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Navigating the Grey Area: Legal Frameworks for Digital Health Monitoring <u>& Use of AI for Elderly Patients in the Nordics.</u>

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Abstract - Digital health technologies are garnering attention for monitoring elderly patients in Nordic countries. However, the legal landscape poses challenges, particularly where stringent data protection regulations intersect with evolving healthcare practices as these technologies progress. This study delves into the existing legal frameworks governing the digital health monitoring of elderly patients across the Nordic region, encompassing Denmark, Finland, Iceland, Norway, and Sweden. Its aim is to pinpoint areas where legal frameworks may be insufficient or unclear in addressing the specific challenges posed by this technology. The research explores the intricate relationship between data privacy, healthcare regulation, and technology innovation within the context of digital health monitoring for elderly populations. It scrutinizes the applicability of data protection laws such as GDPR, 2016, EU AI Act, 2024 as well as the legal basis for collecting and processing health data, consent requirements, data security obligations, and liability considerations. Through a comparative analysis spanning Nordic countries, the study identifies shared characteristics, divergences, and emerging trends in the regulation of digital health monitoring. Moreover, ethical dimensions of digital health monitoring are explored, with a focus on autonomy, dignity, and informed consent, particularly concerning the protection of vulnerable elderly individuals. The research also investigates the influence of regulatory authorities, industry standards, and professional guidelines on the legal landscape for digital health monitoring of elderly patients, pinpointing potential gaps and opportunities for regulatory innovation to promote responsible, ethical usage of these technologies and enhance healthcare outcomes. By providing insights into the legal challenges and opportunities associated with digital health monitoring of elderly patients in the Nordics, this research aims to inform stakeholders, policymakers, and practitioners involved in the development, implementation, and regulation of digital health solutions. Ultimately, its goal is to contribute to the establishment of a robust legal framework that upholds patient rights, ensures data privacy and security, and facilitates the responsible use of technology to bolster the health and well-being of elderly individuals in the region.

1. INTRODUCTION

In recent years, due to the world's rapidly growing population and the prevalence of chronic diseases, there has been a growing need to expand healthcare access infrastructure, as well as the cost benefits of telehealth and remote patient monitoring technology¹. The intersection of healthcare and technology has given rise to a plethora of innovative solutions aimed at improving patient care and outcomes. Particularly notable is the emergence of digital health technologies, which encompass a wide range of applications including telemedicine, wearable devices, health monitoring apps, and remote patient monitoring systems. Telehealth has experienced a remarkable shift since the pre-COVID era, as highlighted by McKinsey. Grand View Research projects that the global digital health market will experience a compound annual growth rate of 15.1% between 2021 and 2028, with an anticipated value of USD 295.4 billion by 2028² further Digital Health Monitoring Devices Global Market Report 2024 highlights the rapid growth of the market size in recent years. It is projected to increase from \$5.65 billion in 2023 to \$6.74 billion in 2024, with a compound annual growth rate (CAGR) of 19.3%³ as technology solutions enhance patient care and enable better health-related decision-making⁴. Another report suggest that AI is transforming various industries, with healthcare expected to be one of the most affected. The global AI market is projected to reach \$173.55

Key Words: Digital Health Technologies; Elderly Patients; Healthcare Practices; Data Security; Patient Rights; Legal Landscape.

¹ Data Bridge Market Research. (2024, February). Global Digital Health Monitoring Devices, By Product (Devices, Software, Services), Type (Wireless Health, M-Health, Tele-Health, EHR/EMR, Others), End User (Hospital, Homecare Settings, Clinics, Ambulatory Surgical Centres, Others) - Industry Trends and Forecast to 2031. Retrieved from https://www.databridgemarketresearch.com/reports/globaldigital-health-monitoring-devices-market

² Christian. (2024, January 15). How To Get Started In Digital Health? A Comprehensive Guide. MedTech Founder. Retrieved from <u>https://medtechfounder.com/get-started-in-digital-health/</u>

³ Harishtbre. (2024, January 22). Digital Health Monitoring Devices Market Overview 2024–2033 — Share, Size, Insights, Forecast. Medium. <u>https://medium.com/@harishtbrc/the-digital-health-monitoring-devices-global-market-report-2024-by-the-businessresearch-company-8d1e8d9502ee</u>

⁴ CSEM. (2023). Digital Health: Monitor. Analyze. Manage. Retrieved from <u>https://www.csem.ch/en/technical-focus/digital-health/</u>

billion in 2029, with AI applications in home care, medical event prediction, and medication sourcing⁵. In the Nordic countries of Denmark, Finland, Iceland, Norway, and Sweden, renowned for their advanced healthcare systems and strong commitment to digitalization, digital health technologies have gained significant traction, promising to revolutionize healthcare delivery and enhance patient well-being. The integration of healthcare and technology has led to the development of digital health technologies, including telemedicine, wearable devices, health monitoring apps, and remote patient monitoring systems. Nordic countries like Denmark, Finland, Iceland, Norway, and Sweden are known for their high-quality healthcare systems. As populations age, there is a growing need for innovative solutions to ensure the well-being of elderly individuals, particularly those requiring long-term care or living in remote areas. Elderly patients are a particularly vulnerable population, and digital health monitoring solutions tailored to their needs offer promising opportunities to enhance care quality, enable proactive disease management, and support independent living. However, the rapid adoption of digital health technologies comes with numerous legal and regulatory considerations, particularly concerning privacy, security, and ethical use of patient data. Navigating the complex legal landscape presents significant challenges, especially in jurisdictions where robust data protection regulations intersect with evolving healthcare practices. The merging of healthcare and technology has inaugurated a transformative era in patient care, characterized by the widespread adoption of digital health solutions geared towards enhancing healthcare delivery and improving health outcomes. Amidst this evolving landscape, digital health monitoring technologies have emerged as a promising avenue for overseeing and addressing the health needs of elderly patients, a demographic group that presents distinct healthcare challenges and considerations. Across the Nordic countries -Denmark, Finland, Iceland, Norway, and Sweden - recognized for their progressive healthcare systems and robust digital infrastructure, the implementation of digital health monitoring tools holds significant promise in meeting the evolving requirements of aging populations and supporting their independence and well-being. Nevertheless, the proliferation of digital health technologies also introduces a myriad of legal and regulatory complexities, particularly in regions where stringent data protection regulations intersect with the dynamic healthcare environment. Telehealth is revolutionizing healthcare by providing remote monitoring, virtual consultations, and emergency care for chronic conditions. As AI algorithms mature, the potential for telehealth to improve lives for elderly and underserved communities is boundless, paving the way for a more inclusive healthcare landscape⁶. The deployment of digital health monitoring technologies for elderly patients presents a

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nuanced array of legal challenges, spanning from concerns regarding data privacy and security to ethical dilemmas surrounding consent and autonomy. Navigating this intricate legal terrain necessitates a nuanced understanding of the interplay between data protection, healthcare regulation, and technological innovation. At the crux of this legal discourse lies the General Data Protection Regulation (GDPR), a pivotal legislation enacted by the European Union to safeguard the privacy and security of personal data. Despite furnishing a comprehensive framework for data protection, the application of GDPR to digital health monitoring of elderly patients poses numerous uncertainties and challenges. Critical issues such as the legal basis for data collection and processing, consent requirements, data security obligations, and liability considerations remain unresolved, bearing significant implications for various stakeholders including healthcare providers, technology developers, policymakers, and others involved in the digital health ecosystem. The recent enactment of EU Artificial Intelligence Act, 2024 (AI Act) is the first-ever legal framework on AI⁷, which addresses the risks of AI and positions Europe to play a leading role globally. Against this backdrop, this research seeks to navigate the ambiguous areas surrounding the legal frameworks governing digital health monitoring of elderly patients in the Nordic region. By delving into the intricate dynamics between data privacy, healthcare regulation, and technological advancement, the study aims to illuminate the specific challenges and opportunities arising from digital health monitoring for elderly populations. Through a comprehensive examination of existing legal frameworks and a comparative analysis spanning Nordic countries, the research endeavors to unearth shared characteristics, disparities, and emerging trends in the regulation of digital health monitoring. Furthermore, the research aims to explore the ethical dimensions of digital health monitoring, with a particular emphasis on autonomy, dignity, and informed consent, especially concerning the safeguarding of vulnerable elderly individuals. By scrutinizing the influence of regulatory bodies, industry standards, and professional guidelines on the legal landscape for digital health monitoring, the study seeks to identify potential gaps and avenues for regulatory innovation. Ultimately, the findings of this research aspire to inform stakeholders, policymakers, and practitioners engaged in the development, implementation, and regulation of digital health solutions for elderly patients in the Nordics.

1.1 Research Objectives

The research objectives are multifaceted with investigation aims to uncover areas of consistency and divergence in legal approaches. The study aims to conduct a thorough examination of the existing legal frameworks governing digital health monitoring of elderly patients in the Nordic region, with a specific focus on Denmark, Finland, Iceland, Norway, and Sweden. Through this analysis, the research endeavors to pinpoint areas where legal frameworks might lack clarity or adequacy in addressing the unique challenges presented by digital health monitoring technologies for elderly populations.

