



## Telemedicine in Nigeria: A Paradigm Shift in Healthcare Delivery

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### ABSTRACT

The use of information and communication technology for health care delivery, particularly in poor settings such as developing economies where access to medical services is inadequate, holds promise in expanding health care access because there is a clear problem with the delivery of health care around the world today and people cannot get the health care they should for various reasons. The increasing cost of health care in Nigeria and other developing economies has called for a change in the way healthcare activities are implemented. Nigeria is faced with fundamental health care related challenges coupled with recent security issues. Uncertainty prevails as health system dynamics unfold, therefore to mitigate the menace of this inadequate healthcare delivery a paradigm shift is required.

**Keywords:** ICT, National Development, Healthcare, Telemedicine

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### 1. INTRODUCTION

Healthcare is the world's largest and fastest growing industry, the context of healthcare is rapidly changing and evolving. One of the greatest challenges facing humankind in the 21st century is to make high-quality health care available to all (Craig & Patterson, 2005). In advanced economies, health care systems are deemed financially unstable, while in emerging economies, they are still being shaped. These systemic changes result from government pressure to contain the cost of health care (Emmanuel, 2014). The delivery of healthcare services, where distance is a critical factor, by all healthcare 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 healthcare providers, all in the interests of advancing the health of individuals and their communities is known as Telemedicine as elaborated by WHO in 2010.

Telemedicine encompasses the whole range of medical activities including diagnosis, treatment, and prevention of disease, continuing education of health-care providers and consumers, and research and evaluation (Craig & Patterson, 2005). At advanced levels, telemedicine involves conducting clinical practices using telecommunication facilities such as teleconferencing. Simple applications of telemedicine may be manifested in medical record keeping, data processing, and information sharing. At a lower level, telemedicine may also involve teleconsultation, whereby health workers can offer consultancy services to peers and/or patients (Stephen Robert Isabalija, Mbarika, & Kituyi, 2013).



However, to ensure stability in the health sector of a nation especially the case of a developing economy such as Nigeria, a paradigm shift in healthcare provisions is required to enable individuals to avoid diseases before they actually occur and, if they have occurred, manage them more efficiently with the help of Information and Communication Technologies. Instead of waiting for the big bang like a hospitalization with very high associated costs and also managing the health of people in their daily lives (Sonntag & Gelissen, 2016). The best way to increase the productivity of any system/ sector is its integration with the latest advancements in technology, more particularly Information and Communications Technology and healthcare is no exception (Markan, 2019). To define IT in healthcare, it refers to the use of IT services, products, software, and solutions such as Telemedicine by healthcare organizations to integrate and streamline various processes. In healthcare, IT is used to develop a secure environment and maintain a uniform flow of information.

It improves the quality and efficiency of the services delivered and helps in reducing errors in the healthcare industry. In a report presented by World Health Organization Global Health Expenditure database (2016) analyzing the percentage spent on public healthcare delivery in Nigeria could arguably provide us with the fact that the health sector in the nation is very much underfunded as the sector only occupies 3.6 percent of the country's GDP, however, achieving a successful health financing system in Nigeria is challenging due to limited institutional capacity, corruption, and unstable political and economic context (Emmanuel, 2014). Therefore, to enable the healthcare industry to foster and deliver efficient healthcare to cater to the huge demand, integration of IT into healthcare is a compelling need (Markan, 2019).

## 2.0 LITERATURE REVIEW

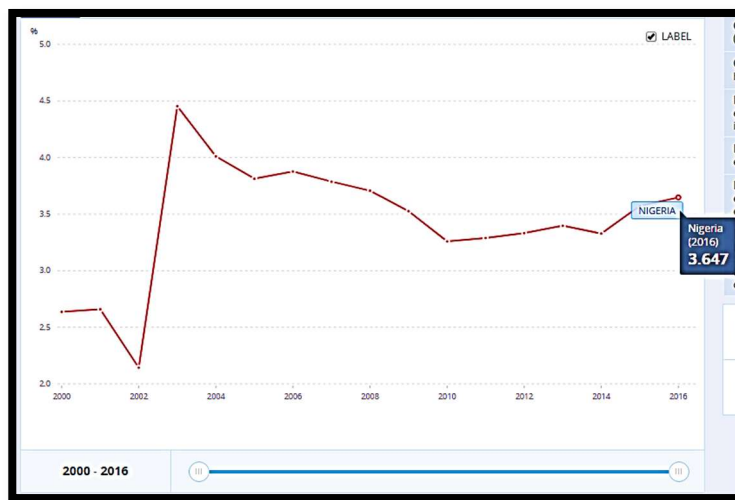
Since the early 1990s, advances in computer and internet technologies have created new possibilities for doctors and their patients. In the developed nations, doctors use computers to send live video, sound, and high-resolution images between two distant locations as well as examining patients in clinics that may be thousands of miles away (Isabaliya, Mayoka, Rwashana & Mbarika, 2011). More so, the rapid pace of mobile phone adoption, with its promise of universal connectivity, lends credence to beliefs that the latest generation of information and communication technologies (ICTs) will support substantial beneficial changes in the organization of the health sector (Abolade & Durosinmi, 2018.). Health issues have generated heightened concern globally due to a preponderance of increasingly life-threatening ailments some of which have defied all curative measures. The nature of health problems related to the health delivery system in Nigeria has made it expedient that the system is studied from various approaches (Imohonopi & Urim, 2013).

