

# Chronic Disease Management in Developing Nations: The Possible Role of Telemedicine.

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## ABSTRACT

Caring for millions of people suffering from chronic diseases such as heart disease, hypertension, and diabetes is expensive and takes a toll on the economy of families and the society as a whole. These diseases, according to the World Health Organization (WHO), account for about 60% of all deaths globally. The concept of caring for patients remotely using telemedicine applications, though in its infancy in a number of developing nations, appears to be generating interest recently, apparently fuelled by the revolution in the telecommunications sector and the upsurge in internet usage.

Telemedicine has been successfully adopted in the management of patients with chronic disease and its introduction in developing economies has the potential to change the course of health care delivery. Reports have indicated that technological interfaces help in promoting adoption of healthy lifestyles and self-care as well as the enhancement of the effectiveness of chronic disease management in the home. In addition, telemonitoring could reduce long-term management costs as well as reduce morbidities associated with these diseases. There is need, therefore, to pursue novel technological innovations, which can increase access to health information and services. We provide some general information on telemedicine and the applicability of technology for the distant monitoring of patients living with chronic disease.

(Keywords: telemedicine, diabetes, hypertension, health information, developing nations)

## INTRODUCTION

Recently there seems to be a paradigm shift in health care delivery from a provider-centered approach to a patient-centered management model that emphasizes patient satisfaction. The application and usage of telecommunication technology have provoked this novel concept of connected health which extends health care beyond the traditional confines of hospitals and doctor's offices to our everyday surroundings. Telecommunication technologies are being used to change the healthcare industry in unprecedented and irreversible ways. For many decades now, the use of advanced telecommunications and information technologies has been investigated in an effort to improve healthcare.

Telemedicine technology embodies the electronic acquisition, processing, dissemination, storage, retrieval, and exchange of information for the purpose of promoting health, preventing disease, treating the sick, managing chronic illness, rehabilitating the disabled, and protecting public health and safety (Bashshur and Shannon, 2009). These technologies can take any number of forms such as web-based applications (Hernandez et al., 2003); mobile phone and alert systems (Lee et al., 2007); and telephone and video conferencing with patients (Finkelstein et al., 2006). Telemedicine has been used successfully to improve the chain of care and may involve complex delivery systems that employ a mix of these technologies in addition to innovative clinical processes (Reardon, 2005).

Telemedicine has a surprisingly long history that began with the advent of the telephone (Adewale, 2004). Previous studies have shown that wealthy families had long been using this process even before the advent of postal services (Jurin, 1726; Porter and Porter, 1989). In recent years, with the improvements made in technology and communications systems, telemedicine has expanded (Curry and Harrop, 1998) and, in a time of limited resources, has become a feasible alternative for smaller and rural medical facilities to provide routine and specialized services. In Nigeria, about 50% of the populations live in the rural areas characterized by low penetration of healthcare services with about 90% of secondary and tertiary healthcare facilities located in cities. Telemedicine, therefore, may be a possible way of making medical care possible over long distances.

Chronic diseases such as diabetes and hypertension are prolonged conditions that often do not improve and are rarely cured completely. Therefore the role of monitoring technology that emphasizes helping individuals maintain independence and keep as healthy as possible through prevention, early detection and management is very important. In the World Health Organization Region for Africa projection, total deaths from chronic diseases will increase by 27%, with diabetes accounting for 42% by 2015 (WHO, 2005). There is often a burden on patients, their families, and finances, so there is the need to explore the role of technology in

reducing this burden. This review paper aims to appraise the roles and applications of telemedicine in the management of chronic diseases.

## METHODOLOGY

This review was undertaken using a narrative synthesis approach to examine a broad range of literature in order to provide an overview on the topic of technology and chronic disease management. Furthermore, in this narrative review we sought literature pertaining to a variety of technologies, from management systems to hand held devices, to assess the support for each technology and to distinguish areas for future research. Publications on diabetes and hypertension that were linked with telemedicine, telemonitoring, e-health, telehealth, telecare, electronic monitoring, and health technology were sought by searching the following databases: Pubmed; Cochrane Library; and Google. Key words and terms used in the search were: diabetes; hypertension; e-health; electronic monitoring; health technology; telehealth; telecare; and developing nations. The results for diabetes and hypertension are displayed in separate tables (Tables 1 and 2). For the purposes of this narrative review duplicates were not removed from the numerical results of the search strategy since the focus was a narrative synthesis of the literature.