⁵ Tyagi, A. (2024). How AI Can Improve Outcomes In Clinical Home Care. Forbes Technology Council. Retrieved from https://www.forbes.com/sites/forbestechcouncil/2024/04/03/how -ai-can-improve-outcomes-in-clinical-homecare/?sh=4cc8871c2bfa

⁶ Singh Rawat, B. (2024). Revolutionising elderly care and healthcare access in remote areas: AI powered telehealth. Computing Intelligence. <u>https://computingintelligence.in/2024/01/16/revolutionising-elderly-care-and-healthcare-access-in-remote-areas-ai-powered-telehealth/</u>

⁷ European Union Artificial Intelligence Act. (2024). Retrieved from <u>https://www.euaiact.com/#:~:text=The%20EU%20AI%20Act&t</u> <u>ext=The%20Act%20is%20the%20first,intelligence%20in%20th</u> e%20European%20Union

Additionally, the study seeks to elucidate the intricate relationship between data privacy, healthcare regulation, and technological innovation in the context of digital health monitoring for elderly populations. By scrutinizing the applicability of data protection laws such as the General Data Protection Regulation (GDPR), EU AI Act, 2024 along with the legal foundations for the collection and processing of health data, consent prerequisites, data security mandates, and liability considerations, the research aims to offer insights into the legal intricacies surrounding the utilization of digital health monitoring technologies for elderly patients in the Nordics. Furthermore, the study endeavors to conduct a comparative analysis across Nordic countries to identify commonalities, disparities, and emerging trends in the regulation of digital health monitoring. Through this comparative approach, the research aims to uncover nuances in legal frameworks and regulatory strategies adopted by various Nordic countries, thereby contributing to a more comprehensive understanding of the regulatory landscape for digital health monitoring in the region. Moreover, the research aims to delve into the ethical dimensions of digital health monitoring, placing particular emphasis on autonomy, dignity, and informed consent, especially concerning the protection of vulnerable elderly individuals. By examining the ethical ramifications of digital health monitoring technologies and their implications for patient rights and well-being, the study aims to provide insights into the ethical considerations that should guide regulatory and policy decisions in this field. Ultimately, the findings of this research endeavor to inform stakeholders, policymakers, and practitioners engaged in the development, implementation, and regulation of digital health solutions for elderly patients in the Nordics. By shedding light on the legal challenges and opportunities associated with digital health monitoring, the research aims to contribute to the establishment of a robust legal framework that safeguards patient rights, ensures data privacy and security, and promotes responsible technology use for the health and wellbeing of elderly individuals in the region. The overarching objective is to champion patient rights, uphold data privacy and security, and advocate for the responsible use of technology to support the health and well-being of elderly individuals across the region.

1.2 Research Questions

Q: To what extent do existing legal frameworks in the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) adequately address the challenges associated with data privacy, security, and informed consent in the context of digital health monitoring for elderly patients?

Q: What are the key legal challenges associated with digital health monitoring of elderly patients in the Nordic region?

Q: How do data protection regulations, such as the GDPR, and the AI Act, 2024 impact the implementation and use of digital health monitoring technologies for elderly patients in Denmark, Finland, Iceland, Norway, and Sweden?

Q: How can regulatory authorities, industry standards, and professional guidelines be leveraged to promote a more robust and ethically sound legal landscape for digital health monitoring of elderly patients in the Nordic region?

2. RESEARCH DESIGN

The research strategy outlined by the author for investigating is characterized by its comprehensive and multifaceted nature, aimed at offering nuanced insights into the subject matter. Initially, the author advocates for the execution of a systematic literature review to gain an extensive comprehension of existing research, legal documents, regulations, and guidelines concerning digital health monitoring and elderly patient care within the Nordic countries. This literature review serves as the cornerstone for identifying gaps in current knowledge and guiding subsequent phases of the research. Subsequent to the literature review, the author recommends employing qualitative research techniques, such as semi-structured interviews and focus group discussions, to glean insights from key stakeholders engaged in digital health monitoring and legal oversight across the Nordic region. These stakeholders may encompass healthcare professionals, technology developers, policymakers, legal experts, and representatives from regulatory bodies. Utilizing these qualitative data collection methods enables a deep exploration of the legal obstacles, ethical considerations, and regulatory environment surrounding digital health monitoring for elderly patients. In addition to qualitative methodologies, the author proposes integrating quantitative research components, such as surveys or questionnaires, to capture broader perspectives and quantitative data regarding stakeholders' attitudes, knowledge, and experiences concerning legal frameworks for digital health monitoring of elderly patients in the Nordics. These surveys could be distributed across a diverse sample of stakeholders throughout the region to capture a comprehensive range of viewpoints. Furthermore, the research design incorporates a comparative analysis of legal frameworks across the Nordic countries - Denmark, Finland, Iceland, Norway, and Sweden. This comparative examination entails scrutinizing and contrasting pertinent laws, regulations, and guidelines related to digital health monitoring to discern similarities, disparities, and areas of inconsistency or divergence among the Nordic countries. By undertaking this comparative approach, the research aims to illuminate the diverse regulatory landscapes and potential implications for digital health monitoring of elderly patients across different jurisdictions. Ethical considerations remain paramount throughout the research process, with stringent measures implemented to safeguard participants' rights and confidentiality. Obtaining informed consent from all participants involved in interviews, focus groups, and surveys, while adhering to ethical guidelines and protocols, ensures ethical integrity throughout the research endeavor. In summary, the proposed research design adopts a multi-method approach, encompassing a systematic literature review, qualitative interviews and focus groups, quantitative surveys, and comparative analysis, to furnish a thorough examination of legal frameworks for digital health monitoring of elderly patients in the Nordics.

3. LITERATURE REVIEW

The study *Madrid, Christine Marie et. al., (2023)*⁸ focuses on developing a device for patient care management in understaffed hospitals, measuring physiological parameters and alerting

⁸ Madrid, C. M., Madrid, J., & Cagadas, D. (2023). Development of inpatient digital healthcare system: A health monitoring device for patient using IoT. Retrieved from <u>https://www.researchgate.net/publication/377221240 DEVELO</u> <u>PMENT_OF_IN-</u> PATIENT DIGITAL HEALTHCARE SYSTEM A HEALTH

MONITORING DEVICE FOR PATIENT USING

doctors. It suggests improvements like blood pressure and sugar monitoring, advanced analytical algorithms, data privacy, and power optimization for improved performance. The article Spatz, E. S., et. al., (2023)⁹ reviews the use of digital wearable technologies for monitoring of three common cardiovascular conditions: hypertension, heart failure, and atrial fibrillation. The study *Garner*, A., et. al., $(2024)^{10}$ highlights the potential of data-driven solutions like remote monitoring technology in improving care by reducing emergency attendances and hospital admissions. Care home staff reported increased confidence in identifying deterioration early and supporting better illness management before hospitalization. The study Kim M, et. al., (2024)¹¹ explores regulatory and funding issues in Digital Therapeutics (DTx), advocating for a framework to guide efforts and promote standardized expectations. It emphasizes the framework's potential to improve health outcomes. The study Butler, S., $(2024)^{12}$ demonstrated the feasibility of a web-based platform for remote monitoring of pain levels, medication adherence, and physical activity in children, highlighting the importance of digital health management. This paper Mhlanga, $D. (2023)^{13}$ explores the potential of artificial intelligence (AI) in enhancing seniors' lives, while also addressing ethical challenges. It advocates for a multidisciplinary approach involving seniors, caregivers, healthcare professionals, and AI developers to ensure responsible AI integration. The study Kim, D.-J., $(2024)^{14}$ discusses the implementation of AI- and IoT¹⁵ based (The Internet of Things, abbreviated as the IoT, is a revolutionary and rapidly evolving technology that has the promise to change the way we interact with our surroundings.) healthcare projects for senior citizens, focusing on the Fourth Industrial Revolution and data-based public health. It suggests enhancing digital healthcare strategies, improving health-

measuring devices, and providing emotional support. The study also emphasizes the need for integrating AI- and IoT-based elderly healthcare services with existing offline models and collaborating with the welfare sector for improved quality. The study Bhatia, M. (2024)¹⁶ proposes an IoT and deep learningbased digital twin architecture for elderly healthcare, identifying and predicting vulnerabilities using four modules: Data Sensation, Data Fusion, Temporal Abstraction, and Secure Service Delivery. The study Zsarnoczky-Dulhazi, F., et. al., $(2024)^{17}$ states that AI-based motion analysis software enhances physical therapy by providing real-time movement data remotely. It aids in assessing and improving patient movements without direct contact, benefiting healthcare and therapy efficiency. The study Shiqiang, Li. (2024)18 explores that continuous health data monitoring, aided by AI algorithms, enhances disease management in cardiovascular diseases and dementia. AI improves patient outcomes, aids in early detection, and supports healthcare decision-making. Further studies Ciottone, R. G., et. al., (2024)¹⁹ provides that medical intelligence in healthcare includes historical insights and modern practices. The paper Tarín-Pelló, A., et. al., (2024)²⁰ discusses using big data and computational models for drug discovery, including in antimicrobial therapy. It highlights the efficiency of prediction models in addressing global health threats. The study Lima de Magalhães, J., (2024)²¹ highlights that the process modeling using information science technologies supports decision-making in Pharmaceutical Development Partnerships, enhancing access to medicines. The study *Jnr., B. A. (2024)*²² explores the use of AI-based voice-assistants in urban mobility for older people, focusing on user-centered service design,

⁹ Spatz, E. S., Ginsburg, G. S., Rumsfeld, J. S., & Turakhia, M. P. (2024). Wearable Digital Health Technologies for Monitoring in Cardiovascular Medicine. New England Journal of Medicine, 390(4), 346-356. <u>https://doi.org/10.1056/NEJMra2301903</u>

 ¹⁰ Garner, A., et al. (2024) The impact of digital technology in care homes on unplanned secondary care usage and associated costs. Age and Ageing. Retrieved from <u>https://doi.org/10.1093/ageing/afae004</u>
 ¹¹ Kim, M., Patrick, K., Nebeker, C., Godino, J., Stein, S., Klasnja, P., Perski, O., Viglione, C., Coleman, A., & Hekler, E. (2024). The Digital Therapeutics Real-World Evidence Framework: An Approach for Guiding Evidence-Based Digital Therapeutics Design, Development, Testing, and Monitoring. Journal of Medical Internet Research, 26, e49208. <u>https://doi.org/10.2196/49208</u>

¹² Butler, S., Sculley, D., Santos, D., Girones, X., Singh-Grewal, D., & Coda, A. (2024). Using Digital Health Technologies to Monitor Pain, Medication Adherence and Physical Activity in Young People with Juvenile Idiopathic Arthritis: A Feasibility Study. Healthcare, 12(3), 392. <u>https://doi.org/10.3390/healthcare12030392</u>

¹³ Mhlanga, D. (2023, December 26). Artificial Intelligence in Elderly Care: Navigating Ethical and Responsible AI Adoption for Seniors. SSRN. <u>https://ssrn.com/abstract=4675564</u> or <u>http://dx.doi.org/10.2139/ssrn.4675564</u>

¹⁴ Kim, D.-J., Lee, Y.-S., Jeon, E.-R., & Kim, K. J. (2024). Present and Future of AI-IoT-Based Healthcare Services for Senior Citizens in Local Communities: A Review of a South Korean Government Digital Healthcare Initiatives. Healthcare, 12(2), 281. https://doi.org/10.3390/healthcare12020281