According to Martínez-alcalá, Muñoz, & Monguet-fierro (2013), doctors and nurses make use of the Internet in two main ways: (1) for communication, to send information through email, and (2) as an extensive library, to consult the clinical information. Also, it is mentioned that they have good computer skills, a positive attitude towards using the computer and the Internet, and are motivated to use both ways of daily activities. However, mentioned that some health professionals still show some resistance towards the acceptance of new technologies such as telemedicine, even when some health sectors are beginning to integrate ICT in some of their fields.

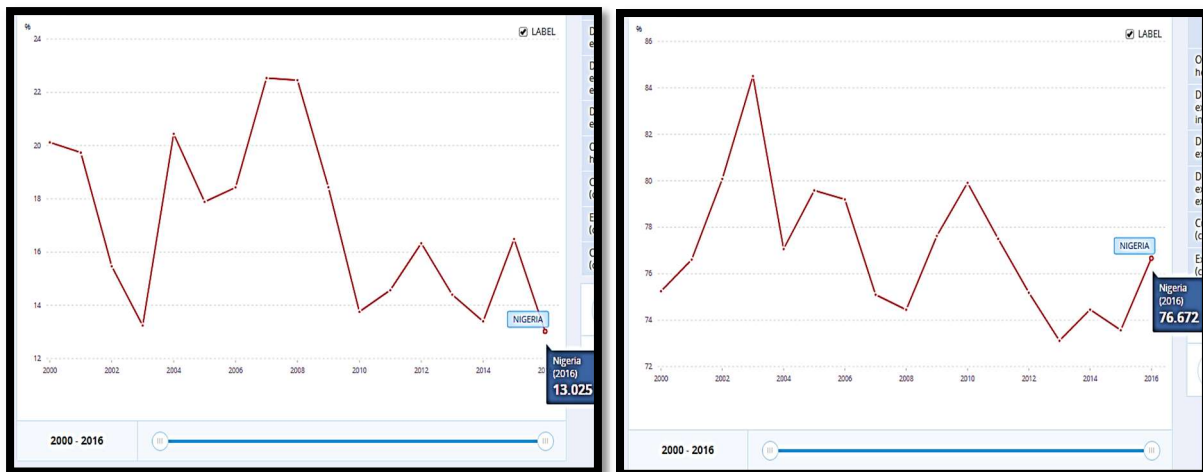
Telemedicine applications have successfully improved the quality and accessibility of medical care by allowing distant providers to evaluate, diagnose, treat, and provide follow-up care to patients in less-economically developed countries (WHO, 2010). They can provide efficient means for accessing tertiary care advice in underserved areas. By increasing the accessibility of medical care telemedicine can enable patients to seek treatment earlier and adhere better to their prescribed treatments, and improve the quality of life for patients with chronic conditions.



According to a report by the WHO Global Expenditure database, Nigeria's public healthcare system is responsible for the spending of about 3.6 percent of GDP in 2016. In contrast, about 13.025 percent of the current health expenditure per annum was spent in the domestic general government sector on healthcare and approximately 76.6 percent is spent in the private sector on healthcare. However, from the report, it could be derived that Nigeria is the fifth country in the world with less domestic general government health expenditure following the likes of Afghanistan, Sierra Leone, Democratic Republic of Congo and Guinea with 5.12, 11.17, 12.25, and 12.29 percent respectively. The country was also among the top ten countries with the highest domestic private health expenditure sitting on the eight positions of the chart. Below are the charts from the report.



