Towards a Globally Recognized and Harmonized Degree of Master of Digital Health (MDH): The Case for an MDH Alliance

Georgi V. Chaltikyan,[a] Dmitry Etin,[a] Eugenia Lvova,[a] Fara Aninha Fernandes,[a] Jishen Pfeiffer[a]

[a]Deggendorf Institute of Technology (DIT)/European Campus Rottal-Inn (ECRI), Pfarrkirchen, Germany

DOI: 10.25929/3jtj-kc09

ABSTRACT

The digital transformation of healthcare is advancing at an unprecedented pace, reshaping systems, providers, and societies worldwide. While technological development accelerates, the education and training of the health workforce lag behind, producing critical gaps in digital competencies and undermining the adoption of innovation. Biomedical and Health Informatics (BMHI) has historically provided the academic foundations for this field, but the emergence of Digital Health as a broader, interdisciplinary paradigm demands new approaches to education. This paper explores the rationale for a globally harmonized Master of Digital Health (MDH) degree, modeled after the success of the Master of Public Health (MPH), and presents a call for the establishment of an MDH Alliance. We review the history of BMHI education, the evolution towards Digital Health, the development of knowledge, skills, and competences (KSCs), and the role of the workforce in digital transformation. We highlight recent calls for an MDH degree by global thought leaders, drawing inspiration from the MPH, and building on our institutional experience transitioning from a Master of Medical Informatics to a Master of Digital Health. We argue that a coordinated international initiative is essential to ensure quality, comparability, and professional mobility in Digital Health education, and to provide the workforce required for equitable and sustainable digital transformation of health systems.

KEYWORDS

Digital health, health informatics, information technology, MDH, education

1. Background

The academic field now referred to as Biomedical and Health Informatics (BMHI) has roots extending back to the early days of computing in the mid-20th century. The first generation of pioneers envisioned the potential of information technology to support medical practice, research, and education. In Europe, François Grémy, a French physician and biostatistician, was among the earliest advocates, promoting the systematic application of computing to medicine in the 1960s [1]. In the United States, Donald A.B. Lindberg, later Director of the U.S. National Library of Medicine, championed medical computing, advancing the idea that electronic systems could support medical knowledge organization and retrieval [2]. In Germany, Peter Reichertz played a key role in integrating clinical information systems into university hospitals [3]. These early contributions laid the foundation for BMHI as an interdisciplinary field bridging medicine, computer science, and information science.

By the 1970s and 1980s, BMHI had grown into a recognized academic community. This period saw the establishment of professional associations such as the International Medical Informatics Association (IMIA) in 1967 and, later, the European Federation for Medical Informatics (EFMI) in 1976 [4, 5]. These organizations were instrumental in convening researchers and practitioners, promoting standards, and initiating international conferences such as MEDINFO and MIE (Medical Informatics Europe), which became flagship scientific gatherings. Importantly, they also encouraged the emergence of formal educational pathways in BMHI. Early programs were mostly research-focused, often embedded in computer science or biomedical faculties, but gradually evolved into specialized master's degrees and doctoral programs.

The 1990s and 2000s marked a period of expansion in both the field and its educational offerings, reflecting the digitalization of healthcare systems. Electronic health records (EHRs) were increasingly implemented, requiring professionals capable of designing, managing, and evaluating such systems. Health information exchange, computerized provider order entry, and clinical decision support became mainstream topics. BMHI curricula expanded to cover system design, interoperability, data quality, usability, and change management. By the early 21st century, dozens of universities worldwide offered structured BMHI or health informatics programs. A landmark in this process was the publication of the IMIA Recommendations on Education in Biomedical and Health Informatics, which provided the first globally accepted guidance on competencies, curricula, and learning outcomes [5].

However, as the 2010s unfolded, it became clear that the concept of BMHI, while robust, might no longer reflect the full and rapidly expanding breadth of digital innovations transforming healthcare. The more and more frequent usage of the term Digital Health represented a paradigm shift. Digital Health was defined as an umbrella term encompassing the broad spectrum of Information and Communication Technologies (ICT) including mobile health (mHealth), wearable technologies, big data analytics, genomics, artificial intelligence, robotics, telemedicine, virtual and augmented reality, and patient engagement tools [6, 7]. This broader framing reflects the increasing interdisciplinarity of the field, integrating not only informatics and medicine but also engineering, behavioral science, ethics, law, and public health.

