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Digital Monitoring of Skills for Better Healthcare Management in Europe

Summary: The healthcare industry is increasingly faced with the need to adapt to rapid technological advances and changing patient needs while providing high-quality healthcare and minimising patient harm risks. The aim of this article is to advocate for the implementation of a skills digital monitoring system within the healthcare sector to enhance the overall quality of care, ensure patient safety, optimise healthcare workforce performance, and ensure that the competencies of workforce align with current and emerging healthcare demands. Implementation of this novel skills digital monitoring system is expected to minimise medical errors and enhance patient outcomes, standardise care quality and reduce healthcare costs by preventing avoidable complications, as well as facilitate robust public health responses and enable a culture of continuous professional improvement. Ultimately, this would contribute to a more sustainable, efficient, and patient-centred healthcare system, empowering healthcare providers to meet current challenges and future demands effectively. This article discusses the preliminary benefits of skills digital monitoring system, outlines the principles of its implementation, considers the impact on stakeholders, identifies possible challenges, and also evaluates applicable practices at both nationally and across Europe.

Keywords: skills monitoring, health quality, patient safety, healthcare institutions, healthcare systems.

Quality of Healthcare

According to World Health Organization, quality health services are effective (providing evidence-based healthcare services to those who need them),

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safe (avoiding harm to people for whom the care is intended), and people-centred (providing care that responds to individual preferences, needs and values) (WHO, 2019). The Committee on Quality of Health Care in America, in the report "*Crossing the Quality Chasm: A New Health System for the 21st Century*," recommends six aims for improvement – safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity (Committee on Quality of Health Care in America, 2001). To provide quality healthcare, the WHO has also identified indicators characterising health services. Health services must be timely – reducing waiting times and sometimes harmful delays, equitable – providing care that does not vary in quality on account of gender, ethnicity, geographic location, and socio-economic status, integrated – providing care that makes available the full range of health services throughout the life course, and efficient – maximising the benefit of available resources and avoiding waste (WHO, 2091). Efforts to provide high-quality services are based on various factors of the health care system, like effective management of the system, institutions, and processes and also a skilled and competent healthcare workforce. Additionally, funding mechanisms that support and promote quality care, as well as information systems that consistently monitor and adapt to the changing environment and the challenges of industry, are critical to the health care system, along with accessible and safe medicines, devices, and technologies, and well-equipped healthcare facilities.

Quality is the main characterising factor of the healthcare system, and as World Health Organization (WHO), World Bank (WB), and Organisation for Economic Co-operation and Development (OECD) have emphasised, "quality does not come automatically; it requires planning, and should be a clearly identified priority of universal health coverage, along with access, coverage and financial protection" (WHO, OECD, WB, 2018). Therefore, quality should be built into health systems through a number of steps, such as: 1) transparency and continuous learning and improvement; 2) people-centredness and involvement of people and communities; 3) reliable quality metrics and continuous monitoring and evaluation; 4) skilled, motivated and sufficient workforce; 5) leadership and culture of continuous quality improvement (WHO, OECD, WB, 2018). These fundamental elements form the cornerstone for policies and practices aimed at the continuous enhancement of healthcare quality. However, maintaining quality should be the collective responsibility, involving government, institutions, different stakeholders, and society.

Challenges of Health Care Quality

Although there is widespread agreement on the importance of quality in healthcare and clear directions identified where most improvement must be developed, and despite awareness of adverse effects, errors and unsafe practices continue to occur at a high rate. Many obstacles can prevent these improvements from being consistently applied across various healthcare settings. Additionally, inadequate implementation of quality measures can lead to patient harm, including medical errors, delayed treatments, and increased infections, which underscores the critical need for vigilance and improvement. Differences in resources and priorities can also cause uneven results in implementing these measures.