**Fig 1: World Health Organization Global Health Expenditure database (2016): Nigeria health expenditure 2000 – 2016 (% of GDP)**



**Fig 2: World Health Organization Global Health Expenditure database (2016): Domestic Public and private health expenditure respectively 2000 – 2016 (% of current health expenditure)**



With the demand for public healthcare far exceeding supply, there arises the need for devising ways and means to increase the productivity of the public healthcare systems with limited resources.

### **2.1 Categories of Telemedicine**

Telemedicine can be divided into two main categories: Store and forward telemedicine and real-time telemedicine. Store and forward telemedicine, also known as asynchronous telemedicine, does not require the communicating sides to be on contact at the same time of data exchange. Data can be collected, organized, and stored. When feasible, the data are sent to the intended destination for diagnosis or analysis. An example is when photographs of a skin lesion or ECG are sent via email along with patient's information and history to a health professional in the related field working in another or remote health facility. Real-time telemedicine, or synchronous telemedicine, differs in that it requires both the health professional practitioner and the patient to be in contact at the same time. Synchronous telemedicine is considered interactive and live, which includes videoconference aided by tools for audio and visual examination. Devices for remote physical examination, such as electronic stethoscopes, can be used.

Remote monitoring, also known as self-monitoring/testing, enables medical professionals to monitor a patient remotely using various technological devices. This method is primarily used for managing chronic diseases or specific conditions, such as heart disease, diabetes mellitus, or asthma. These services can provide comparable health outcomes to traditional in-person patient encounters, supply greater satisfaction to patients, and may be cost-effective.

### **2.2 Telemedicine and Healthcare In Nigeria**

The developing world has had relatively little experience or success with telemedicine. This is in part because of the high costs associated with Internet connectivity, high-end video conferencing systems, and sophisticated peripheral medical devices. Expensive technologies are simply out of the reach of health organizations in developing countries, which may have more immediate priorities (such as providing nutrition, sanitation, and vaccinations to the population). Developing countries face many challenges due to the unavailable funds for health care and the ratio of health care specialists to patients. For many governments especially in sub-Saharan Africa such as Nigeria, healthcare spending is an afterthought since they face many other pressing issues such as civil wars, public unrest, etc (Cetinkaya, 2009).

In these countries, charities try to deliver basic health care to millions of people in need because of the economic situation of the nation at large. Healthcare requires years of education which is harder to afford for many in these developing countries, making the situation worse by increasing the gap between health care suppliers and patients. Although the most immediate solution would be the relocation of existing practitioners to these areas, it might not be realistic due to political and socio-economic factors in these countries. Nigeria with a population of more than 200 million people, a major percentage of which live in the remote rural areas, with little or no access to modern health-care facilities, geographic isolation, the scarcity of physicians and hospitals, and difficulties of travel to larger cities where healthcare is available are among the factors limiting this access to quality healthcare in the country (Ukaoha & Egbokhare, 2012). The lack of good and standard infrastructure has inhibited the timely delivery of quality healthcare service (Okuboyejo, 2013). However, Nigeria is faced with the challenge of ineffective use of past opportunities to develop a vibrant and sustainable health care delivery; so the future of health care seems uncertain (Emmanuel, 2014).

### 3. TELEMEDICINE SYSTEM DEVELOPMENT

One of the main motivations for the application of ICT in both healthcare organizations, public and private, lies in the necessity of improving the information and providing medical care to a multitude of geographically dispersed agents. Clinical studies have shown that telemedicine is safe and cost-effective, compared with hospital treatment, especially with patients suffering from chronic diseases (Martínez-Alcalá et al., 2013). The telemedicine system will provide a solution to the problem of accessing healthcare, especially for the rural healthcare workers, it enables the sending of the patient's demographic and clinical data, X-rays and ultrasound images through the telemedicine network system for diagnosis of any patient's illness. This allows for circumstance for patient's loss of quality of healthcare, increase the access to expert-supported healthcare services based in hospitals located in larger cities and mitigates the isolation of rural health workers by bringing them in regular contact with the physicians in the urban city hospitals (Yisah, 2008).

