industry-statistics/
[164] https://siccode.com/en/pages/what-is-a-sic-code
[165] Establishments primarily engaged in providing skilled nursing or medical care in the home, under supervision of a physician. Establishments of registered or practical nurses engaged in the independent practice of their profession are classified in Industry 8049, and nurses' registries are classified in Industry 7361. Establishments primarily engaged in selling health care products for personal or household consumption are classified in Retail Trade and those engaged in renting or leasing products for health care are classified in Industry 7352.

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Big Data for Health, EHR and HIS products

Big Data for Health, EHR and HIS products are mainly required by clinics and hospitals, due to the dimension and complexity of their management systems, which generate a large amount of data that need to be collected, stored and analyzed. Therefore, public and private clinics and hospitals correspond to the key markets for businesses providing Big Data for Health, EHR and HIS products.

This market guide provides an overview of the US states and cities that have a higher geographical concentration of clinics and hospitals, as well as the states and cities that have clinics and hospitals which individually invest an average of $10,000 (nearly €9,000) or more in technology annually. In the US, there are 70,467 clinics and 7,694 hospitals. Figure 4 - Location of the US areas with higher concentration of clinics and hospitalsFigure 4 provides a US map where it is highlighted the areas with higher concentrations of clinics and hospitals.

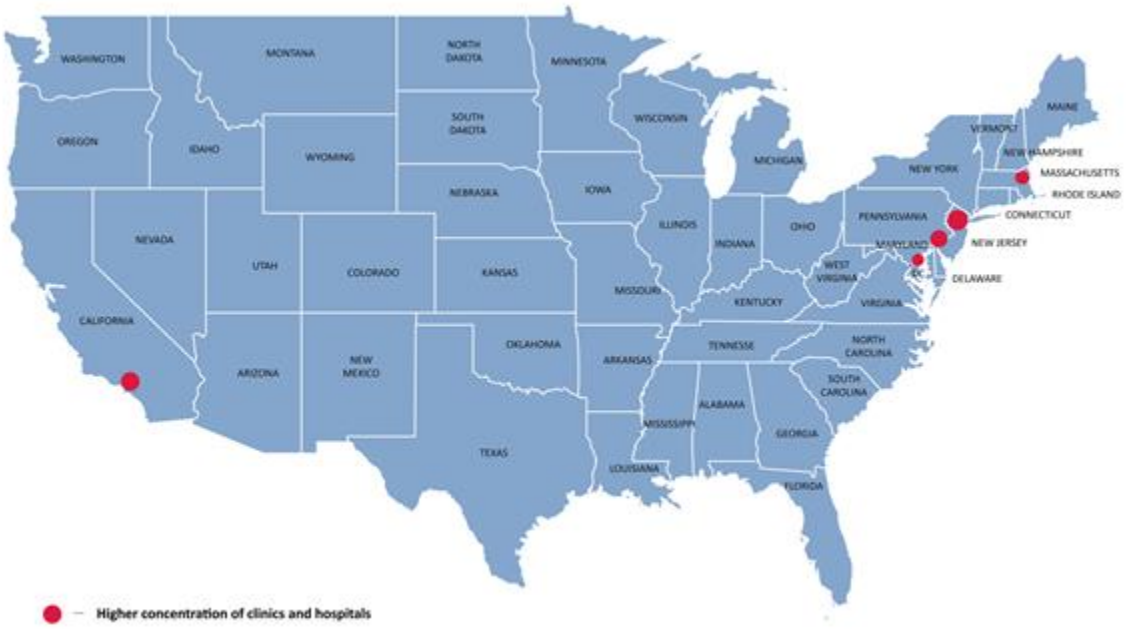

Figure 4 - Location of the US areas with higher concentration of clinics and hospitals

Figure 5 indicates US states and cities with the highest concentration of clinics and hospitals. US clinics and hospitals are primarily located in the high population regions of the country and, therefore, concentrated in the states of California, New York and Texas. This indicates that these three states are important areas to find market opportunities related to Big Data for Health, EHR and HIS products.

Even though California is the state with the highest concentration of clinics and hospitals, it is important to highlight that none of the cities of this state are among the five cities with the highest

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concentration of clinics and hospitals. On the contrary, even though the city of Omaha is ranked as the fifth city in terms of geographical concentration, its state (the state of Nebraska) is not among the US states with the highest concentration of clinics and hospitals.

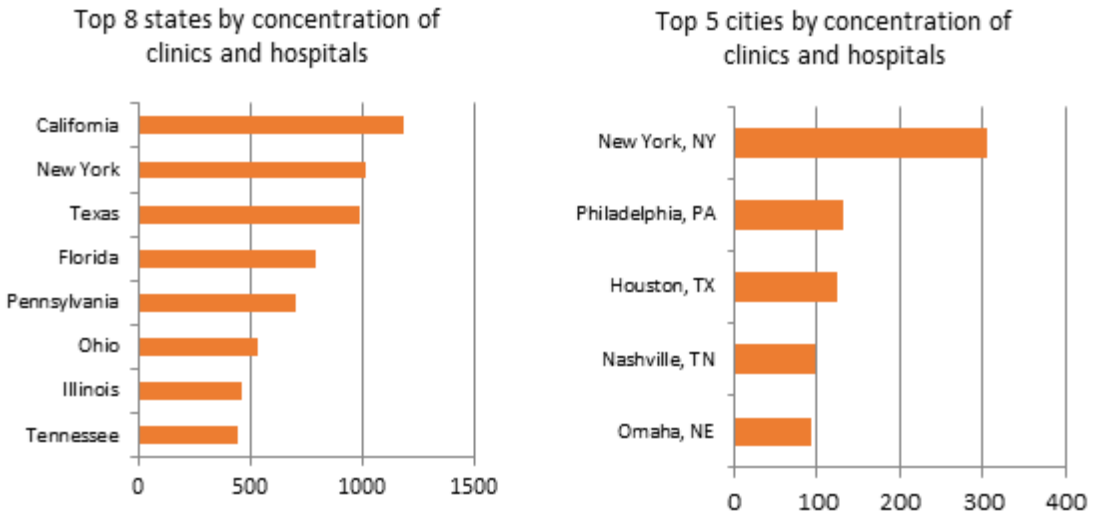

Figure 5 - US states and cities with the highest concentration of clinics and hospitals

eHealth is deeply grounded in the use of advanced ICT to develop a more effective, affordable and faster healthcare delivery. Consequently, the technology expenditure of clinics and hospitals is a key indicator to measure the predisposition of the market to invest in eHealth products, such as Big Data for Health, EHR and HIS related products. From a market perspective, the states and cities with the highest concentration of clinics and hospitals that spend on average per clinic/hospital over $10,000 (nearly €9,000) in technology per year represent important areas in terms of business opportunities.

Figure 6 indicates the US states and cities with the highest concentration of clinics and hospitals that spend on average over $10,000 in technology per year. The majority (84%) of clinics and hospitals spend annually on average between $10,000 (nearly €9,000) and $50,000 (nearly €45,000) in technology. Only 33 hospitals and clinics spend over $50,000 per year in technology. Seven of the hospitals and clinics that spend over $50,000 in technology per year are located in Texas; while the other 26 hospitals and clinics are distributed across the country.

