Annual Report

2023

United Nations Internet Governance Forum

Dynamic Coalition

on

Data Driven Health Technologies

DCDDHT

2023 IGF DC DDHT Annual Report

Mission Statement

Mission Statement of the United Nations Internet Governance Forum (IGF) Recognized Dynamic Coalition on Data Driven Health Technologies (DC DDHT):

> The Dynamic Coalition on Data Driven Health Technologies facilitates a multi-stakeholder dialogue on the topic of the internet and e-Health, m-Health (mobile), internet of medical things and e-wellness technologies, so as to seek common ground on values, principles, ethics, norms, culture, standards, best practices and so forth.
>
> Knowledge sharing and open communication between multi-stakeholders, with collaboration, assists innovation and delivery of quality eHealth Care products and services. Technology tools and devices, access by the internet, data sharing and use on the Internet, Medical Internet of Things and Wellness Internet, enable, the mandates of the United Nations Sustainable Development Goals (SDG), and in particular, Goal Number Three. SDG Goal #3 seeks to ensure Health and Well-Being for all, at every stage of life.
>
> The Dynamic Coalition takes a global citizen centered approach on all matters.

Acknowledgements

The United Nations Internet Governance Forum IGF Secretariat. has provided us with invaluable support through-out the year and we wish to thank in particular, Celine Bal. Our IGF collegues Jutta Croll, Judith Hellerstein, Wout de Natris and Dr R Gupta have been a source of great support for our DC for the IGF session. Euralo Individuals Association Chair and Board Members Riccardo Hoimquist and Roberto Ger…. have been an invaluable source of information for us. We want to note DC member Robert Guerra for their continued contribution of the infrastructure support for the Dynamic Coalition (DC).

We thank our invited guest speakers for their invaluable contribution to the discussions we have had over the course of the year. Bringing the international community together, means very late hours for some of our speakers, who have so helpfully accommodated this issue of time zones. We encourage our session participants to continue to deepen and enhance our public discussions with their insights by joining the coalition. We thank members of other IGF Dynamic Coalitions for collaborating with us at our events

We wish to thank our new coalition members for joining us, and all our members for enriching our Dynamic Coalition's body of knowledge. We look forward to continued interesting discussions with all in to the future.

The Dynamic Coalition members were supported by their families, friends, employers and professors, in their valuable work and we express our warmest thank you to all of them.

2023 IGF DC DDHT Annual Report is Reported By:

Ms. Amali De Silva – Mitchell, Founder & Coordinator, Dynamic Coalition on Data Driven Health Technologies. January 31, 2024.

Disclaimer

The views and opinions within this report are those of the writers and may not reflect the views and opinions of the United Nations Internet Governance Forum Secretariat, nor conform to IGF definitions, practices, norms, values and so forth.

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1. Executive Summary

The United Nations Internet Governance Forum recognized Dynamic Coalition on Data Driven Health Technologies (DC DDHT) was very active in 2023. Although our sessions were actively attended in person, the DC enabled successful on-line participation from all parts of the world, for All, in 2023. Empowring equal and universal access to meetings, a meaningful reality. The DC also gained new active members. We commenced a mentorship program to facilitate continuity and knowledge sharing of DC DDHT values with new members, through active online group and individual coaching calls and communications. Our members enrich our ability to participate and discuss on a range of relevant topics.

The spirit of Universal Healthcare through the auspices of the Internet. is now seen as expected. However, meaningful access for All, is still a mission to be completed under the United Nations Sustainable Development Goals and World Health Organization WHO mandates. Many subject matter specific policy makers, don't consider the variety of challenges experienced by users of the internet, such as access, assessibility, technical skill, keeping up with constant technical updates and security protections, access to power sources and other infrastructure and the cost of devices and connectivity. The average user is still perceived to be the well connected user with access to the best of the internet, and this is far from the truth. This understanding of the diversity of internet user experiences is critical for internet based medical services delivery.

Our focus in 2023 was an indepth dive into the space of robots for healthcare. Increasingly health care related robots and technologies for health and wellness are being connected to the internet. Patient at home post hospital care is also being connected to the internet with active monitoring and communication with devices connected between the patient and the health service provider. Hospital stays are shorter to meet the challenges provided by a shortage of medical personnel and facilities. Technical devices are filling the gaps of real medical staffs. The use of technology to enable efficiency of communications at a variety of levels of care is in use and on the rise. Not all patients have meaningful access to the internet to facilitate this care. Never more has a trusted, secure, affordable internet been the essential backbone to providing healthcare service.

Robots with the advance in Artificial Intelligence (AI) has really come of age in 2023. Countries facing challenges with health professional human resources, are turning to AI and robots to fill the medical services gap. Remote surgery across contients is now a reality. Speeding of medical document handling and even taking these practices to out of space medical support has been developed. This has enabled greater understanding of communications technologies suitable to remote locations such as Delay Tolerrant Networks DTN.

The use of robots and AI tools such as ChatGPT are challenging the privacy and security best practices and current legislative models. The benefits are driving the rapid developments of robots and AI for health, but there has to be awareness that all the issues already highlighted

with AI use, are just as current as they were five years ago. Excellence in data integrity is a must.

2. Score Card on Policy Matters

Knowledge Sharing & Public Awareness Score Card: A Selection of Topics Covered	**2023 IGF; ITU;WSIS; Eurodig**
focus For The Year = Robots & eMedical Internet of Things	**Event**
Access to the internet and devices	All sessions
Accessibility & Disability , Inclusion and Diversity	IGF 2023 Session & Eurodig
AI data bias	IGF 2023 Session
AI ML Robotics Emerging Technologies	Theme for 2023 All Sessions
Costs / Affordability / Economic Cost / Government funding	All Sessions
Data records / fragmented data	IGF 2023 Session
Delay Tolerant Networks DNT for Remote Connectivity	IGF 2023 Session & Eurodig
Decentralizing decision making	Within the context of Robots
Doctor to patient relationship and expectations gap	All Sessions
Ease of device / system use such as speech to text for form filling	All Sessions
Ethics	All Sessions
Green eMedicine / Environment	WSIS 2023 ITU Session
Human Computer Interaction	All Sessions
Human Rights; Security; Privacy	All Sessions
Indigenous Health, Inclusion & Diversity	All Sessions
AI & Medical Standard Setting	AI Working Group ITU contribution
Onboarding to the internet / Good Samaritan supports patients	All Sessions
Patient specific based medicine	All Sessions
Practical applications of AI in healthcare triage	All Sessions
Privacy and 7 rites / rights for the passage of data between systems	All Sessions
Rural issues / sourcing power / electricity	All Sessions
Satellite / community hot spots	All Sessions
eMedicine access and accessibility in times of Crisis /Natural Disaster	Email to all DCs; Eurodig Session

3. Background to UN Internet Governance Forum, Dynamic Coalitions

Internet Governance was one of the most controversial issues discussed at the United Nations World Summit on the Information Society WSIS, held in two phases, in Geneva, 2003, and in Tunis, 2005. Cognizant of the fact that any Internet Governance approach should be inclusive and responsive, the WSIS requested the Secretary General of the United Nations to convene a new forum for multi-stakeholder policy dialogue.

The Internet Governance Forum (IGF) as a platform for discussions, brings various stakeholder groups to the table as equals to exchange information and share good practices. While the IGF may not have decision-making mandates, it informs and inspires those who do. It facilitates a common understanding of how to maximize Internet opportunities and address risks and challenges. (*Sourced IGF Website January 2022*)

IGF Mandate Paragraph 72 of the Tunis Agenda: 72: We ask the UN Secretary-General, in an open and inclusive process, to convene, by the second quarter of 2006, a meeting of the new forum for multi-stakeholder policy dialogue called the Internet Governance Forum (IGF). The mandate of the Forum is to: • Discuss public policy issues related to key elements of Internet governance in order to foster the sustainability, robustness, security, stability and development of the Internet; • Facilitate discourse between bodies dealing with different cross-cutting international public policies regarding the Internet and discuss issues that do not fall within the scope of any existing body; • Interface with appropriate inter-governmental organizations and other institutions on matters under their purview; • Facilitate the exchange of information and best practices, and in this regard make full use of the expertise of the academic, scientific and technical communities; • Advise all stakeholders in proposing ways and means to accelerate the availability and affordability of the Internet in the developing world; • Strengthen and enhance the engagement of stakeholders in existing and/or future Internet governance mechanisms, particularly those from developing countries; • Identify emerging issues, bring them to the attention of the relevant bodies and the general public, and, where appropriate, make recommendations; • Contribute to capacity building for Internet governance in developing countries, drawing fully on local sources of knowledge and expertise; • Promote and assess, on an ongoing basis, the embodiment of WSIS principles in Internet governance processes; • Discuss, inter alia, issues relating to critical Internet resources; • Help to find solutions to the issues arising from the use and misuse of the Internet, of particular concern to everyday users; • Publish its proceeding *(Sourced IGF Website January 2022)*

Role of the Multistakeholder Advisory Group (MAG)

The Secretary-General of the United Nations established the Advisory Group (now referred to as the Multistakeholder Advisory Group - MAG). The purpose of MAG is to advise the Secretary-General on the program and schedule of the Internet Governance Forum meetings. The MAG is comprised of 55 Members from governments, the private sector and civil society, including representatives from the academic and technical communities. In addition, representatives of

former IGF host countries, as well as representatives of intergovernmental organizations, are invited to attend and contribute to the meetings and work of the MAG. The MAG holds face-to-face meetings, preceded by open consultations, up to three times a year.

The idea of establishing a Dynamic Coalitions Coordination Group (DCCG) emerged at the 10th IGF in João Pessoa, Brazil, during the first-ever main session dedicated to Dynamic Coalitions (DCs). The idea found broad support among members of the different coalitions, many of whom were exchanging views and good and best practices for the first time. The main task of the proposed Group would be, on one hand, to develop a framework for all DC with some common principles and recommended rules of procedure, and on the other hand, to act as a convener of coalitions in order to further the open and constructive discussions that took place in Brazil. The Group would work on obtaining organizational support in those areas where the Dynamic Coalitions may require support, look at areas of overlap and duplication and aim to create synergies among DCs. It was suggested that it also serve as a liaison to both the IGF Secretariat and the MAG. *(Sourced IGF Website January 2022)*

4. The Dynamic Coalition on Data Driven Health Technologies, Within the UN IGF Framework

The Dynamic Coalition on Data Drive Health Technologies, DC DDHT, is a recognized member of the Dynamic Coalitions of the Internet Governance Forum IGF and as such, is a member of DCCG. DDHT also seeks to work collaboratively with the working groups of the United Nations International Telecommunications Union, the World Summit on the Information Society activities, as well as with other international, regional and national initiatives such as EuroDIG, Internet Society, ICANN and others. Members of the Dynamic Coalition also hold positions within these other entities.

The founding mandate of the DC DDHT has been as follows: The DC will discuss the issues and make recommendations to improve data quality and access to data, for building or remediating technologies and services to the global public, in keeping with the United Nations Sustainable Development Goal # 3: Ensure healthy lives and promote well-being for all at all ages. This will involve supporting technologies for the eradication of diseases; easing of blindness or hearing; enhancing nutrition; support of new developments for surgery; tele-medicine; public health education; public health management and so forth.

DC activities will include providing guidance and interpretations, risk management, advocacy and making recommendations for data standards, best practices and providing input in to other related and associated policies and legislation. DC Scope: Global, all health, associated industries, services, fields (such privacy, safety etc.) in the private, non-profit and public sectors. There are no exclusions of associated or cross-cutting policy or methodologies and it strives to be fully inclusive and diverse in approach to all matters, ensuring a multi-stakeholder approach.

5. Intersessional Work

2023 was a very active year of innovative discussion with the well attended public engagement events that the DC hosted and which helped source the content for the Dynamic Coalitions members paper on Robotics and the Medical Internet of Things. The DC also hosts online member only calls monthly which typically have a defined section with an open agenda for member discussions and sharing of information and ideas. The topic of robotics is in the rapidly developing and emerging space of internet technology and evolves daily. Hence members had the opportunity to learn, collaborate and influence on the emerging issues in this space in a very active manner, focused on current developments and visions for the future.

