THE INFLUENCE OF MEDICAL TECHNOLOGY ON MEDICAL PRACTICE: A CASE STUDY OF MADURAI, TAMIL NADU

Dissertation submitted to the
Jawaharlal Nehru University in partial fulfillment of the
requirements for the award of the Degree of

Master of Philosophy

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2003

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New Delhi - 110 067

Date: 25. 07. 2003

CERTIFICATE

This dissertation entitled "**THE INFLUENCE OF MEDICAL TECHNOLOGY ON MEDICAL PRACTICE: A CASE STUDY OF MADURAI, TAMIL NADU**" is submitted in partial fulfillment of six credits for the award of the degree of Master of Philosophy (M. Phil) of this university. This dissertation has not been submitted for the award of any other degree of this university or any other universities and it is my original work.

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We recommend that this dissertation can be placed before the examiners for evaluation.

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Acknowledgement

Words will not suffice to thank people who helped me in finalising my dissertation. First I owe to my family who shaped my career till now in spite of my inadequacies.

My sincere thanks to my supervisors Prof. Ghanshyam Shah & Dr. Rama V. Baru for guiding me to complete this work. Prof. Shah through his insightful ideas shaped the work and so Dr. Baru, in spite of her busy schedule found time to read, correct and finally adding valuable comments to my work.

The study would not have been possible without the partial financial support arranged by Prof. K. R. Nayar from European Commission Project and due thanks to Dr. Sanghamitra S. Acharya for her constant inspiration and support. All the faculty members of CSMCH needed special mention for their support. I owe a great deal to Dr. Dhruv Raina who read my field notes and guiding me at various stages.

Mr. Rajendra Ratnoo I.A.S. made my job easier, when necessary, went out of his way to fix up appointments with government officials and to access various government documents. Dr. Arul anna helped me in getting appointment with various medical practitioners and also in getting permission in hospitals. Thanks are due to Mr. Sam, Apollo Orient Hospital, Madurai for helping me to interview doctors. I thank Kavitha in contacting right people in the corridors of government office. People in Madurai especially Tilagavathi, Samsudeen, Xavier, Mahesh and David helped me in many ways. Various government officials from the local planning office, Divisional statistics office, Corporation of Madurai and people in the health department, thanks to all of them and will remain in my memory forever.

Kumaran's insightful ideas helped me in framing my study. I thank him.

My special thanks to my friends Madhu, Swati, Sanjeev, and Dhara Shree who fulfilled my requests. It is their kind help of various nature at different stages, helped me to sail through this dissertation. Friends in JNU Siddharth, R. Karthik, Ramajayam, Dharma and Ganapathy need special thanks.

Madam Rastogi and Dinesh in the Documentation centre of CSMCH, provided necessary materials promptly, at times troubling them at my will, I thank them wholeheartedly.

The seed for this dissertation was actually sown by my friend Ashok who from the beginning had been a source of inspiration and convinced me why I should work on this particular theme. The time spend with him was immensely helped me in many ways in JNU. I thank him.

It would never be an exaggeration to call my friend Pavananthi as my guide, as he is to many of our friends and if there is any technical richness it is due to Srinivasan, his help in formatting and tabling at the last moment helped me to save my energy and time. Their willingness to help others can only be wondered at.

I thank John for his invaluable help.

Man is basically an imperfect creature and its result is errors, so mistakes in this dissertation are mine and mine alone.

V. Francis Adaikalam

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Chapter 1

MEDICAL TECHNOLOGY: RELEVANCE TO PUBLIC HEALTH

General Introduction

Development of modern medicine related very much to the technological progress after the industrial revolution. Modern medicine which was primarily based on the rationality totally eclipsed the traditional knowledge of healing which was largely based on traditional learning and use of natural remedies as well as religious methods. Incorporating various technological advancements into its intervention, biomedicine has gone into the hands of 'experts' who decides the course of treatment (Lane J, 2001). The expertise has been gained through various ways: the industrial revolution, development of technological artefacts, scientific discoveries and institutional arrangements. The scientific and technological advancements in the medical field assimilated into medical practice, where it has become one of the main factors to decide the course of health care services. Apart from this wider social, economical political considerations also played role. Medical care institutions changed continuously in response to the scientific events.

The introduction of X-ray was seen as the hope to alleviate disease and bring happiness to lives. This has changed with the introduction of neo technologies like ultrasounds, CAT scan, MRI etc. Application of all these technologies in the field was done mainly by medical practitioners. Medical practitioners who are part of society have been influenced by the promises of technology along with economic interest. Thus the medical practitioners started playing a vital role in controlling and executing technological artefacts in medical practice. That is why one should note that in public health comprehending the prevalence of medical technology not only important it is also equally essential to know about the medical practitioners and their understanding over medical technology. In essence this contention became the focus of the study.

The city of Madurai, Tamil Nadu was selected to analyse the influence medical technology has made on medical practice. Madurai being the second largest city in the state in Tamil Nadu has got many hospitals ranging from government to corporate. It has wide range of medical services which include government medical college cum

hospital, one corporate hospital, ESI hospital, Christian missionary hospital and a hospital run by Corporation of Madurai. Apart form this numerous mid-size hospitals and small clinics run by Trusts, Societies and independent medical practitioners which numbered around 226.[1] The city has around 1700 to 2000 medical practitioners both general and specialists. This provides a favourable and conducive environment for various scan centres to flourish, be it of small lab or of imaging centres. The existence of CAT, and MRI centres which are six in numbers along with facts and rationale stated and deliberated above are main reasons for the researcher to choose Madurai as the area of the study. The following chapter gives detailed accounts of development of public health and use of science and technology in its intervention. It also gives critique of science and technology in medical practice. Public health, which considered society as an important component is still influenced by the biomedical approach and technological inputs. With growing demand for better technological interventions and super speciality care, rational usage of resources and technological interventions becomes necessity. In this line this chapter also explains what technology is and in particular medical technology. Then it moves on to broader theme of how technology understood the body and its impact on biomedicine.

Public Health, Biomedicine and Use of Science and Technology

Public health which mainly focuses on health of people, developed along with modern institutions like biomedicine which branched out from science. Dependent on 'science' gives credibility to biomedicine and public health approaches. Both share similar belief of science, using rationality and organisation to achieve progress and to fight against illness and disease, rationality in terms of dismissing the 'superstition' that religion has brought. The concept of Public health and science emerged almost simultaneously in the post-enlightenment era (Peterson, A and Deborah Lupton 1996). Technological intervention becomes part of public health intervention right from sanitary movement till now where it controlled the population in a variety of ways. Though biomedicine also used scientific and technological progress, it focused more on individual intervention rather than society. On the other hand public heath compasses all levels of medicine; preventive, promotive and rehabilitative. The main

[1] Details can be found elsewhere.

focus here is what constitutes and determines the health of the population which may be social, political, economic, cultural and other factors. It involves the promotion of health, the prevention of disease, the treatment of illness, the care of those who are disabled, and the continuous development of the technical and social means for the pursuit of these objectives (Baggott, 2000).