¹⁵ Li, C., Wang, J., Wang, S., & Zhang, Y. (2024). A review of IoT applications in healthcare. Neurocomputing, 565, 127017. https://doi.org/10.1016/j.neucom.2023.127017

¹⁶ Bhatia, M. (2024). An AI-enabled secure framework for enhanced elder healthcare. Engineering Applications of Artificial Intelligence, 131, 107831. <u>https://doi.org/10.1016/j.engappai.2023.107831</u>

 ¹⁷ Zsarnoczky-Dulhazi, F., Agod, S., Szarka, S., Tuza, K., & Kopper, B. (2024). AI based motion analysis software for sport and physical therapy assessment. Retrieved from https://www.scielo.br/j/rbme/a/nZdcCvptq99Qmzp7FF6ds5F/?lang=en#
 ¹⁸ Shiqiang Li (2024) The Benefits of Continuous Health Data

¹⁸ Shiqiang, Li. (2024). The Benefits of Continuous Health Data Monitoring in Cardiovascular Diseases and Dementia. Advances in information quality and management, doi: https://doi.org/10.4018/978-1-6684-7366-5.ch014

¹⁹ Ciottone, R. G., & Ciottone, G. R. (2024). Medical intelligence. In G. Ciottone (Ed.), Ciottone's Disaster Medicine (Third Edition) (pp. 582-588). Elsevier. <u>https://doi.org/10.1016/B978-0-323-80932-0.00092-6</u>

²⁰ Tarín-Pelló, A., Suay-García, B., Falcó, A., & Pérez-Gracia, M. T. (2024). Big Data to Expand the Antimicrobial Therapeutic Arsenal: De Novo Discovery and Drug Repurposing. In M. Khosrow-Pour, D.B.A. (Ed.), Encyclopedia of Information Science and Technology, Sixth Edition. Advance online publication. <u>https://doi.org/10.4018/978-1-6684-7366-5.ch027</u>

²¹ Lina de Magalhães, J., Cristina de Freitas da Silveira, C., Figueiredo, T. A., & Guzzo, F. G. (2024). Process Modeling as a Support to Decision-Making for Productive Development Partnerships: A Study in a Brazilian Public-Private Organization. In M. Khosrow-Pour, D.B.A. (Ed.), Encyclopedia of Information Science and Technology, Sixth Edition (pp. 1-17). IGI Global. <u>https://doi.org/10.4018/978-1-6684-7366-5.ch007</u>

²² Jnr., B. A. (2024). User-centered AI-based voice-assistants for safe mobility of older people in urban context. AI & Soc. https://doi.org/10.1007/s00146-024-01865-8

functional requirements, and techno-social factors. It recommends designing AI-driven voice-assistants to reduce falls, injuries, accidents, and transportation inequalities. The paper does not directly address artificial intelligence in healthcare. The chapter Ramos da Silva, B. (2024)²³ explores that the information technology, like AI, enhances operational performance in pharmaceutical manufacturing. Integrating Lean Six Sigma with Industry 4.0 generates crucial data for decisionmaking, benefiting health care. The study Gersten, I. (2024)²⁴ states that AgeTech companies are utilizing artificial intelligence to address the US elder-care staffing crisis by improving products for seniors aged at home. AI technology generates realtime responses, improves communication, and could create rideshare apps. Insurers may cover AgeTech product costs. The article Christogianni, A. (2024)²⁵ highlights the benefits of continuous data monitoring in healthcare, including its potential to improve patient outcomes and support early disease detection in chronic diseases. AI is revolutionizing mental health by analyzing patient data, enhancing efficiency, and providing personalized care, but concerns remain about accuracy, privacy, and bias. The study Mohan, D., et al. (2024)²⁶ highlights that increasing number of falls among elderly individuals, particularly those aged 60 and above, necessitates the development of reliable e-health technologies, with AI-IoT technology emerging as the most effective solution. The study Park, K. W., et. al., (2024)²⁷ highlights that AI technology has improved telemedicine's role in movement disorder diagnosis and treatment. Video-based monitoring, particularly for PD and ET, uses consumer-level cameras, pose estimation, and machine learning algorithms. Future research should address challenges. The article Gharghan, S. K., et. al., (2024)²⁸ explores fall detection methods for elderly individuals using wireless sensor networks, IoT, and AI. Traditional methods rely on rule-based systems, but future innovations aim to improve reliability and usability of these systems. The study Bekbolatova, M., et. al.,

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https://doi.org/10.4103/singaporemedj.SMJ-2023-189

(2024)²⁹ highlights that AI's potential in healthcare is significant, but it's not a replacement. It can handle data analysis, diagnose, and free up time for healthcare professionals. Successful implementation would enhance empathy, decision-making, and patient communication. The article Hilali, O., st. al., (2024)³⁰ highlights the progress of healthcare system digitization in various countries, with Nordic countries leading the way. However, the UK struggles with data transfer, Germany struggles with interoperability, and the US lacks a data protection law. New information technologies are contributing to this progress. The study Kujala, S., et. al., (2024)³¹ highlights a cross-case analysis of usability surveys in Estonia, Finland, Norway, and Sweden found that very positive and very negative experiences account for 19-35% of variation in SUS scores. Finland had the highest SUS score, while Norwegian and Swedish respondents had negative experiences. The study Long, H. $(2024)^{32}$ explores mobile health technology is revolutionizing healthcare, addressing global challenges like ageing populations and chronic diseases. Inlisol, a Finnish company, is exploring its market penetration and strategies for integrating mobile health technology solutions, using successful Finnish companies as benchmarks. The research report Hyppänen, T., & Haikonen, J. (2024)³³ by LUT university highlights disruptive technologies for Finland's public healthcare system to manage rising costs, care needs, and limited resources. It highlights the importance of understanding these technologies for managers and politicians to drive appropriate laws and regulations. The scoping reviews of 119 studies Loft, M. I., et. al., $(2024)^{34}$ highlight social isolation's impact on vulnerable populations and healthcare professionals' distress. They recommend awareness, face-to-face interaction, digital solutions, and future management practices. However, descriptive designs pose challenges. The study

²³ Ramos da Silva, B. M., Nepomuceno de Oliveira, V. A., & Magalhães, J. (2025). Pharmaceutical Manufacturing and Health Information Technology: A Reflection About Lean Six Sigma and Industry 4.0. In M. Khosrow-Pour, D.B.A. (Ed.), Encyclopedia of Information Science and Technology, Sixth Edition. Advance online publication. <u>https://doi.org/10.4018/978-1-6684-7366-5.ch001</u>
²⁴ Gersten, I. (2024). AgeTech Market Insights: AI innovations emerge

in 2024 to address elder-care challenges worldwide. TheStreet. https://www.thestreet.com/retirement-daily/age-

²⁵ Christogianni, A. (2025). The Benefits of Continuous Health Data Monitoring in Cardiovascular Diseases and Dementia. In M. Khosrow-Pour, D.B.A. (Ed.), Encyclopedia of Information Science and Technology, Sixth Edition (pp. 1-22). IGI Global. <u>https://doi.org/10.4018/978-1-6684-7366-5.ch014</u>

²⁷ Park, K. W., Mirian, M. S., & McKeown, M. J. (2024). Artificial intelligence-based video monitoring of movement disorders in the elderly: A review on current and future landscapes. Singapore Medical Journal, 65(3), 141-149.

²⁸ Gharghan, S. K., & Hashim, H. A. (2024). A comprehensive review of elderly fall detection using wireless communication and artificial intelligence techniques. Measurement, 226, 114186. https://doi.org/10.1016/j.measurement.2024.114186

²⁹ Bekbolatova, M., Mayer, J., Ong, C. W., & Toma, M. (2024). Transformative Potential of AI in Healthcare: Definitions, Applications, and Navigating the Ethical Landscape and Public Perspectives. Healthcare (Basel), 12(2), 125. https://doi.org/10.3390/healthcare12020125

³⁰ Hilali, O., & Soulhi, A. (2024, January 15). Digital health system and e-health in the following countries: United Kingdom, Norway, Sweden, Denmark, Germany and United States. Journal of Theoretical and Applied Information Technology, 102(1), 167. Retrieved from <u>https://www.jatit.org/volumes/Vol102No1/14Vol102No1.pdf</u> ³¹ Kujala, S., Simola, S., Wang, B., Soone, H., Hagström, J., Bärkås, A.,

³⁴ Kujala, S., Simola, S., Wang, B., Soone, H., Hagström, J., Bärkås, A., Hörhammer, I., Cajander, Å., Fagerlund, A. J., Kane, B., Kharko, A., Kristiansen, E., Moll, J., Rexphepi, H., & Hägglund, M. A. (2024). Benchmarking usability of patient portals in Estonia, Finland, Norway, and Sweden. International Journal of Medical Informatics, 181, 105302. https://doi.org/10.1016/j.ijmedinf.2023.105302

³² Long, H. (2024). Navigating the adoption of mobile health technology: Strategies for seamless market integration in Finland. Retrieved from <u>https://www.theseus.fi/handle/10024/819915</u>

³³ Hyppänen, T., & Haikonen, J. (2024). Future of Healthcare: Technology report 2024. Retrieved from https://www.researchgate.net/profile/Teemu-

Hyppaenen/publication/377437595 Future of Healthcare Tech nology_Report/links/65a6c8e2cc780a4b19bf3877/Future-of-Healthcare-Technology-Report.pdf

³⁴ Loft, M. I., & Berthelsen, C. (2024). Nordic nurses' areas of research during and related to the COVID-19 pandemic: A scoping review with recommendations for evidence-based practice. Scandinavian Journal of Caring Sciences, 38, 16–23. https://doi.org/10.1111/scs.13203

Bliksvær, T., et. al., (2024)35 examines the impact of COVID-19 on older people's care in Nordic countries, revealing significant variation in managers' assessments. Approximately one-third of managers felt their ability to promote mental and physical health and social life was reduced, while half agreed. However, a significant number disagreed, suggesting policies to stimulate social activity and prevent isolation would address this deficiency. The book *Reine, I., et. al., (2023)*³⁶ explores loneliness among older adults in Latvia, Lithuania, Estonia, Sweden, Denmark, and Finland. It reveals a higher rate in Latvia at 45%, compared to 17% and 20% in Denmark and 20% in Finland. Gender and age disparities are also noted, with women more likely to report loneliness in the Baltics. The article Strange, M. $(2024)^{37}$ explores the political-economic role of AI hype in healthcare, highlighting both positive and negative aspects. It suggests avoiding catch-all terms, fostering diverse dialogues, and situating AI healthcare narratives within existing public health research. The danger of hype is that it closes debate needed to determine if AI truly benefits healthcare, requiring nuance and rethinking broader healthcare aspirations. The study Hagström, J., et. al., (2024)³⁸ found that adolescents trust their electronic health records and feel secure, but want more control over access. Privacy concerns and unauthorized access are common, and some prefer to conceal appointment details. Further research should consider adolescents' varying needs.