The transition from the scientific discipline of BMHI to the domain of knowledge and practice Digital Health had implications for education and workforce development. The WHO Global Strategy on Digital Health 2020–2025 explicitly identifies "strengthening digital health workforce capacity" as a pillar of national digital health ecosystems [7]. Similarly, the European Health Data Space (EHDS) initiative underlines that interoperability, secondary use of data, and digital innovation cannot succeed without appropriately skilled professionals [8].

At the same time, empirical research highlights significant workforce gaps. A systematic review demonstrated that Digital Health technologies can enhance health worker competencies and workplace performance, yet lack of training remains a critical barrier to implementation [9]. In Finland, a national project (MEDigi) identified core eHealth competencies for medical and nursing curricula but concluded

that integration remained patchy [10]. In Catalonia, the COMPDIG-Salut project evaluated over 800 health professionals and found that more than 60% failed to reach an intermediate level of digital competence, particularly in data governance and digital collaboration [11]. Similarly, Estonia developed national digital competence profiles for health professionals and identified fragmentation of digital competences across existing education and training programs [12].

To address these challenges, multiple competency frameworks have emerged:

- HITCOMP (EU–US eHealth Work Project) catalogued over 1,000 competencies across domains and proficiency levels, providing a comprehensive repository for education and workforce planning [13].
- The European Commission's DigComp framework, initially developed for citizens, has been adapted to health professionals, emphasizing digital literacy, safety, and collaboration [14].
- The BeWell Skills Strategy (2023) emphasizes not only digital but also green and soft skills for the health workforce, recognizing sustainability and well-being as integral to digital transformation [15].

These frameworks converge on the idea that Knowledge, Skills and Competencies (KSCs) in Digital Health go far beyond technical literacy. They include ethical reasoning, critical appraisal of technology, understanding of interoperability standards (HL7 FHIR, SNOMED CT, LOINC), data protection, cybersecurity, communication, and leadership for change [5].

The role of the workforce in digital transformation is now recognized as decisive. As our own work has demonstrated, health system digitalization projects often fail when human capacity is neglected, even if technology and infrastructure are well funded [16]. Conversely, where training and workforce development are prioritized, adoption accelerates and sustainability improves.

Taken together, the history of BMHI education, the evolution towards Digital Health, and the emergence of workforce competency frameworks highlight a pressing need: a globally harmonized educational standard that can provide assurance of quality, comparability, and professional mobility. Just as the IMIA recommendations shaped BMHI, and accreditation frameworks shaped public health education, Digital Health now requires a similar step forward. The proposal for a globally recognized and accredited Master of Digital Health (MDH) degree, supported by an international Alliance, emerges as the logical next phase in this historical trajectory.

2. Inspiration: The Story of the MPH

The Master of Digital Health (MPH) stands as one of the most influential and successful professional master's degrees in modern history. Its development illustrates how an emergent interdisciplinary field can move from fragmented beginnings to a globally harmonized, accredited, and professionally recognized qualification. The story of the MPH is thus directly relevant to the current efforts to establish the MDH.

Early Origins of Public Health Education

Public health emerged as a distinct discipline in the late 19th and early 20th centuries, spurred by the need to address sanitation, infectious disease control, and later the growing burden of chronic illnesses. Academic programs initially developed in response to pressing health crises, such as urban sanitation in Europe or the spread of tuberculosis in the United States. The first formal schools of public health were established in the early 20th century, including the Johns Hopkins School of Hygiene and Public Health (founded 1916) and the Harvard School of Public Health (founded 1922). These institutions defined curricula around epidemiology, biostatistics, environmental health, and health administration [17].

Although the early MPH programs varied in content and approach, they shared a focus on practical, applied skills to address population health needs. Unlike research-oriented PhD degrees, the MPH was designed to produce professionals capable of working in government agencies, community organizations, and international health bodies. This orientation towards practice, interdisciplinarity, and policy relevance has remained a hallmark of MPH education.