As stated above though public health and biomedicine started in the same historical period, the approaches differ, in terms of services. Public health uses array of professionals and institutions for measuring, monitoring, regulating and improving health whereas modern medicine uses only specialist expertise. Public health is largely associated with government action; that is public sector but medicine mostly developed by private involvement with or without government support. Services in public health are primarily targeted for public rather than individual specific. But still there were criticisms about public health that population become object; target for knowledge and strategies rather than intervening specific problems through services. Public health witnessed the influence of biomedicine in the first half of the 20th century where its intervention focussed mainly to alleviate disease which is a biomedical focus. It did not go beyond the technological intervention which is largely mechanistic. Thus during this period the agenda of public health had been more or less defined by biomedicine. The preventive aspect which was taken over by the clinical medicine dictates what health, illness is and what are its interventions. The intervention strategy is also the outcome of the ideological debates regarding the freedom of the individual, the authority of the state and the balance between individual and collective responsibilities at that time.[2]

Though public health uses lot of mechanist interventions of biomedicine as critics said the clinical medicine distanced further from public health. It was in this period in United States the bifurcation of medicine and public health has happened. The Rockefeller Foundation decided to create schools of public health independent of schools of medicine (White, 1991). The result was an abandonment of the social impulse within American medical education (Horton, 2000). The net result: public

[2] Quoted in Baggott, Rob,(2000) Public...p2

health (society's concerns for the public-at-large) and clinical medicine (patient-based) have become professionally and politically distinct disciplines.

In light of the historically dominating role played by biomedicine in shaping the scope and agenda of public health, one would think that a critique of biomedicine could alter this dominating position. But then demographic transition from communicable to non-communicable disease over a period of time made the bio medical intervention less effective unlike preventive measures for communicable diseases. Increasing incidence of chronic diseases like heart related ailments, cancer, and diabetes by mid-20th century in most of the western countries, over powered the communicable diseases which were dominating, in the beginning of the industrial era. This made a strong point for various factors for disease causation which scholars call it as 'web of causation'. It led to a relative broadening of the scope of investigation of disease-causation, environmental factors and social factors in determining one's health which was found in 'New Public Health' approach.

On the other hand Armstrong (1993) was very critical of how the different regimes of public health developed from quarantine, sanitary science, personal hygiene and new public health. The individual is focussed in its intervention which is an effect of biomedical influence rather than society. Each regime has historical significance and linked to mode of control: quarantine represents a simple line of inclusion and exclusion; sanitary science regulates the movement between different spaces; and personal hygiene regulates a psychosocial space regarding attitudes and behaviours.

New Public Health

The classical notion of public health, which addressed the structural determinants of health and illness, was somewhat revived by 'new public health' which gives importance to 'social' factors (Baggott, R. 2000). Addressing the question of ill-health of a population would thus require a political and social intervention rather than biomedical alone. Importance to social and other factors was grown out of opposition from various pressure groups, movements and critiques from medicine itself which signified that biomedical claims were no longer going to be accepted uncritically by 'lay' persons. In India, Banaeji (1971) said that new public health approach was

adopted in National Tuberculosis Programme (NTP). Sociological data were used along with epidemiological details for diagnosis and treatment of the cases to make it as people-oriented technology. On the other hand there are criticisms about the 'New Public Health (NPH)' which claims beyond modernist strategies where it distanced itself from hospital-centred curative medicine and focus on multidisciplinary approach. True, NPH distances itself from biomedical approach where individual is given importance to social factors. The adoption of broad concept in its understanding includes psychological, physical and social elements. But then, NPH used medical, scientific and epidemiological knowledge for its intervention. Professional expertise like in biomedicine becomes privileged one over lay expertise in guiding the population. This kind of approach increases the surveillance and enhances the power of professionals further as scope of expert surveillance, assessment and intervention is extended. It is seen as series of regimes of power and knowledge that are oriented to the regulation and surveillance of individual bodies and the social body as a whole (Peterson, A and Deborah Lupton1996, p.3). The new public health given itself into the hand of technology [3] which checks and guides the direction of public health. Technology exercises its power and knowledge by giving greater importance for the technological interventions rather than societal aspects in the intervention. Furedi (1997) argued that trust on the experts and institutions were lost due to creation of 'culture of fear', in which professional with some vested interest risked the individuals. But then Wildavsky (1988, 1991) challenged the claim made by the critiques of science regarding the risk of modern society. He believed that risks are exaggerated and the benefits of the technology are not fully appreciated. In order to gain societal approval Giddens proposed the reformed science through social audit, which can clear the misunderstandings and uncertainties. But then one should note that identification and assessment are social process where society should have a say.

[3] Though there are different views on the meaning and connotation of technology and science. Some view science as 'pure/ basic' and technology as 'applied'. Others don't difference science and technology nowadays inextricably since both are linked with the laboratory. The use of science and technology in the work takes this position. since the debate and difference between science and technology is beyond the scope of this work it is not elaborated in detail. For details see. Poser, Hans (1998) and Bijker, W.E et. al. (1997).

Public Health approach in analyzing Medical Technology and Medical Practice

Critics of modern medicine increasingly note that part of the crisis of biomedicine is due to uncoordinated allocation of resources in health care. This facilitated some persons into a privileged position to get specialised care leaving the comprehensive health care behind. Over the years this phenomenon not only raise health costs in medicine, but also made particular specialisation more important, regional disparity in giving medical care growth of and more super speciality care. Public health intervention here simply advocates: just as citizens enjoy equal political and legal rights irrespective of their individual social, religious, or economic status, and society should enjoy the just and equitable distribution of opportunities for health also. This universal health care which is paramount in public health should be the basis for developing heath care services.

The importance to study technology in medical practice is because it uses knowledge by certain privileged professionals which gives money in return. This made them to dictate the course of health care and to have control over the patients. Moreover, contemporary health technologies deconstruct the physical body and refigure the body in relation to its advancement. It determines whether a person is healthy or not. Developments in technology dematerialise the body not only for lay people but also physicians since science *informaticised* the body and has taken over the language and character of biology through dissection into various minute parts. Medicine now has taken the character of information science depends on mapping and managing information at the level of the cell, protein and gene (Webster, 2002). The development in medical technology especially due to medical imaging creates search for greater technical surety and maintenance of an expert-lay relation in an already complex network of delivery system of medicine. Rather than *'healers'*, medical practitioners become *'technologists of the body'* (op.cit). The effect is the prognostic power of physicians which produced new social, ethical and cultural problems and change the nature of health agency.

By stating the above issues the aim is not to demonise the use of science and technology in medicine. Rather to understand socially how technology is used in biomedicine influencing the medical practice. This deconstruction of 'the technical' to

reveal its 'socially congealed' properties does not mean that the technical which has a materiality and functionality, has no value. To analyse this, conceptual understanding of technology is discussed and then historically how technology understood the body. Since it helps us to understand the relationship between technology and medical services which also shapes the medical practice.

