

A CENTURY OF TELEMEDICINE: CURATIO SINE DISTANTIA ET TEMPORA

Malina Jordanova¹, Frank Lievens²

¹*Space Research and Technology Institute – Bulgarian Academy of Sciences*

²*Executive Secretary of the International Society for Telemedicine & eHealth, Belgium & Switzerland & Managing Director of LIEVENS-LANCKMAN BVBA, Belgium & AKROMED, France*
e-mail: mjordan@bas.bg; lievensf@skynet.be

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Abstract: *The paper presents the series "A Century of Telemedicine. Curatio Sine Distantia et Tempora", dedicated to Telemedicine and eHealth history.*

This is a walk through the history – from the first applications of telegraph and radio communications more than a century and a half ago to space medicine, from the birth of marine telemedicine and emergency radio communication by amateurs to the healthcare support of polar expeditions, from the pioneering era of telecardiology, tele-radiology, telepsychiatry and videoconferencing to clinical biotelemetry, computer telediagnosis and mobile telemedicine and treatment and support of COVID patients..

The series also underlines different national and cultural points of view in the development and implementation of Telemedicine/eHealth solutions for the treatment of patients and wellbeing of citizens.

ЕДИН ВЕК ТЕЛЕМЕДИЦИНА: CURATIO SINE DISTANTIA ET TEMPORA

Малина Йорданова¹, Франк Ливенс²

¹*Институт за космически изследвания и технологии – Българска академия на науките*

²*Изпълнителният секретар, Международно общество за телемедицина и електронно здравеопазване, Белгия & Швейцария*
Директор, LIEVENS-LANCKMAN BVBA, Белгия & AKROMED, Франция
e-mail: mjordan@bas.bg; lievensf@skynet.be

Ключови думи: *Телемедицина, електронно здравеопазване, дигитално здраве, история*

Резюме: *Статията представя поредицата „Век на телемедицината. Curatio Sine Distantia et Tempora“, посветена на историята на телемедицината и електронното здравеопазване.*

Това е разходка из историята на телемедицината – от първите приложения на телеграфа и радио-комуникациите преди повече от век и половина до космическата медицина, от раждането на морската телемедицина до дистанционното консултиране на полярните експедиции, от първите опити за теле-кардиологията, теле-радиологията, теле-психиатрията до клиничната био-телеметрия, компютърната теле-диагностика, мобилната телемедицина и дистанционното лечение и подкрепата на пациенти с COVID.

Поредицата също така разкрива различни национални и културни гледни точки при разработването и прилагането на решения за електронно здравеопазване за лечение на пациенти и повишаване и поддържане благосъстоянието на гражданите.

The Goal

The goal of the series "A Century of Telemedicine. Curatio Sine Distantia et Tempora: A World Wide Overview" is two folded:

1. To present a brief history of Telemedicine/eHealth development and
2. To outline the development and implementation of Telemedicine/eHealth in various countries.

The Series “A Century of Telemedicine. Curatio Sine Distantia et Tempora”

For the moment, the series consists of six volumes.

The first book is Vladzimirsky A., Jordanova M., Lievens F. “A Century of Telemedicine: Curatio Sine Distantia et Tempora”, published in 2016 [1]. It reveals the range and complexity of Telemedicine development over the past 150 years, including facts, theories, and amazing stories from different parts of the world.

Perhaps, it is necessary to start clarifying what is telemedicine. The latter encompasses diagnostic, treatment and prevention processes within the frame of modern health care services, which are carried out primarily by means of telecommunication and computer technologies.

For decades, there was no internationally accepted definition of telemedicine. Recognizing this, the World Health Organization adopted the following broad description of telemedicine:

“The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities” [2-3]. In sum, WHO had underlined that telemedicine includes four germane elements:

- Its purpose is to provide clinical support;
- It intends to overcome geographical barriers, connecting users who are not in the same physical location;
- It involves the use of various types of information technology;
- Its goal is to improve health outcomes.

When presenting the history of telemedicine, some authors refer to the attempts to exchange messages related to medical topics by post, sound alarm (drums, bells) and even smoke alarms, in ancient times and in the middle ages. However, we consider such approach incorrect, as we firmly believe in the ultimate connection between telemedicine and electrical and/or electronic telecommunication tools. Thus, when conducting the research on telemedicine history, we have intentionally limited ourselves to the period after 1850. We also consider that the initial use of modern telemedicine technologies began in the middle of the 1980's and were further developed in the 1990's.