California is the state with the highest technology expenditure of clinics and hospitals; however, none of the cities located in this state are among the five cities with the highest technology expenditures. On the other hand, although the states of Tennessee and Maryland are not among the top eight states, two of their cities are among the five cities with the highest technology expenditure of clinics and hospitals.

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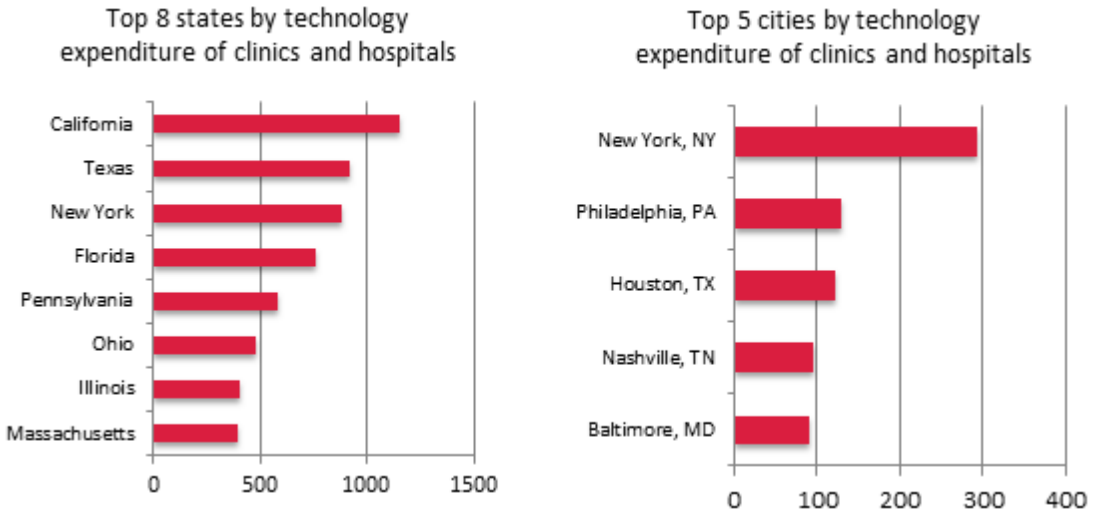

Figure 6 - US states and cities with the highest concentration of clinics and hospitals that spend annually on average over $10,000 in technology

mHealth and Telemedicine products

Home health services can highly benefit from mHealth and Telemedicine related products, as those products allow healthcare professionals to assess the status of patients when required without frequent visits to clinics or hospitals[166]. Therefore, patients and homecare professionals can have a more frequent and effective contact with healthcare professionals, which allows a more comprehensive management of their patients' needs[167]. As a result, from a market perspective, the US states and cities with the highest geographical concentrations of home health services may represent the areas with more mHealth and telemedicine market opportunities across the country.

This market guide identifies the US states and cities that have a higher geographical concentration of home health services, as well as the states and cities with home health services providers that invest annually on average over $10,000 (nearly €9,000) in technology. In the US, there are 46,749 businesses that provide home health services. Figure 7 presents a US map with the higher concentrations of home health services providers highlighted.

[166]https://www.theseniorlist.com/2015/11/how-telemedicine-is-affecting-home-health-care/
[167]https://www.longtermcarelink.net/eldercare/home_telehealth.htm

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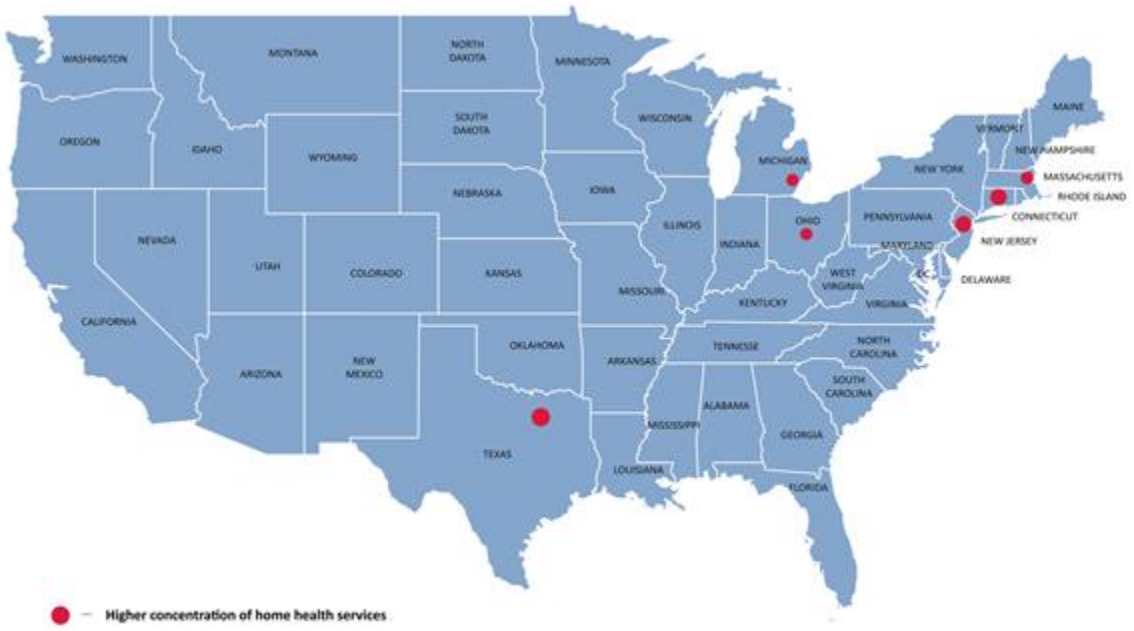

Figure 7 - US areas with higher concentrations of home health services providers

Figure 8 indicates US states and cities with the highest concentrations of home health services providers. Texas seems to be the state with the highest geographical concentration of home health services providers, with the cities of Dallas and San Antonio being also among the top five cities in the country in terms of concentration of home health services providers. Therefore, the state of Texas represents an important market for mHealth and telemedicine providers. Moreover, even though New York City is the city with the highest concentration of home health services, which shows its importance to the market, the New York state is only ranked as the eighth state in terms of geographical concentration of home health services providers.

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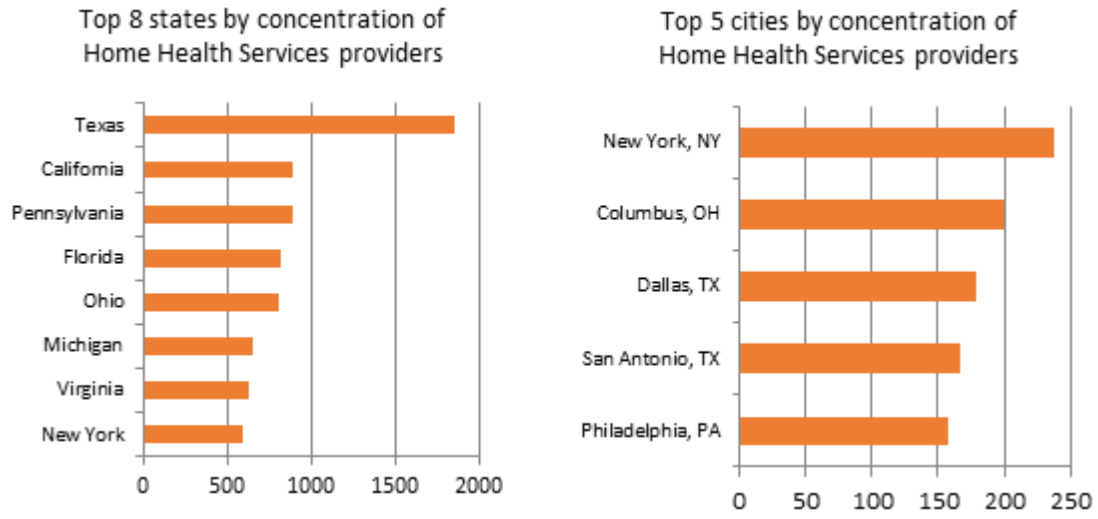