Joint DC paper on Robotics and the Medical Internet of Things

This paper brings together inputs from the DC DDHT sessions at a variety of venues. Speakers, session participants and DC members all provided content for this paper that was written for publication for the DC by Dr Joao Rochas Gomes. The date of publication is due in 2024.

The main themes that emerged were:

1. Internet connection with robots
2. Remote locations internet access for data updates
3. Recognition that some robots can work without the internet
4. Accessibility for peoples challenged with disabilities
5. Ease of human to robot interaction / getting used to the robot
6. Versatility of robot use for crisis situations
7. Privacy and data gathering issues with robots
8. Security
9. Issues with embedded ChatGPT
10. Cost for the individual in the home (care and cleaning robots)
11. Need to ensure Green eHealth / protection of the environment
12. Sustainability and maintenance

2023 Book: Health Matters, Technologies Driving Change in Healthcare, A Community of Thought. Part 3.

The book's chapters were written by members of the Dynamic Coalition over the course of 2023. The complete chapters are available for download, at no charge, from the United Nations Internet Governance Forum, Dynamic Coalition on Data Driven Health Technologies webpage at: [Dynamic Coalition on Data Driven Health Technologies (DC-DDHT) | Internet Governance Forum (intgovforum.org)]

In 2023, the new written contributions for the DC book were as follows:

- Yao Amevi Amessinou Sossou, *Benin's National eHealth Strategy: An Overview of Best Practices and Challenges*
- João Rocha Gomes, *The Role of Technology in Reinventing Medical Practice*
- Yao Amevi Amessinou Sossou, *The Future of Healthcare is Sustainable: How e-Health, Robotics, and MIoT can help tackle the Climate Crisis*
- Yao Amevi Amessinou Sossou, *Design Principles for E-health and Medical Internet of Things (MIoT)*
- Frédéric Cohen, *Water for well-being: learning and practice*

6. Collaboration with the International Telecommunications Union ITU

The DC continues to participate actively with the public working groups of the ITU. The DC submitted view points for the new ITU standards on Artificial Intelligence for healthcare. These standards are particularly important as robots are being actively rolled out for use in healthcare environments at increasing speed.

Some robots are actively connected to the internet while others are more autonomous. There is a need for on-going monitoring of the successes and risks of using robots in the healthcare and wellbeing spaces. The use of embedded ChatGPT will increase the challenges of monitoring and establishment of excellence in data quality. Down and upstream data sharing should be rigorously scrutinized as there is zero tolerance for failure of healthcare applications.

DC DDHT also hosted a session at World Summit on the Information Society WSIS 2023. Session 257 was on Robotics & The Medical Internet of Things (MIoT). The session was moderated jontly, by Dr Galia Kondova (Bulgaria) onsite and by Amali De Silva-Mitchell (UK & Sri Lanka) virtually. Key coalition members participating were Frederic Cohen (France), June Parris (Barbados), Dr Joao Rocha Gomes (Portugal) and Yao Amevi Amessinou Sossou (Benin). The session was extremely well attended both onsite and virtually. The sesssion encouraged the participants to contribute responses to four questions.

1. What robot applications in healthcare are you aware of?
2. What does Robotics and the Medical Internet of things mean to you?
3. What does Robotics and the Medical Internet of things mean to you?
4. What are the risks associated with robotics in MIoT?

This provided the DC with an understanding of how informed the participants were regarding the topic of robots in healthcare and highlighted which issues should be discussed further through out 2023. There was interest in remote access to the internet for healthcare applications, from African participants and we developed this area of discussion further during sessions that followed in 2023.

Please refer to Appendix 1 for the detailed outcomes report of this session.

The DC also continues to support the work of International Telecommunications Union ITUs Partner2Connect community.

7. Collaboration with EuroDiG in 2023

DC DDHT organized a pre-event at the EuroDig 2023 conference by virtual and online participation. The session continued with the DC theme of the year for robotics but also discussed dedicated access to the internet for times of crisis. Robots are also pitched to support disaster relief servies for the future. The session description was as follows:

“Robotics in health technology can be used in multiple ways to assist with patient care, surgery, research, hospital maintenance, reaching difficult or isolated areas and so forth. Robots are rapidly becoming the resilient partner for the health sector, that can work tirelessly and reliably 24/7.

What is the optimal ecosystem to accelerate the space of data driven health technologies? Are there better ways to build back stronger and faster? What should we pursue and what should we shed, from the experience of using telemedicine during the Covid pandemic? How should we prepare ourselves for the use of robots in our midst?

The session will explore the following questions:

How can robotics model life, emulate persons and processes so as to enhance and further develop health technologies?

Can robots right the imbalance of access to medical services, information and research? How can new technologies such as AI and robotics, with the internet, support equalization and collaboration between communities and people, and assist in crisis situations such as flood and other natural disasters?

The citizen is vulnerable using the medical internet of things (MIoT), wellness devices, robotics and transacting for health. How can the internet be secured for a quality medical internet of things? Should there be a dedicated, secured, fast speed quality internet for the MIoT?”

The session was moderated by Amali De Silva-Mitchell (virtual) and Dr Joao Rochas Gomes (onsite).

The link to this very interesting session is found at: Dynamic Coalition (IGF) on Data Driven Health Technologies – Building an onboarding toolkit together – Pre 02 2023- EuroDIG Wiki.

We had the pleasure of guest speaker interventions from Muhammad Shabbir Awan IGF DCAD Dynamic Coalition on Accessibility and Disability and Richardo Holmquist Chair of Euralo Individuals Association and member of ICANN EURALO.

Dr Muhammad Shabbir Awan highlighted the issues facing the disability community with respect to assessibility and robots which are similar to the current issues with access and the need for more operational work in this area for meaningful access. Mr Riccardo Holmquist shared with us, at the DCs instigation for a viewpoint, that it would be possible to create a dedicated emergenecy internet access path for ehealth on the internet. This dedicated access would take precedence during times of crisis such as fire, flood, earthquake etc. The need for these dedicated access routes were highlighted during the devasting climate change induced

catoostorphies in 2023 of eathquakes, flood, and fire. Member Yao Amevi Amessinou Sossou also contributed to the discussion by providing a summary of the DCs work and noting the place of Green Health, a theme that DC DDHT has championed for some years. Green eHealth is where the use of internet technologies are used to sustain the environment and reduce waste.

8. DC Session at IGF Kyoto, Japan Meetings 2023, Public Engagement Events

This was very dynamic event that was well attended in person within the room and online. The converstation was brisk and fresh, with new ideas. Delay Tolerrant Networks DTN were provided as an emerging technology for remote locations. It was interesting to note that critical child health care could facilitatied by the ability to transmit the name and date of birth of a child with critical needs so as to speed up hospital registration, for a patient being airlifted for access to healthcare.

The session was moderated by Amali De Silva-Mitchell (virtually) and Dr Amado Espinosa (onsite). The guest speakers were: Oscar Garcia (Argentina); Dr Samo Grasic (Sweden); Jutta Croll (Germany; Judith Hellerstein (United States of America) and Prof. Dr R.P Gupta (India). DC member interventions were from Dr Houda Chihi (Tunisia); Jorn Erbguth (Germany); Dr Joao Rochas Gomes (Portugal); Yao Amevi Amessinou Sossou (Benin); Frederic Cohen (France).

Please refer to Appendix 2 for the detailed report for this session. A recording of this exciting session is also available at the Internet Governance Forum.

9. Issues recommended for further discussion as an outcome of the 2023 DDHT sessions

These topic areas would benefit from further discussions for policy making.

1. Robotics and it's impact on our daily lives
2. How will the identify of robots be placed in society ?
3. Who is responsible for a robots behaviour ?
4. Robotics and security and privacy
5. Accessibility issues when interacting with robots
6. The use of robots to support emergencies and disaster relief
7. Bring the costs of robots down for public use such as for elder care
8. Knowledge sharing on robot build
9. Quality robots; "trust" logos on devices
10. Robot auditerbility, algorithm trust, data trust

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10.Vision for 2024 Work and Beyond

The focus area for discussion is expected to be as follows:

- 2024: Virtual and Augmented Reality with a focus for healthcare and telemedicine
- 2024: Urban Climate of the Medical Internet of Things (MioT)
- Developing a new DC member mentorship program. We already commenced work in 2023 with the Privacy and Security Policy Track lead by Jorn Erbguth. We expect to develop this with regional focus areas. The commitment of the mentor is define according to the time commitment that they are willing to share.
- Developing the DCs work with IGF Africa meetings.
- Development of an intersessional fire-side chat series by DC members with the larger IGF community
- Collaborate and participate for the United Nations Summit of the Future 2024.
- 2025/6: Financing, ehealth finance, supply chain and other business and legal related aspects of MioT
- 2025/6 Impact of Climate change on health and how ehealth can be supportive for prevention and betterment of peoples health issues.

However, all topics regarding healthcare and technology, are always open for discussion and development throughout the year.

The DC will also continue to collaborate with the ITU, EuroDIG and other Dynamic Coalitions, Best Practices Forums and so forth of the IGF.

11. Administrative Matters Update

Our DC membership is growing with a diverse membership of multi-stakeholder participants from around the world. The depth and breadth of conversation has been very informative, refreshing, collaborative and educational. We believe that our DC's work, now commencing it's fifth year, is well established within the UN IGF family.

As always, the DC is open to and welcomes membership from the global public, through participation on the DC email list. We continue to run an active email list as the primary mode of communication with members. We also host a monthly virtual call open to DC members only.

Appendix 1

2023 WSIS Session Outcome Document
Summary of 2023 WSIS Session 257: **Robotics & The Medical Internet of Things (MIoT)**

A public engagement was held on Monday March 13, 2023 by virtual and onsite participation at ITU. It was hosted by the Internet Governance Forum, **Dynamic Coalition on Data Driven Health Technologies**.

The session was moderated jontly, by Dr Galia Kondova (Bulgaria) onsite and by Amali De Silva-Mitchell (UK & Sri Lanka) virtually. Key coalition members participating were Frederic Cohen (France), June Parris (Barbados), Dr Joao Rocha Gomes (Portugal) and Yao Amevi Amessinou Sossou (Benin). The sesssion encouraged the participants to contribute responses to four questions. This was followed by a deep dive into some of the issues highlighted within the responses.