Evolution into a Global Standard

By the mid-20th century, the MPH had spread internationally, with programs established in Europe, Latin America, Asia, and Africa, often with support from international organizations such as the World Health Organization (WHO). The WHO played a crucial role in promoting public health education globally, including the training of professionals in epidemiology and health systems management [18]. As programs multiplied, the need for standardization and quality assurance became evident. In the United States, the Council on Education for Public Health (CEPH) was founded in 1974 to accredit schools and programs of public health. CEPH accreditation established clear competency-based criteria, covering domains such as epidemiology, biostatistics, environmental health, health policy and management, and social and behavioral sciences [19]. Accreditation became a key driver of comparability and credibility, ensuring that MPH graduates possessed a consistent set of core competencies.

In Europe, similar efforts were launched later. The Agency for Public Health Education Accreditation (APHEA), established in 2011 through a collaboration of the Association of Schools of Public Health in the European Region (ASPHER) and other bodies, developed accreditation criteria tailored to European educational contexts [20]. APHEA's model drew heavily on CEPH but emphasized European priorities such as health systems, equity, and cross-border health challenges.

Through these accreditation efforts, the MPH became the gold standard qualification for public health professionals worldwide. Graduates could demonstrate comparable competencies, employers gained confidence in qualifications, and universities aligned curricula with international expectations. The MPH degree thus exemplifies how a new interdisciplinary domain can institutionalize itself through competency frameworks, harmonized curricula, and accreditation systems.

Impact of the MPH Model

The impact of the MPH has been profound. First, it has provided a globally mobile workforce. Public health professionals trained in accredited programs are able to work across borders, as their qualifications are recognized and trusted internationally. Second, the MPH has influenced policy and workforce planning: many national health systems explicitly integrate MPH-trained professionals into leadership and managerial roles. Third, the MPH has fostered a sense of professional identity and legitimacy for public health, enabling the field to stand alongside medicine, nursing, and other established health professions.

From an academic perspective, the MPH has also provided a platform for continuous evolution. Curricula have been updated to reflect emerging challenges such as HIV/AIDS, health inequities, global health, and more recently, planetary health and climate change. Importantly, accreditation frameworks like those of CEPH and APHEA have demonstrated flexibility in adapting to new knowledge while maintaining consistency in core competencies.

Lessons for Digital Health

The trajectory of the MPH offers several critical lessons for the MDH initiative.

1. **Fragmentation to Harmonization:** Just as early public health programs were fragmented, today's Digital Health education landscape is diverse and inconsistent. Universities offer programs in medical informatics, eHealth, biomedical informatics, digital health policy, and related areas, but without harmonization or mutual recognition [5]. The MPH shows that coordinated efforts can overcome fragmentation and create a global standard.
2. **Competency-Based Education:** The MPH model demonstrates the power of competency-based education, ensuring graduates achieve specific knowledge, skills, and attitudes. For Digital Health,

multiple competency frameworks already exist (HITCOMP, DigComp, BeWell, COMPDIG), but a unified, globally endorsed framework is needed to anchor the MDH [8].

3. **Accreditation as a Driver of Quality:** CEPH and APHEA accreditation made the MPH credible and globally recognized. Similarly, a global accreditation mechanism for MDH would ensure comparability, mobility, and trust. Without accreditation, programs risk remaining local and unrecognized.
4. **Professional Identity:** The MPH gave public health professionals a clear identity and career trajectory. For Digital Health, the establishment of MDH can play a similar role, legitimizing the profession and integrating it into workforce planning.
5. **Flexibility and Adaptation:** The MPH has evolved over time, expanding to include new challenges. Digital Health education must likewise remain dynamic, updating curricula to incorporate emerging technologies such as artificial intelligence, blockchain, and virtual reality.

3. Evolution of Digital Health Education at DIT-ECRI: From MMI to MDH

Our institutional journey provides a microcosm of the broader evolution of the field.
In 2015, Deggendorf Institute of Technology – European Campus Rottal-Inn (DIT-ECRI) launched the Master of Medical Informatics (MMI), building on decades of tradition in BMHI education. The evolution of the program to the Master of Digital Health (MDH) rebranded and restructured in 2019 and consolidated in 2021, illustrates both the shifting boundaries of the field and the growing recognition that Digital Health requires a new, globally harmonized qualification.