Figure 8 - US states and cities with the highest concentration of home health services providers

When comparing the geographical distribution of the home health services providers (Figure 5) with the clinics and hospitals (Figure 8), there are a few differences that stand out. The state of Texas has a much higher concentration of home health services compared to clinics and hospitals; while the states of Ohio and Michigan have only a slightly higher geographical concentration of home health services in comparison with clinics and hospitals. In opposition, there is a lower concentration of home health services versus clinics and hospitals in the states of California and New York.

For instance,, mHealth and Telemedicine use ICT to telemonitor and assess the status of the patients' health, therefore, the technology expenditure of home health services is also a key indicator to identify market opportunities. Figure 9 indicates the US states and cities with the highest concentration of home health services providers that spend on average over $10,000(nearly €9,000) in technology per year.

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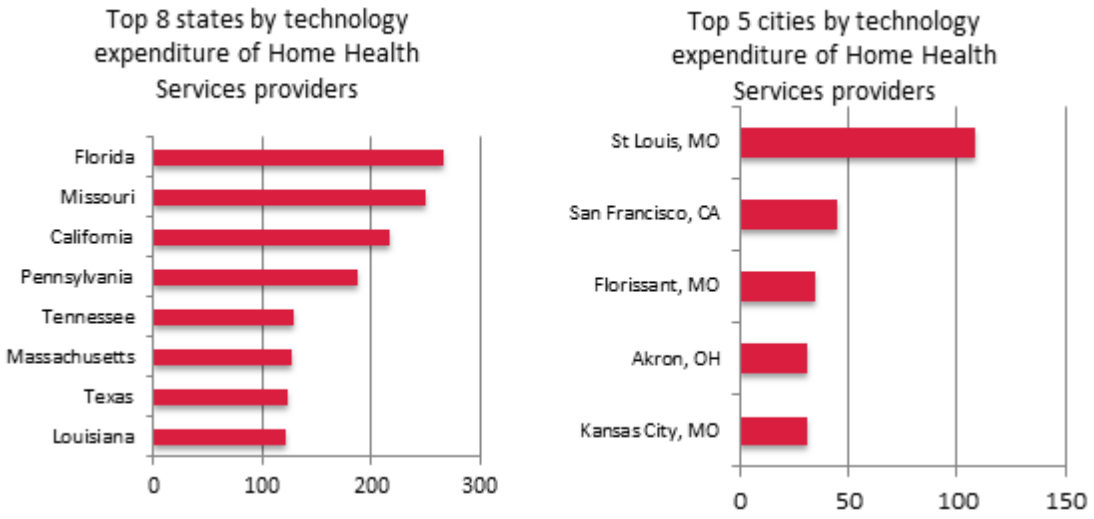

Figure 9 - US states and cities with the highest concentration of home health services that spend annually on average over $10,000 in technology

Florida seems to be the state with the highest technology expenditure of home health services. However, none of the cities located in this state are among the five cities with the highest technology expenditures, which means home health services providers are possibly located outside the urban areas of the state.

Moreover, the state of Missouri, which is ranked second in terms of technology expenditure in home health services, has three cities among the five with the highest technology expenditure of home health services, which highlights its importance for providers of mHealth and telemedicine related products.

3.3. Market considerations

3.3.1. Opportunities

Large and growing eHealth market

As stated in section 3.1., the US represents the largest eHealth market in the world with a strong growth rate. Several conjectural factors can explain the rapid growth, namely: the presence of a technologically updated population base, the increasing efficacy of eHealth technologies, the favorable

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federal regulations, the growing aging population and consequently increasing incidence of chronic diseases, and the current pressure to reduce healthcare delivery costs[168,169].

High and increasing demand for trained Health IT professionals

According to the American Society of Health Informatics Managers, the US has a growing short-supply of trained Health IT professionals. A market guide from the United States Bureau of Labor Statistics, Department of Education, indicated that the country hospitals and practices have a shortage of at least 51,000 qualified Health IT professionals[170]. This high and increasing demand for trained Health IT professionals could indicate the existence of several opportunities for businesses providing eHealth related products and services.

3.3.2. Barriers

Reimbursement challenges

Although payment policies promoting eHealth in the hospitals and clinics are increasing, the limited or lack of reimbursement is still the major barrier for the expansion of its use. As a result, the geographical coverage of telehealth by Medicare, Medicaid[171] and private payers should be taken into consideration when EU businesses analyze the possibility of accessing the US eHealth market. For example, in 2014, there were only 16 US states where telehealth services were covered by Medicare, Medicaid and private payers.

Figure 10 indicates the coverage of telehealth products in 2014 at the state level. It is important to highlight that geographical coverage may have slightly changed by now. This is the case of Arizona, which has only started to cover telehealth services in 2015.

[168]https://marketresearchcommunity.com/ehealth-market/
[169]https://www.discoveryaba.com/statistics/healthcare-industry#:~:text=The%20U.S.%20healthcare%20industry%20is%20worth%20%24808%20billion%20in%202021.
[170] https://www.ashim.com/health-it-training/
[171]Medicare and Medicaid are the two different government-run programs that cover the healthcare expenses of older and low-income Americans who are unable to buy private health insurance.

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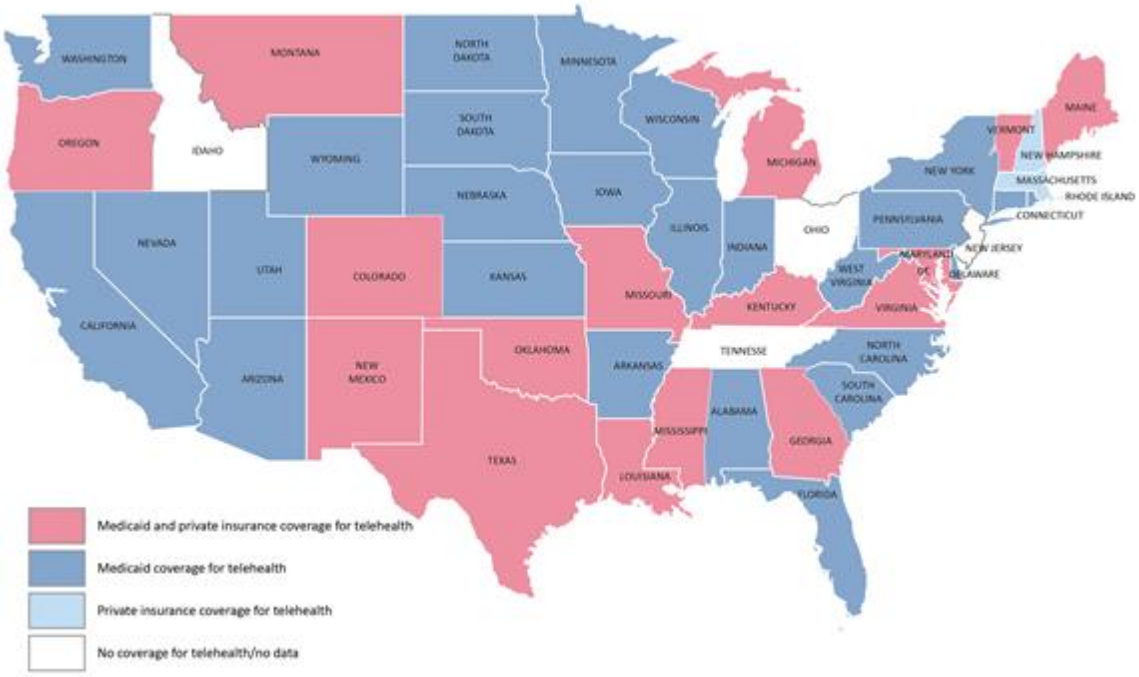