**Table 1: Diabetes Search Results.**

<b>Diabetes and</b>	<b>PubMedCentral n=</b>	<b>Cochrane Library n=</b>	<b>Google n=</b>
Telemedicine	284	19	290,000
Telemonitoring	47	4	46,200
eHealth	49,904	256	20,400,000
e monitoring	1701	33	197,000
Health technology	236	76	26,700,000
Telehealth	80	0	140,000
Telecare	50	2	104000
Telemedicine and DN	6	0	39300
Telemonitoring and DN	0	0	10200
e health and DN	226	1	1,080,000
e monitoring and DN	15	0	32,700
Health technology and DN	7	1	79,800
Telehealth and DN	80	0	140,000
Telecare and DN	50	2	104,000
<b>Total</b>	<b>52,560</b>	<b>392</b>	<b>493,363,200</b>

**Table 2: Hypertension Search Results.**

<b>Hypertension and</b>	<b>PubMedCentral n=</b>	<b>Cochrane Library n=</b>	<b>Google n=</b>
Telemedicine	135	24	90,600
Telemonitoring	34	7	17,600
eHealth	3,1947	160	6,220,000
e monitoring	1,291	28	96,300
Health technology	139	58	254,000
Telehealth	35	0	33,000
Telecare	19	1	17,000
Telemedicine and DN	2	0	20,400
Telemonitoring and DN	0	0	8,900
e health and DN	15	2	8,540
e monitoring and DN	9	1	19,100
Health technology and DN	2	1	59,200
Telehealth and DN	1	0	6,700
Telecare and DN	0	0	4,200
<b>Total</b>	<b>33,765</b>	<b>282</b>	<b>6,855,610</b>

### APPLICATIONS OF TELEMEDICINE

Telemedicine has several applications. In recent years, it has been difficult to find enough doctors, especially in rural areas. This necessitates connections with other professionals to extend the reach of the doctors. Further, in life-threatening emergencies, the availability of telemedical hook-ups can provide life-saving treatment before the patient arrives wherever the specialist needed is located. Telemedicine may be seen as a valuable tool for providing: badly needed specialty care to underserved areas; a more efficient use of existing medical resources and a way to attract patients living outside a hospital's catchment area (Perednia & Allen, 1995; Wootton, 1996). Telemedicine affords care-givers the ability to collect and transfer medical data, still images, and live audio and video transmissions. Some of the common methods used are ordinary telephone lines, the Internet, and satellites, although any means of transmission can be used.

Telemedicine's applications have also been encouraged due to the widespread use of cheaper, more user-friendly telecommunication equipments such as personal computers, internet access, satellites, video-conferencing, and telephone among others. The objectives of telemedicine and its applications are to enhance

citizen's equality in the availability of various medical services and healthcare despite geographical and economic barriers, to reduce direct and indirect cost (loss of production or income) to patients and the healthcare industry, to save travel time and costs for both practitioners and patients from one geographical location to another, and to improve consultation and co-operation among various units of healthcare in both special cases and primary care by bridging the distance between practitioners and specialists (ATA, 2001; Adewale, 2004).

### BENEFITS OF TELEMEDICINE

- a. Improved Access – For over 40 years, telemedicine has been used to bring healthcare services to patients in distant locations (Sosa-Iudicissa et al., 2000; Wootton, and Ferre-Roca, 2000; and Mahen et al., 2001). Not only does telemedicine improve access to patients but it also allows physicians and health facilities to expand their reach, beyond their own offices (ATA, 2001).
- b. Cost Efficiencies - Reducing or containing the cost of healthcare is one of the most important reasons for funding and adopting telehealth technologies in developing

economies. Telemedicine has been shown to reduce the cost of healthcare and increase efficiency through better management of chronic diseases, shared health professional staffing, reduced travel times, and fewer or shorter hospital stays (Fries et al., 1993).

- c. Patient Demand - The greatest impact of telemedicine is on the patient, their family and their community. Using telemedicine technologies reduces travel time and related stresses to the patient. Over the past 15 years studies have documented patient satisfaction and support for telemedical services. Such services offer patients the access to providers that might not be available otherwise as well as medical services without the need to travel long distances (Telemedicine for Rural South Carolina, 1997).

## **ROLE OF TELEMEDICINE IN DISEASE MANAGEMENT**

Disease management is a form of practice that treats high risk, high cost patients that have diagnosed conditions for which there are broad variations in treatment. The approach attempts to standardize the care and treatment of such patients to achieve an impact upon healthcare outcomes and healthcare utilization costs. Disease management is more than case-managing patients. According to DMAA, (2008) disease management is defined as "a system of coordinated health care interventions and communications for populations with conditions in which patient self-care efforts are significant.