Up to 80% of harm can be avoided regarding the harm in primary and ambulatory settings (Slawomirski, Auraaen, and Klazinga, 2017) and up to 50% of overall harm is preventable (Panagioti et al., 2019). Due to unsafe care 1 in every 10 patients is harmed in healthcare leading to more than 3 million deaths each year (Slawomirski, Klazinga, 2020). Each year, 5.7 – m 8.4 million deaths are attributed to poor quality care in low- and middle-income countries (LMICs), which represents up to 15% of overall deaths in these countries (WHO, 2020). As WHO has summarised, some of the most common sources of patient harm are **medication errors** (affects 1 out of every 30 patients in health care), **surgical errors** (10% of preventable patient harm in health care was reported in surgical settings), h**ealthcare–associated infections** (**h**ealth care-associated infections result in extended duration of hospital stays, long–standing disability, increased antimicrobial resistance, additional financial burden on patients, families and health systems, and avoidable deaths), **sepsis** (23.6% of sepsis cases in hospitals were found to be health care associated, and approximately 24.4% of those lost their lives), **diagnostic errors** (occur in 5–20% of physician–patient encounters), and u**nsafe transfusion and injection practices and Patient misidentification as well** (**WHO, 2023**).

Regardless of the nature of patient harm, a significant proportion of these incidents can be attributed to gaps in the professional qualifications and skills of the healthcare workforce. In a study examining the factors causing harm in primary care, 72.9% of the identified errors were classified as process errors, and 26.1% as knowledge/skill errors, and of these knowledge/skill errors 41.5% were associated with patient harm (Hoffmann et al., 2008).

As outlined in the OECD report "Economics of Patient Safety" the economic burden resulting from harm to patients can amount to up to 15% for state hospitals (Slawomirski, Auraaen, and Klazinga, 2017). This under-

scores the urgent need for enhanced training and continuous professional development within the sector. To address this, healthcare systems must develop robust mechanisms to track and monitor the professional skills of their workforce continuously. Implementing such systems will enable timely identification of skill deficiencies and the need for additional training, ensuring that healthcare professionals are well-equipped with the necessary knowledge and competencies. Regular assessment and updating of training programs are essential to keep pace with the evolving demands of healthcare provision, thereby bridging the skill gaps and elevating the overall standard of care delivered to patients.

Consequently, when healthcare institutions fail to ensure safe care, it incurs additional expenses that paradoxically reduce the funding available for healthcare provision. These additional costs often arise from the need to manage complications, provide prolonged treatment, and handle legal repercussions, all of which could have been avoided with better safety practices. This not only strains the financial resources of healthcare facilities but also diverts funds away from critical areas such as patient care, staff training, and infrastructure improvements.

The WHO also notes that investments in promoting patient safety can lead to financial savings, as evidenced by estimates showing that costs associated with medical errors amount to approximately $42 billion annually, excluding lost wages, productivity, or healthcare expenses, collectively comprising nearly 1% of global health expenditures (WHO, 2019).

Ultimately, the financial burden of inadequate safety measures can compromise the quality of care patients receive and undermine the efficiency of the healthcare system as a whole. Therefore, investing in preventive measures and improving safety protocols is essential for both patient well-being and the financial health of healthcare institutions. As indicated in the report "Patient Safety 2030", reducing harm requires the development of an integrated systemic approach that includes fostering a culture of safety, placing patients and healthcare staff at the centre of all intervention measures, as well as implementing evidence-based policies (Yu et al., 2016).

Furthermore, an evidence-based policy aligns with human capital management, as the costs that healthcare institutions spend on reducing harm caused to patients would be more meaningfully invested in improving healthcare quality, primarily by investing in the institution's human capital, developing the skills of healthcare staff, ensuring systematic human capital development, and making data-driven decisions, thereby also reducing risks to patient safety.