Figure 10 - Coverage of telehealth products at the state level[172]

Although Medicare, Medicaid and private payers represent the majority of the healthcare payers, there are also non-traditional payers that reimburse a range of eHealth and services. These include charitable organizations, long-term care and community health providers, self-insured groups and agencies serving special populations[173].

Compliance with multiple state laws

The US law could also constitute a barrier to the commercialization of eHealth products and services. This is mostly because healthcare related laws, such as licensing and prescribing laws, are different among states. These different laws could prohibit a physician based in one state from seeing a patient in another state through eHealth products. As a result, eHealth providers with the intention of accessing the US market are recommended to verify the current and pending heath related legislation in the US states where they aim to implement and commercialize their products[174].

[172] Data from the National Conference of State Legislatures, 2014
[173] https://www.ncbi.nlm.nih.gov/books/NBK207137/
[174] https://aspe.hhs.gov/system/files/pdf/206751/TelemedicineE-HealthReport.pdf

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Cybersecurity

Since the use of eHealth products and services require the upload and/or sharing of sensitive patient data, it is always crucial to ensure that those data are protected from cyber-attacks and privacy breaches. In the US, there is a federal legislation, titled "Health Insurance Portability and Accountability Act (HIPAA) Security Rule", which specifically aims at ensuring that healthcare organizations protect the privacy and protection of their patients' data from all "reasonably anticipated threats." Therefore, all eHealth products and services being commercialized in the US must consider this legislation rule during the development of their products and respective implementation in the country[175].

3.3.3. Other considerations

Purchasing decision process

In the US, the purchasing decision process comprises several actors. In the case of hospitals, there are formal committees to assess the purchase of new technology. These committees are often named "Value Analysis Committee (VAC)," "Technology Assessment Committee," or "Executive Medical Device and Product Committee" and aim to determine which technologies should be purchased by the hospital. Usually, the VAC committee includes the hospital supply chain director, the finance director, the service line director, a representative of the clinical end-users, a member of the administration and a member of the risk management department[176, 177].

The VAC process usually includes six different phases until the purchase of a new technology is finalized: Gather Data, Preliminary Negotiation, Clinical Trial or Approval, Final Negotiation, Implementation and Validation[178]. During these phases a large variety of the new technology attributes are thoroughly analyzed, such as patient safety, product cost, potential for cost savings and quality[177]. Furthermore, the hospitals often request the knowledge and opinion of Key Opinion Leaders (KOL), who verify clinical evidence and offer price benchmark comparisons[179]. Therefore, the VAC process is considered as highly complex and often becomes a barrier and source of delay between the commercial availability of a new technology and its real application[180].

Regulatory considerations

In the US, the Food and Drug Administration (FDA) is a federal agency under the Department of Health and Human Services, that is responsible for protecting and promoting public health through the control

[175]https://www.hhs.gov/hipaa/for-professionals/security/laws-regulations/index.html
[176] https://www.ghx.com/the-healthcare-hub/value-analysis-guide/#what-is-value-analysis
[177] https://medspanresearch.wordpress.com/2015/10/05/hospital-purchasing-value-analysis-committees/
[178]https://www.medicalconstructiondata.com/Content/pdf/MedicalBlog/Understanding%20the%20Steps%20in%20the%20Hospital%20Value%20Analysis%20Process%2005-01-17%20Final.pdf
[179] https://www.definitivehc.com/resources/glossary/key-opinion-leader
[180] https://insights.omnia-health.com/hospital-management/developing-effective-value-analysis-committees

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and supervision of food safety, tobacco products, dietary supplements, prescription and over-the-counter pharmaceutical drugs, vaccines, biopharmaceuticals, blood transfusions, medical devices, electromagnetic radiation emitting devices, cosmetics, animal foods and veterinary products. Since many medical devices (including eHealth products) have now the ability to connect to and communicate with other devices or systems, the FDA is currently developing a draft guide for public comment to help the Healthcare Industry and FDA staff to understand how the 21st Century Cures Act should be applied. The Act aims at clarifying FDA's regulation of medical software. The guide being developed by FDA is expected to include instructions for the use of some eHealth products, such as mHealth, health IT systems, wearable devices, telehealth and telemedicine related products[181].

Broadband connectivity

The price and quality of broadband services in some areas may constrain the use of eHealth products and services. Although the Federal Communications Commission (FCC) and the US Department of Agriculture have programs to support broadband deployment in rural areas and to offset high telecommunications costs, in some cases, the price of broadband services is still three times higher in rural areas than in the urban areas they surround. Besides the price, it is also important to highlight that some areas do not have access to broadband speeds required for the use of eHealth products, as they do not allow the real-time transmission of high-quality video, graphics and data. According to the FCC, more than half of rural Americans lack access to benchmark service (25 Mbps/3 Mbps)[182].

[181] https://www.fda.gov/medicaldevices/digitalhealth/
[182] https://aspe.hhs.gov/system/files/pdf/206751/TelemedicineE-HealthReport.pdf

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4 Recognized networks and events

Networks and events are crucial to enhance the connection between researchers and between academia and industry at both national and international levels. They provide a great opportunity for researchers and industry representatives from eHealth related fields to share knowledge and experience.

Since the technologies applied for the development of eHealth products are changing at a rapid rate[183,184], EU researchers and industry representatives are particularly recommended to contact the key US eHealth related networks as well as to attend events focused on eHealth located in the US. These actions could ensure they are kept updated on the latest emerging innovation and market trends in the US eHealth sector.

Through gaining knowledge of the relevant eHealth related networks and organized events, one can determine the most effective approach to establishing relevant contacts in the US community in order to pursue innovation and industry collaborative opportunities.

4.1. Innovation and market networks/ associations

Innovation as a collaborative phenomenon has led to the development of the concept of innovation/market networks[185]. Innovation/market networks are collaborative platforms of individuals, small and large corporations, startups, academic and government institutions that aim to cooperate to create new ideas, products, services or business models[186][187]. Thus, innovation/market networks can foster important linkages between eHealth actors in order to promote the advancement of technologies[185] .