Origins and Transition: The Master of Medical Informatics (2015-2019)
The establishment of the MMI program at DIT-ECRI in 2015 was rooted in the long-standing traditions of BMHI. At that time, medical informatics was still the dominant terminology, reflecting a focus on information systems in healthcare, data management, and clinical decision support [5]. The MMI program was designed to equip students with skills in electronic health records (EHRs), interoperability, data standards, software development, and health system analysis. The program quickly attracted an international student body, reflecting the growing global demand for professionals with informatics expertise.

By 2017–2018, it had become clear that the field was expanding beyond the remit of "medical informatics." The concept of "Digital Health" was rapidly gaining traction in global policy documents [6, 7] and industry discourse. At DIT-ECRI, the leadership recognized that the academic program had to evolve in tandem with the field itself.
Discussions among faculty highlighted two key insights. First, Digital Health is inherently interdisciplinary, requiring contributions not only from informaticians but also from clinicians, public health specialists, engineers, social scientists, and ethicists. Second, education must be future-oriented, preparing graduates not only for the technologies of today but for those on the horizon — from precision medicine to immersive simulation. These insights provided the rationale for a strategic reorientation of the program.

Rebranding and Reformation: The Master of Digital Health (2019-2024)
In 2019, the faculty began reforming the program towards MDH. This was not simply a name change but a fundamental restructuring of the curriculum to reflect the expanded domain of Digital Health. The MDH integrated new courses on AI in healthcare, data science and big data analytics, digital health entrepreneurship, and regulatory aspects of digital technologies. At the same time, traditional BMHI subjects such as interoperability standards (HL7, SNOMED CT, LOINC, ICD) and health information systems remained foundational.

The rebranding was also accompanied by a new pedagogical model. The MDH adopted the "I3 (I-cube)" principles: Interdisciplinary, International, and Innovative. Students were recruited from across the

globe, creating a diverse classroom that mirrored the international nature of Digital Health challenges. They represented multiple disciplines, emphasizing collaboration between medicine, computer science, engineering, public health, and management. The landmark innovation has been the adoption of Project-Based Learning (PBL) in interdisciplinary small teams simulating real-world innovation.

This reformation positioned DIT-ECRI's MDH among the well-known structured Master of Digital Health programs in Europe, serving as a model for other institutions exploring similar transitions.

Scale and Global Reach: 2024–2025
In 2024, the MDH program had received more than 1,800 applications, with students from all continents, and had graduated more than 220 professionals. Alumni pursued careers in academia, industry, government, and international organizations, often serving as pioneers of Digital Health in their home countries or institutions. The program's popularity demonstrated the global demand for structured, high-quality Digital Health education.

At the same time, the program strengthened its links with international organizations and policy agendas. Since the very establishment of MMI in 2015, DIT-ECRI has been involved in European, international, and global collaboration and networking reflected by its institutional partnership with, and membership in such major non-profits and think-tanks as HIMSS, IMIA, ISfTeH, EFMI, and CHIME. In 2020, a series of online events was launched that developed into the DigiHealthDay – Global Forum for Education, Research, Innovation and Networking in Digital Health attracting more than 1,700 followers including top-tier academics and experts from around the globe [22]. DIT-ECRI became increasingly involved in European projects, and due to its long-lasting collaboration with Data and Digital Health Unit at the WHO Regional Center for Europe, in 2025 was designated a WHO Collaborating Centre for Digital Health Education, Research, and Development — the first in Germany [23]. These developments underscored the program's role as both an educational and research hub, situated at the intersection of academia, policy, and practice.

At the same time, this growth highlighted the limitations of a single-institution model. While DIT-ECRI's MDH program was thriving, other universities were launching their own initiatives — sometimes under the name "Digital Health", sometimes under related labels such as "Health Informatics", "Digital Medicine", or "eHealth". The lack of harmonization risked leading to fragmentation, where graduates of different programs possessed highly variable competencies, and employers lacked confidence in their qualifications.

From Institutional Success to Global Vision: The MDH Alliance
By 2024–2025, it had become clear that the next step was to move beyond institutional success to collective global action. The analogy with the MPH became increasingly compelling. Just as the MPH had, over the 20th century, evolved from disparate programs into a globally harmonized degree supported by accreditation bodies such as CEPH and APHEA, [17, 19], so too could the MDH become the benchmark qualification for Digital Health professionals.