Skills Framework

Facing the shortcomings of the healthcare system and directions for improvement, United Nations (UN) in 2015 identified one of the Sustainable Development Goals by 2030: to ensure a healthy life and promote well-being for all at all ages (Goal No.3), with tasks outlined such as: 1) achieving universal health coverage, including protection against financial risks, access to quality essential healthcare services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all (No. 3.8); and 2) substantially increasing health financing and the recruitment, development, training, and retention of healthcare workforce in developing countries, especially the least developed countries and small island developing states (3.c), with indicators such as healthcare service coverage and density and distribution of healthcare workers (United Nations, 2015). In 2016 European Commission published the "SKILLS AGENDA FOR EUROPE," a call to **join forces** in a collective action. This agenda covered actions to ensure that people have the **right skills for jobs, t**ools, and initiatives to **support people** in their lifelong learning pathways, and a framework to **unlock investments** in skills (European Commission, 2016). WHO suggests improving skill mix composition and considering opportunities to strengthen the skills and employment agenda within countries (WHO, 2016). OECD Skills Strategy calls to d**evelop relevant skills over the life course, use skills effectively in work and society, and strengthen the governance of skills systems** (**OECD, 2019**)**.** Misalignment between the supply and demand for skills in the health workforce contributes to various forms of skills mismatches, over- or under-qualification, skills gaps, and labour shortages. Addressing the skills mismatch challenge in the health workforce can improve healthcare provision and limit these negative economic effects, therefore, the OECD have developed the framework based on variety of data to conduct skills anticipation exercises for the health workforce (OECD, 2022). For skills anticipation exercises to be effective in addressing skills gaps in the health workforce, they must successfully translate into policy. Skills intelligence can be used to provide guidance for education and training policy decisions (like determining intake in health education programmes, defining course content, or providing informed career guidance), to provide the basis to update occupational standards, on-the-job training, retraining, and upskilling courses, and to provide guidance for migration policy (OECD, 2022).

In Working for Health Progression Model WHO suggests: 1) bolstering workforce governance mechanisms and functions, data driven decision-making and long-term workforce planning capacity; 2) building institutional

capacity for the education of the existing and future workforce; 3) maximising the health, economic, and social impact of the workforce through tools, infrastructure, and systems and support, which enable it to be effective and efficient (WHO, 2022).

Investments in healthcare workforce education is not only a strategic component in improving service delivery but also a crucial factor in reducing medical errors and enhancing patient safety. Continual education and skill enhancement are vital in maintaining workforce relevance and efficacy. The outlined documents emphasise the creation of lifelong learning opportunities, the expansion of access to training, as well as structured systems to ensure continuous management of competence of healthcare workforce. These initiatives aim to keep the healthcare workforce abreast of emerging health challenges and innovative treatment modalities. To systematically improve healthcare outcomes, there is a recognised push towards developing robust skills management and monitoring systems. These systems should be designed to continuously track and assess the competencies of healthcare personnel, facilitating targeted interventions to address identified gaps. Such systems would not only help align workforce capabilities with health system needs but also aid in strategic workforce planning and policy-making.

Skills Digital Monitoring System

Upon closer examination of the healthcare sector, it becomes evident that the demand for employment in this field is expected to increase in most countries. This growth is driven by an aging population, technological advancements, and an expanding recognition of the need for comprehensive healthcare services. Consequently, there will be a greater need for skilled healthcare professionals to meet the rising demand for medical and wellness services. This trend underscores the importance of investing in healthcare education and training programs to prepare a workforce capable of handling the evolving challenges. Additionally, it highlights the opportunity for healthcare systems to innovate and improve skills systems to accommodate this anticipated surge in employment. Given this dynamic environment, the skill set acquired by healthcare professionals at graduation is often insufficient to sustain them throughout their careers. Consequently, it is crucial to explore how the quality of healthcare can be enhanced alongside these developments during whole work life of healthcare professionals.

To address this issue, authors of this article have conducted extensive research into the development of a skills management system. Since 2018,

the group of authors developed an innovative skills monitoring system specifically tailored for institutions of higher education in healthcare. This skills monitoring system facilitates transparent management of student skills in alignment with the curriculum in higher education (Slavinska et al., 2021). During prior investigations, the authors have also encountered a notable absence of evidence regarding the practical implementation of any skills monitoring systems within healthcare institutions (Grigorovica et al., 2022). Therefore, building on this foundation and recognising the potential applications of such a system within the healthcare sector, the authors now advocate for the expansion of this system to encompass broader healthcare settings. This proposal aims to enhance the transparency and efficacy of skills management across the sector, ensuring that healthcare professionals' competencies are continually aligned with evolving industry standards and patient care requirements from undergraduate studies to lifelong learning.

Investing in ongoing education and training is crucial, and healthcare professionals must have access to continual learning opportunities to stay abreast of the latest medical advances and technological breakthroughs. This not only ensures their competencies remain current but also directly contributes to the overall quality of care provided to patients. Furthermore, fostering a culture of proactive professional development within healthcare institutions can lead to more innovative and effective healthcare solutions. By prioritizing the development of human capital in the healthcare sector, not only standard of patient care can be improved, but also the resilience and adaptability of healthcare systems.