The development of distant delivery of health care services is the prime result of the progress in telecommunication facilities. Thus, history of telemedicine may be presented as the sequence of stages following the progress of telecommunications and of the remote information exchange. In brief, the development of clinical telemedicine could be classified as:

- Telemedicine development based on telecommunication tools such as telegraph; telephone; radio; television (cable television, with slow scanning, wireless, black-and-white to colour television); satellite-link communication; computer networks, internet; wireless networks and data transfer protocols ...
- Telemedicine development based on clinical application forms - teleconsultations with oral or short written description of clinical evidences; distant learning (elearning); teleconsultations with medical data remote transfer; computing telediagnosis; biotelemetry; telemonitoring; comprehensive clinical telemedical systems; individual telemedicine (tele-homecare), etc.

No doubt, both tracks are rather conventional, most stages interlace or can exist concomitantly. That's why the authors used a mixture of both in the organization of the book.

The access to the content of the book is available free of charge at https://www.isfteh.org/files/media/Telemedicine_history_CD.pdf.

The next five volumes [4-8] are a logical follow-up of the first book. They are dedicated to a more detailed history of Telemedicine and eHealth in different countries. Each volume has several chapters and each chapter presents one country. The number of countries introduced in all parts is 23. Every chapter reveals different national solutions for the treatment of patients and wellbeing of citizens, provides a glimpse and summarizes the best practical achievements, governmental policies, existing achievements, results, problems and experiences.

All five volumes are available at the website of the International Society for Telemedicine and eHealth (ISfTeH). Their content is free to read and download at https://www.isfteh.org/media/category/telemedicine_ehealth_history

Often colleagues asked us, why we have dedicated so many efforts and time to prepare and publish this series. The answer is simple. We firmly believe in the necessity to studying and knowing history and in the benefits of international cooperation and collaboration.

Knowing History

"The Past supplies the key to the Present and Future". These words belong to an ancient historian. History tells us how we came to know what we know today. Marcus Tullius Cicero (106-43 BC), a roman writer, politician and great orator, almost 2000 years ago, summarized the importance of history:

"Not to know what has been transacted in former times is to always remain a child. If no use is made of the experiences of past times, the world will always remain in the infancy of knowledge".

These words are especially applicable to the necessity of studying the history of medicine. The latter is much more than the history of doctors, nurses and medical discoveries. The patients are actually the most important part of the broad picture. No doubt, throughout human evolution, health and diseases always were matters of main concern and had a profound effect on human society, shaping it.

More than a hundred year ago, E. F. Cordell, the President of the Medical and Chirurgical Faculty of Maryland, USA, while giving his presidential address to the Faculty chose the topic "The Importance of the Study of the History of Medicine". In his speech, he criticized the lack of formal teaching of the history of medicine. His words explicitly summarize the necessity of knowing it [9]:

"... since history is ever repeating itself, it is manifestly the part of wisdom to make it the object of our closest study, that we may profit by its lessons, both of success and of failure; for what others have done or have failed to do should point the way to their successors, whether in search of individual, social or national guidance."

Time proved that knowing history of medicine not only contributes to the improvement of clinical healthcare but it provides everlasting lessons in the dominion of medical ethics, gives an appreciation for the profession, shapes every aspect of our commitment to patients and medicine .

The history of Telemedicine/ eHealth is part of medical history. Although it lasts for less than two centuries, we still have a lot to learn. The field is in its childhood and is rapidly developing.

International Cooperation

As already mentioned, the second reason to dedicate time and efforts in publishing this series is that we believe in the benefits of international cooperation and collaboration.

Today Globalization is shaping our world. It is moving closer together - trade, technology and investment increasingly connect countries and people around the globe. People and products move, time and distance are no longer obstacles; ideas do spread faster than ever before. Nowadays we are talking about Global health, i.e. health problems, issues, and concerns that transcend national boundaries, which may be influenced by circumstances or experiences in other countries, and which are best addressed by cooperative actions and solutions.

The globalization and wide application of telecommunication technologies influence healthcare in one more aspect. Healthcare systems are due to serve diverse populations. This never happened before in human history.