Technological progress over time

History witnesses the technological progress in all aspects of social life. Technological progress here means a forward movement, advancement to a higher stage, an improvement to better conditions. This progress not only brings change in social structure and institutions but also risks the society by dictating it, undermining the societal importance (Rivers, T.J.2002). Progress can be traced over the ages, from the Stone Age to the Atomic Age, from the invention of stone tools through the domestication of animals and the cultivation of plants to the atomic bomb, laser and computer. Major technological progress appears in all ages in human history that changed the social life be it of the "print technology", the "food-producing revolution", "the industrial revolution" and its modern continuations like "information revolution", "genetic revolution" and the like. It is not to trap into the technological determinism by describing the process in which technology determines other processes but to understand the importance of the technology through out the human history. Though history witnessed this progress over the ages the industrial revolution brought some profound changes in all walks of life through development of technological tools and its usage. Biomedicine which had its birth and growth in this period was not away from this influence and so public health. This was the reason to restrict the analysis from industrial revolution which influenced technological progress.

Barralla, G. (1988) traced down the European technological revolution from industrial age. First was a combination of innovations in the design and manual construction of the various machines like windmill, water wheel, and the square-rigged sailing ship, the making of armour and fire arms, and the casting of cannon. It is not a single invention, but the accumulation of many innovations that made a complete industrial revolution. The second technological revolution, associated with the beginning of

manufacturing which is distinct from the first phase. It involves coal fired steam power and the machinery development. The third technological revolution was involved with vast expenditures of manual labour to bring about a revolution in steam transport that was essential for steel production and construction of the heavy industry of the late 19th and early 20th centuries. It produced factory-based mass production of assembled machines with interchangeable parts, such as the machine gun and the motor car. Then came fourth technological revolution the electrical and petrochemical industries both in Europe and the United States which was in first half of the 20th century. The latter half of 20th century witnessed the revolutionary era of nuclear power and the electronics based industries associated with the automated production of the uniform products available in the post-war global economy. Major advances in medicine and fertilisers developed along with growing use of radio, refrigerator, television, telephone and washing machine happened in this period. Right now the mechanisation of industry has been superseded by computerised automation. The modern medicine which got birth along with the industrial revolution does not desist from this technological influence. So technological progress in the industry made profound impact in the medical services, administration of the hospital and on medical practitioners in their practice. This leads us in to an understanding of what technology is and then about medical technology. The understanding help us to analyse the influence medical imaging had made on medical practice.

Technology: An explanation

Technology premise on the claim of science that "science is the precondition for the freshly minted world view uncontaminated by unleaded or unemancipated perceptions". [4] Science flushes out superstitions, to eliminate any offending bacteria, to produce clear and ordered world and more importantly promises a materialist paradise (Alvares, 1997). Industrial society believed that through Science and Technology which helps in production of material goods and necessary condition for the good life can be created and 'secret path to paradise' is assured. Society taking technology as neutral and objective firmly went along with the promises of the success of variety of technical aid rather than inquiring about the social consequences.

4. See Alvares,C (1997) for detailed consequences of Science.

So we tend to restrict ourselves to "how things work"-a domain of engineers, inventors and technicians rather than what it does to the society (Winner, L. 1983).

Technology in its broader meaning connotes the practical art which ranges from hunting, fishing, gathering, agriculture, animal husbandry and mining through manufacturing, construction, transportation, provision of food, power, heat, light etc. to means of communication, medicine, and military (Merrill, R. S 1968). According to Bijiker (1990) the meaning of 'Technology' has three layers. First, there is a level of physical objects of technological artefact. For example, bicycles, lamps and bakelite. Second, 'technology' may refer to activities or processes such as steal making or moulding. Third, 'technology' can refer to what people know as well as what they do, what goes into designing a bicycle or operating an uitrasound device in the obstetrics clinic. It also means those things that people have created so that they can expect or manipulate the natural environment in which they are living (Bijker, W.E ed, 1990). Medications are also included as technologies since people created in order to improve their health. Medical imaging falls in this category which has been the tool to do the job in medical practice.

On the other hand people include technologies as organised inputs and associated processes designed to affect outcomes. It refers to not only inputs such as hardware inputs and their operation but also organisational structures, strategies and approaches since they are all designed to achieve defined purpose (Mechanic, D. 2002). Technology is also referred as techniques - bodies of skills, knowledge and procedures for making, using and doing useful things- mean for accomplishing recognised purpose (Merrill, R. S. 1968). The reason for treating all these as technology is because, for example, transformation of medicine comes as much from changing social and organisational technologies as from diagnostic and treatment tools. Technology is not hardware inputs and operation alone but also organisational structure, strategies and approaches. Because new knowledge and tools have important role to play in evolution of social and organizational structure together with culture, national and local politics and economic factor. So the elements of Technology, as historian Howard Segal explained:

> "[Technology]...included numerous materials, both natural and man-made... equally numerous machines and structure..., the processes of discovering or

inventing and refining and producing all of those materials and machines and structures". [5]

In lay terms even the word technology had a general vocabulary; people had variety of meaning and ideas about technology in relation to something else. For example, particular technology is referred in relation to *nature*; the finger they say more natural than machine. Then in relation to *social status* (using a measuring device, they thought, might turn professionals into artisans) and also in relation to *skill* (the person who can diagnose pulse is more skilled than person who read the blood pressure machine). Technology also means in relation to *gender*, for example cooking stove as inherently female. It also means relation to ideas about *God* (humans were created with opposable thumbs because God intended them to be tool users) and about *politics* (machinery of government). All these ideas are connected to each other and components of the intellectual history of technology (Cowan, R.S., 1997).

Medical Technology

Medical Technology in broader terms would include techniques, drugs, equipments and procedures used by health care professionals to deliver medical care to individuals, and the system within which such care is delivered. Techniques here means as Mechanic (2000) puts, 'organised inputs to get the desired output'. Drugs of various kinds are developed to administer through use of technological artefact. Equipments, for example can vary from simple instrument such as syringe to highly sophisticated complex systems such as MRI scan. Procedures here mean the application of organised knowledge to minimise human suffering. This medical technology works through a network including hospitals, pharmacies, insurance companies, government departments, university facilities and the multinational pharmaceutical industry and of course, through professionals. All put together, medical technology is much more than science.

Socio-economic and political factors, all help to shape its evolution. Medical technology influences, changes and shapes the programme, policy, health seeking

[5] Segal, H. (1985) Technological Utopianism in American Thought. University of Chicago. Chicago, pp.80-81 quoted in Cowan, R.S. (1997) A Social History of American Technology. Oxford University Press, New York, p.204.

behaviour, providers' behaviour and cost. These influences promote a particular kind of culture in which values, attitudes and believe become a force which brings change (Johnson, 1995). It applies both for patient, who is the beneficiary and doctor, who apply the technology. In addition to that patients trust on medical technology and confidence of doctors are also important factors for development of the medical technology. Table 1.1 below summarizes the different types of medical technology and their application.