This literature review highlights the dynamic landscape of healthcare innovation, particularly in leveraging digital technologies and artificial intelligence (AI) to address various challenges and enhance patient care. The studies advocate for a paradigm shift towards data-driven and AI-enabled healthcare solutions, such as remote monitoring technologies, digital therapeutics, and IoT integration for elderly healthcare. Ethical considerations and the importance of multidisciplinary collaboration are recurrent themes throughout the literature, with concerns regarding data privacy and algorithmic bias being addressed. As we navigate the complexities of modern healthcare, it becomes evident that technological innovation alone is not a panacea. Instead, the thoughtful integration of technology with human-centered approaches, regulatory frameworks, and collaborative efforts holds the key to unlocking the full potential of AI and digital health solutions. This literature review serves as a testament to the transformative power of innovation in healthcare, urging stakeholders to

embrace a holistic approach that combines technological prowess with empathy, ethics, and a shared commitment to improving patient outcomes and healthcare delivery systems globally. There is a gap in research exploring how AI can be effectively integrated into home-based elderly care, including AI-driven monitoring systems, personalized health interventions, and support for caregivers. There is also a gap in comprehensive discussions about the ethical implications of AI algorithms, data privacy, bias mitigation strategies, and transparency in decisionmaking processes, especially concerning vulnerable populations like the elderly. There is a lack of research investigating the long-term efficacy, sustainability, and scalability of AI interventions in real-world clinical settings. Interdisciplinary collaboration and knowledge transfer are also lacking, with a need to explore effective strategies for fostering collaboration between healthcare professionals, technologists, policymakers, and other stakeholders. Addressing these gaps could contribute to a more holistic understanding of AI's role in healthcare and facilitate the development of ethically sound, user-friendly, and sustainable AI-driven solutions for improving patient outcomes and healthcare delivery.

4. DIGITAL HEALTH TRENDS IN 2024

The healthcare landscape is evolving rapidly, with digital health solutions poised to revolutionize delivery and improve patient outcomes. The top trends in 2024 include wearables and at-home devices, GenAI, FemTech, mental health, food as medicine, digital obesity care, caregiver-focused innovations, big box retailers, Artificial General Intelligence (AGI)³⁹, data interoperability, remote patient monitoring (RPM), and chronic care management (CCM)⁴⁰. The convergence of wearables and at-home devices is transforming patient care by allowing healthcare professionals to meet patients at their convenience. This integration reduces the need for in-person hospital visits and empowers patients to take an active role in managing their care. GenAI's ability to process unstructured data makes it a pivotal player in the "AI era" of healthcare. FemTech⁴¹ is focusing on women's health, leading to the emergence of FemTech and innovative digital solutions. Mental health is also being recognized as critical, leading to the adoption of digital tools to bridge care gaps and offer personalized treatment. Food as medicine is gaining traction, with digitally-delivered nutritional recommendations expanding to prevent and treat various conditions. The increasing number of people over 80 years old in Europe, despite being healthier than previous generations, is a major social problem due to urbanization and the migration of young people to urban areas. To address this, many European countries have high expectations for eHealth, digitalization, and welfare technology⁴². Caregiver-focused innovations are

³⁵ Bliksvær, T., Andrews, T., Lindholst, A. C., Rauhala, A., Wolmesjö, M., Sinervo, T. S., Hansen, M. B. (2024). Health care services for older people in COVID-19 pandemic times – A Nordic comparison. Scandinavian Journal of Primary Health Care, 42(1), 144–155. <u>https://doi.org/10.1080/02813432.2023.2296119</u>

³⁶ Reine, I., Mikelsone, M., Tomsone, S., Guðmundsson, H., Ivanovs, A., S. Guðmundsson, H., & Koroļeva, I. (2024). Loneliness in the Baltic-Nordic Region. IntechOpen. <u>https://doi.org/10.5772/intechopen.1004199</u>

³⁷ Strange, M. (2024). Three different types of AI hype in healthcare. AI Ethics. <u>https://doi.org/10.1007/s43681-024-00465-y</u>

³⁸ Hagström, J., Åhlfeldt, R.-M., Blease, C., Cajander, Å., Rexhepi, H., Moll, J., Kane, B., Scandurra, I., & Hägglund, M. (2024). Security and Privacy of Online Record Access: A Survey of Adolescents' Views and Experiences in Sweden. Journal of Adolescent Health. <u>https://doi.org/10.1016/j.jadohealth.2023.12.027</u>

³⁹ Hashemi-Pour, C., & Lutkevich, B. (2023). Artificial General Intelligence (AGI). In TechTarget. Retrieved from <u>https://www.techtarget.com/searchenterpriseai/definition/artifici</u> <u>al-general-intelligence-AGI</u>

⁴⁰ HealthSnap. (2024, March 19). Top 10 Digital Health Trends in 2024. Retrieved from <u>https://healthsnap.io/top-10-digital-health-</u>trends-in-2024/

 $[\]frac{\text{trends-in-2024}}{^{41}}$ Femtech, short for female technology, is a term that refers to technology-based solutions that cater to women's health.

⁴² Valokivi, H., Carlo, S., Kvist, E., & Outila, M. (2023). Digital ageing in Europe: a comparative analysis of Italian, Finnish and Swedish

transforming the digital health landscape, catering to the needs of caregivers of aging loved ones and individuals experiencing illness or disability. Big box retailers are evolving into healthcare providers, expanding their services beyond primary care and urgent care to include chronic disease management. Data interoperability remains a priority in digital health, with compliance and data-sharing regulations enhancing accuracy, security, and usability. Remote Patient Monitoring (RPM)⁴³ and Chronic Care Management (CCM)⁴⁴ technologies are accelerating these trends by leveraging digital tools to enhance patient care, improve outcomes, and increase efficiency in healthcare delivery. NTT DATA has introduced two AI-powered solutions to assist elderly people with dementia. The first is the Brain Bio-Digital Twin project, which creates a digital model of the brain using artificial intelligence and machine learning to study brain function. This method aims to identify and prevent dementia and mental illnesses. The second solution assesses cognitive ability of elderly drivers to reduce road accidents. NTT DATA is working with Kokusai Motorcars to develop the AI solution, which will be launched as a cloud-based service in the next few years. The company is also exploring the use of digital avatars to communicate with dementia patients⁴⁵. Eight SPRING robots, designed by PAL Robotics and tested by researchers in Europe and the Middle East, have passed the testing phase with patients. These robots are designed to provide comfort to elderly patients, alleviate anxiety, and reduce the burden on nursing staff. The project, funded by Horizon 2020, aims to enhance patient experience⁴⁶. However, in the Nordic countries, there is a noticeable trend towards utilizing device-based methods for population surveillance of physical activity and sedentary behavior. However, there remains a gap as none of these nations have yet gathered device-based data on pre-schoolers or older adults within a national sample. Despite this, steps per day and the mean level of moderate-to-high intensity physical activity demonstrate consistency across the countries, surpassing current health recommendations. Nevertheless, sedentary time remains notably high throughout the Nordic region. Variability in the type of device, its placement, and data procedures exists both within and among the Nordic countries, highlighting the necessity for more standardized data collection methods to enable better comparisons⁴⁷. The recent report encompasses various sectors including telehealth, remote patient monitoring (RPM), consumer

national policies on eHealth. Ageing and Society, 43(4), 835-856. https://doi.org/10.1017/S0144686X21000945

⁴³ DelVecchio, A. (2019). Remote Patient Monitoring (RPM). In TechTarget. Retrieved from https://www.techtarget.com/searchhealthit/definition/remote-

 patient-monitoring-RPM
 Anderson, A. (2022). What Is Chronic Care Management? WebMD. Retrieved from https://www.webmd.com/a-to-z-guides/what-ischronic-care-management

⁴⁶ Gordon, A. (2024). Robots Created to Help Patients in Hospitals Pass Testing Phase. Time. https://time.com/6590440/robots-hospitalpatient-testing-phase-ai-assistance/

5. THE RISE OF WEARABLE TECHNOLOGY IN HEALTH

The proliferation of wearable technology has brought about a significant shift in health monitoring and management methodologies in recent times. These gadgets, spanning from smartwatches to fitness bands, have evolved into indispensable aids for improving overall well-being⁵⁰. Their real-time monitoring capability offers users valuable insights into vital signs, encompassing metrics like heart rate, blood pressure, and oxygen levels. Additionally, wearable technology assists individuals in tracking fitness endeavors, including activities such as running, cycling, and swimming, thereby enabling goal setting and progress tracking over time. Of notable significance is its role in chronic disease management, where wearable devices facilitate tracking essential indicators and medication adherence for conditions like diabetes and heart disease, thereby promoting proactive health management. Furthermore, in the era of telemedicine, wearable technology enables remote patient monitoring, empowering healthcare providers to oversee patients' health data and vital signs for timely intervention and personalized care plans. Moreover, wearable devices contribute to enhancing sleep quality through features such as sleep tracking, which monitor parameters like sleep duration and quality, enabling users to recognize patterns and make lifestyle adjustments for improved rest. Artificial intelligence can enhance senior care by personalizing medical care, reducing social isolation, and addressing complex challenges, particularly in health concerns faced by older adults⁵¹. Nonetheless, challenges such as data privacy, measurement accuracy, and user adherence must be addressed to unlock the full potential of wearable technology in digital health. SAS experts discuss using artificial intelligence and analytics to improve citizens' health and wellbeing in later life, addressing challenges and

⁴⁵ Digital Health. (2024, April). NTT DATA enhances dementia research with artificial intelligence. Digital Health. Retrieved from https://www.digitalhealth.net/2024/04/ntt-data-enhancesdementia-research-with-artificial-intelligence/

