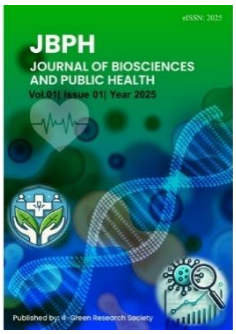

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REVIEW ARTICLE

The Emerging Role of Microcredentials in Higher Education: Advancing Public Health Learning and Beyond

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ABSTRACT

Microcredentials are emerging as a transformative tool in higher education, particularly in the field of public health. They are offering flexible, competency-based learning to meet the demands of the skilled workforces and cope with the rapidly advanced technologies. These short, targeted certifications confirm specific skills, enhancing employability and bridging gaps in areas like epidemiology, health informatics, and disaster management. Initiatives like the European Commission's recommendations and Australia's National Microcredentials Framework demonstrate their potential to promote equitable access and lifelong learning on a global scale. But problems still exist, such as digital disparities in settings with limited resources, employer acceptance, and a lack of standardization specially for the low- and middle-income countries. Significant benefits of microcredentials include enhanced access for underserved and rural populations, as well as quick upskilling during public health emergencies. To optimize their impact, future integration with formal education, developments in blockchain and artificial intelligence (AI), and strong policy frameworks are essential. Collaborative efforts among governments, academia, and industry can ensure scalability and alignment with global health priorities. This review underscores the role of microcredentials in fostering a resilient, skilled public health workforce while demanding for further research and consistent practices to overcome existing barriers.

INTRODUCTION

The public health sector today faces a complex and evolving array of challenges, including emerging pandemics, climate-related health risks, and the rapid integration of advanced technologies such as health informatics and artificial intelligence (AI). While conventional degree programs provide an in-depth education, they take an extensive period of time and are frequently not flexible enough to meet the demands of a workforce that is changing quickly [1]. A recent World Economic Forum study estimates that by 2027, the rapid advancement of technology and automation will require reskilling for over 60% of employees [2]. Microcredentials have become a promising educational innovation in response to the rapid technological changes in higher studies and research as well as pursuing a targeted profession. Microcredentials are short, targeted certifications that are intended to verify specific skills or competencies, usually offered via digital platforms to meet the demands of contemporary industries and students [3]. Unlike the traditional education system, microcredentials emphasize flexible, competency-based learning, which renders them especially appropriate for rapidly changing professions like public health [4]. In addition, employers frequently aren't aware of the abilities that graduates of standard degree programs bring to the table. Microcredentials offer a clearer means of indicating the skills and how they are especially relevant to the position [5].

The rising adoption of skill-based learning in public health reflects the urgent need for education systems that are scalable and directly aligned with global and local health priorities. By enabling rapid upskilling and reskilling, microcredentials can empower public health professionals to respond effectively to dynamic health scenarios and diverse system demands [6,7]. These programs offer focused training in key areas such as epidemiology, health policy, data analytics, and disaster management, bridging workforce skill gaps with efficiency and precision [8, 9]. For instance, to meet the rising demand for professionals skilled in digital health technologies and electronic health records (EHR) management, several public health institutions have collaborated with healthcare IT companies to co-develop micro-credential programs tailored to these needs [10]. Such industry-academic partnerships not only improve employability but also ensure the public health workforce remains agile and future-ready [11].

In developed countries, microcredential programs have already been launched under national policy frameworks to ensure their success, particularly for the younger generation. For example, in 2022, the Australian government introduced a National Microcredentials Framework (NMCF) to standardize short courses and support lifelong learning [12]. In Canada, several provinces, including Ontario, have implemented microcredential initiatives to address skills gaps and enhance employability among youth and adult learners [13]. Similarly, in 2022, the European Commission adopted a proposal for a Council Recommendation on a European approach to microcredentials, aiming to improve three objectives: (i) to enable individuals "to acquire the knowledge, skills, and competencies they need to thrive in an evolving job market and society"; (ii) to concentrate on the "readiness of providers of MCs to enhance the flexibility of the learning offer"; and (iii) to advance "equal opportunities and diversity, contributing to the achievement of resilience, equity, and prosperity for all [14].