The diversity goes far beyond a language barrier. It includes culture, gender, sexual orientation, religious beliefs, and socioeconomic aspects. Attitudes toward what is acceptable and what is not in health care and treatment may vary among different populations. Medical staff has to provide care that acknowledges and recognizes these differences. This could be achieved only through international collaboration and cooperation.

Pros and cons of the series

The outline of the Telemedicine/eHealth history is one of the advantages of the series as this is a scientific research in one specific field of the History of Medicine, the one of telemedicine. Apart from outlining the global picture, the series presents many interesting and not well-known facts that may amaze researchers. Let us illustrate this with only three facts.

First: In 1858 Dr Jabez Baxter Upham, in cooperation with the engineer Moses Gerrish Farmer, doctor William Francis Channing, Mr. Steams, Mr. Kennard and Mr. Rogers, created a telemedical device called «sphygmophone». It allowed fixing heart pulse as a curve and sending these data via a telegraph. On January 24, 1859 the device was successfully tested, and heart rate data of Mr. Eugene A. Groux, who suffered from congenital sternal fissure, were sent via wires from

Boston to Cambridge (USA). Ten years later, in 1869, Dr Upham repeated the experiment at the American scientists' conference.

Second: When the term telemedicine was used for the first time? Many authors dated it to 1974, referring to the article of R. G. Mark [10], despite of the fact that the "telemedical technique/technology" was used by R. L. Murphy et al. in 1970 [11]. Further historical investigations have forced us to revise this. In 2014, while working with reference sources, we found that the term "telemedicine" was used as far back as 1927!

A column of the retrospective articles and letters to the editors were published on page 47 in the newspaper "Greeley Daily Tribune", Greeley Town, Colorado, USA, on November 16, 1970. They cited the story of Geo W. Gale "Wants Plane to Change Weather Here". This information represented a rather doubtful discourse concerning meteorological changes that could be caused by planes. However, the last paragraph was of special interest as the author unexpectedly quotes the following: "If we have telephotography, why can't we have telemedicine, so that you could walk up to the radio machine, drop your dollar in the slot, take down the particular receiver required and apply it to that part of your anatomy where the pain is? (Doctors, please snicker)" [12] (Fig. 1).

The cited article is from December 29, 1927. It is obvious that this material is not a scientific article. Nevertheless, we record that the term "telemedicine" was used for the first time in a publication in December 1927.

If we have telephotography,
why can't we have
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walk up to the radio machine,
drop your dollar in the slot,
take down the particular
receiver required and apply it
to that part of your anatomy
where the pain is? (doctors,
please snicker).
I would like to hear from
others on these matters and to
be corrected where it is
necessary to do so.
Signed: Geo. W. Gale
Tribune, Dec. 29, 1927

Fig. 1. Fragment of the note with the term "telemedicine" dated 29.12.1927

Third: In 1953, L. Basan and I. Lovdzhiev developed the procedure of radiotelemetry of physiological parameters on a human in motion and natural working environment. Initially the equipment allowed recording respiration duration and respiration rate. By 1955, with improvement of the sequential system, the authors were able to perform telemetry of respiration rate, air volume during respiration, inhalation duration, respiratory pause and air discharge (Fig. 2) [13].



Fig. 2 Radio biotelemetry system for respiratory function study, Bulgaria, 1953-1955 [1]

The equipment operating principle consisted in conversion of airflow vibration into electrical oscillation with the help of frequency modulation of transducer radio wave, which changed its frequency following the respiratory phases. There were several models of transducers: a small one -

transmitting distance up to 150 m, dimensions 15x12x4 cm, weight 900 g and a big one - transmitting distance up to 60 km, dimensions 26x18x16 cm, weight 3 kg. This biotelemetry system was used in sports medicine and occupational physiology.

Let's turn back to the advantages of the series.

According to the editors, the main benefit of this series is not the outline of the development of Telemedicine/eHealth but of the presentations of different national and cultural expertise in its the development and implementation.

This is the possibility to share the available information with international, national and regional institutions and policy makers as well as with all groups and individuals involved with healthcare. The books provide directions of a wide variety of decisions, able to affect the form and functioning of the healthcare sector and offer clues towards the expected future of health organization at community level. The results and guidelines presented apply to all – national and local administration, individual practitioners, group practices, healthcare systems, as well as to providers of health-related services where there are Telemedicine/eHealth interactions either directly to the patient or from provider to provider for the purpose of healthcare delivery.