⁴⁷ Dohrn, I.-M., Tarp, J., Steene-Johannessen, J., Vasankari, T., & Hagströmer, M. (2024). Device-measured physical activity and sedentary time in the Nordic countries: A scoping review of populationbased studies. Journal of Sport and Health Science. Advance online publication. https://doi.org/10.1016/j.jshs.2024.04.003

⁴⁸ Tsao, N., & Skyrme, T. (2024). Digital Health and Artificial Intelligence 2024-2034: Trends, Opportunities, and Outlook [Slides 166]. IDTechEx. https://www.idtechex.com/en/researchreport/digital-health-and-artificial-intelligence-2024-2034trends-opportunities-and-outlook/985

⁴⁹ Brasier, N., Wang, J., Dincer, C., Schaffarczyk, D., Ghaffari, R., & Goldhahn, J. (2024). Next-generation digital biomarkers: continuous molecular health monitoring using wearable devices. TRENDSTALK, 42(3), 255-257. https://doi.org/10.1016/j.tibtech.2023.12.001

⁵⁰ Pusat. (2024). Wearable Technology For Digital Health: Monitoring And Managing Well-Being. Empowering Digital Health. Retrieved from https://carepathfinder.info/wearable-technology-for-digitalhealth-monitoring-and-managing-well-being/

⁵¹ Labbé, A. (2024). AI To Benefit Humanity: Innovations In Senior Care. Forbes Technology Council. Forbes. https://www.forbes.com/sites/forbestechcouncil/2024/01/30/aito-benefit-humanity-innovations-in-seniorcare/?sh=37985a2963b0

opportunities of aging populations, particularly in low and middle-income countries, and addressing the 'silver tsunami'5253. The Vancouver Home Health Care Agency is focusing on the use of artificial intelligence (AI) in improving home health care for the elderly. AI-driven monitoring systems can detect early signs of decline, reducing emergencies and hospital readmissions. However, concerns about data breaches and privacy violations highlight the need for robust security measures and careful design to prevent biases and disparities in care⁵⁴. Looking ahead, advancements in sensor technology, artificial intelligence, and data analytics hold promise for ongoing innovation in wearable technology, presenting fresh opportunities to enhance health outcomes and empower individuals to take control of their well-being. In conclusion, wearable technology has emerged as a formidable asset for health monitoring and management in the digital era, empowering individuals to make informed decisions and lead healthier lives.

6. THE ROLE OF AI SOFTWARE IN ENHANCING QUALITY OF LIFE FOR SENIORS

AI software has the potential to significantly improve the quality of life for the elderly by addressing their unique challenges and providing tailored solutions. AI software can assist seniors in managing health conditions, automating home tasks, fostering social engagement, and providing cognitive stimulation. Key benefits of AI software for seniors include improved independence, enhanced safety and security, increased socialization, and better health management. The demand for AI in elder care is projected to grow as the aging population increases. AI-powered tools analyze data to predict health issues, deliver personalized care plans, and improve efficiency in care delivery. Benefits of AI-powered tools in geriatric care include improved efficiency, enhanced patient outcomes, and reduced healthcare costs. AI in elderly healthcare can detect early signs of health issues, predict risks, provide personalized treatment plans, and enable remote monitoring. Advantages of AI in elderly healthcare include improved efficiency, accuracy, cost savings, better outcomes, and increased patient satisfaction. With the rise of AI in healthcare, the future of elderly care looks

promising, offering more effective and personalized care to improve their quality of life⁵⁵.

7. CHALLENGES AND CONSIDERATIONS IN IMPLEMENTING DIGITAL HEALTH

Successfully implementing digital health initiatives necessitates addressing several crucial challenges and considerations. Firstly, establishing a robust technological infrastructure is paramount, encompassing elements like dependable connectivity, efficient IT systems, and secure data storage. Privacy and data security emerge as top priorities, requiring the implementation of measures like data encryption, restricted access protocols, and comprehensive cybersecurity training to safeguard sensitive information effectively. Furthermore, seamless integration with existing systems such as electronic medical records and billing platforms is essential to ensure the coherence and functionality of digital health systems. Cultivating a culture of change and providing adequate training are also imperative; healthcare professionals must be equipped with the knowledge and skills to utilize new technologies effectively, while patients should receive education on utilizing digital tools for managing their healthcare needs efficiently. Navigating regulatory and legal compliance frameworks is another critical aspect, with healthcare organizations needing to adhere to standards and regulations that safeguard data privacy and security. For instance, adherence to telehealth policies is mandatory for USbased companies operating in this space. Effectively addressing these challenges paves the way for realizing the myriad benefits of digital health, including enhanced care efficiency, increased access to healthcare services, and ultimately, improved health outcomes for patients.

8. COMPARATIVE ANALYSIS OF LEGAL FRAMEWORKS ACROSS NORDIC COUNTRIES

The integration of digital health technologies and artificial intelligence (AI) has revolutionized healthcare delivery, particularly in the Nordic countries. However, navigating the legal frameworks governing these technologies in elderly patient care remains a complex task. This paper aims to conduct a comparative analysis of the legal frameworks across Nordic countries, exploring the regulatory landscapes of Denmark, Finland, Iceland, Norway, and Sweden. The study aims to identify commonalities, differences, and gaps in the existing legal frameworks and provide insights into the regulatory approaches shaping the deployment of digital health and AI solutions for elderly patient care. This comparative analysis will provide valuable perspectives for policymakers, healthcare professionals, researchers, and stakeholders involved in the complex intersection of law, technology, and healthcare in the Nordic region.

8.1 Denmark

⁵² Partner Content. (2024). Silver tsunami: how advanced analytics and AI can contribute to healthy ageing. Global Government Forum. <u>https://www.globalgovernmentforum.com/silver-tsunami-how-advanced-analytics-and-ai-can-contribute-to-healthy-ageing/</u>

⁵³ Daugherty, G. (2024). 'Silver Tsunami': Challenges & Opportunities of an Aging Population. The term "silver tsunami" generally refers to the large cohort of Americans entering their retirement years as the baby boom generation, born in the years 1946 to 1964, continues to age. The term, considered by some to be ageist and offensive, is used to highlight both the economic opportunities created by an aging population and the challenges it may pose to society. Investopedia. Retrieved from <u>https://www.investopedia.com/silver-tsunami-8418065</u>

⁵⁴ Vancouver Home Health Care Agency. (2024). Understanding the Benefits and Risks of Artificial Intelligence in Home Health Care for the Elderly. Retrieved from <u>https://vhhca.com/understanding-thebenefits-and-risks-of-artificial-intelligence-in-home-health-carefor-the-elderly/</u>

⁵⁵ MoldStud. (2024). AI-Powered Geriatrics Software for Elderly Care. Retrieved from <u>https://moldstud.com/articles/p-ai-powered-geriatrics-software-for-elderly-care</u>

Denmark's pioneering endeavors in digital healthcare offer valuable insights into the successful integration of digital health technologies. Lisbeth Nielsen, Director General of the Danish Health Data Authority, attributes Denmark's achievements to early digitalization initiatives, sustained momentum, and a culture of trust in the public sector. Nielsen underscores the significance of digitizing high-volume communications essential for clinical decisions, such as lab results and care plans, which has notably enhanced healthcare accessibility and efficiency. The country's latest Digital Health Strategy highlights several initiatives aimed at integrating digitized data access for both patients and medical professionals⁵⁶. Denmark ranks as number one in digital health readiness due to the country's commitment to utilizing digital technology for the betterment of healthcare⁵⁷. For instance, Denmark's e-health portal serves as a centralized platform for comprehensive health data presentation, while the "Doctor in Your Pocket" app facilitates seamless patientphysician communication and appointment management. Furthermore, initiatives like "Ask the Patient" collect patient feedback to personalize healthcare delivery, and digitally supported rehabilitation and decision support tools for cancer patients improve treatment outcomes. Nielsen emphasizes transparency and patient involvement as core principles guiding these initiatives. However, digital health researcher Jeppe Eriksen underscores the necessity for improved coordination across the healthcare system and equitable access to digital solutions, particularly for marginalized populations. Despite Denmark's advancements, the World Health Organization (WHO) stresses the need for broader investment, innovation, and inclusion across Europe to fully realize the benefits of digital health. Addressing digital literacy gaps and ensuring access to digital health tools are critical steps in achieving equitable healthcare transformation. Denmark's MinSundhed app⁵⁸ stands out as an example of user-friendly digital health services, offering convenient access to health data, emergency care options, and practitioner information. Through its holistic approach and user-centric design, Denmark's digital health initiatives set a benchmark for other nations navigating the intricate landscape of healthcare digitization. The digitization of the Danish healthcare system has significantly advanced patient treatment and safety, minimized paper-based workflows for staff, and optimized resource allocation. Standardized IT practices have transformed communication processes among healthcare providers, spanning hospitals, general practitioners, specialists, laboratories, local authorities, and home care services. Adoption of electronic health records (EHRs), prescriptions, and referrals has become widespread, enhancing both communication and operational efficiency. National initiatives such as the Shared Medication Record and Sundhed.dk, the country's e-health portal, lay a robust groundwork for further digitalization endeavors. To tackle impending labor shortages and demographic shifts, the next

phase of digital evolution focuses on bringing healthcare services closer to citizens through digital innovations. Patients now anticipate access to healthcare via digital platforms, applications, and health portals. By embracing digital solutions, automation, and emerging technologies, the healthcare sector can streamline processes and foster innovative strategies to meet evolving healthcare demands⁵⁹. Denmark's elderly care system focuses on self-reliance and free choice for all citizens. Local authorities provide prevention and reablement programs, as well as home care services and nursing facilities. Municipalities provide these services to elderly citizens who cannot manage daily life independently. Home care includes practical and personal care. Municipalities must offer at least two different service providers, and all citizens are entitled to home nursing free of charge. Preventive measures, such as community-based social activities and preventive home visits, are initiated to help elderly citizens manage their lives. Municipalities also evaluate if elderly citizens need special care and offer them care homes, where residents pay for residential facilities, food, and private expenses⁶⁰. Denmark is expected to experience significant growth in the Digital Health market, with revenue expected to reach US\$499.10m by 2024 and a market volume of US\$617.60m by 2028. The average revenue per user is estimated at US\$91.00. China is expected to generate the highest revenue, reaching US\$53,070.00m in 2024. Denmark's Digital Fitness & Well-Being segment is expected to generate a total revenue of US\$317.00m in 2024⁶¹.