Moreover, the development of innovation processes has contributed to the increase of the role of innovation activities in SMEs and startups. However, the majority of SMEs and startups do not own innovation capacities and face financial constraints. Thus, innovation/market networks can help SMEs and startups to reach innovation targets, access to complementary resources, attract investment and advance technologies[188,189].

In turn, a professional association is a body of practitioners of a given profession, formed usually to control entry into the profession, maintain standards, and represent the profession in discussions with

183https://www.forbes.com/sites/bernardmarr/2016/09/23/how-machine-learning-big-data-and-ai-are-changing-healthcare-forever/#93db0411a1c0
184https://www.forbes.com/sites/forbestechcouncil/2017/01/04/why-leveraging-technology-is-the-key-to-improving-healthcare/#438dad857cb8
185 http://www.emeraldinsight.com/doi/full/10.1108/JBIM-03-2015-0042
186http://www.helixinnovation.com/what-is-an-innovation-network/
187https://arxiv.org/ftp/arxiv/papers/1308/1308.2234.pdf
188 https://www.oecd-ilibrary.org/sites/f5539f94-en/index.html?itemId=/content/component/f5539f94-en#section-d1e24809-f5f00d432c
189 https://www.econstor.eu/bitstream/10419/25613/1/547164319.PDF

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other relevant bodies[190,191]. Professional associations are a crucial segment of the US Industry. In 2013, membership organizations alone employed over 1.3 million people in the US[192].

Table 3 provides a brief description of some of the main research networks/ professional associations in the eHealth related fields.

[190]https://www.vocabulary.com/dictionary/professional%20association
[191]http://www.dictionary.com/browse/professional-association
[192]http://www.thepowerofa.org/wp-content/uploads/2012/03/PowerofAssociations-2015.pdf

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Table 3 - Examples of key US eHealth related networks and associations

Network	Main goal	Internet link
International networks and associations		
Healthcare Information and Management Systems Society (HIMSS) North America	HIMSS North America is a business unit within HIMSS which aims to positively improve the quality, cost-effectiveness, access, and value of in the United States and Canada by using information and technology. It represents 70,000 individual members, 630 corporate members, and over 450 non-profit organizations.	https://www.himss.org/
Federal networks and associations		
American Association of Healthcare Administrative Management (AAHAM)	AAHAM was founded over 45 years ago and is the premier professional organization in Healthcare administrative management. Its main goal is the professional development of its members, which is achieved through the development of publications, professional certifications and benchmarking, as well as through the planning and organization of conferences and networking events.	http://www.aaham.org/
American Medical Informatics Association (AMIA)	AMIA is a non-profit association based in Bethesda, Maryland, which aims at improving the health of US citizens by connecting a broad community of professionals and students interested in applying informatics to the Healthcare sector. AMIA actively supports activities in five fields: Translational	https://www.amia.org

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Network	Main goal	Internet link
	Bioinformatics, Clinical Research Informatics, Clinical Informatics, Consumer Health Informatics, and Public Health Informatics.	
American Society of Health Informatics Managers (ASHIM)	ASHUIM is a non-profit and non-governmental association of IT professionals who are specialized in Health IT. This association sponsors a credentialing program, currently titled "Certified Health Informatics Systems Professional - CHISP® credentialing program", that certifies IT experienced professionals working in the Healthcare industry.	https://www.ashim.com/about-ashim/
American Telemedicine Association (ATA)	ATA is a non-profit association based in Washington DC that comprises over with a 10,000 industry players and professionals in the Healthcare sector who are interested in sharing knowledge and experience.	https://www.americantelemed.org/about-us/
eHealth/mHealth Research Interest Group	The eHealth/mHealth Research Interest Group (EMRIG) was founded in 2013 and is sponsored by UConn Health. It comprises researchers who are interested in Electronic Health and mHealth research and in the application of mobile technologies, social media, web-based interventions, sensors, and other emerging technologies to improve health behavior. .	https://chip.uconn.edu/research-interest-groups-rigs/
The American Nursing Informatics Association (ANIA)	The American Nursing Informatics Association (ANIA) is a US association of professional nurses and associates aiming at providing networking, education and information resources that strengthen the role of nurses in the field of informatics.	https://www.ania.org/about-us
State networks and associations		

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Network	Main goal	Internet link
Arizona: REACH Stroke Network	The REACH Stroke Network in the state of Arizona aims at connecting rural hospitals with stroke experts from the Medical University of South Carolina. Using eHealth technology as telemedicine, doctors in remote hospitals can consult with experts on ambiguous cases. The main goal of this network is to increase compliance of acute ischemic stroke patients in remote areas to the Alteplase treatment, avoiding their permanent disability.	https://www.healthsciencessc.org/initiative/reach-stroke-network/245
Maine, New Hampshire, and Vermont: New England Telehealth Consortium	The main goal of the New England Telehealth Consortium is to build a sustainable broadband healthcare network to improve the capability and efficiency of healthcare in the states of Maine, New Hampshire, and Vermont.	www.netelc.org/
Texas: Statewide Telemedicine Network	A statewide telemedicine network is being created by the University of Texas Medical Branch (UTMB) Health. The network aims to leverage the telehealth expertise of the UTMB to provide technical, business and clinical knowledge and share experience to all eight UT System health-related institutions.	https://www.utmb.edu/impact/home/2017/02/17/utmb-leading-creation-of-statewide-telemedicine-network

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Network	Main goal	Internet link
Utah: Telehealth Network	The objective of the Utah Telehealth Network is to improve the connection between health care providers and patients across the state of Utah through the usage of leading edge telecommunications technology. Using Telemedicine, this network aims at ensuring that rural patients and providers have access to services that are often only available in more populated urban areas.	www.utn.org
Virginia: Telemedicine Network	The Virginia Telehealth Network is a non-profit public charity of which main objective is integration of telehealth and related technologies in the state of Virginia. In order to ensure to ensure all Virginians have access to high quality health care independently of their location and time of the day, this network has five top priorities: facilitate the sharing of resources; support quality improvement initiatives; identify and address barriers to implementation; educate stakeholders; and to facilitate the development of model policies, procedures and protocols.	www.ehealthvirginia.org/

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4.2. Innovation and market events

The geographic distribution of the US eHealth related conferences and other networking events reveal a high degree of spatial concentration in the southwest region of the country, particularly in the state of California. In addition, the identified conferences and other networking events are also highly concentrated in the first six months of 2018, as the events occurring in the second semester of 2018 are possibly in the planning phase at the moment.

Since eHealth is a fast-growing market in the US due to the increasing application of ICT in both public and private health sectors, the number of conferences and other networking events focused on eHealth related fields has been increasing and is expected to continue increasing in the short-term. Table 4 lists some of the main conferences and other networking events focused on eHealth. These were identified in this market guide by desk research, which included an extensive literature review and a review of the conferences sponsored by recognized networks in the eHealth area.