Table 1.1 Types of Medical Technology (MT)

Types of MT	Forms of development in MT	Application of MT
1.Drugs 2.Devices 3.Medical and surgical procedures 4.Support systems 5.Organisational systems	1.Process innovation 2.Product innovation	1.Screeing 2.Prevention 3.Diagnosis 4.Treatment 5.Rehabilitation

Adapted from Bhatt, R (1994)

Use of Body as technology

How does technology use body in its intervention can be traced back from the Galileo period in medicine. But profound changes have happened over the past two centuries in understanding and viewing the human body, due to the advancement of science and technology. In the medical world, since the 17th century till recently, the body was solely viewed through the naked eye or via elementary mechanical magnification with the help of compound lensed microscopy. With the development of advanced biomedical technologies bodily imaging: techniques have become the centre of diagnostic medicine. Today, we consider our bodies through scientific fact, an objective analysis in consonant with the enlightenment tradition of rationalist thinking. The Cartesian idea of philosophical introspection, a simultaneous separation of mind from lived-in body becomes dominant. The sacred and numerous qualities of body, viewed by the Church and religion changed into body as secular. The body is no longer seen as analogous to the divine but rather as similar to the engines of

industry. Thus body is equalled with machine. This tone was echoed by Dr. Robert Haynes, president of the 16th International Congress of Genetics:

> "...the traditional view is built on the foundation that life is sacred...well, not anymore. It's no longer possible to live by the idea that there is something special, unique, and even sacred about living organisms".[6]

This theory was started long back by Galileo, who being a mathematician, a key figure in the transformation of Western society's view of nature from *Terra Mater* (Mother Earth) to the mechanistic universe of modern science. His thinking "to abandon completely the false opinion that the sun is the centre of the world and does not move and the earth is not the centre of the world and moves" (Finocchiaro, M. A, 1989) is seminal to the seventeenth-century reduction of life to machine. He believed that all things, animate and inanimate, could be seen as the interaction of tiny, ultimately measurable particles of matter. The doctrine was known as "atomism". He was seen as the ultimate symbol of the modern enlightenment. As Lewis Mumford historian noted that:

> "Galileo... surrendered man's historic birthright: man's memorable experience, in short, his accumulated culture. In dismissing (human) subjectivity Galileo had excommunicated history's central subject, multi-dimensional...Under the new scientific dispensation... all living forms must be brought into harmony with the mechanical world picture ...For the machine alone was the true incarnation of this new ideology ... To be redeemed from the organic, the autonomous, and the subjective, man must be turned into a machine...".7

The other leading lights of the century who contributed for this notion were -Bacon, Kepler and Newton- called as the "world-splitters". They separated all non-mechanical aspects of nature and humankind and held them as incapable of analysis. In doing so they treated nature with mathematical and mechanical terms, by taking clock for their analysis. The mechanistic view of nature crated by enlightenment is still our governing metaphor (Kimbrell, 1993).Francis Bacon was the first to extend the clockwise analogy to animal bodies. In *Novum Organum (*1620) Bacon wrote: "the making of clocks... is certainly a subtle and exact work: with orderly motion, the pulse of animals".[8] Science, according to him should take precedence over

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6 Quoted in Kimbrell, Andrew. (1993) p.233

[7] ibid., p. 236

[8] ibid., p.238

experience. Bacon assumed that new discoveries can only come from the study of nature that is uncorrupted by ancient learning.[9] Although an advocate of science rather than of technology, Bacon believed that technology benefited from the advancement of science, practical applications of science, what he called as "mechanical arts", has aided human advancement and will continue to so do (Blumenberg H., 1976).

With the discovery of the "pump" like circulation of the blood by English physician William Harvey, in 1628, bolstered the growing seventeenth century view that the body was machine (Kimbrell A.1993). On the other hand Descartes in his work *Discourse on Method* (1637) argued that virtually all body movement and processes could be understood in terms of machine like activity. He gave mechanical analysis of living bodies. He dismissed the whole theology of church that human beings have an immortal soul inseparable from the body and believes that the theology was not in accord with observable fact:

> I wish to consider... that all the functions which I have attributed to this Machine, such as digesting of meats, the beating of the heart and arteries, nourishment and growth, respiration, waking and sleeping; the reception of light, sounds, odours, tastes, warmth, and other similar qualities, into the exterior organs of sensation...the corresponding ideas upon a common sensorium and on the imagination...and finally the external motions of all the members of the body...I wish, I say, that you would consider all these functions as... neither more nor less than the movements of a clock or other automation...".[10]

Descartes's theory made machine as a convincing analogue for biological processes. For example the advances in the anatomy compared the body and its parts to number of well-known mechanical devices. According to Descartes, though human body is like a 'machine' it still had immortal soul, based firmly in the unique human power of reason.

Gottfried Wilhelm von Leibniz, an enlightenment scholar maintained that "the machines of nature, i.e., living bodies, are even in the smallest of their parts, machines and *ad infinitum*"[11]. Another scientist saw the organs of the body "resembling pillars,

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[9] See K. Löwith, (1949). Meaning in history. University of Chicago Press, Chicago, quoted in T. J. Rivers (2002).

[10] Quoted in Kimbrell, A (1993) p.239

[11] Quoted in Rabinbach, A (1990) p. 64.

props, crossbeams, fences, covering; some like axes, wedges, levers, and pullies, others like cords, presses or bellows; and others again like sieves, strains, pipes, conduits and receivers"[12]. Materialistic, Julien Offray de La Mettrie in his work, *L'Homme Machine* (Man a Machine, 1748), maintained that humans, just as other animals were soulless machines. He differed with Descartes in fundamental issue-saw no need to distinguish the beast-machine from man-machine. His view that mechanical laws produced body motion and thoughts, so no need for humans to have soul. These ideas had far reaching consequences. Firstly, as historian David F. Channell puts,

> By the end of eighteenth century, mechanical philosophy seemed able to explain organic life....In the reductionist world of the mechanical philosophy, machine and organisms could both be explained in terms of mechanical principles...reducing life to technology. Life in general, even human beings, were at their base functioning as mechanical organisms".[13]

Secondly, as Donald Worster said, the machine thesis on human beings provided the philosophical basis for the commercialization of life-forms and human body shop. "By reducing... animals to insensate matter...the naturalist was removing the remaining barriers to unrestrained economic exploitation".[14] By twentieth century human body and the development of medical technology in this line made advancement in computing the body through genetic engineering. In this way biomedicine has been emphasised and its authority is stressed. Most of the diagnostic and therapeutic techniques are of course experimental upon the body. And these technologies are overvalued for its usefulness and believed that it results in alleviating and curing disease (Towers, B 1971). By and large, man tends to seize uncritically on new medical facilities, always in the hope that somehow they will prevent the ever-flowing stream of disease and death. (ibid.). The gullibility is not general public alone but of scientists and doctors who believed the efficacy of technology in totem, whether it is of iatromechanical or iatrochemical. Mankind is scared of suffering and death and this fear makes them an easy prey to the optimism of medical technology. The same enthusiasm provides money for the advancement of medical technology.