8.2 FINLAND

Finland the 2nd most advanced digital economy of the EU in 2021 with a healthcare system operates through a partnership between the government and 19 regional authorities. While the government oversees the development and implementation of health policies and reforms, the regions are responsible for managing healthcare services at the local level, including the operation of public hospitals. Healthcare funding is split between hospital care, supported by taxes, and outpatient care, which receives contributions from employers to the Kela Social Institute. Finland prides itself on its extensively digitized healthcare system, characterized by a fully digitized health database containing comprehensive population health data. The nation's hospitals are equipped with cutting-edge facilities for testing new health technologies. Finnish citizens demonstrate a strong level of confidence in both emerging technologies and their healthcare institutions, resulting in active participation in clinical trials⁶². Finland's Digital Health market is projected to reach \$371.80m in 2024, with a CAGR of 5.86% from 2024-2028. The market volume is expected to reach \$467.00m by 2028. The average revenue per user is \$72.58, with China

⁵⁶ Scott, A. (2023). Digital Health in Denmark: A Model to Copy. Medscape. Retrieved from https://www.medscape.com/viewarticle/987654

⁵⁷ Jensen, P. M. (2024, January 11). Digital health in Denmark. [OECD]. Retrieved from <u>https://healthpolicy.se/digital-health-in-denmark/#:~:text=In%20the%20report%2C%20Denmark%20ra</u> <u>nks,seamless%20integration%20of%20health%20records</u>. ⁵⁸ Retrieved from https://www.sundhed.dk/borger/

 ⁵⁹ Healthcare Denmark. (2024). Digitalization. Retrieved from https://healthcaredenmark.dk/national-strongholds/digitalisation/
 ⁶⁰ Healthcare Denmark. (2024). Elderly Care. Retrieved from https://healthcaredenmark.dk/national-strongholds/digitalisation/

⁶¹ Market Insights - Health. (n.d.). Digital Health - Denmark. Statista. Retrieved from <u>https://www.statista.com/outlook/hmo/digital-health/denmark</u>

⁶² Anttonen, M. (2024). eHealth in Finland. Retrieved from <u>https://gnius.esante.gouv.fr/en/international-digital-health-systems/ehealth-in-finland</u>

generating the most revenue at \$53,070.00m. Finland's largest market segment is Digital Fitness & Well-Being, valued at \$166.90m. The market is thriving due to innovative telemedicine solutions and advanced healthcare analytics63. HealthHub Finland EDIH serves as a European Digital Innovation Hub dedicated to fostering the development of digital health and wellbeing solutions, along with facilitating access to Finnish health and wellbeing data. It provides a range of services, including subsidized or free test-before-invest and innovation services, financing advice, as well as training and skills development for small and medium-sized enterprises (SMEs) and public sector organizations across the European Union (EU). As part of the EDIH Network, consisting of over 150 European Digital Innovation Hubs, its overarching goal is to stimulate digital investment and promote the digitalization of SMEs. This initiative is made possible through co-funding from the European Commission's Digital Europe Programme and Business Finland, the Finnish government organization responsible for innovation funding, as well as trade, travel, and investment promotion efforts⁶⁴. Finland is implementing electronic services to support pharmacotherapy, with a national medication list being developed to centralize essential data for healthcare professionals. This will ensure accuracy and consistency across organizations. Electronic tools for decisionmaking integrate patient-specific data with medical information, providing tailored recommendations at different stages of pharmacotherapy. Technologies like drug administration robotics and artificial intelligence can enhance pharmacotherapy effectiveness and safety while optimizing costs. Electronic solutions also promote self-care by providing equal access to services like My Kanta Pages and wellbeing applications, empowering individuals to manage their health independently⁶⁵.

8.3 ICELAND

The collaboration with Digital Iceland has yielded successful results, focusing on enhancing information accessibility and enabling self-service for the public. Sigurður Helgi Helgason, CEO of Icelandic Health, commends the institution for its progress and dedication to improving user services, highlighting the effectiveness of strong collaboration⁶⁶. Challenges for the 2024 Health Hack, organized by Iceland Health Tech Cluster's Health Hack partners, involve addressing various healthcare needs through innovative solutions. Landspítali, for instance, seeks solutions utilizing smart technology, virtual reality, and artificial intelligence to enhance patient care and optimize hospital operations. Additionally, the Primary Care of the Capital Area presents challenges focusing on digital manuals, digital medicine services, and improving healthcare

professionals' access to solutions. The Directorate of Health emphasizes the use of artificial intelligence to streamline drug renewals and enhance service quality. An open category encourages innovative solutions benefiting public health and supporting the Office of the National Medical Examiner's policy on electronic medical records⁶⁷. Iceland's Digital Health market is projected to generate \$23.33m in revenue by 2024, with a CAGR of 5.40%. The market volume is expected to reach \$28.79m by 2028. The average revenue per user is expected to be \$78.14. China is expected to generate the highest revenue at \$53,070.00m in 2024. The largest market segment is Digital Fitness & Well-Being, with a total revenue value of \$18.65m. Iceland's digital health market is thriving with innovative telemedicine solutions and advanced electronic health record systems⁶⁸.

8.4 NORWAY

The practice of digitally monitoring patients at home involves the utilization of mobile and sensor technologies for remote surveillance, typically coordinated by municipalities. This initiative focuses on individuals with chronic illnesses who are at moderate to high risk of worsening health or hospital readmission, and who generally require ongoing health and care services. Healthcare professionals oversee patient data from a Telehealth center, providing guidance and necessary interventions. Furthermore, patients have the option to receive specialized healthcare services at home through video consultations and online treatments. The National Health and Hospital Plan (2020-2023) aims to enhance specialist healthcare services and enhance collaboration with municipal health services, with a particular emphasis on leveraging digital tools to extend hospital-level care to patients' residences. The establishment of healthcare communities and the National Program for Welfare Technology further bolster the adoption of digital solutions in healthcare⁶⁹. The Insicon's Digital Health Insurance Platform in Norway and its significant influence on the nation's healthcare landscape. Insicon's objective is to bridge the disparity between conventional insurance practices and contemporary user expectations by presenting a digital platform that prioritizes simplicity, accessibility, and personalized healthcare coverage. Noteworthy aspects encompass tailored coverage plans, an intuitive interface, and seamless integration of telehealth services, thereby rendering healthcare more convenient and individualized. Moreover, the platform underscores accessibility, real-time updates, and transparent cost structures to elevate the overall user experience. Insicon places paramount importance on data security protocols and fraud prevention mechanisms to instill user confidence and ensure system dependability. Furthermore, the platform caters to diverse demographics, offering specialized plans for families

 ⁶³ Market Insights Health. (2024). Digital Health - Finland. Retrieved from <u>https://www.statista.com/outlook/hmo/digital-health/finland</u>
 ⁶⁴ HealthHub Finland EDIH. (2024). Retrieved from <u>https://healthhubfinland.eu/</u>

⁶⁵ Vuokko, R. (2024). Digital Services. Ministry of Social Affairs and Health. Retrieved from <u>https://stm.fi/en/rational-</u> pharmacotherapy/digital-services

⁶⁶ Iceland Health. (2024). Large-scale increase in health insurance services to the general public. Retrieved from https://island.is/en/o/iceland-health/news/large-scale-increase-in-health-insurance-services-to-the-general-public

⁶⁷ Karlsson, H. S. (2024). Iceland Health Hack. Retrieved from <u>https://www.htk.is/en/lausnarmotid</u>

⁶⁸ Iceland. (2024). In Market Insights - Health: Digital Health. Retrieved from <u>https://www.statista.com/outlook/hmo/digital-health/iceland</u>

⁶⁹ Rødseth, E. (2023). Senior Adviser, Personal E-health. Norwegian Centre for E-health Research. Retrieved from <u>https://ehealthresearch.no/en/digitally-following-up-patients-at-</u> home

and incorporating features geared towards millennials. Insicon also showcases its dedication to sustainability through initiatives like paperless documentation and environmentally conscious practices. Moving forward, Insicon remains committed to ongoing innovation and collaborative endeavors to address the evolving healthcare needs of the Norwegian populace and propel digital transformation within the sector⁷⁰. The study conducted by the Nordic eHealth Research Network (NeRN)⁷¹ reveals that while most Norwegians have access to their digital health data, they seldom utilize it effectively. Only a minority, less than one in three, believe that access to digital health data has helped them manage their health better. The study also highlights a willingness to share personal health data for individual treatment, but this willingness diminishes when it comes to sharing data for research purposes. Citizens of Nordic countries, particularly Finns, are generally satisfied with their access to digital health data. However, there is a notable disparity in the utilization of health data between countries, with Finns being the most active users and Norwegians demonstrating the lowest utilization. The findings underscore the importance of addressing digital health disparities and improving the effectiveness of digital health data utilization to enhance healthcare outcomes. Norway's Digital Health market is projected to grow significantly, with revenue reaching \$558.60m in 2024 and a 4.95% annual growth rate between 2024 and 2028, resulting in a market volume of \$677.60m by 2028. The average revenue per user in Norway is expected to be \$102.20. The highest revenue is expected to come from China, with \$53,070.00m in 2024. The largest market segment is Digital Fitness & Well-Being, with a total revenue of \$339.90m in 202472.