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Table 4 - eHealth related innovation and market events

Date[193]	Conference/ Event title	Interval	Location	Areas	Internet link
2 January 2024	International Healthcare Robotics	Annual	New York City, New York	Robotics, Telemedicine, Big Data	https://asar.net.in/event/index.php?id=2180000
25-28 February 2024	VIVE 2024	Annual	Los Angeles, California	EHealth funding, Healthcare Information Systems, mHelath, EHR, Telemedicine	https://www.viveevent.com/
6 March 2024	International Conference on Nanotechnology in Medicals	Annual	Washington, Columbia	Nanotechnology, Big Data, Healthcare Information Systems, mHealth, Telemedicine	https://itar.in/conf/index.php?id=2231420
May 2024	Reuters Digital Health 2024	Annual	San Diego, California	Big Data, AI in Healthcare, Telemedicine, mHealth	https://events.reutersevents.com/healthcare/digital-health-usa

[193] Dates for market events have been updated in 2023.

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Date[193]	Conference/ Event title	Interval	Location	Areas	Internet link
20-21 May 2024	FORTUNE Brainstorm Health 2024	Annual	Dana Point, California	Big Data, EHR, Healthcare Information Systems, mHealth, Telemedicine	https://fortune.com/conferences/fortune-brainstorm-health-2024
29-31 May 2024	thINc360- The Healthcare Innovation Congress	Annual	Washington, Columbia	Big Data, Digital Health, Healthcare Information Systems, mHealth,	https://thinc360.com/2024event/#
11-13 June 2024	AHIP 2024	Annual	Las Vegas, Nevada	Big Data, Telemedicine, EHR, Digital	https://www.ahip.org/conferences/ahip-2024/agenda#content
11-13 September 2024	Rise West 2024	Annual	Colorado Springs, Colorado	Telemedicine, EHR, AI in Healthcare systems, Big Data,	https://www.west.risehealth.org/
8-9 October 2024	2nd Digital Health Innovation Summit	Annual	Boston, Massachusetts	Telemedicine, Health IT systems, mHealth, EHR	https://worldbigroup.com/2nd-digital-health-summit/

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5 US innovation initiatives and programs

The US governmental funding system is highly decentralized and comprises several actors, such as agencies of federal and state governments, universities, the private sector and non-profit organizations[194]. The US government has identified the importance of eHealth R&D for the transformation of healthcare. Funding eHealth related initiatives and programs is currently a priority for both federal and state agencies, which are focused on supporting the development of new or advanced technologies.

A review of the US funding initiatives and programs at both federal and state levels was conducted to identify some examples of relevant innovation initiatives and programs in the eHealth related fields. The following subsections provide descriptions of the initiatives and programs. Annex 1 provides a summary table of the initiatives and programs detailed in this chapter.

5.1. Federal initiatives/programs

At the federal level, the US Department of Health and Human Services, the NSF and the US Department of Defense are the entities primarily responsible for initiatives and programs that promote innovation in the eHealth related fields[195] (Figure 11). In the case of the US Department of Defense, it should be highlighted that there could be some restrictions in terms of the eligibility of EU academic and industry representatives due to required sharing of sensitive data/information.

[194]http://www.euussciencetechnology.eu/assets/content/documents/InnovationSystemInnovationPolicyUS.pdf
[195]https://www.healthit.gov/sites/default/files/federal_telehealth_compendium_final_122316.pdf

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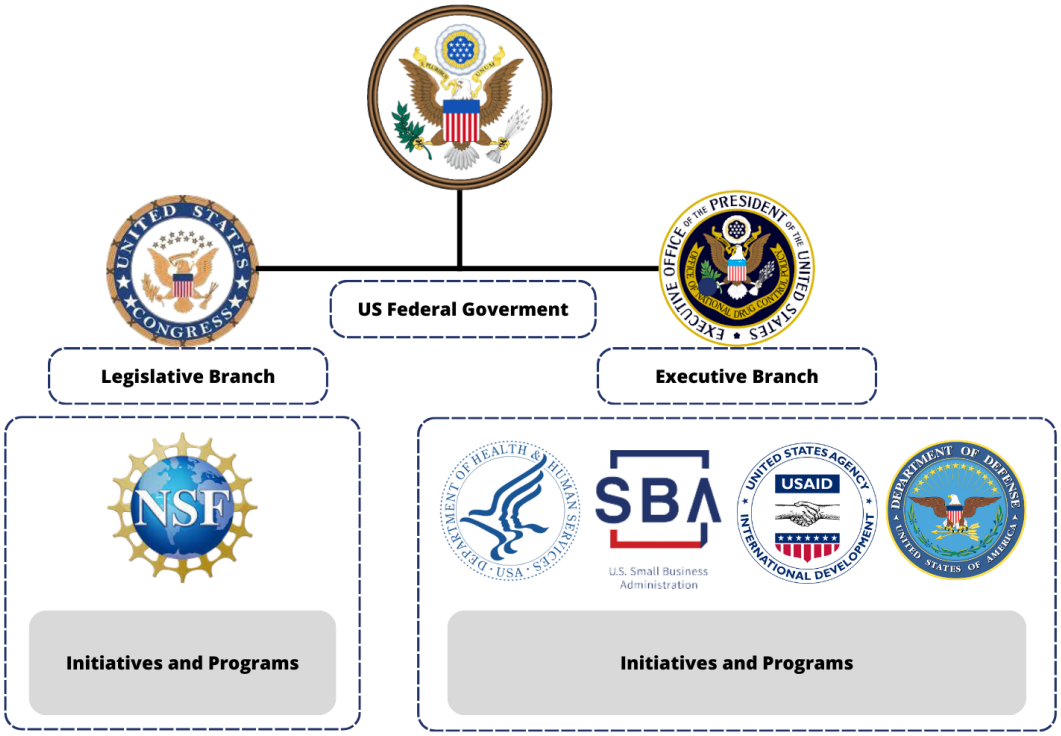

Figure 11 - US Government Organizational Chart highlighting the main sponsors of innovation programs in eHealth related fields

A review of the US Federal Government innovation initiatives and programs was conducted to identify some of the most relevant ones in fields related to eHealth. Although this market guide only provides federal initiatives and programs established by its main sponsors, it is important to highlight that there are several initiatives and programs in fields related to eHealth promoted by several other US departments and entities. These include the US Department of Veterans Affairs[196, 197], the US Department of Agriculture[198, 199] and the National Aeronautics and Space Agency[200].

[196]https://www.telehealth.va.gov/
[197]https://www.hsrd.research.va.gov/research_topics/ehealth.cfm
[198]https://www.rd.usda.gov/programs-services/distance-learning-telemedicine-grants
[199]https://aspe.hhs.gov/system/files/pdf/206751/TelemedicineE-HealthReport.pdf
[200]https://spinoff.nasa.gov/category/Health%20and%20Medicine

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5.1.1. National Science Foundation (NSF)

Smart Health and Biomedical Research in the Era of Artificial Intelligence and Advanced Data Science (SCH)

Responsible entities: NSF Directorate for Mathematical & Physical Sciences; NIH

The goal of this interagency program solicitation is to fund transformative high-risk, high-reward advances in computer and information science, engineering, mathematics, statistics, behavioral and/or cognitive research to address pressing questions in the biomedical and public health communities. Scientific and engineering innovations by interdisciplinary teams that develop unique techniques to collect intuitively and intelligently, sense, link, analyze, and interpret data from humans, devices, and systems to enable discovery and optimize health are at the heart of transformations. Solutions to these complicated biomedical or public health concerns necessitate the development of interdisciplinary teams capable of addressing these issues while furthering fundamental research and engineering[201].