However, in underdeveloped and many developing countries, several structural barriers persist. These include the absence of a comprehensive national micro-credentialing framework in health education, limited digital infrastructure in rural areas, and a shortage of skilled healthcare workers [15]. Despite these challenges, it is becoming more widely acknowledged that developing institutional capacity, creating evidence-based national health policies, and forming strategic partnerships with local universities, non-governmental organizations, and international organizations such as WHO and UNICEF are essential to the advancement of context-specific micro-credential programs [16, 17]. Microcredentials thus present a viable, inclusive, and scalable solution to bridge education and workforce development gaps in developing nations—especially in vital sectors like public health. Their adoption has the potential to accelerate progress toward Sustainable Development Goals (SDGs), universal health coverage, and economic resilience [18].

The conceptual frameworks, implementation strategies, advantages, drawbacks, and potential future directions of microcredentials in public health education are examined in this mini-review. The review emphasizes the transformative potential of microcredentials to develop a more resilient, responsive, and equitable public health workforce by focusing on industry reports, academic research, and global health policy frameworks.

CURRENT TRENDS AND IMPLEMENTATION MODELS

As new approach in public health capacity building and higher education is represented by microcredentials. Therefore, effective implementation frameworks and their increasing acceptance can enhance outcome-based education, improve workforce readiness, and encourage lifelong learning on a global scale.

A conceptual implementation framework of MCs, including their basic components, has been demonstrated in **Figure 1**. Here, microcredentials are an integral part of the higher education (HE) curriculum, which requires an understanding of the forces at work in two domains. Here are major components of the microcredentials operational domain. The first domain is the MCs' operational domain, which relates to the conceptualization of microcredentials implementation, including development and operations anchored by a technology-supported platform [19]. The second domain encompasses the major components of microcredentials ecosystem. The main forces within this ecosystem include job market skill requirements, contemporary and evolving industry professional practices, and government policies on education quality and standards [20].

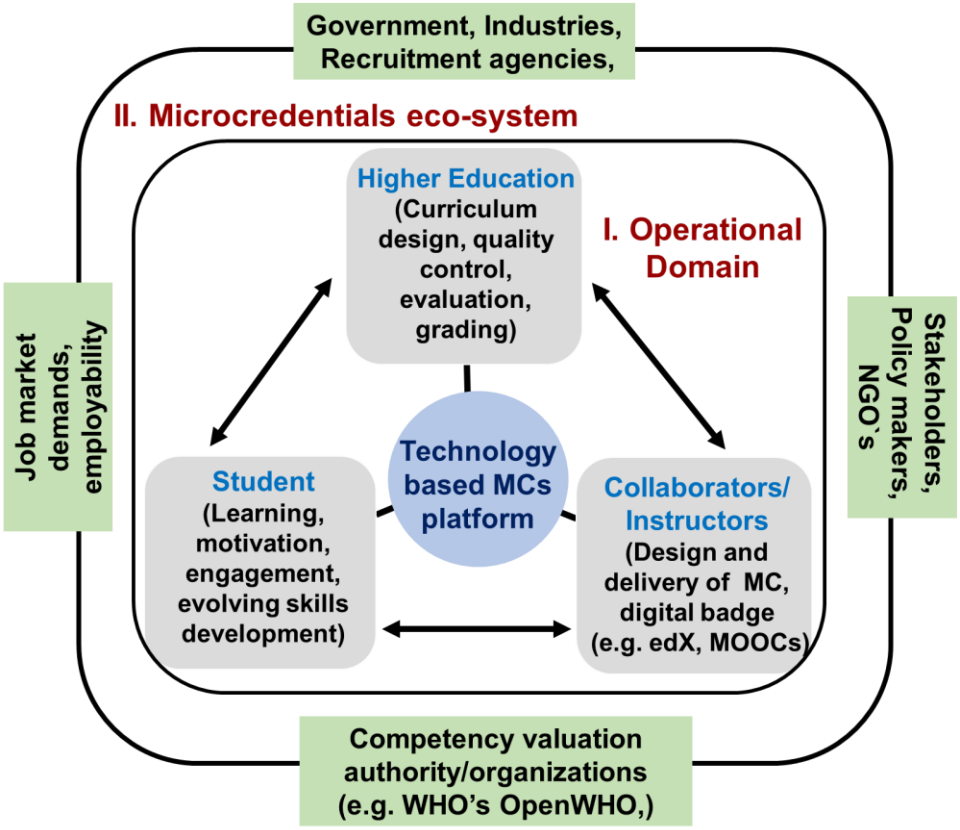

Figure 1. A conceptual framework of Micro-credentials for implementing in higher education level.