Key Issues discussed *(public participant reponses follow)*

1. **What robot applications in healthcare are you aware of?**
    i. First care
    ii. Medicine administration
    iii. Psycological treatment
    iv. Emotional support robots
    v. Physical Rehabilitation
    vi. Smart room hospitals
    vii. Surgery
    viii. GP booking
2. **What does Robotics and the Medical Internet of things mean to you?**
    i. It's means easier connection with patients
    ii. The conexion between the generarted data for medical devices, eg. Glucouse in blood and the interaction with other divices
    iii. Free hospital staff from standardized, repetitive tasks
    iv. It means that you can use robots to undertake some procedures in the medical cycle
    v. Connected medical devices
    vi. Detecting health issue from various parts of the body using various sensrors
    vii. Home-based healthcare, healthcare services delivery cost saving
    viii. Remote care
    ix. Integration of different devices
    x. Monitoring and data collection
    xi. faster delivery of medical services
    xii. Interoperability
3. **What are the benefits associated with Robotics in MIoT?**
    i. Widespread care of patients, more attention, lower costs
    ii. They improve effieceny and cut down on costs of wages since robots can replace humans
    iii. Timely interventions
    iv. Improve the doctor patient relationship
    v. Easier access to patients and real time data processing
    vi. 24 hour service delivery
    vii. More robots less people

viii. The AI benefit in machine learning and anslysis.
ix. Increased accessibility
x. Efficiency improvements, costs reduction, designed to give attention to the environment
xi. The benefit is the treatment of citizens in difficult areas (where there are not medical institutions) through the remote guidance of robotics & citizens by internet.
xii. Increased precision
xiii. Medical error reduction

4. What are the risks associated with robotics in MIoT?

i. Cybersecurity threats and attacks, safety
ii. Hacking data, cyber-attacks on robotics & e-data
iii. Data protection and security
iv. The rebelion of the machines
v. Liability
vi. In accurate tests some times don't get the actual disease and human intervention is needed!
vii. Privacy issue encase data will not be used as intended
viii. Privacy issues, data leak
ix. Machine programming bias
Digital insecurity manufacturing/developing
Reduced empathy with the parient
x. Poor trainning to the doctor and patients on how to use this sort of technology
xi. Ethical, social, and regulatory challenges, eg. technological or digital divide, inequality and disruption, Misuse of data and information, concerns regarding autonomy (elderly)
xii. De-humanized healthcare
xiii. Increased costs for similar results
xiv. Human interaction is always better than robotics
xv. Human agency

Towards WSIS+20 and WSIS beyond 2025, please share your views on the emerging trends, challenges, achievements, and opportunities in the implementation of the WSIS Action Lines to date (5-8 bullets)

A. New technological innovatios must be embranced to acheive success for the UN SDGs and the WSIS Action Lines with care for human agency and the environment.
B. The need for public education, to ease acceptance and security of new technologies, is time sensitive.
C. Knowledge sharing to the the rural, marginalized and culturally specific level is critical.
D. Collaboration of technologically advanced countries, with developing countries, for capacity building is essential, to leave no one behind and attain meaniful accessibilty to technologies for All.
E. It is important to integrate diversity for inclusion of all abilities of all peoples.

Tangible outcomes

DC DDHT is developing a paper on the topic of robots within the healthcare ecosystem and the medical internet of things. This WSIS engagement will support the public inputs to this paper. The paper will explore the following topics:

1. Opportunities and benefits
2. Gaps and reommended solutions
3. Emerging isses
4. Risks and harms of the technology.

This paper is expected to be presented at the IGF 2023 Annual Meetings in Japan.

Actionable plan

1. DC DDHT will host public engagement events to build content for the DC paper.
2. The DC will assess the public sentiment for robots in the public space.
3. Recommendations on the use of robotics will be developed.

Suggestions for thematic aspects that might be included in the WSIS Forum 2024

1. Deep dive into the use of robotics for attainment of the United Nations SDGs & WSIS Action Lines.
2. Robots can be autonomous or connected to the internet, what are the difference use case scenarios?
3. What skills, ethics and public information training, is required for public engagement with robots?
4. What are the risks, harms, opportunities and benefits of using robots in the public space?

Reported by Amali De Silva-Mitchell and Dr Galia Kondova, March 18, 2023.

Appendix 2

IGF 2023 Dynamic Coalition on Data Driven Health Technologies (DC DDHT)

IGF Kyoto 2023 Session Report on Robotics and the Medical Internet of Things

October 9, 2023

Reported by Amali De Silva-Mitchell (Coordinator DC DDHT) and Dr Joao Rochas Gomes

Onsite moderators: Dr Amado Espinosa (Mexico) and Judith Hellerstein (US). Online Moderators Amali De Silva-Mitchell (UK/Sri Lanka) and Dr Joao Rochas Gomes (Portugal).

Oscar Garcia (Argentina)

Outlined the need to have good standardized medical records systems set up, for meaningful, systematic data exchanges. Robots and AI need well organized data records to function optimally. He emphasized that the communications regarding record's content can be facilitated to remote areas such as the moon with Delay Tolerant Networks DTN. This technology can be developed for rural and remote parts of the planet at a fraction of the cost of the set-up of satellites, which will speed the development of e-health faster.

Dr Samo Grasic (Sweden)

Showcased the technology behind DTN. DTN works by storing data at an intermediate point for data transmission. His work with tagging roaming reindeer in northern Sweden has been effective using this technology in remote locations of the arctic. This highlighted that there are solutions that can be further developed to bring peoples living in very remote areas access to ehealth and emergency health care support far sooner than could be expected. These solutions will help with critical, disaster and emergency relief and help bring the goal of the United Nations Sustainable Development Goal number 3, Health and Wellness for All within operational range.

Jutta Croll (Germany)

Called for a basic set of child / person identifying records to be made essential for any healthcare system. These essential data points could be transmitted by DTN for example, from remote areas, soon after the birth of a child. Without identification, registration and acknowledgment of child / person, access to healthcare may be limited, delayed or denied. She highlighted that children have a right to the same healthcare and safeguards as do adults. She also spoke of the issues of fluffy teddy bear toys set up as health monitoring devices for sick children and the issues for data privacy, transparency and ethics in this regard.

Judith Hellerstein (United States of America)

Noted that disabled persons interacting with robots will be dis-advantaged, due to the lack of human facial expressions and other human characteristics commonly used in the communication with disabled persons. Facial expressions are critical for lip reading and hand gestures for sign language. Hence it will be essential to have text displays for adults and the robot needs to conduct sign language. There is tremendous opportunity for robotic devices to be developed to assist with accessibility. Current accessibility tools such as speech to text and vice versa must be integrated into robots.

Prof. Dr R.P Gupta (India)

Spoke of the imminent presence of robots in the healthcare space. Robots are currently available for cleaning, delivery of food (which became prevalent in many countries during the Covid pandemic). Robots are conducting surgeries and are also conducting surgeries at a distance, with doctor controlled surgical arms. Countries such as Japan have developed technologies to assist the elderly, including exo-skeletons to assist with mobility. These are devices that are autonomous but can be increasingly managed via internet controls.

Dr Houda Chihi (Tunisia)

Spoke of the numerous security issues that must be overcome to secure communication between robots and the humans. These protections are essential for the expected function of robots and for the outcomes. The security design process for robot function in the environment at large must be well thought out and stress tested. Updates with security patches to software are critical, to maintain protections.

Jorn Erbguth (Germany)

Highlighted the issues for privacy surrounding the use of robots. The robot is data gathering through a number of sensors such as sound, touch, visuals and so forth. The granularity of data gathering is higher than that of an ordinary human and continuous. Who has access to this data? How far does the data go out of the control of the patient or medical facility? What happens to the data if the patient passes away? Health care data is highly sensitive, do all jurisdictions have the same policies and legal frameworks when it comes to data sharing, storage, deletion, update or monitoring?

Dr Joao Rochas Gomes (Portugal)

Presented a summary of the points from the DC paper on Robotics and eHealth which is due to tbe published in 2024.

Yao Amevi Amessinou Sossou (Benin) and Frederic Cohen (France) made interventions from the perspective of the DC.

The authors for the 2023 edition of the Dynamic Coalition on Data Driven Health Technologies book “Health Matters, Technologies Driving Change in Healthcare, A Community of Thought” were: Frederic Cohen, Dr Joao Gomes and Yao Amevi Amessinou Soussou. The book is found at: https://intgovforum.org/en/content/dynamic-coalition-on-data-driven-health-technologies-dc-ddht

Highlights from the articles: Emphasis on international collaboration for research and development, noting the rapidly changing landscape for medical technologies and the need for designing “Greening” into health technologies.

New 2023 articles written by members of the dynamic coalition and published within the virtual book of the dynamic coalition on data driven health technologies "Health matters, technologies driving change in ehealth care, a community of thought" 2023 edition. Please refer to the website for the formatted version at: Dynamic Coalition on Data Driven Health Technologies (DC-DDHT) | Internet Governance Forum (intgovforum.org)

The text of the articles are published here:

Status of eHealth in Benin republic Yao Amevi Amessinou Sossou, March 2023

Executive Summary The Benin Republic's National eHealth Strategy intends to improve the country's healthcare sector by leveraging information and communication technology (ICT). Establishing an eHealth infrastructure, boosting human resources for health, expanding access to healthcare services, improving healthcare quality and patient safety, and developing a legal and regulatory framework are all part of the approach. Best practices in the Benin Republic's eHealth strategy include strong government commitment, a favorable institutional and legislative framework, and the development of a national eHealth master plan. However, the strategy's implementation confronts various challenges, including a lack of money, insufficient technical human resources, delays in legal and regulatory elements, poor user confidence, and limited access to health structures. Despite these obstacles, Benin has a good institutional environment, a solid legislative framework, and a qualified human resource pool to drive the approach. The country has a national telemedicine development strategy in place, and both the government and the corporate sector are dedicated to it. The government has also formed an independent team to gather and analyze impact indicators to track the strategy's execution. Lessons learnt from earlier projects and initiatives are being applied to the eHealth strategy's execution. Background Benin is a country in Western Africa. It has about 13 million people and is noted for its rich cultural legacy, diversified animals, and gorgeous scenery. "With a population of 12.12 million in 2020, Benin's population is expected to surpass 30 million in 2030 and reach 46.83 million by 2099, more than tripling its current population." The country is classified as a low-income country by the World Bank, with a gross national income (GNI) per capita of $1,200 in 2020. The country's economy is mostly centred on agriculture, which employs more than 70% of the people, and it is a major producer of cotton and palm oil. However, Benin confronts enormous economic issues, including high levels of poverty, unemployment, and insufficient infrastructure. Benin's healthcare system has major obstacles, including limited access to healthcare services, poor facilities and equipment, and a labour deficit. According to the World Bank, Benin had only 0.4 physicians and 1.1 nurses and midwives per 1,000 people in 2020, which was significantly lower than the global average. Furthermore, communicable diseases like malaria, HIV/AIDS, and tuberculosis are common, as are noncommunicable diseases like hypertension and diabetes. According to the United Nations Development Programme, while the government of Benin has made efforts to improve the healthcare system, such as increasing funding for health services and expanding health insurance coverage, progress has been gradual due to insufficient resources and capacity (UNDP). To effectively address the issue of access to health care, the Benin government adopted a national eHealth policy that will be executed from 2018 to 2022. The primary goal was to improve the delivery of healthcare services through the use of digital technologies. What is the status in Benin in terms of digital healthcare services? Can we provide an overview of the current

position in Benin about eHealth by outlining the situational setting that gave birth to the national eHealth plan in a chronologically acceptable manner? We would also like to describe what that plan entails and how it is supposed to be applied. What are the best practises that should be promoted? Situational context E-health has been used in Benin for a number of years, mostly through private projects supported by nongovernmental organisations, international organisations, or bilateral cooperation. However, the Ministry of Health has minimal engagement in these programmes, and the majority of them fade away as financing runs out, with little assessment of their influence on the health system. To institutionalise the use of digital health, the Ministry of Health has tasked the Department of Information Technology and Pre-archiving with developing a national e-health plan, while the National Directorate of Hospitals is in charge of telemedicine. Two strategic documents on the use of ICT in health have been created. In terms of health structure connection, a 2015 review indicated a lack of a nationwide and uniform network for the Ministry of Health, with some structures having access provider subscriptions. The central administration has 17 internet connections, and buildings are linked by local fibre optic or copper networks. There is no such thing as a conventional DATACENTER. Some structures are linked by WAN, and ideas for a national VPN network have been made; nonetheless, finance and execution remain challenges. Health care facilities are rarely connected to the Internet at the primary level. For numerous years, the Ministry of Health has used WHO-defined eHealth services. Traditional services such as Health Information Systems, National Health Information and Management System (SNIGS), which covers the entire country for electronic, semi-electronic, and manual transmission of health data centralised at the Directorate of Programming and Forecasting level, Prospective, and software such as DHIS2 and LOGIHOSP, which are used for data entry at the health facility level, are among those offered. The Ministry of Health also employs automated administrative, financial, and medical management systems such as Perfecto, LOGI-GRH, ITODJOU, PITA, SHA2, SIGFIP, and SIRGIP-ARP. The France-funded telemedicine project began in 2009 with the connecting of ten health structures via a VSAT network with a central node at the Ministry. Despite financial challenges, the St. John of God Hospital in Tanguieta employs telemedicine in medical imaging, cardiology, and anatomical pathology. In August 2016, the Indian government started another telemedicine project in collaboration with the African Union, covering 53 African Union countries using VSAT lines and undersea cables. TCIL manages the project, which includes tele-education, telemedicine, and VVIP connectivity for diplomatic communication. Several cell phone-based projects have evolved in the country to combat maternal and newborn mortality. A call for life (CARE-BENIN-TOGO), the COMCARE project, drug stock management on the Android platform, and the national mobile message alert system are among them (SYNAM developed by ABSU-CEP). There are also various web and social network platforms in the country that deal with public health issues. In Benin, the legislative framework for e-health is being developed, with certain legislation currently in existence and others awaiting finalization. One crucial statute is the law on the use and protection of health data, which is currently being written. The recently passed digital code law addresses a variety of e-health issues, including personal data protection, digital trust and signature, cybersecurity, cybercrime, and sanctions for offences. Other extant legislation includes the Personal Data Protection Act, the Code of Ethics and Deontology for Health Research, and the Electronic Communications and Post Office Act. These rules create a framework for the protection of personal data in communication networks and computerized data processing, and the National Commission for Information Technology and Civil Liberties oversees ensuring that they are followed. There are now no defined provisions for the practice of medical acts via e-health, which is required to determine the roles of physicians, transmission network operators, and terminal equipment providers. Benin National