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[12] Quoted in Kimbrell, A (1993) p.241

[13] ibid., p.242

[14] Worster, D. (1979) p.40

This results in viewing human in to a narrowly mechanical analysis with the application of mechanical and chemical techniques (ibid.).

Public health and technological influence in India

Soon after the Independence, August Comte's vision of applying principles of rationality, empiricism, and enlightenment to society got refreshed in political independence of the third world countries with the assurance in upliftment of standards of material well being (Alvares, 1997). Nehru in 'Discovery of India', said 'it was science and science alone that could solve the problems of hunger and poverty, of insanitation and illiteracy of superstition and deadening custom and tradition' (ibid.). The science policy that India adopted in 1958 gave importance to science in eliminating poverty and set standard of living. Science was so much embedded in the planning that it becomes important in designing in Five year plans. Planning is science in action and the scientific method means planning. Public health interventions also did not desist from technological influence. Health programmes of the government focussed mainly on technological intervention leaving out social, cultural and economic aspect and were implemented by top-down approach. There was slight deviation when tuberculosis programme was designed. It was developed and implemented based on the felt and real need of the community with cost effective technology, Banerji (1971) calls it appropriate technology. WHO defines appropriate technology as the "level of medical technology needed to improve health conditions in keeping with the epidemiologic, demographic and financial situation of each country".[15] In this direction Alma Ata Declaration of 1978, recognises public health as social control over the health services that are meant to serve population covering entire population ; providing services in an integrated form; use of appropriate technology; use of relevant elements from the traditional systems of medicine; use of only essential drugs and so on. The WHO estimates that 80% of diagnostic radiology [i.e. Basic Radiological Units (BRU) which is low cost, effective, diagnostic X-rays] can be performed by simple, safe and low cost equipment, supported by training of local people to operate and maintain the equipment.

[15] Quoted in Tulchrisky, T. et.al. (2000) p.738.

But the truth is that at one level, due to minimal allocation to government funds to health, rural urban partialities, focus on family planning programmes and concentration of tertiary services created a big gap between poor and rich, rural and urban. On the other hand professional influence, condition of funding agencies led into the National Health Policy 1983 which advocated the promotion private sector in providing health care. This is in clear contrast to the recommendation of Bhore Committee before Independence which emphasised government involvement for comprehensive health care. It states 'inability to pay should not be allowed to come in the way of seeking health services by all citizens of the country'. The promotion of private sector increased medical cost and accumulation of clinic and hospitals in urban areas with introduction of latest technology from screening to diagnosis. The proliferation of medical technology has played very important role in promoting the growth of this sector which targets individual focus in diagnosis, treatment, biophysical and psychological status, physical examination and laboratory test. Medical care nowadays becomes an important aspect in private sector in terms of offering medical facilities, varying complexity and sophistication. At one hand the urban area is concentrated much with tertiary hospital care, medical research units, and super speciality hospitals both by public and private sector. On the other hand rural population is totally neglected where non availability of basic instruments is pretty much evident for this scenario.

Methodology of the Study

Objectives

The overall objective of this study is to examine the place of medical technology in health services in relation with biomedicine and its practice. Also to know the influences it had made for public health.

- To understand the distribution of medical imaging in relation with health services;
- To study the changes medical technology brought about in medical practice and
- To know the perception of medical practitioners regarding technology on medial practice.

Study Design

The study restricts itself to medical practitioners who are practicing public, private hospitals within corporation limit. It also includes practitioner who are practicing independently.

Data collection

Indirect collection of data includes nature of ownership and fees charged in high technology scan centres. Details regarding scan centres, the staffs working there, and details regarding the medical practitioners perceptions regarding medical imaging in relation the their practice gathered after getting appointment from them. The distribution of scan centres details in the corporation limit and throughout the district got from various government and private sources. Departments of public health in the Corporation of Madurai office, regional statistics office and local planning authority were consulted to get details on various aspects about the field area. Local libraries were also consulted.

Selection and sampling procedure

Criteria for selection of sample are done through purposive sampling. Medical practitioners from different specialities were interviewed. Data collected through open ended interview schedule. Before the actual interview a brief write up about the study alone with the possible points to be discussed was handed over to the respondents. Data also collected through discussions and observation discussion interviews were conducted.

The researcher met 32 medical practitioners to get an appointment for interview, of them 14 are neurologist, 8 are cardiologist and 10 are gynaecologist. The researcher could get appointment only with 13 practitioners, which includes 4 neurologists and 3 neuro surgeons, 3 cardiologists, 2 gynaecologists and one cardiac surgeon. They all are varied in terms of place of practice, some in public sector, some have their own clinic and some employed in corporate hospital.

Difficulties encountered

With most of the medical practitioners the interview could not take place though they promised to spend time with the researcher. The reason is for the respondent each minute spend with the researcher is clearly a great loss of monetary benefits in other words they are specialist always in want of time who cannot find time for anything else except their medical practice. The researcher some times had to wait till late night after doctors complete their practice only to get an appointment for the interview.

Time constraint and also the lack of interest and unwillingness of the doctors to read single page discussion points is another major constraint researcher faced. Data collection would have been better it doctors reflect upon the discussion paper

Permission from the corporate hospital is another major hurdle though permission was granted.

Meeting doctors in public sector was denied- administrative hurdles. Also to collect the details of the scan centres in the district was denied on various grounds, so too the details from corporation.

Chapterisation

The first chapter gives account of the theoretical understanding of the technology. It explains the understanding on technology and also gives historical account on how technology influences various thinkers and lastly, about the medical technology and a brief analysis on biomedicine which was very much influenced by the technological intervention.

In continuation with the previous chapter which explains technology at some length, the second chapter gives account of the relevance of medical technology in public health. How important it is in development of health services and medical practice. Influences of medical imaging in medical practice are also discussed. In this chapter technological adoption of various countries in their health services were discussed.

The third chapter elaborates the features of Madurai city where the data collected. Socio-economic details of Madurai is analysed then about the distribution of scan centres and the services available in the city. Lastly this chapter talks about the cost and availability of medical imaging in the city and the influences it has made on medical practice.

In the final chapter collected data is analysed and discussed.

Chapter 2

TECHNOLOGICAL INFLUENCES IN MEDICAL PRACTICE

The modern medicine which started examining patients through clinical examination got a sea change after medical imaging was introduced for diagnosing patients. Technology rather becomes inevitable too in diagnosis and treatment. Practitioner's judgement without technological tool is no longer valid and taken seriously. Doctors are sometimes being given status based on their knowledge about the disease, and use of technology sometimes frequently. This chapter deals with various aspects of clinical examination in diagnosing the patient, role of technology in medical practice- whether it changed the clinical examination or not, the impact of medical imaging on the medicine in general and medical practice in particular. This chapter also gives an account of how medical imaging brought changes in the medical care services and hospitals. Let us now look into the importance of physical examination in medical practice, clinical medicine and the influence of medical imaging.