The current practices of microcredentials and methods of implementation have been focused on here.

Delivery Platforms and Approaches: Microcredentials are primarily delivered through some digital platforms. For example, Coursera, edX, OpenWHO, and Massive Open Online Courses (MOOCs) are crucial in delivering microcredentials, democratizing access to public health education. Specifically, Harvard's courses on global health ethics and biostatistics are available on edX, while Coursera offers specializations such as Johns Hopkins' programs in health informatics and epidemiology [21, 22]. WHO provides free, multilingual training on subjects like pandemic preparedness and health equity to more than 6 million learners worldwide through OpenWHO in 2024 [23].

Online and Hybrid Delivery Models: Online platforms or hybrid models are becoming more popular, especially for practical skills like community health interventions, which combine online education with in-person workshops [24]. It can increase accessibility for working professionals, rural students, and international learners in public health disciplines. To ensure practical application, Gavi's immunization training programs in Africa, for instance, combine field-based assessments with digital modules [25]. Additionally, mobile learning is becoming more popular. FutureLearn and other platforms provide microcredentials that can be accessed through smartphones, which is essential in areas where desktop access is scarce [26].

Stackable Credentials and Lifelong Learning: Stackable credentials, like specialized certificates and modular courses, provide a flexible path to lifelong learning to help professionals stay competitive. These short-term certifications can be along to full degrees and emphasize particular skills. Leading universities in this change are Georgia Tech and the University of Wisconsin-Madison, which are responding to the industry's need for modern, specialized skills [27]. Similarly, Johns Hopkins Bloomberg School of Public Health's MPH program grants microcredentials that can be applied toward degree credits [22]. According to a 2022 Coursera survey, 55% of students prefer programs that offer stackable certificates, and 76% of students are more likely to enroll in programs that offer microcredentials [28]. This model helps people advance in their careers and keep learning new skills.

Stakeholder Involvement (Industry/Professional Body Partnership): Collaboration with stakeholders, including universities, governments, NGOs, and the private sector, are effective initiatives for micro-credential implementation. For instance, UNICEF collaborates with edX to train community health workers in LMICs [29, 30]. Governments, such as Australia's, have integrated microcredentials into national skills frameworks, recognizing them as valid qualifications for public health roles [12].

Competency-Based Assessments: Rather than only evaluating theory, microcredentials test practical skills. They demonstrate what students can actually do, such as evaluating health data, managing crises, or interacting during a medical emergency, using resources like case studies, simulations, and digital badges. For instance, real-life scenarios are used in the WHO's OpenWHO platform to assess a person's capacity to handle disease outbreaks [23]. This practical approach makes students more employable, which is particularly crucial for public health work.

ADVANTAGES OF MICROCREDENTIALS IN HEALTH EDUCATION

According to a Coursera survey conducted in 2022, 90% of students worldwide think that professional certificates improve their employability, and 80% of employers think that these credentials strengthen job applications, especially for positions requiring specialized skills. Additionally, 72% of employers prefer to hire candidates with professional certificates. Furthermore, according to 95% of American university administrators, industry microcredentials are going to assume a crucial role in higher education [28].

Rapid changes in global public health are being driven by globalization, technological advances, and unfamiliar health risks [31]. Microcredentials cover competency gaps that are essential to contemporary public health and closely match workforce demands. Through microcredentials, the Centers for Disease Control and Prevention (CDC), for instance, highlights the necessity of public health informatics expertise to support data-driven decision-making [29]. The World Health Organization (WHO) has collaborated with online platforms to provide certified training in health equity, vaccination tactics, and pandemic preparedness [23]. These programs ensure microcredentials are pertinent to global health priorities and easily accessible. Microcredentials in health education may cover specialized health sectors such as: (i) Digital Health

Competencies (e.g., EHR proficiency, AI in healthcare); (ii) Public Health Specializations (e.g., epidemiology, health equity); (iii) Clinical Advancements (e.g., precision medicine, geriatric care). **Figure 2** presents a detailed overview of the key benefits associated with microcredentialing in health education.