The series "A Century of Telemedicine. Curatio Sine Distantia et Tempora: A World Wide Overview" is especially important now, in the time of COVID pandemic as Telemedicine/eHealth comes in many shapes and sizes and offers numerous advantages over the traditional healthcare treatment. Before the pandemic, Telemedicine/eHealth was often neglected. The COVID threat quickly changes the attitude towards it.

The weakest point of the series is that only 23 countries are included so far.

Conclusions

We are convinced that this series offers useful information to those who are preparing to expand Telemedicine/eHealth/Digital Healthcare in their regions or countries. It will allow them to rely on the experience of the others and make them aware of the benefits and problems that were encountered during and after implementation of systems or services, and as such, will help to possibly avoid mistakes and reduce potential problems.

References:

1. Vladzomyrskyy, A., Jordanova M., Lievens F. "A Century of Telemedicine: Curatio Sine Distantia et Tempora", Sofia, Bulgaria, 2016, ISBN 978-619-90601-0-0, https://www.isfteh.org/media/a_century_of_telemedicine_curatio_sine_distantia_et_tempora_book_free_for_d.
2. WHO Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth 2009 (Global Observatory for eHealth Series, 2), WHO, Geneva, Switzerland, 2010.
3. Atlas of eHealth country profiles: the use of eHealth in support of universal health coverage, WHO, Geneva, Switzerland, 2016, <https://www.who.int/publications/i/item/9789241565219>.
4. Vladzomyrskyy, A., Jordanova M., Lievens F. (Eds.) A Century of Telemedicine: Curatio Sine Distantia et Tempora. A World Wide Overview – Part I, 2017, Sofia, Bulgaria, ISBN 978-619-90601-2-4, https://www.isfteh.org/files/media/A_Century_of_Telemedicine_Part_I.pdf.
5. Jordanova, M., Lievens F., Vladzomyrskyy A. (Eds.) A Century of Telemedicine: Curatio Sine Distantia et Tempora A World Wide Overview. Part II, 2018, Sofia, Bulgaria, 2018, ISBN 978-619-90601-3-1, https://www.isfteh.org/files/media/A_Century_of_Telemedicine_Part_II.pdf.
6. Jordanova, M., Lievens F., Vladzomyrskyy A. (Eds.) A Century of Telemedicine. Curatio Sine Distantia et Tempora: A World Wide Overview, Part III, Sofia, Bulgaria, 2019, ISBN 978-619-90601-4-8; https://www.isfteh.org/files/media/A_Century_of_Telemedicine_-_Part_III.pdf.
7. Jordanova, M., Lievens F. (Eds.) A Century of Telemedicine. Curatio Sine Distantia et Tempora: A World Wide Overview, Part IV, Sofia, Bulgaria, 2021, ISBN 978-619-90601-5-5; https://www.isfteh.org/files/media/A_Century_of_Telemedicine_-_Part_IV.pdf.
8. Jordanova, M., Lievens F. (Eds.) A Century of Telemedicine. Curatio Sine Distantia et Tempora: A World Wide Overview, Part V, Sofia, Bulgaria, 2022, ISBN 978-619-90601-6-2; https://www.isfteh.org/files/media/A_Century_of_Telemedicine_-_Part_V_2022.pdf.
9. Cordell Eugene F. The Importance of the Study of the History of Medicine, 1904, pp. 268–282, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1692237/pdf/medlibhistj00016-0051.pdf>.
10. Mark, R. G. Telemedicine system: the missing link between homes and hospitals? Mod Nurs Home, 1974 Feb, 32, 2, pp. 39–42.
11. Murphy, R. L., Barber D., Broadhurst A., Bird K. T. Microwave transmission of chest roentgenograms. Am Rev Respir Dis, 1970 Nov, 102, 5, pp. 771–777.
12. Gale, G. W. Wants Plane To Change Weather Here, Greeley Daily Tribune, Greeley, Colorado, Mon, Nov 16, 1970, p. 47.
13. Basan, L., Lovdzhiev I. Metodika dlya issledovaniya po radio dykhaniya vo vremya truda i sportivnykh uprazhneniy//Fiziologicheskiy zhurnal USSR im.I.M.Sechenova.-1958.-№8.-p.773–775./ Басан Л., Ловджиев И. Методика для исследования по радио дыхания во время труда и спортивных упражнений, Физиологический журнал СССР им. И. М. Сеченова, 1958, 8, с. 773–775.