This realization led to the decision to convene a Master of Digital Health (MDH) Alliance. The Alliance would bring together universities, professional associations, policymakers, industry, and students to co-create a Global MDH Competency Framework, harmonize curricula, and establish an international accreditation and quality assurance mechanism. In this way, the institutional journey of DIT-ECRI from MMI to MDH became the prototype for a global movement, illustrating both the necessity and feasibility of establishing the MDH as a recognized and accredited global standard.

A similar approach has also been highlighted by thought leaders in the field. In 2025, Car and Topol published a viewpoint paper in JAMA explicitly calling for the creation of a globally recognized MDH degree. They argued that the rapid digitalization of health systems requires a new generation

of professionals trained not only in informatics but also in data science, artificial intelligence, ethics, regulation, and patient-centered innovation. Importantly, they emphasized that the MDH should follow the model of the MPH, which successfully established a global benchmark for public health education in the 20th century. Their call underscored both the urgency and feasibility of harmonizing Digital Health education into a coherent, internationally recognized qualification — a vision strongly aligned with the concept of an MDHAlliance [21].

4. Motivation: Why an MDH alliance?

The proposal to establish an MDH Alliance arises from both structural challenges in current education and the strategic opportunities provided by global health system transformation. The rationale is anchored in three interrelated observations: the fragmentation of existing programs, the absence of accreditation and quality assurance mechanisms, and the pressing workforce demand driven by digitalization policies at national and international levels.

Fragmentation of Programs
At present, Digital Health education exists in multiple forms across the globe: health informatics, biomedical informatics, eHealth, digital medicine, and digital health master's programs. While these share overlapping content, their scope, depth, and competencies vary significantly [5]. Some focus on technical informatics, others on health systems management, and others on entrepreneurship or regulatory aspects. Without harmonization, graduates leave with heterogeneous skill sets, creating uncertainty for employers and limiting professional mobility. This fragmentation is further compounded by the absence of a unifying professional identity. Unlike medicine, nursing, or public health, which are anchored by widely recognized qualifications, Digital Health professionals cannot point to a globally standardized degree. The consequence is a lack of clarity in career trajectories and workforce planning.

Absence of Accreditation and Quality Assurance Mechanisms
The second motivation arises from the lack of accreditation or quality assurance systems for Digital Health education. In contrast, the MPH achieved global recognition precisely because of the establishment of accreditation bodies such as CEPH in the United States and APHEA in Europe [19]. Accreditation provides quality control, comparability, and trust. It ensures that programs adhere to defined competency frameworks and that graduates achieve measurable learning outcomes. Digital Health currently lacks such a framework. Although efforts such as COMPDIG, HITCOMP, DigComp, and BeWell have produced important competency models [11, 13–15], these have not yet been consolidated into a globally recognized accreditation process. Without accreditation, programs risk remaining localized, undermining global professional mobility and legitimacy.

Workforce Demand and Policy Drivers
The third motivation is the growing workforce demand created by national and international digitalization strategies. The WHO Global Strategy on Digital Health 2020–2025 identifies workforce capacity-building as a key pillar of Digital Health ecosystems [7]. The European Commission's EHDS emphasizes that interoperability, secondary use of data, and digital innovation require a digitally skilled workforce [8]. Projects such as BeWell further demonstrate the recognition that digital competencies are not optional but essential for Europe's 15 million health workers [15]. At the same time, empirical evidence confirms that workforce readiness remains insufficient [9–11].

Essential Activities of an Alliance
The MDH Alliance can respond to these challenges through a set of essential activities. First, it can develop a Global MDH Competency Framework, synthesizing existing models into a harmonized standard endorsed by universities, professional bodies, and policymakers. Second, it can facilitate curriculum harmonization, ensuring that MDH programs worldwide share a common foundation while allowing for elective specialization. Third, it can establish a pathway for international accreditation, modeled after CEPH and APHEA, to ensure quality and comparability. Fourth, it can promote advocacy

and visibility, elevating Digital Health to the same level of professional recognition as Public Health. Finally, it can serve as a platform for mobility and collaboration, enabling student and faculty exchanges, joint degrees, and collaborative research.

A Call for Collective Action
The establishment of the MDH Alliance is not merely an academic exercise but a call for collective global action. The analogy with the MPH is instructive: just as public health professionals once faced fragmented training and uncertain identity, today's Digital Health professionals need a unifying qualification to anchor their field. As Car and Topol argue in their JAMA paper, the time has come for a Master of Digital Health that parallels the MPH in scope and legitimacy [21].