However, it is essential to be aware that investments in human capital must be targeted, and professional development programs and the achieved results must be meaningful. Therefore, a certain structure must be created, within which it is possible to monitor the current situation, identify needs and plan future actions. Based on the analysis, the authors propose to create a skills digital monitoring system in the healthcare sector for managing the skills of healthcare professionals.

The skills monitoring system proposed by the authors collects detailed data on the specific skills and proficiency levels of the existing workforce within healthcare institutions. This system forms the core of skills monitoring by creating comprehensive skills portfolios at both the individual and institutional levels. Such detailed skills information provides a solid foundation for data-driven decision-making in various management areas, including investments, strategic planning, human resources, and funding allocation. Effective management of healthcare institutions, supported by this system, leads to improved quality of care and enhanced patient safety. Additionally, the system facilitates dialogue and collaboration with other

stakeholders in the healthcare sector at both national and international levels, fostering a more integrated and efficient approach to healthcare delivery (Fig.1).

Fig.1: Skills Monitoring System for Healthcare Sector.

The integration of a skills monitoring system within the healthcare sector would be paramount to ensure that these educational investments are effectively translated into improved practice. Such a system would provide a structured and systematic approach to assess and enhance the competencies of healthcare professionals continuously. By regularly evaluating the skills of healthcare workers, institutions can identify gaps in knowledge and areas requiring further development, thereby tailoring training programs more precisely to the needs of their staff.

Implementing this kind of monitoring would not only help maintain high standards of patient care but also promote a culture of continuous professional improvement. It encourages healthcare providers to engage in life-

long learning and adapt to rapidly changing medical landscapes. Additionally, a robust skills monitoring system can serve as a feedback mechanism for healthcare institutions to adjust their operational and clinical approaches based on real-time data about workforce capabilities. Ultimately, the establishment of such a system is crucial for ensuring that healthcare professionals are not only well-prepared to handle current medical challenges but are also equipped to tackle future developments. This proactive approach would significantly contribute to the sustainability and efficiency of healthcare services, benefiting patients, practitioners, and healthcare systems alike.

Principles of Skills Digital Monitoring System

For a practical and effective digital skills monitoring system in the healthcare industry, the authors propose several key principles to ensure it is both comprehensive and adaptable.

Assessment of current skills and requirements: assessment of the existing skills of all healthcare professionals within the organisation must be conducted and evaluate the current and future skills required, considering upcoming technological advancements and shifts in medical practices. This dual assessment helps in identifying specific gaps and the areas where updates or improvements are necessary.

Development of an institutional skills framework: a detailed skills framework must be developed that outlines essential competencies for various roles within the healthcare sector. This framework should be developed in collaboration with clinical experts, educational institutions, and regulatory bodies to ensure it meets industry standards and covers all critical areas of healthcare provision.

Implementation of regular skills refreshments and assessments: implementation of regular and systematic assessments using a variety of methods such as simulations, practical exams, peer reviews, and self-assessments. These assessments should be designed to be non-disruptive and integrated into the daily routine as much as possible to encourage compliance and reduce burden.

Continuous learning and development opportunities: linkage of the outcomes of the skills assessments to tailored training programs that address identified gaps. This could involve online courses, workshops, seminars, and on-the-job training. Ensure these opportunities are accessible and aligned with the workers' schedules and professional commitments.

Real-time feedback and reporting: a real-time feedback mechanism establishment that allows healthcare professionals to receive immediate in-

sights into their performance. This system should also enable managers and educators to track progress over time and adjust training programs as needed.

Integration with HR and professional development: Integration of the skills monitoring system with human resources and professional development plans. This integration helps in career planning, succession planning, and enhances motivation among healthcare workers by showing clear pathways for advancement and skill acquisition.

Technology utilization: utilization of technology to facilitate the tracking and management of the skills digital monitoring system. Linkage between skills monitoring system and other IT systems of institution, like patient reporting systems, must be established, to use data analytics to analyse current gaps, trends, predict future skills needs, and provide a scalable solution that can adapt as the organization grows and evolves.