In recent years, telemedicine technology has been used as a tool for the delivery of disease management care in homes. Warsi et al., (2004) provided insight into self-management programs and the efficacy of patient self-management education for chronic disease. The study revealed that diabetic patients involved with self-management education programs demonstrated improvements in systolic blood pressure. Another study conducted of patients receiving care over a telemedicine network showed that the disease management programs conducted using telecommunication indicated increased number of diabetics who brought their blood sugar under control (Dimmick et al., 2003) Although effective disease management

requires the patient to take an active role in his/her health but telemedicine has been shown to offer added benefits of reducing costs, without sacrificing the level of care (Schneider, 2004; Finkelstein et al., 2006).

These successes are usually attributed to patients taking an active role in disease management, facilitated by appropriate diet, exercise, daily self-measurement (e.g., weight scales and blood pressure devices), medication compliance, education, recognition of disease-related symptoms, and support from health care professionals [Edwards, 2005; Havranek, 2005; Inglis et al., 2006]. A randomized control trial of medicare recipients with diabetes found that telemedicine case management using data capture from home monitoring devices improved glycemic control, blood pressure levels, total cholesterol and low-density lipoprotein at one-year follow-up (Shea et al., 2006). Likewise, another study showed that diabetes education via telemedicine was effective as in-person education in improving glycemic control, and both methods were well accepted by the patients (Izquierdo et al., 2003).

Until recently, hypertension was thought to be rare in rural Africa; on the other hand, hypertension and its complications, including stroke, heart failure, and renal failure, have been reported in blacks all over the world. Hypertension is now being widely reported in Africa and is the most common cause of cardiovascular disease on the continent. It is also a major factor in the high mortality of adults in sub-Saharan Africa (WHO, 2002). Also, healthcare costs for heart failure and hypertension are increasing. The need for a better care, however, has to be matched with a policy of cost containment. A way to improve the cost-effectiveness of heart failure care is the disease management approach, in which therapy, education and follow-up are tailored for each patient by a multidisciplinary team.

Such a complex intervention can be facilitated by the use of telemedicine, which allows the remote control of considerable amounts of clinical data. Recent reports by Seibert et al. (2008) revealed that telemedicine could improve the control of congestive heart failure (CHF) as well as facilitate home health care and self-management for CHF patients. CHF is a chronic condition where appropriate disease management is critical (Albert et al., 2004).

Indeed, CHF is an area where patient empowerment medicine is of particular importance. Despite the dismal prognosis, there are numerous examples of CHF patients living beyond the years normally expected for people with the disease (Seibert et al., 2008).

Several research studies have testified to the cost effectiveness, quality of care and patient acceptance of telemedicine application in the management of disease conditions. Darkens et al. (2008) reported a dramatic reduction in costs and an equally dramatic increase in quality of care rendered to veteran patients with chronic conditions through a national home telehealth program, Care Coordination/Home Telehealth (CCHT) between 2003 and 2007. CCHT is now a routine non-institutional care (NIC) service provided by Veterans to support veteran patients with chronic conditions as they age. The program has reduced hospital admissions appreciably. In another study to evaluate the cost-effectiveness of telemedicine and standard ophthalmoscopy for retinopathy of prematurity (ROP) management, Jackson et al. (2008) demonstrated that telemedicine is more cost-effective than standard ophthalmoscopy in the management of ROP.

Various reports have demonstrated that web-based information as well as telephone and e-mail access to specialist nurses could provide practical advice and emotional care to demented patients (Harvey et al., 1998). In a randomized trial of cognitive training conducted by Poon et al., (2005), the authors showed that the televisual treatment group was as effective as conventional treatment group. It has also been demonstrated that a video-conference link is as effective as face-to-face interviews in the assessment and diagnosis of dementia (Loh et al., 2007). Web sites targeted at the disease allow patients and caregivers to access information and participate in therapy, training and support.

## CONCLUSIONS

Telemedicine is an attractive method of delivering services to patients without a need for both the patient and health care professional to be in the same location at the same time. Its major role in providing remote treatment to patients with chronic conditions cannot be overemphasized. It is an iterative process which

delivers evidence based health care to the patient in conjunction with analysis and adjustment of the care by process improvement. This use of technology enables patients to get access to medical expertise that may not be available at the patient's site, which more often than not, is the scenario in most developing nations. Telemedicine networks contribute to the cost effective use of medical resources and have strong impact in developing countries since it allows remote parts to get access to medical care. It is the process of reducing healthcare costs and/or improving quality of life for individuals by preventing or minimizing the effects of chronic diseases through integrative care. It could fill a service gap among those who have limited access to expert care.