Figure 2. Strategic advantages of microcredentials in health education. Here, SDOH means Social Determinants of Health.

Enhancing Evolving Skills and Employability: Microcredentials enable professionals to effectively reskill or upskill by providing focused, competency-based learning experiences that align employee competencies with organizational requirements. For example: a graduate in public health who obtains a Health Equity Micro-Credential could be eligible to work as a policy advisor. Clinicians who have earned their telehealth certification may commence delivering virtual care.

Addressing Critical Healthcare Workforce Shortages and Skill Gaps: Microcredentials facilitate quick upgrading or reallocation of current employees into high-demand roles, reducing disruption and preserving operational continuity in the face of growing workforce shortages, particularly in critical healthcare roles [30]. For example, the AACN report 2022 found that nurses with certifications in critical care or informatics had higher hiring rates [32].

Facilitating Rural and Underserved Healthcare Workforces: There is a serious shortage of healthcare providers in many low-resource and rural areas. By facilitating local professionals' quick upskilling, microcredentials help to close gaps in access to care. For instance, through virtual mentorship, Project ECHO (Extension for Community Healthcare Outcomes) employs micro credentialing to teach rural providers how to manage complex conditions (such as diabetes and hepatitis C) [33].

Rapid Response to Public Health Emergencies: The necessity of responsive training systems was brought to light by the COVID-19 pandemic. Large-scale workforce mobilization was made easier by microcredentials. For instance, local health departments' capacity was greatly increased by the CDC's Workforce Micro-Credential Program, which offered just-in-time training in crisis communication and vaccine distribution [29].

Addressing Health Equity and Social Determinants of Health (SDOH): The experts can incorporate equity-focused practices into the provision of care with the aid of microcredentials. For example, according to the Australian Institute of Health and Welfare, these modules can address things like recognizing SDOH in practice, comprehending how SDOH affects health outcomes, putting SDOH screening and referral procedures into place, and supporting laws that advance health equity [34]. Another example is the Mental Health First Aid (MHFA) Credentials, which reduce stigma and enhance early intervention by teaching non-specialists (such as teachers and police) how to identify and handle mental health crises [35].

Supporting Global Health Initiatives: Microcredentials cover in the gaps in specialized training in low- and middle-income (LMIC) nations. For example, WHO's Digital Health Leadership Program on Telemedicine and Data-Driven Decision Making in LMICs [36].

CHALLENGES AND LIMITATIONS

Despite their potential, microcredentials face several challenges. The lack of standardization across providers leads to variability in quality and recognition. Some of them have been addressed briefly in this section.

Standardization and Recognition: Despite their potential, microcredentials face several challenges. Lack of standardization leads to variability in quality and recognition. Without universal frameworks, microcredentials may be undervalued compared to degrees. The European Skills Agenda 2020 addresses this, but global adoption remains inconsistent [37]. A 2022 Coursera survey noted that while 88% of employers value professional certificates, 60% still prioritize degrees for senior positions [28].

Acceptance by Employer: Employer acceptance is another concern, as some stakeholders in traditional sectors perceive microcredentials as less rigorous than the conventional degrees. This perception can limit their value in competitive job markets, particularly for roles requiring comprehensive training, such as clinical or leadership positions [38]. Integrating microcredentials into formal education systems requires institutional buy-in, which can be challenging in conservative academic environments.

Equity and Access: The digital divide poses a significant barrier, particularly in low- and middle-income countries, where rural internet facility is low, language barriers and costs limit access, and health inequities [39]. Gender disparities also exist, as women in LMICs often face additional barriers to digital education due to household responsibilities [40].

Quality Assurance: To keep credibility, it's important to make sure evaluations are fair and robust. Evaluations may not correctly assess a learner's abilities if they are poorly designed, such as by depending only on multiple-choice questions without any practical activities [19]. More effective methods, like simulation-based assessments or peer reviews, provide better intuitions into real abilities. These approaches, however, are time-consuming and require money and resources, which can be challenging to administer with constrained funding [41].