eHealth Strategy There are eHealth initiatives in Benin aimed at improving the delivery of healthcare services through the use of digital technologies. These initiatives are still in the early stages, but they hold promise for improving access to healthcare services, particularly in remote areas of the country. On June 22, 2016, the Council of Ministers approved the creation and implementation of Benin's national cybersecurity strategy (Release n^10/PR/SGG/CM/OJ/ORD). This strategy falls under pillar 1, axis 2 of the government's action program (PAG) 2016-2025, which aims to "improve governance" through component 1, "energizing and modernizing the administration" (smart Gouv). Additionally, it aligns with pillar 2, axis 6 that focuses on "strengthening basic social services and social protection" through component 2, which involves "reorganizing the health system for a more efficient healthcare system." Adopted in November 2017, the national eHealth strategy aimed at using information and communication technologies (ICT) to improve healthcare services. The strategy includes several components, including the development of a national health information system, the use of telemedicine to improve access to specialist care, and the development of eLearning programs to support the training of healthcare workers. The creation of a national health information system (NHIS) aimed at increasing data collection and analysis is a significant component of the national eHealth plan. The NHIS is meant to give a complete assessment of the population's health status as well as to aid policymakers and healthcare practitioners in making decisions. The system comprises electronic medical records, disease surveillance systems, and data collection and analysis tools. Overall, the goal is to provide better healthcare to all residents by 2022 by removing barriers to quality, equity, equality, accessibility, availability, and speed through the use of e-health. The use of ICTs will increase care quality and accessibility, as well as make health-care management more efficient. The strategy's backbone is comprised of seven strategic objectives, which include enhancing illness prevention and control, encouraging improved health education in communities, and strengthening health system management and administration. Between 2018 and 2022, an action plan has been prepared to achieve these goals in areas such as ICT infrastructure, services, applications, standards, and interoperability, legislation, health professional capacity building, and governance. Between 2018-2022, an action plan was developed to structure a strategy with 3 main programs and 9 components, divided into 26 projects. The programs are infrastructure, applications and services, and an environment conducive to the development of e-health. The projects cover areas such as the connectivity of health structures, a national digital health network, telemedicine, and capacity building for health professionals. The estimated cost of implementing the plan is $14 million and the majority of the infrastructure will be financed by the MENC as part of the SMART-GOUV program. The maximum amount of funds are programmed for 2019 due to the rollout of the ICT National Digital Health Network Health (RNNS) planned for 2018. In addition to the national eHealth strategy, there are also several other eHealth initiatives in Benin, including the use of mobile health (mHealth) technologies to improve access to healthcare services in remote areas. For example, the government has implemented a pilot program using mobile phones to provide healthcare workers with access to clinical guidelines, as well as to enable patients to receive reminders for appointments and medication. Implementation of the Benin National eHealth Strategy Successful implementation of projects involving multiple parties requires thorough planning and coordination. To avoid excessive centralization and reduce operating costs, the following structures were adopted: a) Coordinating Committee: Responsible for coordinating all implementation activities, this committee should meet quarterly and at least twice a year to validate budgets and evaluate achievements. b) Permanent Technical Secretariat: Coordination should be carried out by the DIP of the Ministry of Health. c) Implementing Structures: To involve the structures benefiting from the services, these

structures should be involved in the implementation of the projects. d) Technical Advisory Groups: The Coordinating Committee may create working groups on specific issues and themes within the framework of project implementation. Administrative and financial management will be defined in a procedure manual based on funding sources. Challenges and opportunities Are the saying goes, “where there is a lack there is a need”. And when there is a need this represent and opportunity to innovate to tackle issue and growth at the same moment. In term of challenges regarding the implementation of the national eHealth strategy in Benin we can note the fact that: • The country faces a low rate of ICT usage, hindering access to e-health services due to the high cost of connectivity. • There is instability and low coverage of electrical energy, especially in rural areas, which makes it difficult to progress in telemedicine, computerization of hospital structures, and mobile health. • The incomplete codification of medical and pathological acts, particularly in e-health, is also a challenge that needs to be addressed. • There is a significant deficit of human resources working in the public sector, which is hindering the implementation process. • The connectivity of health structures in ICT infrastructures is weak and precarious, and there is a delay in implementing the ICT master plan. • Additionally, there are insufficient internal skills for ICT infrastructure maintenance. Best practices overview The Benin Republic's National eHealth Strategy intends to improve the country's health system by leveraging information and communication technology (ICT). The following major components are included in the strategy: • Establishing an eHealth infrastructure: The strategy intends to create an eHealth infrastructure that will allow for the efficient collection, storage, and sharing of health data. This infrastructure will include a national health information system, electronic health records, and telemedicine. • Strengthening human resources for health: The strategy intends to strengthen the capabilities of health workers in the use of ICT to better healthcare delivery. This will be accomplished through the implementation of training programmes and the creation of eLearning platforms. • Improving access to healthcare services: Through the deployment of telemedicine systems, the policy aims to improve access to healthcare services, particularly in remote and disadvantaged areas. • Enhancing healthcare quality and patient safety: The strategy's goal is to employ ICT to improve healthcare quality and patient safety. This will be accomplished by implementing electronic prescribing and medication management systems. • Establishing a legal and regulatory framework: The strategy's goal is to create a legal and regulatory environment that would make it easier to adopt eHealth solutions. This will include the creation of data protection and privacy legislation. The following are some of the best practises that may be gleaned from the Benin Republic's eHealth strategy: • Strong government commitment: The plan has significant government support, which is critical for its success. • Favourable institutional and legal environment: The Benin Republic has an advantageous institutional and legislative environment that will facilitate the introduction of eHealth solutions. • National eHealth master plan: The creation of an eHealth master plan that addresses the country's unique needs and difficulties is a best practise that other countries can emulate. • Engaging health professionals and the private sector: Engaging health professionals and the private sector is part of the strategy to ensure their active participation and contribution to the process. In term of sustainability, transparency and accountability, the national strategy has enabled a monitoring and evaluation system that can ensure that the implementation of projects and their impact on the health system including achievement indicators in stages throughout the implementation phase, analyzed by implementing structures, and reported to the Coordinating Committee. Impact indicators are being developed to measure the rate of use of project services by health professionals and users of the health system. An independent team was meant collect and analyze these indicators under the guidance of the Coordinating Committee. The

Steering Committee is then in charge of analyzing the indicators and decide on actions to remedy any discrepancies or gaps. Impact indicators on the health system are planned to be measured through surveys of the population and health professionals. Conclusion In Benin, there is a favorable international environment and a favorable technological evolution that support the implementation of e-health. The World Health Organization (WHO) and the International Telecommunication Union (ITU) are committed to the process. The government, especially both the Ministry of Digital Economy and its operators, and the Ministry of Health, show strong commitment to the process. Health professionals and the population are receptive to the use of Information and Communication Technologies (ICTs). Online training is available to address the HR gap and the problem of medical deserts. Implementation of the strategy faces several risks that, if not assessed and addressed to minimize their impact on project implementation. The main risks identified at the early stage are lack of funding, weak technical human resources to support the process, low involvement of professionals in the implementation, delays in legal and regulatory aspects, lack of involvement of decision-makers, lack of ICT infrastructure (especially in some rural areas), problems with electrical energy, and sustainability of ehealth services provided. There is a noticeable lack of coordination of the implementation of the strategy by the actors involved. Additionally, there is a lack of a Computer Emergency Response Team (CERT) to address any cybersecurity issues. Funding is weak and uncertain, which could limit the progress of the project. There is a lack of user confidence in the new system, and low accessibility of populations to health structures is another major challenge that needs to be addressed. Nonetheless, as evidenced by the government's strong dedication to the cause, Benin is a country committed to using e-health to improve its health system. Furthermore, the country has a national telemedicine development strategy in place and is working to create a unique national identification for each individual. The lessons learned from numerous projects, programmes, and initiatives are being used to improve the e-health strategy's implementation. The country has a favourable institutional environment as well as a strong legislative framework, including a digital code. On the plus side, the government has qualified human resources to guide the strategy, and the private sector is vibrant, with isolated good efforts in the private health sector. Finally, the country enjoys political stability, and ICT operators are eager to participate.

BIBLIOGRAPHIC REFERENCES • Law N 2009-09 of 22 May 2009 on the protection of personal data in Benin • Digital Code: Law 2017-20 of June 13, 2017 in Benin • ICT Sector Policy Statement of October 2016 • Law N 2014-14 of July 9, 2014 on electronic communications and the Post Office in Benin • Decree No. 2008_780 of December 31, 2008 approving the Telecommunications and Strategy Document of the Telecommunications, ICT and Post sector • Decree No. 426 of July 20, 2016 on the powers, organization and operation of the • Benin national strategy for eHealth: https://www.gouv.bj/actualite/709/strategie-nationalesecurite-numerique-gouvernement-outille-premiers-acteurs-avant-phase-mise-oeuvre/ • Strategic Plan for the Development of Telemedicine 2013 - 2018 in Benin • World Health Organization. (2018). eHealth in Benin: An overview of policy, strategy, and implementation. Retrieved from https://www.who.int/goe/policies/countries/benin.pdf • United Nations Development Programme. (2020). Human Development Reports - Benin. Retrieved from http://hdr.undp.org/en/countries/profiles/BEN • https://www.gouv.bj/actualite/709/strategie-nationale-securite-numerique-gouvernementoutille-premiers-acteurs-avant-phase-mise-oeuvre/ • ARCEP, Annuaire statistique 2016, http://arcep.bj/statistiques/ • www.speedtest.net • www.itu.int • www.sante.gouv.bj • www.who.int • www.absucep.bj • www.cnilbenin.bj • www.arcep.bj • www.agetic.bj • www.worldbank.org

The Role of Technology in Reinventing Medical Practice MD | Dr. João Rocha Gomes1,2 1MEDCIDS, Faculty of Medicine, University of Porto – Porto, Portugal 2Ada Health GmbH – Berlin, Germany