New telecommunication technologies would perhaps enhance the quality and intensity of therapy delivered to patients at home, and provides important clinical information to the health provider and thus may help to maximize cost-effectiveness in health care delivery. The application of telemedicine therefore could be one of the strategic components in the health care delivery system for the equitable delivery of health-care and the accessibility of specific skills in the developing nations of the world.

## REFERENCES

1. Adewale, O.S. 2004. "An Internet-Based Telemedicine System in Nigeria". *International Journal of Information Management* 24. 221-234,
2. Albert, N.M., Eastwood, C.A., and Edwards, M.L. 2004. "Evidence-Based Practice for Acute Decompensated Heart Failure". *Critical Care Nurse*. 24(6):14-29.
3. ATA. 2001. American Telemedicine Association. [http://www.atmeda.or/\(1.1.2001](http://www.atmeda.or/(1.1.2001)
4. Ausseresses, A. 1995. "Telecommunications Requirements for Telemedicine". *Journal of Medical Systems*. 19(2):143-151.
5. Bashshur, R.L. and Shannon, G.W. 2009. *Telemedicine and E-care*. 15(6): 600-610.
6. Baum, H.M. and Rothschild, B.B. 1983. "Multiple Sclerosis and Mobility Restriction". *Archives of Physical Medicine and Rehabilitation*. 64:591-6.
7. Bloom, D. 1996. "Viewpoint: The Acceptability of Telemedicine Among Health-Care Providers and Rural Patients". *Telemedicine Today*. 4(3).

8. Craig, J. 1999. "History of Telemedicine". In: J. Wootton and J. Craig (eds.). *Introduction to Telemedicine*. Royal Society of Medical Press: London, UK.
9. Craig, J.J., McConville, J.P., Patterson, V.H., and Wootton, R. 1999. "Neurological Examination is Possible Using Telemedicine". *Journal of Telemedicine and Telecare*. 5:177-81.
10. Curry, G.R. and Harrop, N. 1998. "The Lancashire Telemedicine Ambulance". *Journal of Telemedicine and Telecare*. 4(14):231-238.
11. Darkins, A., Ryan, P., Kobb, R., Foster, L., Edmonson, E., Wakefield, B., and Lancaster, A.E. 2008. *Telemedicine and e-Health*. 14(10): 1118-1126.
12. Dellifraire, J.L. and Dansky, K.H. 2008. "Home-Based Telehealth: A Review and Meta Analysis". *J. Telemed Telecare*. 14(2):62-6.
13. Demaerschalk, B.M., Miley, M.L., Kiernan, T.E., Bobrow, B.J., Corday, D.A., Wellik, K.E., Aguilar, M.I., Ingall, T.J., Dodick, D.W., Brazdys, K., Koch, T.C., Ward, M.P., and Richemont, P.C. 2009. "STARR Coinvestigators: Stroke Telemedicine". *Mayo Clin. Proc.* 84(1):53-64.
14. Diaz, N. and Bronstein, J.M. 2005. "Parkinson's Disease Research Education and Clinical Centers (PADRECC): Background and Overview". *NeuroRehabilitation*. 20:153-60.
15. Dimmick, et al. 2008. *Telemed Journal and e-Health*. 9(1): 13-23.
16. DMAA. 2008. The Care Continuum Alliance. "DMAA Definition of Disease Management". Retrieved - 12-04.