Importance of physical examination and use of clinical skills

The importance of physical examination has a long history. It helped practitioners to know the status of the patient and to decide what action is needed. Clinical skills such as observation, examination and interpretation are considered important and required for physical examination through the use of skills (Phoon, 2000). The rest in medicine which includes counselling, prognosis, medical and surgical treatment is wholly based on the physical examination. Along with the medical history, physical examination is and has been the frontline tool for diagnosis. *Mosby's Medical and Nursing Dictionary* defined physical examination as:

> [An] investigation of the body to determine its state of health using any or all of the techniques of inspection, palpation, percussion, auscultation, and smell. The physical examination, medical history, and initial laboratory tests constitute the data base on which a diagnosis is made and on which a plan of treatment is developed.[1]

Physical examination, the oldest technique is mainly based on *observation.* A patient's colouring, the condition of the tongue, and other detailed clinical observations,

1Glanze, W. D ed.(1986) p. 880.

including auscultation, were important to Chinese diagnostics (Wallnöfer, H.1965; Ackerknecht, E. H. 1982; Bruhn, J. G. 1978). Patient examination in bedside may be traced back some 6,000 years ago in ancient Egypt (Zoneraich, S.P. et.al. 1996). Detailed case histories recorded 3500 years ago by Edwin Smith and Ebers Papyri in Egypt include a provisional diagnosis and methods on examining patients with diagnostic signs (Ackerknecht, E. H. 1982). Egyptians also studied the pulse and made several observations on cardiac disease and circulatory insufficiency (Ghalioungui, P. 1984) so also the ancient civilizations of Mesopotamia and India (Ackerknecht, E. H. 1982). Pre-Columbian Mesoamerican civilizations document as far back in 1500 BC, detailed observations of human disease. Sculptures portray hunchbacks, dwarfs, swellings of the body and face, blindness, asymmetric faces, eye problems, limb deformities, and pustules (Winning, H. V.1986). Clinical medicine reached new heights in the 4th century BC with Hippocrates, the "father of medicine," who used physical examination skills in addition to careful history-taking. Hippocratic medicine placed much emphasis on the value of observation of the disease process (Ackerknecht, E. H. 1982). In the late 19th and early 20th centuries, clinical examination advanced into the art of clinical diagnosis and the usefulness of physical examination was felt. During this time, with the birth of biomedicine, William Osler, one of the great clinicians of all time, felt that a thorough physical examination, along with a careful history, was among the "principles of practice" of medicine (Harvey, A. M, et. al.1989). On the "natural method of teaching" to medical students, Osler wrote:

> The student starts . . . as an observer of disordered machines, with the structure and orderly functions of which he is perfectly familiar. Teach him how to observe, give him plenty of facts to observe and the lessons will come out of the facts themselves. . . . *The whole art of medicine is in observation.* . . . [pp. 596-97, italics added].[2]

But then advancement in medical technology especially in early part of 20th century loosened the physician control over patient. This was due to the subjective nature of diagnostic judgement. The diagnostic tools readily provided the data claimed itself as "objective". So the strength of physical examination findings which are subjective and somewhat mysterious became less importance. In order to know about the use of

[2] Quoted in Cushing, H. (1925).

technology and the changes it had brought, it may be necessary to briefly look into the role of medical technology in medical practice.

Evolution of Medical Practice and Medical Technology

The use of technology in treatment started with the use of curves and roots. Evidences discovered in parts of Europe, Asia and South America suggest that various surgical procedures were tried. For example, crude surgical attempts, skulls with holes in people were found. As civilization passed on to the next generation, the state of medicine has reached a high level of sophistication (Lane, J. 2001). Earlier, physicians were treated as God of healing. Hippocrates installed a scientific spirit by changing the nature and nomenclature of physicians and viewed them as scientists rather than priests. Diagnostic observations and clinical treatment began to replace superstition under his regime. According to him, body has the potential to recover naturally and the role of a physician was to aid these natural processes. In Renaissance period, sickness and pain were seen as processes which provide genuine insight into the workings of heart, lung, brain and muscle structures. Body temperature and pulse rates become measures that could relate to other symptoms.

The practice of medicine in early modern England was dominated by the humoral theory, from ancient Greece. There were four cardinal humours-blood, phlegm, choler (yellobile) and melancholy (black bile) associated with the elements of air (blood was warm and moist), water (phlegm was cold and moist), fire (yellow bile was warm and dry) and earth (black bile was cold and dry). The practitioners of medicine thought these elements imbalance the body. Their task was to restore the humoral balance by using medicines with qualities opposite to those of the excessive humour- for example, a hot dry drug for a phlegmatic patient (Lane, J 2001). So 'bedside medicine' was dominant till nineteenth century, the patient-doctor relationship was a very important component of the medical treatment. Sick person was the centre of medical treatment and treated as a whole person. The account of patient's narration of symptoms and feelings were given importance.

Meanwhile, social and economic changes due to industrialisation gave full support to the new and secular definition of the world detached from religion. During this

period, medicine also developed rapidly as a new and powerful science even though its therapeutic effectiveness was limited. Medical ideas, the activities and pronouncements of doctors became very powerful social force. The power to doctors arose from the ideological importance of medicine in defining and justifying new modes of social and economic organisation as well as from the growing significance of the medical practice itself as a mechanism of social control (Lane, J 2001). The physicians were viewed as a 'magical member of the middle class' and this had an important effect on the nature of medical practice.

So, hospital medicine shifted from a belief in disease as a disturbance of the total system to what is called 'localised pathology,' i.e., ill health could be caused by malfunctioning of one particular part of the body. Doctors correlate the external symptoms[3] with those internal malfunctions that they could discover[4] using various instruments[5] which were developed during this period. The public health field which was developed during this period used preventive and environmental strategies but it was of little interest to most practitioners of curative medicine. With the development of germ theory in the late 19th century, the emphasis of medical practice swung more towards individual care. This was the period of 'laboratory medicine' where doctors probed deeper into the bodies of human. It was the final victory of the mechanistic world view that saw body as different parts without harmonising with other parts of the body and with wider social, economic and environmental factors.

Industrial revolution also made some profound changes in technology which had an effect on the course of medical practice. In the first industrial revolution, machines were put in place of animals and human muscles. The second industrial revolution initiated the use of machinery for functions that was hither to performed by the senses and human mind. After World War II, technological improvement was mainly in pursuit of military objectives which also brought nuclear medicine and medical imaging and this has made great impact on the medical care till 1970s. Improvements in clinical chemistry, computing, clinical microbiology etc, in recent years brought specialised medical care.

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[3] those reported by patients were considered as less importance

[4] often on autopsy

[5] They include thermometer, stethoscope, and laryngoscope and so on.