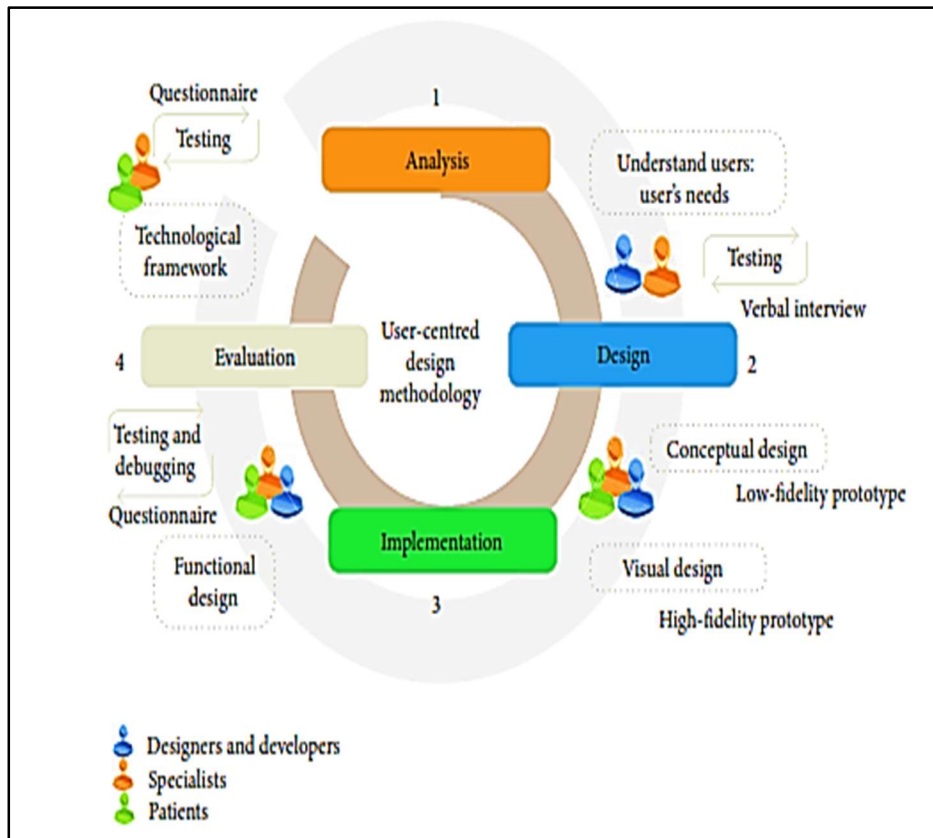


Fig 3: Design process of the telemedicine systems centered on the user  
 (Source: Martínez-alcalá et al., 2013)

To strategize, develop and implement any telemedicine solution into the system, the requirement of reliable and adequate facilities is the starting point which are:

### Telemedicine Consultation Centre (TCC)

Telemedicine Consulting Centre is the site where the patient is present. In a Telemedicine Consulting Centre, equipment for scanning/converting, transformation and communicating the patient's medical information can be available.

### Telemedicine Specialty Centre (TSC)

Telemedicine Specialty Centre is a site, where the specialist is present. He can interact with the patient present in the remote site and view his reports and monitor his progress.

### Telemedicine System

Telemedicine is a recombinant innovation; it relies heavily on innovations in the fields of communication, computers, software, education and finally robotics. The Telemedicine system consists of an interface between hardware, software and a communication channel to eventually bridge two geographical locations to exchange information and enable tele-consultancy between two locations. The diagram below illustrates an overview of the telemedicine ecosystem by identifying the main technologies involved in setting up a functional telemedicine ecosystem.