17. Doughty K. and Cameron, K. 1998. "Continuous Assessment of the Risk of Falling using Telecare". *Journal of Telemedicine and Telecare*. 4 Suppl1:88-90.
18. Edwards, C.S. 2005. "Design and Implementation of a Comprehensive Heart Failure Management Program". *Journal of Healthcare Management*. 50(6):411-416.
19. Ermer, D.J. 1999. "Child and Adolescent Telepsychiatry Clinics". *Psych Services*. 29(7): 409-14.
20. Finkelstein, S.M., Speedie, S.M., and Potthoff, S. 2006. "Home Telehealth Improves Clinical Outcomes at Lower Cost for Home Healthcare". *Telemedicine Journal and e-Health*. 12(2):128-136.
21. Fries, J.F., Koop, C.E., Beadle, C.E., Cooper P.P., England, M.J., Greaves, R.F., Sokolov J.J., and Wright, D. 1993. "Reducing Health Care Costs by Reducing the Need and Demand for Medical Services". *The Health Project Consortium. New England Journal of Medicine*. 329(5):321-325.
22. Ganapathy, K. 2005. "Telemedicine and Neurosciences". *Journal of Clinical Neuroscience*. 12:851-62.
23. Giansanti, D. 2008. "Telemonitoring and Telerehabilitation of Patients with Parkinson's Disease: Health Technology Assessment of a Novel Wearable Step Counter". *Telemedicine and e-Health*. 14:76-83.
24. Harrop, N. and Curry, G.R. 1998. "Mobile Telemedicine: Preliminary Experience with a Telemedicine Ambulance". In: R. Wootton (ed.). *European Telemedicine*. Kensington Publication Limited: London, UK. 108-111.
25. Harvey, R., Roques, P.K., Fox, N.C., and Rossor, M.N. 1998. "CANDID -Counseling and Diagnosis in Dementia: A National Telemedicine Service Supporting the Care of Younger Patients with Dementia". *International Journal of Geriatric Psychiatry*. 13:381-8.
26. Hatzakis, M., Haselkorn, J., Williams, R., Turner A., and Nichol, P. 2003. "Telemedicine and the Delivery of Health Services to Veterans with Multiple Sclerosis". *Journal of Rehabilitation Research and Development*. 40:265-82.
27. Havranek, E.P. 2005. "Improving the Outcomes of Heart Failure Care: Putting Technology Second". *Journal of the American College of Cardiology*. 45(10):1665-1666.
28. Hernandez, C., Casas, A., Escarrabill, J., et al. 2003. "Home Hospitalisation of Exacerbated Chronic Obstructive Pulmonary Disease Patients". *Eur Resp J*. 21:58-67. <http://dx.doi.org/10.1183/09031936.03.00015603>
29. Inglis, S.C., Pearson, S., Treen, S., Gallasch, T., Horowitz, J.D., and Stewart, S. 2006. "Extending the Horizon in Chronic Heart Failure: Effects of Multidisciplinary, Home-Based Intervention Relative to Usual Care". *Circulation*. 114(23): 2466-2473.
30. Izquierdo, R., Knudson, P., Meyer, S., Kearns, J., Ploutz-Snyder, R., and Weinstock, R. 2003. "A Comparison of Diabetes Education Administered through Telemedicine versus in Person". *Diabetes Care*. 26:1002-1007.