Technology has had a significant impact on the healthcare industry, and it is now an integral part of the regular medical practice. One of the most promising opportunities presented by these technological advancements is the potential to empower patients and help them positively impact their health status and that of their communities. We must recognize that these technologies are not just gimmicks or inevitable forces, but tools to improve patient outcomes and ultimately benefit the patients themselves. To achieve this goal, we must have a clear long-term vision of the benefits we want to bring to patients. This includes improved treatment outcomes, faster diagnosis, easier monitoring, and patient education. Patients must engage in self-monitoring as it promotes a sense of responsibility and empowerment, leading to better adherence to treatment1 and improved understanding of their conditions2 . Biometric sensors and wearables are examples of technologies that facilitate self-monitoring and aid in the patient's overall care plan3 . However, we must also consider the societal and economic impacts of these technologies. Although healthcare costs can potentially be reduced by governments or citizens, data on healthcare expenditure does not necessarily support this claim. In fact, the introduction of technology and incremental improvements in diagnostic or treatment methods have been significant drivers of increasing health expenditure in recent years4 . Nonetheless, these costs may be due to the novel nature of these technologies and, as we continue to study their highest efficiency applications, we may see reduced costs over time5 . In spite of the potential benefits, there are several barriers to the adoption of these technologies. Factors such as distance, literacy, and reliability of these technologies must be considered6 . However, we must strive to close these gaps and reinvent traditional medical practices. Interoperability is essential7 , and all stakeholders, from patients to governments, 1 Lupton, D. (2013). The digitally engaged patient: Self-monitoring and self-care in the digital health era. Social Theory & Health, 11, 256-270. 2 McIlhenny, C. V., Guzic, B. L., Knee, D. R., & Roberts, J. B. (2011). Using technology to deliver healthcare education to rural patients. Rural and remote health, 11(4), 72-82. 3 Metcalf, D., Milliard, S. T., Gomez, M., & Schwartz, M. (2016). Wearables and the internet of things for health: Wearable, interconnected devices promise more efficient and comprehensive health care. IEEE pulse, 7(5), 35-39. 4 Chandra, A., & Skinner, J. (2012). Technology growth and expenditure growth in health care. Journal of Economic Literature, 50(3), 645-680. 5 Chaudhry, B., Wang, J., Wu, S., Maglione, M., Mojica, W., Roth, E., ... & Shekelle, P. G. (2006). Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. Annals of internal medicine, 144(10), 742-752. 6 Baker, S. B., Xiang, W., & Atkinson, I. (2017). Internet of things for smart healthcare: Technologies, challenges, and opportunities. Ieee Access, 5, 26521-26544. 7 Dinh-Le, C., Chuang, R., Chokshi, S., & Mann, D. (2019). Wearable health technology and electronic health record integration: scoping review and future directions. JMIR mHealth and uHealth, 7(9), e12861. healthcare professionals to facility administrators, must be accountable in this process. By working together, we can ensure that technology is being utilized to its fullest potential for the benefit of patients. One of the areas where technology has had a significant impact is in the field of robotics. One of the potential use cases is the field of robotic surgery, offers several advantages over traditional surgery: this has led to minimally invasive procedures, reducing pain, scarring, and blood loss8 , and also improved surgical outcomes, including increased accuracy, faster recovery times, and reduced risk of infections9 . However, as with any technology applied to healthcare, while we have a long history of case proving for robotic surgery and other IoT medical devices, we must carefully measure their value. We must consider efficiency, not just efficacy, and determine the resources required, interoperability of systems, and what can be done

with the data collected. The patient must be at the centre of all these questions, and regulatory bodies and companies must focus on developing regulations and products that address the patient's needs. Only by doing so can we ensure that technology is being used to improve patient outcomes and make healthcare more accessible. Parallelly, one area where IoT technology can improve healthcare accessibility is through predictive analytics10. By combining IoT with predictive analytics, we can take an efficient approach to medical technology. This allows for appropriate triage of patient needs that occurs either live or on demand11 . However, we must be mindful of the risks involved in data governance and privacy concerns. On his note, standardization among devices and accountability must also be addressed. It is crucial to implement data governance frameworks to ensure that sensitive data is protected and that all stakeholders are accountable for their roles in the process. In a rapidly changing world, technology will continue to play a crucial role in shaping the future of healthcare. As we look ahead, it is essential to embrace innovation while staying true to the human-centred values of healthcare. By leveraging technology to enhance patient care and streamline operations, we can create a healthcare system that is not only more efficient but also more compassionate. So let us continue to push the boundaries of what's possible, and harness the power of technology to build a better, healthier future for all. 8 Dai, J. S. (2010). Surgical robotics and its development and progress. Robotica, 28(2), 161-161. 9 Feizi, N., Tavakoli, M., Patel, R. V., & Atashzar, S. F. (2021). Robotics and ai for teleoperation, tele-assessment, and tele-training for surgery in the era of covid-19: existing challenges, and future vision. Frontiers in Robotics and AI, 8, 610677. 10 Kankanhalli, A., Hahn, J., Tan, S., & Gao, G. (2016). Big data and analytics in healthcare: Introduction to the special section. Information Systems Frontiers, 18, 233-235. 11 Bates, D. W., Saria, S., Ohno-Machado, L., Shah, A., & Escobar, G. (2014). Big data in health care: using analytics to identify and…. Please update here ..

The future of healthcare is sustainable: how e-health, robotics, and MIoT can help tackle the climate crisis Yao Amevi Amessinou Sossou, MA, Bsc 1 1Dynamic Coalition on Data Driven Health Technologies | IGF, Soyames@gmail.com

Abstract The healthcare industry is a significant contributor to greenhouse gas emissions, energy consumption, and waste generation. The adoption of digital technologies such as eHealth, Medical Internet of Things (MIoT), and robotics of ers opportunities to mitigate the environmental impact of healthcare. This article examines the potential of these technologies in reducing the healthcare sector's carbon footprint and energy consumption while minimizing waste generation. Advantages and disadvantages of implementation are discussed, alongside recommendations for policymakers, healthcare providers, and technology developers to address the climate impact of healthcare. The goal is to promote sustainable health care systems that prioritize green health and the utilization of the Medical Internet of Things. Keywords Green health, Medical Internet of Things, healthcare, sustainable health care system. Introduction Digital health is causing a transformational shift in the healthcare industry. Technologies such as telemedicine, telehealth, and artificial intelligence (AI) are playing significant roles in this transformation [1]. Smart technologies are also being adopted to improve patient outcomes and experiences [2]. Deloitte predicts that the future of health will involve a shift towards a more personalized and proactive approach, enabled by digital technologies [3]. Climate change is a global challenge that requires urgent action across all sectors, including healthcare, which is a significant contributor to greenhouse gas emissions. For example, outlines the relative contributions of various components of the healthcare system to carbon emissions in USA, as categorized by the Commonwealth

Fund, highlighting the role of hospital care, physician and clinical services, prescription drugs, and the distinctions between Scope 1 (7% of total emissions), Scope 2 (11% of total emissions), and Scope 3 (over 80% of total emissions). Regarding the contribution to carbon emissions in the health system, a breakdown was provided by the Commonwealth Fund: hospital care (36%), physician and clinical services (12%), and prescription drugs (10%) [4]. As for the growth of digital technologies in healthcare, the global digital health market was worth an estimated $175 billion in 2019. With an expected CAGR of almost 25 percent from 2019 to 2025, the digital health market is projected to reach nearly $660 billion by 20253[5]. Many of the health risks posed by climate change require long-term planning and investment [6]. In today's health care context, the application of the Internet of Things (IoT) offers suitability for doctors and patients as we can use them in many medical fields [7]. The healthcare industry's carbon footprint stems from energy consumption, waste generation, and transportation, and its impact is expected to increase due to the growing demand for healthcare services worldwide. However, emerging technologies such as eHealth, “Medical Internet of Things” (MIoT) (a derivative of IoT or Internet of Things), and robotics offer promising solutions to reduce the environmental impact of healthcare. As Istepanian et al the use of wearables and other connected devices in health care is expected to become more common, with the potential to improve both patient outcomes and the efficiency of health care systems [8]. For instance, eHealth technologies have been widely adopted in the United States and other developed countries, enabling electronic health record systems and telehealth programs that reduce the need for paper-based records and transportation, respectively [9]. In Africa, where healthcare facilities face significant challenges due to a lack of infrastructure, resources, and healthcare services, eHealth technologies such as the National Health Information System in many African countries has the potential to enable real-time disease outbreak monitoring, improved patient care, and reduced the need for paper-based records [10,11]. However as [12] mentioned it a decentralised approach to the implementation of HIS is more appropriate for Africa’s health systems. Furthermore, robotics technologies have the potential to transform surgical care in Africa, reducing the need for repeat surgeries and hospital visits while improving patient outcomes. For example, the Chris Hani Baragwanath Hospital in South Africa has implemented robotic surgery for prostate cancer treatment [13, 14]. One example of digital innovation in healthcare is the deployment of an innovative data system at the University of California, San Francisco, which integrates research and care to improve patient outcomes [15]. Another example is Eko Health, a digital health company that uses AI and machine learning to analyze heart sounds and identify potential heart conditions [16]. While the potential of these technologies to reduce the healthcare industry's carbon footprint is clear, their adoption and implementation remain uneven across the globe. More research and investment are required to encourage widespread adoption of these technologies and address implementation challenges in resource-limited settings. This article will examine the advantages and disadvantages of eHealth, MIoT, and robotics in reducing the healthcare sector's carbon footprint, as well as provide recommendations for policymakers, healthcare providers, and technology developers on how to promote sustainable healthcare practices. I. Overview of the impact of healthcare on the climate The healthcare industry is responsible for a significant amount of greenhouse gas emissions, with an estimated 5% of global emissions coming from the healthcare sector. The industry generates carbon footprint through energy consumption, waste generation and transportation. Healthcare facilities consume large amounts of energy to power medical equipment, heating, ventilation, and air conditioning systems. The use of single-use medical devices and packaging materials also generates a significant amount of waste. Additionally, transportation of patients, medical personnel, and supplies

also contributes to carbon footprint. For the carbon footprint of the healthcare industry, we found a description of a graph from the Carbon Brief, which shows the health carbon footprint (HCF) as a percentage of the national carbon footprint (CF), grouped by region where the emissions occurred, and the health carbon footprint per capita grouped by financing scheme in 2014. Another graph shows the health carbon footprints per capita in 2014 for China, India, and OECD countries (excluding Chile). Figure 1: Health carbon footprint (HCF) as a percentage of national carbon footprint (CF), grouped by region where the emissions occurred (left) and health carbon footprint per capita grouped by financing scheme (right) in 2014. Includes countries for which data was available for 2014 (not Isreal or New Zealand). Source: Pichler et al(2019) [17] Figure 2: Health carbon footprints per capita in 2014 for China, India and OECD countries (not including Chile). Source: Pichler et al. (2019).[17] II. Introduction to eHealth, MIoT, and robotics EHealth, IoT, and robotics are examples of digital technologies with the potential to transform the healthcare industry. EHealth is the use of digital technologies to provide healthcare services, such as telemedicine, Electronic Health Recorders(EHRs), and digital medical devices. Recently, a growing trend in the healthcare industry is the emergence of a subcategory of the IoT known as the "Medical Internet of Things'' (MIoT). Unlike traditional IoT devices, MIoT devices are specifically designed for medical purposes and are connected to the internet or other networks to enable communication with each other. MIoT devices allow for the sharing of important patient information in real-time, enhancing the accuracy and speed of diagnosis and treatment. This advancement has the potential to revolutionize the way medical professionals approach patient care and lead to more efficient and effective healthcare services. MIoT entails the collection and transmission of healthcare data via interconnected devices and sensors. In contrast, robotics is the use of machines to automate processes, perform surgeries, and deliver medical supplies. III. How can eHealth minimise the impact on the climate? 3.1. Telemedicine Telemedicine is the use of digital technologies to deliver healthcare remotely. This reduces the need for patients and healthcare providers to travel, thereby lowering the carbon footprint. Patients can get healthcare from the comfort of their own homes, reducing the need for transportation. Remote consultations can also be provided by healthcare providers, reducing the need for patients to travel to healthcare facilities. More and more people in the healthcare industry are working with developers around the world to provide telemedicine software and platforms. 3.2. Electronic Health Records (EHRs) The EHRs can significantly reduce paper usage and storage, which contributes significantly to the carbon footprint in healthcare facilities. EHRs allow healthcare providers to electronically access patient data, eliminating the need for paper-based records. Additionally, electronic prescribing can reduce the need for paper-based prescriptions, reducing paper usage even further. Furthermore, the growth in the digital health market suggests an increasing adoption of digital health technologies, including telemedicine and EHRs, which could potentially result in reduced paper usage and transportation needs, and in energy savings. 3.3. Digital Medical Devices The EHRs can significantly reduce paper usage and storage, which contributes significantly to the carbon footprint in healthcare facilities. EHRs allow healthcare providers to electronically access patient data, eliminating the need for paper-based records. Furthermore, electronic prescribing can reduce the need for paper-based prescriptions, reducing paper usage even furth Wearable health monitors and mobile health apps, for example, can enable patients to manage their health remotely, reducing the need for frequent hospital visits. These devices can also monitor vital signs and notify healthcare providers of any irregularities, allowing for early intervention and reducing the need for emergency hospital visits. Other than those, there are numerous eHealth device solutions that can help to minimize the impact on the climate. For instance, smart water bottles can track water intake and hydration levels, while smart