First Approach	
Contact	European researchers and SMEs interested in the SCH Program could contact Goal Yamini
Email	sch-correspondence@nsf.gov
Phone Number	703-292-5367
Internet link	https://new.nsf.gov/funding/opportunities/smart-health-biomedical-research-era-artificial

5.1.2. Department of Health and Human Services (HHS)

Evidence-Based TeleHealth Network Program

Responsible entity: Health Resources and Services Administration (HRAS)

The purpose of this program is to demonstrate how telehealth networks are used to: expand access to, coordinate, and improve the quality of health care services; improve and expand the training of

201 https://new.nsf.gov/funding/opportunities/smart-health-biomedical-research-era-artificial

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health care providers; and/or expand and improve the quality of health information available to health care providers, and patients and their families, for decision-making. [202].

First Approach	
Contact	European researchers and SMEs interested in the program could contact the project manager Carlos Mena S
Email	cmena@hrsa.gov
Phone Number	(301) 443-3198
Internet link	https://www.grants.gov/search-grants.html?cfda=93.211

The Evidence-Based Tele-Emergency Network Grant Program (EBTNP)

Responsible entity: Federal Office of Rural Health Policy (FORHP), Health Resources & Services Administration

The EBTNP supports the implementation and evaluation of a range of telehealth networks to ensure the establishment of 24-hour Emergency Department consultation services via telehealth to rural providers without emergency care specialists.

First Approach	
Contact	European researchers interested in receiving funding from EBTNP you should contact the program officer, LCDR Jenna Cope
Email	JCope@hrsa.gov
Phone Number	301-443-5503
Internet link	https://www.grants.gov/search-grants.html?cfda=93.211

Big Data to Knowledge (BD2K) Program

Responsible entities: NIH

The Big Data to Knowledge (BD2K) program promotes the research and development of novel and revolutionary ideas and technologies for maximizing and accelerating the utility of big data and data science in biomedical research. Understanding health and illness is hampered by the inability to extract

202 https://www.grants.gov/search-grants.html?cfda=93.211

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relevant insights from vast data. Through the optimization of harvest and analysis of valuable information contained in biological big data, which enables BD2K to simplify data-driven discovery[203].

First Approach	
Contact	European researchers and businesses interested in participating in the Program should contact the NIH Office of Strategic Coordination, Director Douglas Sheeley, Sc.D.
Email	Douglas.Sheeley@nih.gov
Phone Number	01-594-9762
Internet link	https://commonfund.nih.gov/bd2k

5.1.3. United States Agency for International Development (USAID)

Innovative Health Practice

Responsible entity: United States Agency for International Development (USAID)

The United States Agency for International Development (USAID), through a Broad Agency Announcement (BAA), is in search of participants to collaborate on innovative research and development projects aimed at reducing disease and mortality rates worldwide, especially in low-and-middle-income countries. USAID invites organizations and companies, including for-profit and non-profit, public, and private entities, to submit an Expression of Interest (EOI) and engage in the development of innovative tools and strategies that boost and maintain health indicators in low-and-middle-income countries (LMICs)[204].

First Approach	
Contact	European researchers and SMEs interested in the Innovative Health Practice initiative could contact the project manager Sharon Davis
Email	shdavis@usaid.gov
Phone Number	(202) 567-4755
Internet link	https://npin.cdc.gov/funding/innovation-health-practices

[203] https://commonfund.nih.gov/bd2k

[204] https://www.usaid.gov/node/501001

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5.1.4. Department of Defense (DOD)

US Army Medical Research and Development Command for Extramural Medical Research

Responsible entity: US Army Medical Research and Development Command (USAMRDC)

The mission of the US Army Medical Research and Development Command (USAMRDC) is to address medical challenges significant to both American Service Members domestically and abroad, as well as the broader public. The direction and emphasis of these efforts are shaped by advancements in military and civilian medical science and technology, operational needs, assessments of military threats, and national defense strategies[205].

First Approach	
Contact	EU researchers and businesses interested in the Program could contact the CDMRP Help Desk.
Email	help@eBRAP.org
Phone Number	(301) 682-5507
Internet link	https://npin.cdc.gov/funding/broad-agency-announcement-extramural-medical-research

5.1.5. Small Business Administration (SBA)

Small Business Innovation Research (SBIR) program

The SBIR program is a highly competitive program that encourages US small businesses to participate in Federal Research/R&D with the potential for commercialization. Thus, the SBIR awards competitive funds to businesses so they can advance their technological potential and commercialize new products[206]. Each year, Federal agencies with extramural R&D budgets that exceed $100 million (nearly €90 million) are required to assign around 3.2% of their R&D budget to SBIR programs. Regarding eHealth, the SBIR program is highly committed to funding health-related technology development in some of its areas, such as EHR and mHealth.

Considering SBIR eligibility criteria, only US small businesses are eligible to submit applications to SBIR funds. Collaborating research institutions are considered subcontractors to the small businesses and

205 https://npin.cdc.gov/funding/broad-agency-announcement-extramural-medical-research

206 https://www.sbir.gov/about/about-sbir

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may not apply as applicants. Moreover, the R&D projects awarded with SBIR funds must be performed entirely in the US. In the cases where the project requires use of a foreign site, the researcher must provide compelling scientific justification in the application for the use of a foreign site[207].

First Approach	
Contact	European researchers and SMEs interested in the SBIR program could contact the program managers
Email address	sbir@od.nih.gov
Internet link	https://www.sbir.gov/feedback

5.2. State initiatives/programs

As referred in section 3.3, each US state has independent authority to regulate and oversee the practice of medicine within its boundaries and these requirements could inhibit the wider use of some eHealth products and services[208]. Despite that independence, there are some federal initiatives and programs at the federal level with an emphasis on the US states, such as the National Medicaid & CHIP Program and the State Innovation Models initiative, promoted by the HHS (detailed in section 5.1).

Some US states are particularly focused in being at the forefront of eHealth technology development and application in their healthcare systems. These states, which include the states of Arizona, California, and Maryland, recognize the potential impact of eHealth related testing programs and initiatives that bring together companies and research facilities. A sample of state initiatives that exist at the state level are provided below.

[207] https://sbir.nih.gov/about/eligibility-criteria#collapseThree
[208] https://aspe.hhs.gov/system/files/pdf/206751/TelemedicineE-HealthReport.pdf

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5.2.1. Arizona: Telemedicine Program for the prison system and rural underserved communities

The Arizona Telemedicine Program is a multidisciplinary initiative that provides telemedicine services, distance learning, informatics training, and telemedicine technology assessment capabilities to the Arizona communities. The Program, which has been established by the College of Medicine of the University of Arizona, is particularly dedicated to the Arizona prison system and state rural underserved communities.

First Approach	
Contact Person	European SMEs interested in the Telemedicine program for the state of Arizona could contact the University of Arizona
Phone Number	(877) 535-6166
Internet link	http://telemedicine.arizona.edu/contact

5.2.2. California: California Telehealth Network (CTN)

Telemedicine is considered a primary strategy for the state of California. The CTN is designed to drive deployment into rural and remote areas. This is a state initiative sponsored by a consortium of key stakeholders led by the University of California, with the aim to foster advanced IT and services to improve access to high quality healthcare focusing on medically underserved and rural areas in California[209]. Under this initiative, the California Emerging Technology Fund (CETF) provides support to build a statewide network that aims to bring together specialized health and medical care to underserved rural and urban communities, both rural and urban.