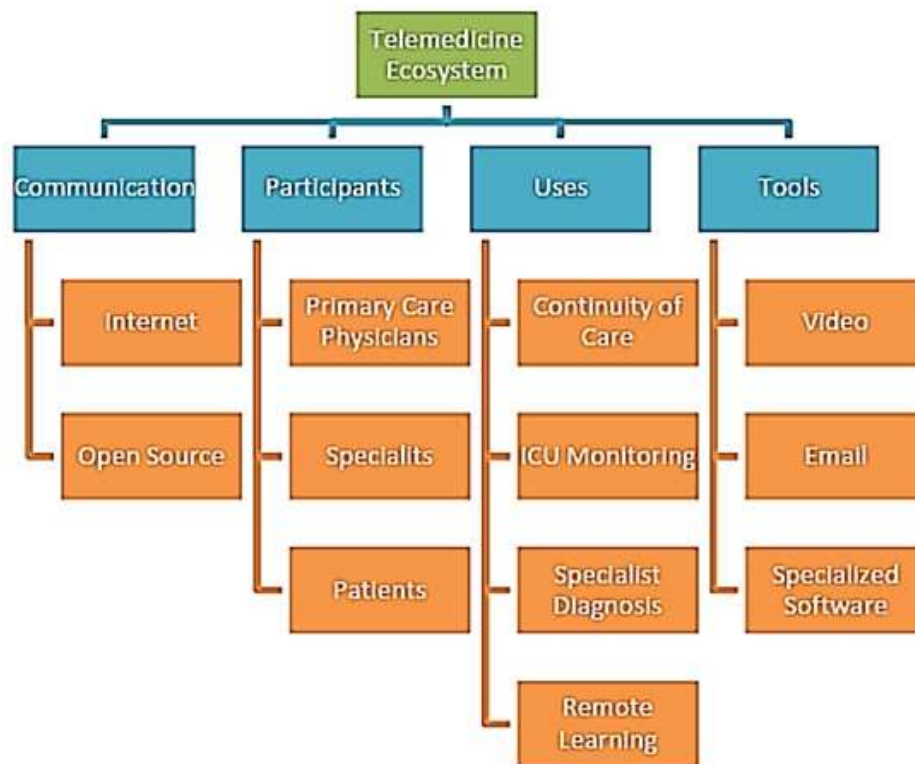


Fig 4: Components involved in setting up a Telemedicine Ecosystem



In further reference to the above illustration about the development of Telemedicine Applications, various considerations are also to be put in place to ensure adequate functionality of the system.

Some of this includes:

- i. Software architecture: Several types of software architecture can be deployed. The most common are: Web Based, Web Application, Applications.
- ii. Connection Type: The system can provide users with different types of connection such as Point-to-point connection, multipoint connection, Synchronous and asynchronous connections, Transferred information, etc.
- iii. Storage Capacity: More powerful telemedicine systems are required to provide the remote computers with redundant storage so that failures (typically, hard disk failures) do not wipe all the information stored.
- iv. Technology Acceptance by Users: As for the acceptance, user interface obviously is one of the most important issues. However, local languages, especially in developing countries, must be suitably adopted.

The Real Problem in Telemedicine Systems: Speaking of what are the real problems hindering the implementation and usability of the telemedicine service, it is derived that Technology represents only 10 to 20% of the total cost of implementing a telemedicine system: Therefore, technology is not the problem. However, between 80 and 90% are related to people (organization, structure, training of qualified personnel, change management, process reengineering, continuous monitoring, etc.) People are the real challenge.

Furthermore, the high rate of failures in the implementation of telemedicine systems is mainly due to human factors of which includes:

- Recruitment
- Resistance to change
- The adaptation of the structures and processes of the organization
- Training Plan
- Continuous monitoring
- The rest is due to sustainability problems

Telemedicine Systems Solutions: Below are some of the solutions to the successful implementation and usage of various telemedicine services

- CHANGE the PARADIGM: embrace telemedicine as routine
- Set achievable goals
- Define a correct implementation strategy
- Select the ICT platform according to the needs
- Define an owner or top manager
- Establish a formal organization dedicated to the project
- Select the right staff
- Ensure project sustainability
- Education, education, and more education



#### 4. CONCLUSION AND RECOMMENDATION

Telemedicine is gradually, if not rapidly, becoming a technological and clinical reality. Therefore, it is essential to address the challenge that exists in the successful evaluation of a telemedicine system. By reviewing the literature related to telemedicine systems, we noticed the necessity to concentrate on the specific user requirements, particularly referring to patients, in order to develop an intuitive and effective system. However, it is recommended that after developing and building an effective system, there are some final balance to be put in place to ensure adequate usage and adoption some of this includes adaptation to the new paradigm, locate the right personnel, connectivity and broadband for effective communication, selection of a model adapted to the needs of each medical service, creating a commitment for telemedicine among medical personnel, dynamic framework for new demands: not to fear change.