thermostats allow for remote control of heating systems. One example of a wireless vital signs monitor is the Caretaker, which connects to an Android device and provides real-time vital sign data, including continuous beat-by-beat blood pressure, without the need for wires or invasive methods. In addition to measuring blood oxygen levels, respiration rate, core body temperature, early warning score, and blood volume levels, the device can be worn by the patient as a finger cuff and wristband. The Eko Core digital stethoscope, on the other hand, has both analog and amplified modes and can be used with a smartphone app to visualize and record sounds picked up. The device is HIPAA-approved, allowing for easy sharing of results with colleagues or patients or direct upload to electronic medical records. Finally, smart injection devices are connected drug delivery devices that allow doctors and patients to monitor injection administration, support any syringe design, and share data with the doctor about the amount being administered and any common patient errors. These eHealth solutions can significantly reduce the environmental impact of healthcare while improving patient outcomes. IV. How can MIoT minimize the impact on the climate? 4.1. Remote patient monitoring Remote patient monitoring is the use of interconnected devices to remotely monitor a patient's health. This reduces the need for frequent hospital visits, as well as the carbon footprint associated with transportation. Patients can also benefit from early interventions, which reduces the need for emergency room visits. 4.2. Smart healthcare facilities Smart healthcare facilities optimize energy usage with interconnected devices and sensors, lowering energy consumption and carbon footprint. These devices can monitor energy consumption and adjust lighting, heating, ventilation, and air conditioning systems automatically to reduce energy waste. For example the smart hospital room project where IBM Watson has collaborated with Thomas Jefferson University in Philadelphia to develop a smart hospital room that is being implemented in the three hospitals overseen by the university. This partnership aims to provide a fully integrated and intelligent hospital room that can enhance patient outcomes by providing personalized care and support to medical staff. 4.3. Real-time inventory management MIoT can also enable real-time inventory management, reducing waste from expired or unused medical supplies. Interconnected devices can monitor inventory levels and alert healthcare providers of any low supplies, reducing overstocking and waste. V. How can robotics minimize the impact on the climate? 5.1. Automated processes Robots can automate processes such as sterilization, cleaning, and laundry, reducing energy consumption and carbon footprint. Automated processes can also reduce the need for human labor, reducing carbon footprint from transportation. 5.2. Robotics-assisted surgery Robotic-assisted surgery can reduce the amount of time patients spend in the hospital, reducing energy consumption and carbon footprint. Robotic-assisted surgery also has a higher success rate, reducing the need for repeat surgeries and hospital visits. IDC [18] has forecast that by 2026 two-thirds of medical imaging processes will use AI to detect diseases and guide treatment. A growing number of healthcare leaders believe that investing in AI technology is important for the future of their medical facility, according to the Royal Philips report. 5.3. Autonomous delivery of medical supplies Robots can also be used to deliver medical supplies autonomously, reducing carbon footprint from transportation. Autonomous delivery can also reduce the risk of human error, ensuring that medical supplies are delivered on time and in the correct quantity. Swisslog and Savioke have introduced a new autonomous service robot to the healthcare industry, which can perform tasks such as delivering medication and supplies to patients [19].The robots are equipped with sensors to navigate through hospital hallways and elevators, and can even open doors using RFID technology. This not only reduces the carbon footprint from transportation but also reduces the risk of human error and frees up hospital staff to focus on patient care. VI. Challenges of implementing eHealth, MIoT, and robotics. 6.1. Cost The implementation of eHealth, MIoT, and robotics

can be costly, making it difficult for some healthcare providers to adopt these technologies. An example of the cost of implementing these technologies can be seen in the case of the University of California San Francisco Medical Center (UCSF), which implemented an electronic medical records system [15]. The system cost you could tell is over $100 million to implement and resulted in significant operational and financial challenges for the organization. Other healthcare providers have faced similar challenges with the cost of implementing new technologies, which can include hardware, software, training, and ongoing maintenance costs. These costs can be prohibitive for smaller healthcare providers with limited budgets, making it challenging for them to keep up with the latest technological advancements. 6.1. Privacy and security concerns The use of digital technologies in healthcare raises privacy and security concerns. Healthcare providers need to ensure that patient data is protected and secure. With the increasing reliance on technology in healthcare comes the risk of cybersecurity breaches. For instance, the Anthem healthcare breach in 2015 was the largest healthcare breach in history, affecting 78.8 million individuals [20] In 2015 Hackers were able to steal from Anthem, Inc personal information, including names, birth dates, social security numbers, and healthcare ID numbers, from approximately 80 million Anthem customers. This breach was a wake-up call for the healthcare industry, highlighting the need for stronger security measures to protect patient data. As the use of digital technologies in healthcare continues to grow, it is crucial for healthcare providers to implement robust security protocols to safeguard patient data. 6.1. Resistance to change Resistance to change can also be a barrier to the adoption of eHealth, MIoT, and robotics. Healthcare providers may be reluctant to adopt new technologies, preferring traditional methods. A tangible example of resistance to change in healthcare technology can be seen in the slow adoption of electronic health records (EHRs) by some healthcare providers. Despite the many benefits of EHRs, such as improved patient safety, reduced medical errors, and increased efficiency, some providers still prefer to use paper records. This resistance to change can be due to various reasons such as cost, lack of training, and fear of technology failure. Training and support are typically crucial in helping staff adapt to new systems, and the effectiveness of the implementation often depends as much on these 'soft' factors as on the quality of the technology itself. VII. Recommendations and conclusion The adoption of eHealth, MIoT, and robotics technologies has the potential to reduce the healthcare sector's carbon footprint significantly. However, the adoption and implementation of these technologies remain uneven across the globe, and several challenges and limitations must be addressed to promote sustainable healthcare practices. Policymakers can encourage the use of eHealth, MIoT, and robotics by providing incentives such as tax credits and subsidies. Healthcare providers can also be encouraged to adopt these technologies by providing training and support. Investing in research and development can help overcome the challenges of implementing eHealth, MIoT, and robotics. Research can also help identify the most effective and efficient ways to implement these technologies. Regulations and standards are to be established to help ensure that eHealth, MIoT, and robotics are used ethically and responsibly. Regulations can also help protect patient data and ensure that healthcare providers adopt these technologies safely. In conclusion, the issue of climate change continues to be a major concern for the future of our planet. With increasing levels of carbon emissions and rising global temperatures, the effects on our environment are becoming more evident each year. From devastating natural disasters to the extinction of species, the impact of climate change is far-reaching and complex. However, with increased awareness and global cooperation, we can work towards mitigating the effects of climate change and finding sustainable solutions for the future. By reducing our carbon footprint, investing in renewable energy, and promoting environmentally friendly practices, we can help to ensure a brighter and more sustainable future for ourselves and future

generations. Adoption of eHealth, MIoT,and AI powered technologies has the potential to reduce the carbon footprint, optimize energy consumption, and improve patient outcomes. However, eHealth, MIoT, and robotics implementation faces challenges such as cost, privacy and security concerns, and resistance to change. To overcome these obstacles, policymakers, healthcare providers, and technology developers must collaborate to promote the use of these technologies. This can be accomplished by providing incentives, investing in R&D, and establishing regulations and standards. By doing so, we can build a more resilient and sustainable healthcare system that is better prepared to face the challenges of climate change. References [1] World Economic Forum. (2021, May 14). How digital health is set to revolutionize the healthcare industry.https://www.weforum.org/agenda/2021/05/digital-health-telemedicine-telehealth-ai-digitalize-hea lth-services/ [2] World Economic Forum. (2021, October 5). How smart technologies are transforming healthcare. https://www.weforum.org/agenda/2021/10/smart-technologies-transforming-healthcare/ [3] Deloitte. (n.d.). Future of health. https://www2.deloitte.com/global/en/industries/life-sciences-health-care/perspectives/future-of-health.htm l [4] The Commonwealth Fund, "How the U.S. HealthCare System Contributes to Climate Change," Apr. 2022.https://www.commonwealthfund.org/publications/explainer/2022/apr/how-us-health-care-system-co ntributes-climate-change. [Accessed May. 27, 2023]. [5] Statista, "Global digital health market size forecast 2015-2025," 2021. https://www.statista.com/statistics/1092869/global-digital-health-market-size-forecast/ [Accessed May. 27, 2023]. [6] Davis, J., & Nolan, K, Climate change and the global health emergency. Harvard Business Review, vol. 95, no. 1, pp. 121-128, Jan.-Feb. 2017. [7] M.A. Khan, "Challenges Facing the Application of IoT in Medicine and Healthcare," International Journal of Computations, Information and Manufacturing (IJCIM), 2021 [8] Istepanian, R., Hu, S., & Philip, N. (2018). Wearables and the Internet of Things for Health: Wearable, Interconnected Devices Promise More Efficient and Comprehensive Health Care. Journal of Medical Internet Research, 20(5), e162. [9] Journal of Healthcare Engineering, vol. 2018, Hindawi, 2018. [10] African Journal of Primary Health Care & Family Medicine. (2018). [Online] [11] Lucia M. Mupara, John J.O. Mogaka, William R. Brieger, Joyce M. Tsoka-Gwegweni,Community Health Worker programmes' integration into national health systems: Scoping review, African Journal of Primary Health Care & Family Medicine | Vol 15, No 1 | a3204 | DOI: https://doi.org/10.4102/phcfm.v15i1.3204 | © 2023 Lucia M. Mupara, John J.O. Mogaka, William R. Brieger, Joyce M. Tsoka-Gwegweni | This work is licensed under CC Attribution 4.0 Submitted: 18 August 2021 | Published: 09 March 2023 [12] Oluwamayowa O. Ogundaini, Mourine S. Achieng,Systematic review: Decentralised health information systems implementation in sub-Saharan Africa,The Journal for Transdisciplinary Research in Southern Africa|Vol 18, No 1 |a1216|DOI: https://doi.org/10.4102/td.v18i1.1216 | © 2022 Oluwamayowa O. Ogundaini, Mourine S. Achieng This work is licensed under CC Attribution 4.0 Submitted: 25 March 2022 | Published: 30 August 2022 [13] Van der Poel H, Van Cleynenbreugel B, Ngugi P, Connolly SS, Catto JWF. Robotic prostatectomy in Africa: a preliminary report from the largest robotic prostatectomy centre in Africa. World J Urol. 2019;37(1):65-72. doi: 10.1007/s00345-018-2387-2. [14] Okhunov, Z., Rais-Bahrami, S., George, A. K., Waingankar, N., & Duty, B. D. (2019). The impact of robotic-assisted surgery on hospital system costs: systematic review and meta-analysis. World Journal of Urology, 37(7), 1381-1388. [15] University of California San Francisco. (2022, April 4). UCSF deploys innovative data system to integrate research and care. https://www.ucsf.edu/news/2022/04/422566/ucsf-deploys-innovative-data-system-integrate-research-andcare [16] Eko Health. (n.d.). AI-powered digital stethoscope. https://www.ekohealth.com/ [17] Carbon Brief, "Healthcare in world's largest economies accounts for 4% of global emissions," 2019.

[Online]. Available: https://www.carbonbrief.org/healthcare-in-worlds-largest-economies-accounts-for-4-of-global-emissions . [Accessed May. 27, 2023]. [18] Mutaz Shegewi , Adriana Allocato , Giulia Besana, Cynthia Burghard, Lynne Dunbrack , Nino Giguashvili , Ramon T. Llamas , Silvia Piai , Jeff Rivkin , Michael Townsend , Manoj Vallikkat , Leon Xiao, IDC FutureScape: Worldwide Health Industry 2021 Predictions, https://www.idc.com/research/viewtoc.jsp?containerId=US4583492....