Sustainability: Sustaining micro-credential programs requires ongoing funding and institutional support. Reliance on donor-funded initiatives may limit long-term viability. Developing sustainable models, such as public-private partnerships, is crucial to ensure continued access and scalability [42].

FUTURE PERSPECTIVES

The future of microcredentials in higher education—particularly in public health—is dignified for significant growth and transformation. By providing flexible and focused learning pathways these short, skills-focused certifications are revolutionizing how students acquire competencies. A few more specific perspectives are addressed below.

Integration with Formal Education: Integrating microcredentials into formal curricula, such as MPH or medical programs, could enhance their legitimacy. Microcredentials allow learners to earn credits while working; for example, a Bachelor of Public Health (BPH) student could earn microcredentials in health informatics or quick response to disaster or pandemic awareness services as part of their degree, along with regular academic activities. Many universities, such as Johns Hopkins, already incorporated microcredentials into undergraduate and postgraduate programs, allowing students to customize learning based on career goals [22].

Technological Advancements: Emerging technologies like AI and blockchain hold transformative potential. These innovations could make microcredentials more scalable and credible, particularly in global health contexts. Suppose, AI can support learning by personalizing content to each learner’s needs, services to the community people, making it more engaging and effective. Pilot programs, such as those by MIT’s Digital Credentials Consortium, demonstrate blockchain’s feasibility in education [43].

Addressing Global and Local Health Needs: Microcredentials can support global health priorities, such as pandemic preparedness, health equity, and climate resilience. WHO’s collaboration with OpenWHO exemplifies how microcredentials can address urgent needs, with over one million enrollments in COVID-19 outbreak response in 2022 [44]. Therefore, collaborative efforts between global and local stakeholders are crucial to align microcredentials with national health priorities.

Rural Community Health Improvement: Skilled workers can deliver higher-quality care, improving health outcomes in rural areas. For example, a health professional like a nurse or public health learner from a rural area could earn a

microcredential in telehealth and then be able to counsel people living in that remote area, which can improve patient access to care.

Industry-Academic Cooperation: Microcredentials created in collaboration between academic institutions and industry stakeholders can guarantee workforce alignment, as health-related industries are looking for graduates with particular competencies. Credentials specific to clinical trial management, pharmaceutical manufacturing, hospital management, and medical device design are examples of future applications.

Accreditation of Experiential and Informal Education: The skills learned through internships, volunteer work, or on-the-job training can be formalized with microcredentials. To support career advancement and workforce reinforcement, community health workers, peer counselors, or caregivers, can be recognized for their experience through microcredentials.

Research and Evaluation: More empirical research is needed to assess microcredentials impact on skilled job demand and health outcomes, particularly within the context of public health education. For example, pilot programs supported by local and international organizations, NGOs, could evaluate effectiveness in areas like community health worker training.

CONCLUSIONS

An innovative approach to public health education, microcredentials provide workforce-aligned, flexible, and accessible training to address substantial gaps in global health, epidemiology, and health informatics. As demonstrated by their increasing recognition with 90% of students and 88% of employers globally on platforms like Coursera and edX, their advantages include quick upskilling, inclusivity for diverse learners, and alignment with employer needs. To optimize their impact, however, issues like employer perceptions, lack of standardization, and equity barriers—especially in countries with limited resources like Bangladesh—must be resolved. Further advances in blockchain, AI, and modular integration into formal education could enhance microcredentials' scalability and credibility. The public health workforce in Bangladesh could be strengthened through context-specific initiatives and collaborations with regional and global organizations, meeting urgent needs in underserved and rural areas. To fully realize the potential of microcredentials, more empirical research, standardized frameworks, and institutional adoption are required. Microcredentials have the potential to transform public health education to meet the demands of a rapidly evolving global health landscape by raising a workforce of public health professionals who are knowledgeable, fair, and resilient.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. All aspects of this research were conducted impartially and independently.

ETHICS STATEMENT

This article is a review of previously published literature and does not involve any new studies with human participants or animals performed by the author. Therefore, ethical approval was not required. All sources have been appropriately cited to acknowledge the original authors.

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