## REFERENCES

1. Abolade, T. O., & Durosinmi, A. E. (2018). The Benefits and Challenges of E-Health Applications in Developing Nations : A Review. 14th ISTEAMS Multidisciplinary Conference, Vol 14, 37–44.
2. Cetinkaya, B. (2009). Telemedicine: A paradigm shift healthcare November 26, 2009, Burag Cetinkaya.
3. Craig, J., & Patterson, V. (2005). Introduction to the practice of telemedicine. *Journal of Telemedicine and Telecare*, 11(1), 3–9. <https://doi.org/10.1258/1357633053430494>
4. Combi, C., Pozzani, G., & Pozzi, G. (2016). Combi, C., Pozzani, G. and Pozzi, G. (2016) 'Telemedicine for Developing Countries A Survey and Some Design Issues', *Appl Clin Inform*, 718518(7), pp. 1025–1050. doi: 10.4338/ACI-2016-06-R-0089. Telemedicine for Developing Countries A Survey and Some Design. *Appl Clin Inform*, 718518(7), 1025–1050. <https://doi.org/10.4338/ACI-2016-06-R-0089>
5. Emmanuel, A. N. (2014). Challenges of implementing sustainable health care delivery in Nigeria under environmental uncertainty. *Journal of Hospital Administration*, 3(6), 113–126. <https://doi.org/10.5430/jha.v3n6p113>
6. Gozner, M. (2019). Editorial : The paradigm is shifting. *Modern Healthcare* 1–3.
7. Hassan, A., & Hiba, A. (2015). Telemedicine. *Telemedicine*, (October 2015), 184–192. <https://doi.org/10.1201/b13434>
8. Imhonopi, D. O., & Urim, U. M. (2013). ICT and Health Delivery System in Nigeria.
9. Isabaliya, S. R., Mayoka, K. G., Rwashana, A. S., & Mbarika, V. W. (2011). Factors Affecting Adoption, Implementation, and Sustainability of Telemedicine Information Systems in Uganda. In *Journal of Health Informatics in Developing Countries* (Vol. 12). Retrieved from <http://www.jhidc.org/index.php/jhidc/article/view/173>
10. Isabaliya, Stephen Robert, Mbarika, V., & Kituyi, G. M. (2013). A Framework for Sustainable Implementation of E-Medicine in Transitioning Countries. *International Journal of Telemedicine and Applications*, 2013, 1–12. <https://doi.org/10.1155/2013/615617>
11. Kuznetsov, D. (2016). Development of Telemedicine System. *MATEC Web of Conferences*, 79, 01074. <https://doi.org/10.1051/mateconf/20167901074>
12. Markan Suchita (2019). A Paradigm Shift and the Way Forward. Retrieved from <https://www.expresshealthcare.in/healthcare-it/a-paradigm-shift-and-the-way-forward/389244/>
13. Martínez-Alcalá, C. I., Muñoz, M., & Monguet-Fierro, J. (2013). Design and Customization of Telemedicine Systems. *Computational and Mathematical Methods in Medicine*, 2013, 1–16. <https://doi.org/10.1155/2013/618025>
14. Okoroafor, I. J., Chukwunke, F. N., Ifebunandu, N., Onyeka, T. C., Ekwueme, C. O., & Agwuna, K. K. (2017). Telemedicine and biomedical care in Africa: Prospects and challenges. *Nigerian Journal of Clinical Practice*, 20(1), 1–5. <https://doi.org/10.4103/1119-3077.180065>
15. Ortiz, D. N. (2016). Framework for the Implementation of a Telemedicine Service. In Pan American Organization, World Health Organization.
16. Rosa, F. G. La. (2016). " Telehealth and Telemedicine : A New Paradigm in Global Health ".
17. Sonntag, D., & Gelissen, J. (2016). A Paradigm Shift in Healthcare Provision A Paradigm Shift in Healthcare Provision. *KI - Künstliche Intelligenz*, (June 2015). <https://doi.org/10.1007/s13218-015-0359-y>
18. Sutjiredjeki, E., Soegijoko, S., Mengko, T. L. R., & Tjondronegoro, S. (2007). Development of a Mobile Telemedicine System with Multi Communication Links for Urban and Rural Areas in Indonesia. [https://doi.org/10.1007/978-3-540-68017-8\\_166](https://doi.org/10.1007/978-3-540-68017-8_166)



19. WHO. (2010). WHO Library Cataloguing-in-Publication Data Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth 2009. (Vol. 2). Retrieved from [http://www.who.int/goe/publications/goe\\_telemedicine\\_2010.pdf](http://www.who.int/goe/publications/goe_telemedicine_2010.pdf)
20. World Health Organization Global Health Expenditure database (2016): Current health expenditure (% of gdp), domestic general government health expenditure and Domestic private health expenditure (% of current health expenditure) Retrieved from <https://data.worldbank.org/indicator/SH.XPD.PVTD.CH.ZS?view=chart>