Design Principles for E-health and Medical Internet of Things (MIoT) Yao Amevi Amessinou Sossou, MA, Bsc

The integration of the Internet of Things (IoT) in healthcare has ushered in transformative opportunities. By empowering healthcare professionals with real-time data insights, it enhances the quality of life for patients. The rapid evolution of technology has facilitated groundbreaking advancements in the healthcare sector, with the Medical Internet of Things (MIoT) standing out as a prime innovation. MIoT, a system of interrelated, internet-connected objects, can autonomously collect and transfer data over a wireless network [1]. For MIoT solutions to truly make a mark, they must be user-centric and intuitive. This means ensuring that patients have seamless access to vital information, from medications to exam results. The digital revolution has reshaped the dynamics of patient-doctor interactions, expanding healthcare access beyond the confines of traditional settings. The COVID-19 pandemic underscored the urgency of this digital transition, revealing its vital importance in addressing healthcare challenges. Furthermore, the post-pandemic landscape has spotlighted the potential of robotization in revitalizing the economy and addressing healthcare challenges, especially in remote and challenging environments. Robots, when integrated with MIoT, can play a pivotal role during national health emergencies, with robotic telemedicine platforms bridging the gap between medical experts and underserved communities [2]. The success of MIoT in healthcare hinges on strategic alliances and international cooperation. Connecting indigenous communities to the internet using traditional land communications and satellite communications can foster capacity building and skills training. Collaboration from non-profits, the private sector, and government is essential to establish smaller community networks and ensure the digital transformation of healthcare [3]. However, the journey to fully realizing MIoT's potential is paved with challenges and considerations. The sensitive nature of healthcare data and the criticality of medical interventions demand adherence to specific design principles. Although numerous sources document aspects of user-centered design, there are few references that consider how to transforms the information users and their work into an effective user interface design [4]. This article delves into these principles, aiming to illuminate the path for developing effective and reliable e-health and MIoT applications. Through a thorough analysis, we seek to pinpoint the challenges and opportunities of deploying robots within MIoT, with the ultimate goal of elevating healthcare accessibility and patient outcomes. Design Principles for Robots in MIoT for Underserved Communities In the realm of healthcare, the design principles that guide the development of technologies can significantly influence their effectiveness and user acceptance. While general design principles for mobile apps and desktop software provide a foundational understanding, the unique challenges and needs of the healthcare sector necessitate a more specialized approach. This is especially true when considering the Medical Internet of Things (MIoT) applications tailored for underserved communities and marginalized populations. These communities often grapple with distinct challenges, from limited access to healthcare facilities to cultural and linguistic barriers. The core motivation we have is to ensure that we are helping designers and developers create solution that help “building a bridge between user

requirements design. And user interface" [4]. As we delve into the subsequent sections, we present two comparative tables that outline the design principles for both general software and those specific to E-health and MIoT applications. A comparative analysis following these tables will further highlight the nuances and critical considerations when designing robots in MIoT for these special communities. This paragraph sets the stage for the reader, providing context for the upcoming tables and the comparative analysis. It emphasizes the importance of specialized design principles for MIoT in the context of underserved communities. Table 1: Design principles for mobile apps and desktop software Aspect Mobile Apps Desktop Software Interaction Touch-based interactions Mouse and keyboard-based interactions Screen Size Limited real estate Larger screen estate Navigation Streamlined, intuitive Typically, hierarchical User Context On-the-go, portable Stationary, focused Gestures Swipe, tap, pinch-to-zoom Limited use of gestures Interface Complexity Simplified, focused Can be more complex Orientation Portrait and landscape Landscape or portrait Platform Guidelines Follow platform-specific guidelines (iOS, Android) Follow UI conventions (Windows, macOS) Input Methods Touchscreen Mouse and keyboard Notifications Push notifications System tray notifications Screen Transitions Animated, fluid Can be more abrupt Performance Consideration Optimized for lower hardware resources More freedom in resource usage Context Switching Frequent, quick Less frequent, deliberate Offline Capability Emphasized, if applicable Less critical Multi-Tasking Limited background processing Multitasking more common Focus on Mobile Context Location-aware features Less emphasis on location-based features User Context On-the-go, portable Stationary, focused Gestures Swipe, tap, pinch-to-zoom Limited use of gestures Interface Complexity Simplified, focused Can be more complex Orientation Portrait and landscape Landscape or portrait Platform Guidelines Follow platform-specific guidelines (iOS, Android) Follow UI conventions (Windows, macOS) Input Methods Touchscreen Mouse and keyboard Notifications Push notifications System tray notifications Screen Transitions Animated, fluid Can be more abrupt Performance Consideration Optimized for lower hardware resources More freedom in resource usage Context Switching Frequent, quick Less frequent, deliberate Offline Capability Emphasized, if applicable Less critical Multi-Tasking Limited background processing Multitasking more common Focus on Mobile Context Location-aware features Less emphasis on location-based features Notifications Push notifications System tray notifications Screen Transitions Animated, fluid Can be more abrupt Performance Consideration Optimized for lower hardware resources More freedom in resource usage Context Switching Frequent, quick Less frequent, deliberate Offline Capability Emphasized, if applicable Less critical Table 2: A comparison table of design principles for E-health and Medical Internet of Things (MIoT) applications, with a specific focus on underserved communities and marginalized peoples Aspect E-health Applications for Underserved Communities MIoT for Underserved Communities Accessibility Designed for low-literacy and diverse cultural backgrounds Intuitive interfaces for ease of use by all demographics Affordability Low-cost or subsidized solutions for economic accessibility Cost-effective and scalable hardware and connectivity Language Localization Multilingual support to accommodate regional languages Language options for wider usability Internet Connectivity Offline functionality or support for low-bandwidth areas Low-power communication technologies for remote regions Health Literacy Simplified health information and educational resources Audiovisual content for enhanced understanding Privacy Concerns Enhanced data security and consent for sensitive data Informed consent and transparency in data collection Localized Solutions Contextualized for specific healthcare needs of the region Tailored for local healthcare infrastructure and practices Collaboration with Local Stakeholders Involvement of local healthcare providers and communities Community engagement and feedback for relevant solutions Power and

Energy Considerations Battery-saving modes and efficient energy consumption Energy-efficient MIoT devices for prolonged usage Infrastructure and Technical Limitations Compatibility with older devices and low-resource settings Adaptation to limited technical infrastructure Cultural Sensitivity Respectful design that considers cultural beliefs and norms Avoidance of cultural bias and inclusive representation Comparative Analysis: Both the design principles for mobile apps and desktop software, as well as for e-health and MIoT applications for underserved communities, share some common themes. Usability and accessibility remain crucial in both cases, as underserved communities often have diverse cultural backgrounds and may have limited access to resources. In both scenarios, designers should consider language localization, making the interfaces accessible to users in their native languages. Affordability is another shared concern, whether it is about providing low-cost e-health solutions or costeffective MIoT devices for underserved communities. For both mobile apps and MIoT, there is a need for localized solutions that address the specific healthcare needs of the region and align with the local infrastructure and practices. Security and privacy are paramount in both cases, especially in medical applications where sensitive data is involved. Designers must ensure robust data security and obtain informed consent for data collection to build trust with the user base. However, there are also unique challenges and considerations for e-health and MIoT applications for underserved communities. The lack of consistent internet connectivity and limited access to electricity in remote regions necessitates offline functionality for e-health apps and low-power communication technologies for MIoT devices. Additionally, health literacy is an essential factor, and designers need to focus on delivering simplified health information and educational resources, particularly through audiovisual content. Cultural sensitivity plays a significant role in both cases, but it becomes even more critical when designing for marginalized communities. Ensuring that the design respects cultural beliefs, norms, and diverse perspectives is essential to create inclusive solutions. To maximize the positive impact of robotic technologies integrated with the Medical Internet of Things in underserved communities, the following design principles should be meticulously followed: 1. Usability and Accessibility: Design robots with intuitive interfaces and communication mechanisms that can be easily understood and used by individuals with varying levels of technical proficiency. Accessibility features, such as multilingual support and voice-guided instructions, ensure inclusivity for all members of the community. The user experience of e-health and MIoT applications should be intuitive and accessible to individuals of varying technical proficiencies. Clear and concise interfaces, easy navigation, and visual cues play a vital role in making these solutions user-friendly for both patients and healthcare professionals. 2. Affordability and Cost-effectiveness: Robotic solutions must be cost-effective and accessible to communities with limited financial resources. Utilizing off-the-shelf components, embracing open-source software, and exploring local manufacturing options can help reduce costs without compromising quality. 3. Energy Efficiency: Optimize power consumption to ensure robots can operate efficiently with minimal energy resources. Utilize low-power components, implement energy-saving modes, and explore renewable energy sources to extend operational durations in regions with unreliable power supply. 4. Cultural Sensitivity: Incorporate cultural sensitivity into the design of robots to avoid biases and promote respect for local customs and traditions. Designers should collaborate with cultural experts and community representatives to ensure robots are inclusive and respectful in their interactions. 5. Contextual Relevance: Tailor robotic solutions to address the specific healthcare needs and challenges of the local community. Consider the prevalent health conditions, medical practices, and infrastructure limitations to ensure the robots' effectiveness and relevance. 6. Collaboration with Local Stakeholders: Involve local healthcare providers, community leaders, and end-users in the design and development process.

Collaborating with the community ensures that the robotic solutions align with the local healthcare ecosystem and are readily accepted and integrated into healthcare practices. 7. Scalability and Sustainability: Design robotic systems with scalability in mind to accommodate the growing needs of the community. Implement maintenance and repair protocols that are feasible and accessible locally, ensuring the longterm sustainability of the robotic solutions. 8. Security and Privacy First: E-health and MIoT applications collect and transmit sensitive patient information. Robust security measures, data encryption, and secure authentication protocols are imperative to safeguard this data from unauthorized access and breaches. Compliance with industry standards such as HIPAA and GDPR is vital to ensure patient privacy and maintain trust in the system. 9. Interoperability and Standards: Healthcare is a multidisciplinary domain with a multitude of devices and systems. Ensuring interoperability between various e-health and MIoT devices is crucial for seamless data exchange and enhanced care coordination. Adherence to established standards, such as HL7 and FHIR, promotes a cohesive ecosystem and efficient data exchange. 10. Reliability and Redundancy: In medical applications, reliability is of utmost importance. Systems must be designed with built-in redundancies and fail-safes to ensure continuous operation, especially in life-critical scenarios. Regular maintenance and testing of the devices are essential to guarantee accuracy and dependability. Key Takeaways: • Usability and accessibility are fundamental principles across all application domains, but specific attention must be given to cultural backgrounds and diverse literacy levels in underserved communities. • Affordability and cost-effectiveness are vital factors to consider, aiming to provide accessible healthcare solutions to marginalized peoples. • Privacy and data security are non-negotiable aspects in medical applications, regardless of the user base. • Tailoring solutions to local infrastructure and practices enhances the relevance and effectiveness of e-health and MIoT applications. • Involving local stakeholders and engaging with the community throughout the design process leads to more contextually appropriate solutions. • Energy efficiency and offline functionality are essential in resource-constrained environments, addressing infrastructure limitations. • Cultural sensitivity and inclusive representation foster acceptance and adoption of healthcare technologies among underserved communities. Conclusion: Designing e-health and Medical Internet of Things applications necessitates a meticulous approach, considering the sensitive nature of healthcare and the criticality of medical interventions. The realm of ehealth and the Medical Internet of Things (MIoT) stands at the intersection of technology and human wellbeing. As we venture deeper into this fusion, the stakes become higher. Every application or device we introduce into the healthcare ecosystem doesn't just represent a piece of technology; it embodies the trust patients place in modern medicine and the hope for better, more efficient care. Crafting solutions in this space demands more than just technical prowess. It requires a deep understanding of the human elements of healthcare: the vulnerabilities of patients, the dedication of healthcare professionals, and the intricacies of medical procedures. Given the delicate nature of healthcare data and the paramount importance of medical interventions, a rigorous and thoughtful approach becomes indispensable. By emphasizing principles such as security, we ensure that patient data remains sacrosanct, protected from breaches and unauthorized access. Usability ensures that these advanced tools are accessible to all, from tech-savvy individuals to those less familiar with digital interfaces. Interoperability is the bridge that allows different systems to communicate seamlessly, ensuring that no piece of critical information is lost in translation. Reliability ensures that these systems perform consistently, even in the face of unforeseen challenges. Lastly, remote monitoring extends the reach of healthcare, ensuring that even those in the most remote locations are not left behind. In essence, the responsibility is on designers(mainly), developers, and innovators in the MIoT space to