Regulatory compliance and updates: regularly update the skills monitoring system is needed to comply with new healthcare regulations and standards. And engaging with regulatory bodies can ensure that the system remains relevant and effective in improving healthcare quality and patient safety.

By following these principles, healthcare institutions can develop a robust skills digital monitoring system that not only enhances individual performance but also elevates the overall quality of care provided to patients.

Impact of Skills Digital Monitoring System

Integrating skills digital monitoring system in the healthcare sector offers a myriad of benefits across various stakeholders. In this concept paper authors have identified stakeholders who would gain from enhanced training and competency evaluation mechanisms, though their specific benefits might differ based on their roles and interests:

Healthcare professionals: 1) skills enhancement – regular skills assessment helps healthcare professionals identify and rectify gaps in their knowledge and abilities, ensuring their skills remain up-to-date with current medical practices and technologies; 2) career development – A structured system offers clear pathways for professional advancement, motivating employees to engage in continuous learning and achieve higher credentials; 3) job satisfaction – increased competence can lead to higher confidence and job satisfaction, reducing professional burnout and improving overall work-life quality.

Healthcare institutions: 1) improved patient care – enhanced skills lead directly to better patient care outcomes. A more competent workforce can provide more accurate diagnoses, fewer errors, and improved patient handling; 2) regulatory compliance – institutions can ensure compliance with regulatory standards by maintaining a workforce that meets all professional and accreditation requirements; 3) reduced costs – by minimizing errors and improving efficiency, organizations can reduce the costs associated with malpractice and inefficiencies.

Patients: 1) increased safety – patients receive care from a workforce that is continually assessed and updated in their practices, reducing the risk of medical errors and complications; 2) better service – improved skills among healthcare providers mean better customer service for patients, leading to improved patient experience and satisfaction; 3) trust in healthcare systems – knowing that healthcare providers are regularly assessed and trained enhances patient trust in the healthcare system.

Educational and training institutions: 1) curriculum relevance – feedback from ongoing skills assessments can inform educational providers about the evolving needs of the healthcare sector, allowing them to tailor their curricula accordingly; 2) partnership opportunities – educational institutions may find more opportunities for collaboration with healthcare institutions, such as customized training programs and continuing education courses.

Policy makers and regulatory bodies: 1) standardized care: helps in standardizing practices across different regions and institutions, ensuring a uniform level of care and expertise; 2) evidence-based policymaking – access to detailed data on workforce competencies can guide policy decisions, workforce planning, and resource allocation more effectively; 3) healthcare innovation – regular upskilling can accelerate the adoption of innovative practices and technologies in healthcare, fostering a more dynamic and responsive healthcare environment.

Insurance providers: 1) reduced risk – a better-trained healthcare workforce means fewer claims due to errors and omissions, lowering risk and potentially reducing insurance costs; 2) partner in health management – insurance companies can work with healthcare providers to ensure that ongoing training leads to better preventive care and health management strategies.

By considering these perspectives, it becomes clear that a skills digital monitoring system is a strategic investment that significantly enhances operational efficiency, safety, and satisfaction across the healthcare ecosystem. This system not only supports individual growth and organizational effec-

tiveness but also fundamentally improves the quality of healthcare delivered to patients.

Challenges of Skills Digital Monitoring System

Developing and integrating skills monitoring system in the healthcare sector may involve also several challenges that must be navigated carefully to ensure its success and effectiveness. Authors have highlighted these potential challenges:

Resource allocation: 1) financial constraints – establishing the comprehensive skills monitoring system requires substantial initial and ongoing investments in technology, training, and personnel. Healthcare institutions may face financial constraints that limit their ability to implement such systems; 2) time constraints – healthcare professionals already face significant demands on their time. Finding additional time for training and assessments can be challenging without overburdening staff.

Technological integration: 1) complexity of implementation – integrating new technologies with existing systems can be technically challenging. Ensuring compatibility and interoperability between different software and hardware components is essential; 2) data management – effective skills monitoring systems generate large volumes of data that must be securely managed and analysed. Ensuring data integrity and protection against breaches is crucial and as well as to provide personnel resources with appropriate competence for data analysis.