In this context, the MDH Alliance is envisioned as the central coordinating body driving the initiative forward. By convening universities, policymakers, industry, and professional associations, it can provide the governance and momentum needed to turn vision into reality. Its success will ensure that future Digital Health professionals are not only technically competent, but also ethically grounded, policy-aware, and globally mobile — the leaders needed for the safe and equitable digital transformation of health systems.

5. Conclusions

The past half-century of academic development in Biomedical and Health Informatics demonstrates how an emergent field can institutionalize itself through education, research, and professional identity. Yet as the landscape of healthcare has expanded to encompass Digital Health — with its integration of mobile technologies, artificial intelligence, genomics, extended reality, and patient-centered innovation — it has become evident that traditional BMHI frameworks are no longer sufficient. Education must adapt to reflect the breadth and complexity of Digital Health, and the workforce must be equipped not only with technical knowledge but also with ethical, regulatory, and leadership competencies.
The experience of the MPH offers a compelling precedent. Emerging in the early 20th century from disparate programs, the MPH achieved global recognition by establishing shared competencies, harmonized curricula, and formal accreditation systems [19, 20]. The MPH today anchors professional identity in public health, supports international workforce mobility, and provides governments and employers with a trusted standard of training. This trajectory demonstrates that new interdisciplinary domains can move from fragmentation to harmonization, provided that educational leaders act collectively.

Our own institutional journey — from the MMI launched at Deggendorf Institute of Technology in 2015, through the rebranding and reformation as the MDH in 2019, to the program's consolidation and global reach by 2024 — illustrates both the necessity and feasibility of this evolution. The transition was not cosmetic but reflected the real expansion of the field and the demands of students, employers, and health systems. With more than 1,800 applications annually from over 120 countries, the MDH at DIT-ECRI has proven the significant global demand for structured Digital Health education. At the same time, the emergence of parallel programs in other universities has underscored the risks of fragmentation if harmonization is not pursued.

The evidence is compelling: Digital Health technologies can enhance care and professional competence, but without adequate training, their impact is blunted [9]. WHO's Global Strategy on Digital Health (2020–2025) calls for workforce capacity-building as a prerequisite for national Digital Health ecosystems. European initiatives such as the BeWell Skills Strategy and COMPDIG-Salut in Catalonia have demonstrated both the urgency and feasibility of defining competencies and creating accreditation pilots [11, 15]. Yet these remain regional and fragmented. What is missing is a globally recognized qualification that can anchor Digital Health education with the same authority that the MPH achieved for public health.

The MDH Alliance is proposed as the platform to achieve this goal. By uniting universities, professional bodies, policymakers, and industry, the Alliance can define a Global MDH Competency Framework, harmonize curricula, and create an international accreditation and quality assurance system. Such an initiative will not only ensure quality and comparability but also provide graduates with professional mobility, employers with confidence, and governments with a workforce capable of leading digital transformation.

In this sense, the MDH Alliance is more than an academic collaboration: it is a strategic response to a global health challenge. Without harmonization, Digital Health education risks fragmentation and inequity, with some regions advancing rapidly while others are left behind. With harmonization, the MDH can become the gold standard for Digital Health professionals worldwide, equipping a new generation of leaders to guide health systems safely, effectively, and equitably into the digital era.
The time to act is now. Just as the MPH catalyzed public health education in the 20th century, the MDH must catalyze Digital Health education in the 21st century. This concept paper calls on universities, policymakers, professional associations, and industry partners to join in the establishment of the MDH Alliance — to seize this historic opportunity, to prevent fragmentation, and to ensure that Digital Health education serves as a cornerstone of sustainable, equitable, and resilient health systems for decades to come.

Acknowledgements

The authors acknowledge the use of ChatGPT (OpenAI, GPT-5 model) to assist with desk research, refinement of text, grammar and stylistic improvements, and the formatting of references. The tool was used strictly as a writing and editing aid. All substantive ideas, analysis, interpretation, and conclusions expressed in this article are those of the authors. The authors take full responsibility for the structure, accuracy, and content of the paper.

Conflicts of Interest

None declared

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