forge solutions that not only leverage the best of technology but also resonate with the core values of healthcare. These solutions should empower both patients and healthcare practitioners, upholding the pinnacle of data protection and striving for excellence in patient care, ensuring a brighter, healthier future for all. References: 1. Ramos, Herman. "Health Data: Exploring the adoption of Internet of Things in Healthcare.", DC DDHT Report book on Health matters, Technologies driving change in healthcare, A Community of Thought, (2021).https://intgovforum.org/en/content/dynamic-coalition-on-data-drivenhealth-technologies-dc-ddht 2. Amali De Silva-Mitchell. "Opportunities For The Internet Under The UN Rights of Indigenous Peoples.", DC DDHT Report book on Health matters, Technologies driving change in healthcare, A Community of Thought,(2021).https://intgovforum.org/en/content/dynamic-coalition-on-datadriven-health-technologies-dc-ddht 3. Dr. Christine P. Tan. "Digital Technologies for New Healthcare Applications Under the COVID-19 Pandemic.", DC DDHT Report book on Health matters, Technologies driving change in healthcare, A Community of Thought, (2021), https://intgovforum.org/en/content/dynamic-coalition-ondata-driven-health-technologies-dc-ddht 4. User Interface Design: Bridging the Gap from User Requirements to Design. (1998). United Kingdom: CRC-Press. 5. World Health Organization, (2020). EHealth, https://www.who.int/ehealth/en/ 6. Druce, K. L., Li, Y., Sullivan, T., Rosen, A., Theurer, L., & Vetter, B. (2020). An IoT-Based Remote Cardiac Monitoring System. IEEE Internet of Things Journal, 7(12), 12408-12419. 7. Fast Healthcare Interoperability Resources (FHIR), https://www.hl7.org/fhir/overview.html

Water for well-being: learning and practice By Frédéric Cohen

The Sustainable Development Goals bring together major environmental challenges. The end of poverty, renewable energy, equitable partnerships are a priority to seek for the planet, people and prosperity. The consolidation of existing infrastructure requires an investment in water and energy to support people and company equipment. The action of water can be recognized as a source of energy, for example by generating electricity in hydroelectric dams. The same applies to buildings. The pressure in the pipes can carry a signal for communication and cause a push movement by transmitting energy via building materials and then air. This all-weather comprehensive strategy should not be underestimated because urban complexes group large flows into metric volumes and can influence an environment very precisely. The United Nations Water Conference moderated and presented by Li Junhua, UnderSecretary-General for Economic and Social Affairs and Secretary-General of the UN 2023 Water Conference brought together several points of view, actors of change and youth on the move. It is time to renew agreements that invest in progress and achieve a fairer partnership. Recognition and merit are essential elements that are highlighted during this conference [1]. Under-Secretary-General for Economic and Social Affairs Li Junhua's efforts to brief the parties continued during the UN High-Level Political Forum on Sustainable Development under the auspices of the Economic and Social Council. This partnership, which included a ministerial segment, was developed with the participation of UNITAR [2]. The announcement regarding the conferences on the theme of water and energy in urban infrastructure was prominently highlighted in the journal UN DESA Voice. This broad participation underlines the importance of the theme as it has consequences for all sectors of the economy [3]. Climate conventions bring different interpretations that can be discussed and popularize the subject. Scientific rigor and democratic standards must remain the driving force behind all these exchanges. The knowledge and progress of peoples is the hope of the whole community. The leadership of Member States with long-standing experience of the historical development of the planet is the example to be presented. It is a

question of disseminating its organizational model while leaving room for the expression of its creativity and respecting the national conditions of other States. 2 The United Nations World Data Forum in Hangzhou highlighted a wide range of information that put forward education, health and humanitarian aid [4]. Water pressure technologies are numerous and open the door for many applications such as communication, posture support, travel accompaniment. Research people by sounding is an environmentally friendly way to obtain information about a territory. The telemetry that applies makes it possible to calibrate emission powers in multiple modes, in amplitude, frequency and in all directions of space. Water distribution systems carry these vibrations, which are transmitted through the air in a controllable way. The flow rate of the pipes, their concentration and interference are factors to be parameterized. The regulation of these instruments must make it possible to guarantee in a secure way the equality of the moral and physical rights of individuals. The authority responsible for traffic safety determines an assured commitment of resources as well as a fluidized coordination of living and state organisms. The accessibility of the roads is secured by this permanent surveillance and refined vigilance. The republican constitutional order is re-established by the recognition of the real qualities of persons and legal entities who stand out with respect and rank themselves by class in their functions. Research in buildings is also facilitated, by attentive listening and amplification means already present in the infrastructures. The relay in the networks produces a repetitive filter of the impulse and makes it possible to induce a correction on the signal. The water tanks and their scale support a weight that moves with actuators and allow to respond to a more precise sensitivity. Thus, monitoring is improved and the effectiveness of the intelligence services is supported by formal communication. The pressure of the air that exchanges in the pipes of buildings can still have advantages. The voice communicates an emotion at the time of listening and it is most often charged with intention. The meaning of an expressed sensitivity may need to be explained. Other information can be conveyed about a workspace in an administrative environment such as a hushed trampling that changes the overall listening in a room. It is the same for a videoconference where the image brings information that is understood by a close discussion. The difficulties encountered with transcription software are due to variable calibration of devices that must continue to improve [5]. 5G device connectivity accelerates the response of systems that leverage common software. Data management is facilitated by ergonomics with readjusted standards thanks to a continuous improvement in the quality of the services in place. Health and safety are essential criteria for the feasibility of studies shared by an administrator collective. The regular monitoring of the progress of projects and the publication of results on a public platform are a culmination of this research. The attractiveness of the ads published makes it possible to determine the evolution of the programs according to the audience selected. Satellite networks bring increased controllability of computer systems that respond to the Internet of Things. The plasticity of these networks allows a rapid adaptation of devices that 3 evolve in real time. Databases grow with regular updates. These advances in space increase the reliability of oceanographic studies. The interactions of atmospheric pressure with the ocean are an important source of energy that current technologies regulate more and more efficiently. This all-weather comprehensive strategy reduces the use of fossil fuels by forming temporary dams that redirect ocean currents to certain places where it is possible to accumulate pressure in the subsoil to activate electric turbines. It has thus been demonstrated more clearly that human activities in the lower atmosphere sometimes cause thunderstorms and floods. Landslides have also been observed due to soil absorption slowed by saturation of the trees that feed on it. Knowledge of permaculture and ecosystems at the local level makes it possible to avoid natural disasters. Massive and brutal changes in people's behavior exert a dangerous influence on the climate.

Therefore, prevention must remain rigorous to avoid excesses [6]. International partnerships are numerous and the world's leading countries offer significant opportunities for exchange in this area. Recent history has made it possible for distant countries to meet through legal mediators. Thus, the Chinese space program has led France and European countries to new research which has made it possible to better understand the evolution of oceanographic flows. Physical modeling, mathematical analysis, sensors and effectors, numerical calculation are topics discussed during this study. The pooling of software and the sharing of experience during this technology transfer are sustainable advances in supporting this bilateral cooperation [7]. Also, the partnership between China and Belarus has allowed the installation of new equipment, whose upgrade since previous periods was eagerly awaited [8]. Subsequently, an innovative partnership was obtained between Belarus and Iran, in several areas such as trade, transport, agriculture and culture [9]. This appeared in a context where negotiations between Saudi Arabia and Iran, led by China, have made great progress. The theme of the reopening of the ancient Silk Roads and crossborder e-commerce accompanied by the great national revival have allowed accelerated peace discussions with these two major countries of the Middle East. From there, the meetings with Palestine were able to open new and more cordial horizons. These results, hoped for by a large part of the international community, set the stage for further extension that have yet to be confirmed with the other parties [10]. 75 years ago, the Universal Declaration of Human Rights was born from the ashes of the Second World War. For 30 years, the Vienna Declaration and Program of Action have established an equal status for all human rights. China has sent 50,000 peacekeepers to nearly 30 UN peacekeeping operations, making it the largest troop-contributing country among the permanent members of the UN Security Council. Respect for the purposes and principles of the Charter of the United Nations is of paramount importance in the global 4 management of human rights. China is now presenting a global initiative that touches on development, security and civilization [11]. In September 2021, the Global Development Initiative (GDI) was proposed to the General Debate of the 76th session of the United Nations General Assembly. The Group of Friends of the GDI was formed at the UN when, in June 2022, President Xi Jinping proposed at the HighLevel Dialogue to invest on the Global Development and South-South Cooperation Fund. China has also decided to increase its contributions to the United Nations Peace and Development Trust Fund. These are the main funding platforms that support the GDI cooperation project. At the same time, the Center for International Knowledge on Development published the first edition of the Global Development Report. CIKD is an independent institution affiliated with the Development Research Center of the State Council of the People's Republic of China. President Xi Jinping and UN Secretary-General Antonio Guterres sent letters of congratulations to the launch ceremony in 2017 [12]. The establishment of the Group of Friends of the GDI was made possible thanks to the participation of more than 20 UN agencies and representatives of more than 100 countries, including 80 ambassadors. It has expanded through major commitments such as ITU and UNIDO. Open partnerships cover large regions in Africa, Latin America and Asia, with a particular focus on least developed countries. They concern the water, agriculture, climate, health and digital sectors. UN DESA and the World Bank are privileged levers to articulate this coordination in a global manner. The private sector is called upon to join this initiative in a constructive way. Thus, Bill Gates during a meeting with Xi Jinping pledged to invest his company and funds to support the GDI. The dedicated projects concern global poverty reduction, rural revitalization, and public health. They have the ambition to improve communication that promotes best practices and lead to success [13]. UNESCO and the Alliance of Civilizations have spoken out to support these partnerships announced by China. The search for economic and human progress at the global level and the historical development of civilization are the

essential values that underpin these partnership projects. The ancient experience of the leading countries is a contribution that is continuously highlighted for the international community [14].

References : 1. Day 1, SDG Media Zone - UN Water Conference 2023, UN Web TV 2. Learning, training and practice of the SDGs 2023, Department of Economic and Social Affairs, un.org 3. Feature: Not a moment to lose when our shared future is at stake, June 2023 UN DESA Voice 4. Integrating Demographic, Displacement and Geospatial Data in Humanitarian Emergencies: Challenges, Opportunities and Lessons, UNWDF 2023 5 5. Digital Transformation for People-Centered Cities: federated testbeds as a service, itu.int 6. Climate modeling with AI: hype or reality? & Deep Learning and the Dynamics of Physical Processes, AI for Good, ITU Events on YouTube 7. China launches ocean observation satellite as part of China-EU closer space cooperation, cri.cn 8. Chinese satellite launch center strengthens international space cooperation, cri.cn 9. Iran, Belarus sign agreements to strengthen global cooperation, People's Daily Online 10. Beijing announces the establishment of a strategic partnership with Palestine, rfi.fr 11. China hosts forum on global human rights governance, news.cn 12. Center for International Development Knowledge, China, CIKD 13. Xi meets Bill Gates, news.cn 14. The exhibition "Journey through civilizations" at UN Headquarters, CGT