Thus, the theme of the medical history during 19th century was the integration of diverse skills into one medical profession but in 20th century it has been fragmented into various branches. One can find specialists in diseases of the nervous system, or the neurologist, the fever specialist, the specialist for the liver, the specialist for the stomach, the specialist for ovariotomy, specialists for kidneys, specialists for children's diseases etc. This great acceleration of specialization was mainly a product of science and technology. Emphasis shifted from the generalist to the generalist with a special interest, and finally to full-time specialist. The era of General Practitioner (GP) specialist ended with service of the consultant specialists and Independent GP surgery was replaced with specialist surgeon. This is how technology played an important role in changing the role of medical care and hospital during the 20th century using applied sciences[6]. The following section focus on the improvement of medical technology particularly medical imaging in 20th century which had transformed the medical practice in a profound manner.

Technological improvement in 20th century Medicine

From physics, (bio) chemistry, astronomy, neuroscience to molecular genetics, technological imaging is changing the way we see ourselves and also the world around us: it tells us what we are and how we really look. Wilhelm Roentgen's discovery of X-rays in 1895 led us to see the human body. But over the last three decades, the wide-spread use of high-resolution electron microscopy has provided powerful micrographic images on a molecular level.

The technical advances in 20th century related to enhanced visualization include: TI (Thermal Imaging), MRI (Magnetic Resonance Imaging), CT (Computed Tomography X-ray imaging) and PET (Positron Emission Tomography) contributed to a radical shift in viewing the body and view of medical practitioners. On the one hand, the body can be seen in a quantifiable, voluminous fashion. This re-draws our body in tune the imaging which was just flesh and bone before. Now it is a mass of various readings, each one giving a different character to the whole. On the other

[6] chemistry, physics, engineering, microbiology, physiology, pharmacology etc.

hand, the new technologies have produced a dimensional multiplication of how the human body is conceptually and visually recognized (Czegledy, Nina and André P. Czegledy 2000). The body is also seen in plural ways: via electronic pulses, magnetic cadences, thermal signatures, etc. The intervention of medical imaging created opportunities to have different qualitative understanding.

In the United States technological improvement in medicine can be traced along with the change in industry. In 19th century, the practising physicians were traditional healers and the industry consisted of small-scale entrepreneurs. This structure has transformed in the 20th century where medicine was highly institutionalised and specialised. In the industry too big firms monopolised the market through institutions and highly tailored jobs were created. There was an alliance between the state in funding the research units, professionals who are research elite with profit motives and corporate sector (which processed and disseminated the technology). The post-1900 technologies such as hospital organization, operating room design, and medical records--essentially, *the hospital itself*—which are considered as "softer" technologies became a new-model American medical practice system after the First World War. Howell (1995) stated that this development had come when progressive norms of efficiency swept across many facets of society through engineering marvel. This according to him, has led to an early attempt in creation of standards, reproducibility, and control. He calls this, persuasively, as an early "guidelines movement".[7] The standardisation became an assurance and was treated as good diagnosis for medical treatment. The table below give account of the health related technological progress over the last four centuries.

Table 2.1 Health care innovations from the Seventeenth to Twenty- First Centuries

Period	Examples of scientific, technologic and organisational innovations
17th century	Biological basis of disease(Descartes), circulation of blood(Harvey), microscope (Leeuwenhoek)
18th century	Thermometer, Vaccination (Jenner), surgical anatomy(Hunter), clinical sciences (Sydenham)
19th century	Stethoscope, anaesthesia, laryngoscope, ophthalmoscope, blood pressure cuff, sanitation, antisepsis, Braille printing, hygiene in obstetrics, nursing, microscopic pathology, pathological chemistry,

7 Howell, J, .D (1995) p. 245.

Period	Examples of scientific, technologic and organisational innovations
	microbiology, vaccines, X-ray, syringes
1900-1930	Biomedical education, salvarsan, insulin, blood groups, vitamins, conquest of yellow fever, vitamin B, cost-benefit analysis
1931-1945	Penicillin, randomized clinical trials, anti-malarial and vector control
1946-1960	Vaccines, anti-hypertensive, psychotropic drugs, cancer chemotherapy, prepaid group practice
1961-1980	DNA, oral dehydration therapy, vaccines, open heart surgery, pacemakers, organ transplantation, computerized tomography(CT), eradication of smallpox
1981-2000	Magnetic resonance imaging(MRI), position emission tomography(PET), endoscope surgery

Source: Adapted from Tulchrisky, T.H and Elena A. Varavi Kova (2000): p.746.

Technological web in medicine and its impact

The advancement in technology not only helped to see the body in plural ways but also transformed the medical care to be more dependent on increasingly sophisticated technologies which had been drawn from bioscience, engineering and information technology. It redefined and deconstructed the physical body in relation to health and disease. Increase of techno-science intervention had impact on in dismantling the traditional practices and expertise. The increasing reliance on such technologies marked what Pickstone (2000) has called as a shift from 'biographical medicine' to 'techno-medicine'. This obsession with 'miracle technology' made a fundamental shift from public health approach into technological oriented intervention (Webster, 2002).

No doubt advancement in health status and increasing life expectancy as well as public health measures were not only because of social economic improvement but also due to technology based public health interventions in the West (Lupton, 1994). But as Ehrenreich (1978) pointed out, through the use of technology, the nature of biomedicine exerted 'social control in two ways, exclusionary and co-optative'. The first, i.e., the exclusionary kind of social control fits in with the traditional political economic approach - the exclusion of certain groups from medical services and denial of access by various means, geographical inaccessibility and social status. The second type of social control, i.e., co-optation attempts to expand the jurisdiction of biomedicine to more and more aspects of human life. This is achieved through the

treatment of those who enter the sick role and a further encouragement to seek medical treatment for a variety of 'non-sick' situation. Through this '... medical practitioners bring large numbers of people into the fold of professional management of various aspects of their lives' (Ehrenreich, J.1978).

Medical imaging: Impact on medical practice and treatment

The influence of medical imaging on clinical practice can be traced from the introduction of X-ray in the last decade of 19th century and perhaps the ultra sonogram made profound changes in the later part of 20th century. However, the use of advanced and complex machinery has become a central feature of modern medical practice nowadays and the more complex and advanced the machine is, the more professional the physician is thought to be (Cowan, R, .S 1997). Advanced diagnostic imaging has altered for example the practice of neurology by providing new ways of seeing into the human brain and body (quoted in. Kevles, R 1997).The new technologies affect the clinical decision making process. As Wolpe (1985) noted the change as:

> 'Medicine provides us with the best opportunity to examine our relationship to our new machines, for it is in the medical realm that we have the most intimate contact with our technology. We do more than "interface" with medical instruments; we assimilate them, allowing them entry past the natural defining barriers of our physical bodies'.

This techno-science intervention created risk society. It deconstructs the intervention of disease and legitimises monoculture when technology can alleviate disease. Understanding medical technology in reaction to work of body is important in analysing the power of 'the medical gaze' that took over the human body for its so called objectivity analysis that moved deeper and deeper into body structures - from the surface anatomy, through X-rays to intrabody physiology and now to genetics. At another level it is also taken position to rule out the abnormalities by trying to find the disease at very early stage. [8] As a result 'everyone lives under the medical regime, a light regime for those who are not yet patients, stricter according to how dependent on doctors one becomes' in the process.[9] Patients were created without symptom and the intervention determines the normality and abnormality - illness and disease - which led to medical intervention. Powerful medical gaze occurs not only at the individual

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[8] Prior (2001) in Lupton (1995).