31. Jackson, K.M., Scott, K.E., Zivin, J.G., Bateman, D.A., Flynn, J.T., Keenan, J.D., and Chiang M.F. 2008. "Cost-Utility Analysis of Telemedicine and Ophthalmoscopy for Retinopathy of Prematurity Management". *Arch. Ophthalmol.* 126(4):493-499.
32. Janca. 2000. "Tele-psychiatry: An Update on Technology and its Implications". *Curr Op in Psych.* 13: 591-7.
33. Jerant, A.F., Azari, R., Martinez, C., and Nesbitt, T.S. 2003. "A Randomized Trial of Telenursing to Reduce Hospitalization for Heart Failure: Patient-Centered Outcomes and Nursing Indicators". *Home Health Care Serv Q.* 22(1):1-20.
34. Jurin, M.S.S. 1726. MS letter of Hallet Turner to James Jurin. Welcome Institute for the History of Medicine London.
35. Lai, J.C., Woo, J., Hui, E., and Chan, W.M. 2004. "Telerehabilitation: A New Model for Community-Based Stroke Rehabilitation". *Journal of Telemedicine and Telecare.* 10:199-205.
36. Lee, R.G., Chen, K.C., Haiso, C., and Tseng, C.L. 2007. "Mobile Care System with An Alert Mechanism". *IEEE Trans Inf Technol Biomed.* 11(5):507-17.
37. Leggett, P.F., Graham, L., Steele, K., Gilliland, A., Stevenson, M., O'Reilly, D., Wootton, R., and Taggart, A. 2001. "Telerheumatology: Diagnostic Accuracy and Acceptability to Patient, Specialist, and General Practitioner". *British Journal of General Practice.* 51(470):746-8.
38. Loh, P.K., Donaldson, M., Flicker, L., Maher, S., and Goldswain, P. 2007. "Development of a Telemedicine Protocol for the Diagnosis of Alzheimer's Disease". *Journal of Telemedicine and Telecare.* 13:90-4.
39. Mahen, M., Whitten, P., and Allen, A. 2001. "E-Health, Telehealth and Telemedicine: A Practical Guide to Startup and Success". Jossey-Bass Publishers: San Francisco.
40. Ministry of Health, British Columbia. 2007. <http://www.health.gov.bc.ca/cdm/>
41. National Academy Press. 1996. "Telemedicine: A Guide to Assessing Telecommunications in Health Care". <http://www.nap.edu/readingroom/books/telemed/summary.html>
42. Norman, S. 2006. "The Use of Telemedicine in Psychiatry". *Journal of Psychiatric and Mental Health Nursing.* 13:771-7.
43. Patterson, V. 2005. "Teleneurology". *Journal of Telemedicine and Telecare.* 11:55-9.
44. Perednia, D. and Allen, A. 1995. "Telemedicine Technology and Clinical Applications". *Journal of the American Medical Association.* 273(6):483-488.
45. Poon, P., Hui, E., Dai, D., Kwok, T., and Woo, J. 2005. "Cognitive Intervention for Community-Dwelling Older Persons with Memory Problems: Telemedicine versus Face-to-Face Treatment". *International Journal of Geriatric Psychiatry* 20:285-6.
46. Porter, D. and Porter, R. 1989. *Doctors and Doctoring in Eighteenth Century.* Polity Press: London, UK. 189-207.
47. Reardon, T. 2005. "Research Findings and Strategies for Assessing Telemedicine Costs". *Telemed J. E Health.* 11:348-369.
48. Sadovnick, A.D., Remick, R.A., Allen, J., Swartz, E., Yee, I.M., Eisen, K., Farquhar, R., Hashimoto, S.A., Hooge, J., Kastrukoff, L.F., Morrison, W., Nelson, J., Oger, J., and Paty, D.W. 1996. "Depression and Multiple Sclerosis". *Neurology.* 46(3):628-32.
49. Schneider, N.M. 2004. "Managing Congestive Heart Failure Using Home Telehealth". *Home Healthcare Nurse.* 22(10):719-722.
50. Seibert, P.S., Whitmore, T.A., Patterson, C., Parker, P.D., Otto, C., Basom, J., Whitener, N., and Zimmerman, C.G. 2008. "Telemedicine Facilitates CHF Home Health Care for Those with Systolic Dysfunction". *International Journal of Telemedicine and Applications Volume.* Article ID 235031, doi:10.1155/2008/235031.
51. Shea, S., Weinshock, R., Starren, J., et al. 2006. "A Randomized Trial Comparing Telemedicine Case Management with Usual Care in Older, Ethnically Diverse, Medically Underserved Patients with Diabetes Mellitus". *J. Am. Med. Inform. Ass.* 13:40-51.
52. Sibbald, B., McDonald, R., and Roland M. 2007. "Shifting Care from Hospitals to the Community: A Review of the Evidence on Quality and Efficiency". *J. Health Serv. Res. Policy.* 12:110-117.
53. Sosa-Iudicissa, M., Wootton, R., and Ferre-Roca, O. 2000. "History of Telemedicine". <http://www.telemed.co.yn/NOVI/istorijat3.htm>.
54. Telemedicine for Rural South Carolina. 1997. "Telemedicine for Rural South Carolina" [On-line].

55. The World Health Organization. 2002. "Reducing Risks, Promoting Healthy Life". WHO: Geneva, Switzerland.
56. Villani, A., Malfatto, G., Della Rosa, F., Branzi, G., Boarin, S., Borghi, C., Cosentino, E., Gualerzi, M., Coruzzi, P., Molinari, E., Compare, A., Cassi, M., Collatina, S., and Parati, G. 2007. "Disease Management for Heart Failure Patients: Role of Wireless Technologies for Telemedicine. *G. Ital. Cardiol.* (Rome). 8(2):107-14.
57. Warsi, A., et al. 2004. *Arch. of Int. Med.* 164(9.23):1641-1649.
58. Willemain, T.R. and Mark, R.G. 1971. "Models for Remote Health Care Systems". *Biomedical Sciences Instrumentation.* 8:9-17.
59. Wootton, R. 1996. "Telemedicine: A Cautious Welcome". *British Medical Journal.* 313:1375-1377.
60. World Health Organization. 2005. "World Health Organization Report on Chronic Diseases". [http://www.who.int/chp/chronic\\_disease\\_report/en/](http://www.who.int/chp/chronic_disease_report/en/)

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