Cultural resistance: 1) change management – resistance to change is common in any organization. Some healthcare professionals might view continuous assessment as punitive or as an added stressor rather than a beneficial tool; 2) engagement issues – motivating staff to actively participate in regular skills assessment and training can be difficult, particularly if the benefits are not immediately apparent or communicated effectively.

Regulatory and compliance issues: 1) meeting standards – aligning the skills monitoring system with various regulatory standards and legal requirements can be complex. Healthcare is a highly regulated field, and any new system must comply with all relevant laws and guidelines; 2) privacy concerns – handling personal and performance-related data raises significant privacy issues. The system must ensure compliance with laws like GDPR in Europe, HIPAA in the United States, and other local privacy laws.

Scalability and flexibility: 1) adapting to growth – the system must be scalable to accommodate the growth of the healthcare organization and the ever-evolving nature of healthcare demands and technology; 2) flexibility:

the system should be flexible enough to adapt to different specialties and changing healthcare practices without requiring major overhauls.

Training and support: 1) effective training – ensuring that all users are adequately trained to use the new system is vital. Poor training can lead to underutilization or misuse of the system; 2) ongoing support – continuous support and troubleshooting are necessary to address any issues that arise during the use of the system. This includes technical support for IT systems and educational support for users.

Addressing these challenges requires a well-thought-out plan that includes stakeholder engagement, careful resource management, and a clear understanding of the intended outcomes and benefits of the skills monitoring system. Effective communication, robust project management, and a commitment to continuous improvement are essential to overcoming these obstacles and ensuring the system achieves its goals.

Potential of Skills Digital Monitoring System

National Level

Integrating the skills monitoring system across all state healthcare institutions and connecting all data in a unified national system would bring substantial benefits at the national level. These benefits encompass improvements in healthcare quality, operational efficiency, and strategic planning, as authors have outlined below:

Standardization of healthcare quality: 1) uniform standards – a national system would help standardize skills and competencies across regions, ensuring that all patients receive the same high quality of care, regardless of their geographic location; 2) reduced disparities – this uniformity helps in reducing healthcare disparities by ensuring that rural and underserved areas receive the same level of skilled care as urban centres.

Enhanced public health management: 1) proactive responses – with centralized data on the skills and capabilities of the healthcare workforce, the system can quickly identify areas with skill shortages and deploy additional resources proactively during public health emergencies or outbreaks; 2) data-driven decisions – policymakers can use the aggregated data to make informed decisions about healthcare strategies, workforce planning, and resource allocation based on actual needs and trends identified through the system.

Increased healthcare efficiency: 1) optimized resource use – by identifying skills surpluses and deficits, the system can help in optimally allocat-

ing healthcare professionals where they are most needed, thereby enhancing the overall efficiency of the healthcare system; 2) cost efficiency – improved skills and reduced medical errors lead to lower healthcare costs related to corrective treatments and malpractice claims.

Improved training and development: 1) targeted training programs – 1) a national skills database would enable the identification of common skills gaps and the development of targeted training programs, improving the overall competence of the healthcare workforce; 2) continuous professional development – facilitates ongoing education and professional development, ensuring that healthcare workers remain competent in the latest medical practices and technologies.

Enhanced research and development: 1) research opportunities – the comprehensive data collected can be a valuable resource for academic and clinical research, providing insights that can drive innovations in medical care and training; 2) evidence-based practice – enables a more systematic approach to implementing evidence-based practices across the healthcare system, enhancing treatment outcomes.

Greater accountability and transparency: 1) accountability in healthcare – with clear data on the skills and training of healthcare providers, patients can be assured of the competency of the professionals treating them, leading to greater trust in the healthcare system; 2) transparent operations – regular public reporting on workforce competencies and institutional performance based on these competencies can increase transparency and motivate institutions to maintain high standards.

Long-term healthcare improvements: 1) strategic health planning – long-term data trends allow for better strategic planning for future healthcare needs, including addressing aging populations or the rising prevalence of certain diseases; 2) sustainability – by ensuring a well-trained and adaptively skilled workforce, the healthcare system becomes more resilient and sustainable, capable of meeting the challenges of the future.

The integration of a skills monitoring system on a national level thus not only improves the quality of individual patient care but also enhances the strategic capability of the healthcare system as a whole, fostering a robust, responsive, and equitable healthcare environment.