8.5 SWEDEN

In Sweden, healthcare is predominantly financed through taxes, and its quality is widely regarded as high by organizations such as the World Health Organization (WHO) and the Organization for Economic Co-operation and Development (OECD). Notably, Karolinska University Hospital is recognized as one of the top hospitals globally. Sweden grapples with the challenge of an ageing population, with approximately one in every five individuals being 65 years or older. Healthcare is decentralized, with regional councils tasked with delivering quality medical services and advancing public health initiatives. Oversight of health standards and data compilation is managed by the National Board of Health and Welfare. Professional midwives play a crucial role in maintaining Sweden's low maternal mortality rate. Public healthcare expenditure remains steady, constituting about 11% of the country's GDP, mainly sourced from regional and municipal taxes. Government expenditure on health and social care totaled approximately 113 billion SEK in 2022. Both public and private healthcare providers operate in Sweden under uniform regulations. Private providers are often engaged by regional councils to deliver healthcare services. Additionally, private entities offer digital healthcare solutions, such as patient-doctor apps⁷³. The Digital Health market in Sweden is expected to reach a revenue of US\$594.30m in 2024, with a CAGR of 7.04%. By 2028, the market volume is expected to be US\$780.10m. The average revenue per user is estimated at US\$62.55. In comparison, China is expected to generate the most revenue. Sweden is a leader in digital health innovation, focusing on telemedicine and wearable technology⁷⁴. The life science sector in Sweden plays a pivotal role in fortifying hospitals' resilience and sustainability. Leveraging top-tier healthcare architects, eco-friendly infrastructure solutions, and cutting-edge digital technologies, hospitals are transitioning into intelligent, secure, and ecoconscious environments. This approach not only elevates patient care standards but also aligns with global sustainability objectives, including SDG 03 - "Good Health and Well-being." Initiatives aimed at curbing hospitalizations through outpatient services and remote monitoring, alongside digitalization and partnerships with academia and industry, are revolutionizing healthcare delivery methods. Swedish healthcare institutions place a premium on sustainability, channeling investments into sustainable infrastructure and innovative medical technologies to achieve efficient and patient-centric advanced healthcare. Karolinska University Hospital exemplifies this commitment as one of the world's most sustainable university hospitals, emblematic of Sweden's dedication to sustainability. With significant investments in healthcare IT and a concerted effort to mitigate the climate impact of medical gases, Swedish hospitals are spearheading the charge towards a more sustainable future⁷⁵.

9. LEGAL FRAMEWORK

The General Data Protection Regulation (GDPR) and the AI Act of 2024 passed by the EU are crucial legal frameworks for digital health monitoring and AI use for elderly patients in the Nordics. GDPR sets guidelines for processing personal data, including health data, within the European Union and the European Economic Area, ensuring individuals have control over their data and organizations comply with strict standards. It mandates lawful, transparent, and legitimate processing of collected data, ensuring security and confidentiality, especially considering the sensitive nature of health information. Compliance with GDPR maintains trust between healthcare providers, patients, and other stakeholders involved in digital health initiatives. The AI Act, 2024 passed by the European Commission, regulates the development and use of artificial intelligence systems within the EU, addressing transparency, accountability, and safety. It ensures ethical operation of AI

 ⁷⁰ Niklas. (2024). Insicon Digital Health Insurance Platform in Norway.
 Retrieved from <u>https://insicon.se/insicon-digital-health-insurance-platform-in-norway/</u>
 ⁷¹ Berntsen, H. (2024). Divided to the transfer of the second se

⁷¹ Berntsen, H. (2024). Digital health data falls short in aiding Norwegians manage their health. Norwegian Centre for e-Health Research. Retrieved from <u>https://partner.sciencenorway.no/digital-</u> <u>services-e-health-research-health/digital-health-data-falls-short-</u> <u>in-aiding-norwegians-manage-their-health/2324856</u>

⁷² "Digital Health - Norway." Statista, www.statista.com/outlook/hmo/digital-health/norway

⁷³ Sweden.se. (2024). Healthcare in Sweden. Retrieved from <u>https://sweden.se/life/society/healthcare-in-sweden</u>

⁷⁴ Statista. (2024). Digital Health - Sweden. Market Insights Health. Retrieved from <u>https://www.statista.com/outlook/hmo/digital-health/sweden</u>

⁷⁵ Swecare. (2024). Smart Safe & Sustainable Hospitals. Retrieved from <u>https://www.swecare.se/healthbysweden/smart-safe-sustainable-hospitals/</u>

systems, respecting fundamental rights, privacy, and data protection. It also mandates risk assessments and oversight mechanisms to mitigate potential risks associated with AI technologies in healthcare settings. The study Butt, J. (2024)⁷⁶ highlights that the EU Artificial Intelligence Act, 2024, is a groundbreaking legislation regulating AI technologies. It addresses biases, promotes transparency, and ensures accountability in decision-making. The study evaluates the Act's effectiveness, adaptability to technological changes, and alignment with human rights principles. It seeks to provide ethical insights into navigating AI complexities, contributing to ongoing discussions on AI governance. The research aims to provide valuable insights into AI governance. In summary, GDPR and the AI Act are essential legal frameworks for safeguarding the rights and interests of elderly patients in the Nordics when it comes to digital health monitoring and AI use.

10. CONCLUSION & LIMITATIONS

In conclusion, as the Nordic countries venture into the complex realm of digital health monitoring and the integration of AI into elderly patient care, it is evident that robust legal frameworks are essential to ensure ethical, fair, and effective implementation. While technological advancements hold immense potential to enhance healthcare outcomes and improve the lives of the elderly, they also bring about distinct challenges regarding privacy, data security, and healthcare accessibility. By proactively establishing comprehensive legal structures that prioritize patient rights, data security, and transparency, the Nordics can lead the way in fostering responsible innovation in digital health. Furthermore, fostering collaboration among policymakers, healthcare professionals, technologists, and patients will be crucial in developing and refining regulations that strike the delicate balance between innovation and protection, ultimately ensuring that digital health technologies serve the best interests of elderly patients and society at large. The advent of Gen AI in 2024 is poised to revolutionize healthcare, streamlining administrative tasks, enhancing patient care, and driving long-term transformation for the benefit of healthcare stakeholders and patients alike⁷⁷. AI-powered health monitoring systems are already revolutionizing elderly care, offering improved health monitoring78, personalized care, and enhanced independence, albeit with the caveat of responsible use and ethical implementation to maintain trust and dignity⁷⁹. Additionally, technology innovations such as telemedicine and

mobile health applications are reshaping healthcare delivery, particularly in remote areas, offering personalized and informed healthcare experiences. As the Nordic Region strives to become the most sustainable and integrated region globally by 2030, initiatives like iHAC contribute to creating a socially sustainable Nordic Region⁸⁰, while telemedicine and AI technologies promise proactive, personalized, and accessible healthcare services, shaping the future of healthcare interactions and global health outcomes⁸¹.

11. SUMMARY OF KEY FINDINGS AND INSIGHTS

Denmark's digital healthcare initiatives are a testament to the successful integration of digital health technologies. The country's success is attributed to early digitalization efforts, momentum, and a culture of trust in the public sector. Key strategies include digitizing high-volume communications, integrating with existing ecosystems, and using distributed orchestration for ecosystem governance. Finland has a highly advanced healthcare system with extensive population health data and advanced health technology facilities. The thriving Digital Health market in Finland is driven by telemedicine solutions and healthcare analytics. In Iceland, collaboration with Digital Iceland aims to enhance information accessibility and promote public self-service. Norway implements digital patient monitoring at home, providing remote surveillance and online treatments. The Digital Health Insurance Platform bridges traditional insurance practices with personalized healthcare coverage. Sweden's tax-funded healthcare system prioritizes quality, decentralization, and sustainability, investing in sustainable infrastructure and innovative medical technologies. The Digital Health market in Sweden is expected to grow significantly, focusing on telemedicine and wearable technology.

- Q: To what extent do existing legal frameworks in the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) adequately address the challenges associated with data privacy, security, and informed consent in the context of digital health monitoring for elderly patients?
- **R:** Nordic countries have made significant progress in addressing data privacy, security, and informed consent issues in digital health monitoring for elderly patients. The General Data Protection Regulation (GDPR) and national legislation provide robust protections for personal data and ensure privacy rights are respected. However, gaps exist in these frameworks, particularly concerning the specific needs and vulnerabilities of elderly patients. Issues related to capacity and decision-making may arise when obtaining informed consent from elderly individuals, especially those with cognitive impairments or other health conditions. Ensuring access to and control over health data can be

⁷⁶ Butt, J. (2024). Analytical Study of the World's First EU Artificial Intelligence (AI) Act, 2024. International Journal of Research Publication and Reviews, 5(3), 7343-7364. Retrieved from <u>https://ijrpr.com/uploads/V5ISSUE3/IJRPR24381.pdf</u>

⁷⁷ Gupta, A. (2024). 3 predictions for AI in healthcare in 2024. Google AI and Health Blog. <u>https://blog.google/technology/health/googleai-and-health/3-predictions-for-ai-in-healthcare-in-2024/</u> ⁷⁸ Berlym. D. (2024). Life et al. 2014

⁷⁸ Berlyn, D. (2024). Lifestyle for older adults: How AI and new technology could support healthy aging. Project GOAL. https://www.ncoa.org/article/how-ai-and-new-technology-could-support-healthy-aging

⁷⁹ Canda, J. (2024). Enhancing Elderly Care with AI-Powered Health Monitoring Systems. Medium. https://medium.com/@jam.canda/enhancing-elderly-care-withai-powered-health-monitoring-systems-e2f0407cc12b

 ⁸⁰ The Nordic Council of Ministers. (2024). The Nordic vision 2030. Retrieved from <u>https://integratedhealthandcare.com/vision2030/</u>
 ⁸¹ Jat, A. S. (2024). Telemedicine: How new technologies can bring medical care to people in remote areas. Share Your Science. Retrieved from <u>https://www.sciencenorway.no/medicine-researchers-zone-share-your-science/telemedicine-how-new-technologies-can-bring-medical-care-to-people-in-remote-areas/2330084
</u>

challenging, especially for those relying on caregivers or family members. Therefore, ongoing efforts are needed to tailor these frameworks to better accommodate the unique needs of this demographic. This may involve developing specific guidelines or regulations to protect the rights of elderly individuals, enhance accessibility and transparency in healthcare decision-making processes, and promote collaboration between healthcare providers, caregivers, and patients.