[209] https://www.caltelehealth.org/about

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First Approach	
Contact	European researchers and SMEs interested in the CTN could contact the Director of Operations, Monica Koiv
Email	koivm@ochin.org
Phone Number	916-256-2199
Internet link	https://www.caltelehealth.org/contact

5.2.4. Maryland: Maryland Health Care Commission (MHCC) - Telemedicine Task Force

The Telemedicine Task Force was created by the MHCC in 2010 with the aim to develop a plan for a statewide telemedicine system of care. Thus, the Task Force identified several areas for improvement to foster effective telemedicine delivery in the state. Under this telemedicine initiative, the MHCC has awarded five rounds of telehealth grants to specialized organizations to implement innovative projects in Maryland to promote the effectiveness of telehealth technologies in healthcare.

First Approach	
Contact Person	European researchers and SMEs interested in the MHCC telemedicine initiative could contact the MHCC Program Manager, Denise Ridgely
Email	denise.ridgely@maryland.gov
Phone Number	410 764 3780
Internet link	http://mhcc.maryland.gov/mhcc/pages/home/contacts/contacts.aspx

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7- Observations

The US is one of the countries with the highest healthcare expenditure in the world and the country that generates more revenues in the world from eHealth products and services. Although the US industry players from ICT areas have increased their investments in medical and health R&D in the past five years, there is still a short-supply of trained Health IT professionals in the country, which is expected to grow. As a result, the US is possibly the market with the most eHealth innovation and business opportunities in the world. The opportunities seem to largely compensate the respective barriers, but it is particularly important to emphasize the need to ensure that the eHealth products and services are compliant with federal regulations and the various state laws.

There is a particular concentration of innovation hubs/facilitators and industry related R&D centers in the states of California, Texas, Massachusetts and New York. When analyzing the US eHealth market, the identification of the regions with a higher number of business opportunities are not as obvious. This is mostly because those opportunities depend on the type of eHealth related products and services aiming to be commercialized in the country, as well as on the budget of the potential final end-users. It seems however that the final-end users of Big Data for Health, EHR and HIS related products, the clinics and hospitals, are especially concentrated in the states of California, Texas, New York, Florida and Pennsylvania; whereas the final-end users for mHealth and Telemedicine products, the home health service providers, seem to be primarily located in the states of Florida, Missouri, California, Pennsylvania and Tennessee.

The technologies applied for the development of eHealth products are rapidly advancing. Therefore, in order to be kept updated on the latest emerging innovation and market trends in the US eHealth sector, EU researchers and industry representatives are recommended to be in contact with the key US eHealth related networks, as well as to attend eHealth conferences and networking events located in the US.

In the US, the eHealth innovation is highly supported by federal and state initiatives and programs that prioritize research areas that can lead to technological breakthroughs. At the federal level, the eHealth innovation is primarily supported by programs and initiatives from the HSS, NSF and DOD. Since each US state has independent authority to regulate and oversee the practice of medicine within its boundaries, only some states have eHealth as a priority and, as a result, not all states have initiatives and programs aiming to promote eHealth innovation. Although there are several programs and initiatives at both federal and state levels, it is important to note that the information related to funds and grants for European representatives is difficult to find. In most cases, the European innovators and business representatives interested in US eHealth initiatives and programs need to contact the program officers to know specific details about international eligibility.

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Overall, the assessment carried out by this market guide demonstrates there are several and relevant EU-US innovation and business cooperation opportunities in the eHealth sector. Both regions consider eHealth as a priority and are highly committed to promote innovation in this field with the aim of transforming the way healthcare is delivered, from reactive and centered healthcare systems to more preventive, evidence-based, and person-centered healthcare systems.

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Annex 1: Summary of the US Federal and State Funding Initiatives and Programs

The table below summarizes the US Federal and State funding initiatives in the field of eHealth and provides relevant information on how EU researchers could first approach them.

Table 5 - Summary of the US Federal and State Funding Initiatives and Programs

US State Department/ Agency	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
Federal Initiatives and Programs				
National Science Foundation (NSF)	Smart Health and Biomedical Research in the Era of Artificial Intelligence and Advanced Data Science (SCH)	NSF Directorate for Mathematical & Physical Sciences NIH	Contact the NSF website t (https://www.nsf.gov) nsfpubs@nsf.gov (703) 292-5111	https://new.nsf.gov/funding/opportunities/smart-health-biomedical-research-era-artificial
Department of Health and Human Services (HHS)	Evidence-Based TeleHealth Network Program	Health Resources and Services Administration (HRSA)	Contact the Program Manager Carlos Mena cmena@hrsa.govmailto: cmena@hrsa.gov (301) 443-3198	https://www.grants.gov/search-grants.html?cfda=93.211

US State Department/ Agency	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
	Innovative Health Practice	United States Agency for International Development (USAID	Contact the Innovative Health Practice team: shdavis@usaid.gov (202) 567-4755	https://www.grants.gov/web/grants/search-grants.html
	The Evidence-Based TeleHealth Network Program (EBTNP)	Health Resources & Services Administration (HRSA)	Contact the Program Manager Carlos Mena cmena@hrsa.gov (301) 4433198	https://www.grants.gov/search-grants.html?cfda=93.211
	Big Data to Knowledge (BD2K) Program	NIH Office of Strategic Coordination NIH	Contact the NIH Office of Strategic Coordination, Director Douglas Sheeley, Sc.D. Douglas.Sheeley@nih.gov 01-594-9762	https://commonfund.nih.gov/bd2k
Department of Defense (DOD)	US Army Medical Research and Development Command for Extramural Medical Research	US Army Medical Research and Development Command (USAMRDC) – Department of Defense	Contact the CDMRP Help Desk help@eBRAP.org : (301) 682-5507	https://npin.cdc.gov/funding/broad-agency-announcement-extramural-medical-research

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US State Department/ Agency	Programs/ Initiatives	Responsible entities	Contact Info	Internet link
Small Business Administration (SBA)	Small Business Innovation Research (SBIR) program	Small Business Administration (SBA)	Contact SBIR by the e-mail: sbir@od.nih.gov	https://www.sbir.gov/thinking-beyond-nih-for-health-related-sbir-sttr-funding
State Initiatives and Programs				
Arizona	Telemedicine Program for the prison system and rural underserved communities	College of Medicine of the University of Arizona	Contact the University of Arizona: http://telemedicine.arizona.edu/contact (877) 535-6166	http://telemedicine.arizona.edu/
California	California Telehealth Network (CTN)	California Telehealth Network (CTN)	Contact the Director of Operations, Monica Koiv: koivm@ochin.org 916-256-2199	www.caltelehealth.org/about
Maryland	Telemedicine Task Force	Maryland Health Care Commission (MHCC)	Contact the MHCC Program Manager, Denise Ridgely: denise.ridgely@maryland.gov 410 764 3780	http://mhcc.maryland.gov/mhcc/pages/hit/hit_telemedicine/hit_telemedicine.aspx

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