International Level

Integrating skills monitoring system across all European healthcare institutions with data linked in a unified European system could have profound benefits on an international level. According to the authors, such an initiative would leverage the power of standardization, collaboration, and

data-driven decision-making, enhancing healthcare across the continent in several key ways:

Standardization of healthcare competencies: 1) harmonized standards – a Europe-wide system would ensure that healthcare professionals across different countries adhere to the same high standards of care, reducing variability in treatment outcomes and increasing the overall quality of healthcare services; 2) easier credential recognition – facilitates the process of credential recognition across countries, making it easier for healthcare professionals to work in different European nations, thus promoting workforce mobility.

Enhanced collaboration and benchmarking: 1) cross-border learning – institutions can learn from one another by comparing performance and sharing best practices on a continental scale. This would foster innovation and the spread of effective healthcare solutions across borders; 2) benchmarking – enables benchmarking against best practices and performance metrics, encouraging hospitals and clinics to strive for higher care standards and operational efficiency.

Data-driven public health initiatives: 1) coordinated public health response – in the event of a public health crisis, such as a pandemic, a Europe-wide system provides the data needed for coordinated responses, ensuring resources are efficiently allocated based on actual workforce capabilities; 2) surveillance and early warning – the system could function as part of a larger surveillance network, providing early warnings about emerging health challenges that require a collective response.

Improved healthcare policy making: 1) informed policy decisions – policymakers can use the insights gained from comprehensive data analytics to craft policies that better address the needs of the European population and tackle disparities in healthcare access and quality; 2) long-term planning – supports strategic planning and foresight activities by providing data on trends in healthcare competencies and needs, helping Europe prepare for future healthcare challenges.

Research and innovation: 1) rich data resource – 1) the system would create a vast pool of data that can be utilized for academic research, leading to innovations in medical training, patient care, and health system management; 2) clinical trials and studies – facilitates multinational clinical trials and studies by providing a framework for quickly identifying institutions and professionals who meet specific research criteria.

Economic benefits: 1) cost efficiency – by reducing redundancies and enhancing care quality, the system can lead to significant savings in healthcare costs across Europe; 2) economic integration – further integrates the

European economic area through the healthcare sector, strengthening the single market.

Patient-centric benefits: 1) increased patient mobility – patients can be more confident when seeking treatment across borders, as a unified system assures them of consistent care quality no matter where they go in Europe; 2) empowered patients – transparency in healthcare provider skills and standards empowers patients to make informed decisions about their healthcare options.

Implementing such a system would not only strengthen individual nations' healthcare systems but also transform the way healthcare is delivered across Europe. It would enable a more unified approach to healthcare, enhancing the capacity to manage common challenges and benefitting from shared knowledge and resources.

Conclusion

In this concept paper, the authors propose a novel skills digital monitoring system for the healthcare sector. The integration of skills digital monitoring system within the healthcare sector represents a transformative advancement towards enhancing the overall quality of care, ensuring patient safety, and optimising healthcare workforce performance. Such proactive management of skills helps in addressing the direct correlation between healthcare workforce capability and patient outcomes, significantly reducing the incidence of medical errors and the associated healthcare costs. By instituting a framework for ongoing professional development, healthcare institutions not only safeguard patient well-being but also foster a culture of continuous improvement and learning. The broad-scale implementation of this system could standardise care quality, facilitate robust public health responses, and enhance the efficiency of healthcare services across regions. Moreover, the aggregation of data on a national or even European level would provide invaluable insights for policy-making, strategic planning, and fostering innovation within the sector.

Ultimately, a skills digital monitoring system is not just an investment in the healthcare workforce; it is an indispensable strategy for future-proofing healthcare systems against the complexities of emerging health challenges. It ensures that healthcare professionals are not only well-prepared to manage current needs but are also equipped to adapt to future demands, thus securing a resilient, responsive, and high-performing healthcare system. This integrated approach promises substantial benefits for patients, practitioners, and healthcare systems alike, paving the way for a more sustainable,

efficient, and patient-centred healthcare landscape, therefor authors invite stakeholders within the healthcare sector to engage in a collaborative discussion and reach a consensus on the initial practical steps for the targeted monitoring of healthcare workforce skills.

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