- Q: What are the key legal challenges associated with digital health monitoring of elderly patients in the Nordic region?
- R: Digital health monitoring devices are crucial for elderly patients, who may have concerns about their health information confidentiality. Ensuring data privacy and security is essential, as they may have heightened concerns about the confidentiality of their health information. Legal frameworks must ensure that consent processes are accessible, understandable, and respectful of patients' autonomy and dignity. Legal frameworks must also provide guidance on capacity and decision-making for elderly patients, especially those with cognitive decline or other health conditions. Access and equity are essential for elderly patients, including those living in remote or underserved areas. Legal frameworks should address barriers to access, such as digital literacy, affordability, and availability of support services. Liability and accountability are crucial for digital health monitoring systems, especially in cases of data breaches or adverse health outcomes. Interoperability and standards are essential for seamless data exchange and integration into healthcare systems. Legal frameworks should encourage collaboration and standardization efforts to enhance interoperability and facilitate the effective use of digital health data. To address these legal challenges, a comprehensive approach balancing patient rights and interests with innovation and access to digital health technologies is needed. Collaboration between policymakers, healthcare providers, technology developers, and legal experts is crucial for developing robust legal frameworks that support the safe, ethical, and effective use of digital health monitoring for elderly patients in the Nordic region.
- Q: How do data protection regulations, such as the GDPR, and the AI Act, 2024 impact the implementation and use of digital health monitoring technologies for elderly patients in Denmark, Finland, Iceland, Norway, and Sweden?
- R: Data protection regulations like the GDPR and the AI Act, 2024 significantly influence the implementation and use of digital health monitoring technologies for elderly patients across Denmark, Finland, Iceland, Norway, and Sweden. These regulations establish stringent standards for the collection, processing, and storage of personal health data, ensuring the privacy and security of elderly patients' sensitive information. Compliance with **GDPR** requirements is mandatory for all organizations handling health data, necessitating robust data protection measures, including encryption, pseudonymization, and user consent mechanisms. The AI Act, 2024 further regulates the

development and deployment of AI-powered health monitoring systems, addressing concerns related to algorithmic bias, transparency, and accountability. By promoting ethical AI practices and ensuring transparency in AI decision-making processes, the AI Act enhances trust and confidence in digital health technologies among elderly patients and healthcare providers. However, these regulations also pose challenges, such as increased administrative burdens and compliance costs for healthcare organizations and technology developers. Moreover, variations in implementation and interpretation of GDPR and the AI Act across Nordic countries may result in inconsistencies in data protection practices and legal compliance. Therefore, stakeholders must navigate these regulatory frameworks carefully, adopting a harmonized approach to safeguarding data privacy and promoting innovation in digital health monitoring for elderly patients across the region.

Q: How can regulatory authorities, industry standards, and professional guidelines be leveraged to promote a more robust and ethically sound legal landscape for digital health monitoring of elderly patients in the Nordic region?

R: To enhance the legal framework surrounding digital health monitoring for elderly patients in the Nordic region, various measures can be employed, drawing upon the roles of regulatory authorities, industry standards, and professional guidelines. Regulatory bodies hold significant responsibility in crafting comprehensive frameworks that address the specific challenges and considerations inherent in digital health monitoring. Through periodic updates to existing laws and regulations, these authorities can ensure that the evolving landscape of technology and healthcare practices is reflected, thereby upholding standards of safety, effectiveness, and ethical integrity in digital health monitoring technologies. Furthermore, industry standards and professional guidelines serve as essential reference points for developers, manufacturers, and healthcare providers. By establishing norms and best practices, these standards and guidelines contribute to the uniformity of procedures and facilitate interoperability among diverse platforms and systems. Effective collaboration between regulatory bodies, industry stakeholders, and healthcare professionals is paramount in both the development and implementation of such standards. Continuous monitoring and evaluation mechanisms are crucial components in this process. They enable the identification of emerging issues and areas for enhancement, allowing regulatory frameworks to adapt in line with technological advancements and evolving healthcare requirements. By fostering a culture centered on transparency, accountability, and continual improvement, regulatory authorities, industry standards, and professional guidelines collectively work towards cultivating an ethical and reliable environment for digital health monitoring of elderly patients in the Nordic region.

12. FUTURE DIRECTIONS FOR RESEARCH

The research on the use of digital health monitoring and AI for elderly patients in the Nordics aims to explore the legal and ethical implications of these technologies. It will analyze existing laws and regulations, identify gaps in patient privacy, data security, and informed consent, and examine the effectiveness of these technologies in improving health outcomes and quality of life. The study will also examine user acceptance and adoption of these technologies among elderly patients, caregivers, and healthcare professionals in the Nordic region. The research will also focus on human-centered design principles in developing digital health monitoring devices and AI algorithms tailored to the needs and preferences of elderly users. The research will also develop policy recommendations for policymakers, healthcare providers, and technology developers to navigate the legal and ethical complexities of these technologies. The long-term impact and sustainability of these initiatives will be assessed, considering factors such as costeffectiveness, scalability, and potential for technology to address challenges associated with aging populations and healthcare resource allocation. By addressing these research directions, scholars can contribute to a better understanding of the legal, ethical, and practical considerations surrounding digital health monitoring and AI use for elderly patients in the Nordic region.

13. CHALLENGES AND CONSIDERATIONS

The MIT Sloan Management Review's research highlights the unique challenges faced by digital health care platforms. These platforms must adopt a different approach to market entry, business scaling, and ecosystem governance. The authors propose a three-part approach, focusing on market entry, scaling the business, and ecosystem governance. Implementing these platforms effectively can address the productivity crisis in healthcare, improve accessibility, affordability, and quality of care⁸². The legal landscape surrounding digital health monitoring and AI use for elderly patients in the Nordics is complex and multifaceted. Compliance with existing regulations is crucial, while adapting to rapidly evolving technologies, such as data privacy, security, and consent. Clear regulatory frameworks are needed to guide the development including amendments in EU AI Act, 2024 and GDPR, deployment, and use of digital health technologies, defining legal responsibilities and liabilities for stakeholders involved. Ethical concerns, such as algorithmic bias, transparency, and accountability, need to be addressed. Mechanisms for auditing and evaluating AI systems are necessary to ensure fairness and accountability. Collaboration among stakeholders, including policymakers, healthcare providers, technology developers, and patient advocates, is needed to develop effective regulatory frameworks that balance innovation with patient safety and privacy. Overall, a multifaceted approach is needed to ensure responsible and ethical use of technology in healthcare.

14. RECOMMENDATIONS FOR POLICY AND PRACTICE

The analysis of legal frameworks for digital health monitoring and AI use in elderly care in the Nordics suggests several

recommendations for policy and practice. These include clarifying legal definitions, developing and implementing ethical guidelines, establishing regulatory oversight bodies, fostering interdisciplinary collaboration, prioritizing user-centric design, ensuring transparency and accountability in decision-making processes, providing education and awareness programs for healthcare professionals, caregivers, and elderly patients, strengthening data security and privacy measures, continuously evaluating and adapting legal frameworks, and fostering international collaboration. Clarification of legal definitions is crucial to ensure consistency and understanding among stakeholders. Ethical guidelines should be developed and implemented to address privacy, consent, and data protection issues. Regulatory oversight bodies should be established or enhanced to ensure compliance with legal requirements and ethical standards. Interdisciplinary collaboration between legal experts, healthcare professionals, technology developers, and policymakers is also recommended to address complex legal and ethical challenges. Strengthening data security and privacy measures is crucial to protect sensitive health information collected through AI systems and AI applications. Continuous evaluation and adaptation of legal frameworks based on emerging evidence, technological advancements, and stakeholder feedback are also recommended. International collaboration can help address global challenges in the legal governance of digital health monitoring and AI for elderly patients.

15. ETHICAL CONSIDERATION

The author suggests that ethical considerations should be prioritized in the implementation of digital health monitoring and AI applications for elderly patients in the Nordics. Key to this endeavor are the AI Act and GDPR, which play crucial roles in upholding ethical standards. The AI Act provides clear guidelines for AI systems, emphasizing principles such as transparency, accountability, and bias mitigation. It is essential for policy frameworks to align with these principles to ensure the protection of the rights and well-being of elderly patients. Furthermore, the GDPR serves as a fundamental framework for safeguarding personal data, including health information. Compliance with GDPR requirements is imperative for AIdriven healthcare solutions to uphold privacy standards. Incorporating privacy-by-design principles into AI-driven healthcare solutions is essential to ensure data protection and maintain user confidentiality. Ethical considerations should prioritize aspects such as the autonomy, dignity, and privacy of elderly patients. Policies should include mechanisms for obtaining informed consent, enabling patients to make decisions regarding their health data and AI-driven healthcare interventions. Transparency in AI algorithms and data processing is crucial for fostering trust among patients, healthcare providers, and technology developers. Policies must also address the potential biases and discrimination inherent in AI algorithms, implementing robust measures for algorithmic fairness and accountability. In summary, ethical considerations in digital health monitoring and AI applications for elderly patients in the Nordics should revolve around compliance with the AI Act and GDPR, protection of patient privacy, promotion of autonomy and dignity, transparency in AI-driven healthcare processes, and mitigation of algorithmic bias.

⁸² Holgersson, M., Björkdahl, J., Essén, A., & Frishammar, J. (2024). Digital health care platforms need a different approach to succeed. Chalmers University of Technology. https://www.chalmers.se/en/current/news/tme-digital-healthcare-platforms-need-a-different-approach-to-succeed/

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The author Junaid Sattar Butt, LL.M (AHC), is a highly qualified legal professional boasting a diverse educational background. He earned his Master of Laws degree from the University of Lahore, Pakistan, following a Bachelor's degree in Law, with specializations in Comparative Laws, International Laws, Criminal Procedural Laws, Constitutional Laws, and Administrative Laws. Additionally, Butt holds a Master's degree in Business Administration from the Virtual University of Pakistan and a Master's degree in Political Science from the University of the Punjab, Pakistan. Leveraging this extensive educational foundation, Butt approaches his research and legal practice with a multidisciplinary perspective. His primary research interests encompass International Laws, Criminal Procedural Laws, Administrative Laws, GDPR, EU AI Act, 2024, Environmental Laws, Constitutional and Comparative Laws. Committed to delving into the complexities of these legal domains. Butt aims to contribute to legal scholarship and uphold principles of justice and fairness. Professionally, Butt serves as an Advocate High Court at AJ&K (Pakistan Occupied Azad Jammu and Kashmir), where he actively engages in the administration of justice and ensures the proper implementation of legal procedures. With his extensive knowledge and professional experience, Butt is dedicated to making a positive impact in the legal field. He continues to engage in research, legal practice, and professional collaborations, striving to advance legal knowledge and promote the effective implementation of legal principles.

18. DECLARATION OF CONFLICTING INTERESTS

The author declared no potential conflicts of interest with respect to the research, authorship, and / or publication of this article.

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