[9] de Swaan,A.(1990:57).

level (diet, body regulation, sports medicine) but also at public level by the state and its public health agencies through the various intervention programmes.

Some of the new technologies not only demand new diagnosis by replacing the existing screening, procedures, structures and manpower but also transform ideas about health, illness and disease and there by redefine health, medicine and body (Webster, 2002). High-tech medicine does not rely upon causality but rather depends upon the language of *risk* and probabilities which underpins the scientific 'destiny' by increasing the level of complex, integrated, specialist knowledge (op. cit.). The risk and probabilities made patients into psychologically distress persons at various levels (Peterson, A. 1996). They are, at first; false negatives where individual is assured of not having disease, lose hope in the medical system if further tests proved that the earlier tests were incorrect. Secondly, false positive results, where the individual is told of having the disease which made him sick psychologically [10] and lastly, those who were told the need of further investigation to confirm.[11] This dependence on the ever-sophisticated technology would weaken the epistemological and professional authority of medical science and practice and more importantly, the interpersonal relationship that exits between the doctor and the patient.

There are number of consequence for patients as result of this development. First, as Rapp argued, those patients who are caught up in high-tech medicine find themselves at the precarious edge of medical innovations, where uncertainty still prevails. Rapp declares such people as 'moral pioneers' and crucial to the process of both the technical and social process of medical innovation.[12] Medical technology at one level helps physician to arrive at the correct diagnosis and subsequently prescribing the appropriate medicines and procedures. Especially the diagnostic technologies such as CAT and MRI are important tools for supplementing the physical exam but then in the right setting to help and guide life-saving therapies. On the other side it influences the practice and makes the physician handicapped due to total reliance on it.

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10 Nelkin and Tan credi (1989) p.46-7 quoted in Peterson, A (1996).

11 Marteau (1990) p..26 quoted in Peterson, A(1996).

12 Quoted in Webster, Andrew. (2002) p.448.

Commercial benefits of medical imaging also shaped the medical practice. The MRI technology which is highly dependent upon digitization technology, gives minute details of the body where it has fast becoming star performers for profit-minded institutions and enterprises. The commercial expansion of these technologies had even reshaped biomedicine in ways that would have been barely imagined a decade ago:

> Although the inroads made by imaging technologies are occurring throughout science, they are most pronounced in biomedical research, where radiology departments have been re-baptized as departments of Medical Imaging, where entire issues of journals are devoted to imaging technologies and where a prominent publication—the New England Journal of Medicine—now carries a regular feature on medical imaging.[13]

Various studies have shown that medical imaging changed the course of medicine, from 'clinical' into 'techno'; a move towards evidence based medicine; doctors' role in the medical services; increase of cost and unrestricted presence of diagnostic facilities. In this section let us now go into some of the specificities of medical imaging and its impact upon the medical services and medical practice.

Medical care services: Role of doctors

Improvements in medical technology made half of the doctors in the United States to be employed by health plans, a setting in which the doctor is increasingly an employee of an administrative unit that ultimately mediates the doctor-patient relationship. Physicians are in a position between benefits for the individual patient against the aims and performance of Managed Care Organizations (MCO). This effect, according to Larson, M. S. (1980), made the doctors to lose their autonomy in economic, organisational and technical areas. Economic alienation in terms of doctors being a salaried employee should place hospital interest above theirs. Organisational structure with in which the doctors have to play their role, such as the hospital mangers who create and coordinate work and technical alienation when process of curtailing or removing the actual decisions involved in diagnosing and treating patients. Alford, R. (1975) even went further and said doctors are increasingly become physician administrators which can be termed as "corporate rationalizers". These corporate rationalizers, being full time administrators, pay full attention to

13 Crease, R. (1993) p. 554.

fiscal side of the medical rather than patient's benefit. In this way they serve their loyalty more for the hospitals than patients.

Move towards Evidence Based Medicine

Objective analysis of human body made the medical practice more towards Evidence-Based Medicine(EBM) which has been defined[14] as "the process of systematical finding, appraising and using contemporaneous research findings as the basis for clinical decisions." Clinicians can incorporate evidence into their practices in three ways (Guyatt G.H.1991). First is the "doing" mode, in which there are steps carried out before an intervention is offered. Steps in terms of diagnosing the patient using various technological interventions. Second is the "using" mode, in which searches are restricted to evidence sources that have already undergone critical appraisal by others, such as evidence-based guidelines or evidence summaries. This Randomised Clinical Trials (RCTs) constitute a vital technique adopted in EBM to obtain relevant evidence. Third is the "replicating" mode, in which the decisions are taken for individual patients.

The impact of EBM on clinical side is both positive and negative. Clinicians can have access to powerful, precise and up-to-date information sources on which both diagnosis and treatment (Schattner, A and R.H. Fletcher 2003) are carried out. But it also leaves behind the possible risk. The patients are being treated as mere machines comprising of various parts and of course assembled into a body. Apart from this there are other problems like the data collected through RCT or under the care of the physician or on hospital ward, are often different. As a result, even data collected from carefully conducted and controlled studies may not be directly applicable to an individual patient. Applying average results derived from groups of patients to a unique patient is bound to be problematic. As Mant.D (1999) says: 'a clinical trial is the best way to assess whether an intervention works, but it is arguably the worst way to assess who will benefit from it'. In addition, there are too many differences related to the population (cultural, environmental, healthcare facilities) and individual differences (age, co-morbidity, past or current treatments, non-biological variables)

14 Evidence-Based Medicine Working Group. A new approach to teaching the practice of medicine. JAMA (1992): 268: 2420-5.[Medline]

may affect the translation of evidence from study sample to individual patient.[15] Also how far the clinician can able to get the reliable information and how is he going to analyze the available in relation to diagnosis, prognosis, treatment, iatrogenic harm, quality of care, or health economics which are all highly complex. Moreover EBM's main focus is on the disease symptom which will further divide the body and view it a purely mechanical part rather than considering the social determinants and structural constraints of health.

Practice of Defensive medicine

Due to increased consumer movement and folding the medical services into consumer act medical practitioners nowadays practice what is called "defensive" medicine. The medical practitioners at one level assert their supremacy through EBM and at another level go in for more tests to confirm the clinical diagnosis in order to evade the possible law suit. This pushed the patients pay more for the diagnostic tests which are otherwise unnecessary. Another consequence of defensive medicine is overuse of technology. 52nd round of NSS account this as the out of pocket expenses which are described in the following chapter.

The Medical Liability Costs in the United States, according to the Health Care Liability Alliance, increases the cost of health insurance and medical care; of which 57% of medical malpractice premiums go toward attorneys' fees (Schattner, A and R.H. Fletcher 2003). To fend off litigation and cope with steep liability premiums, doctors ultimately are being forced to practice defensive medicine. A nationwide study in the US by the Quarterly Journal of Economics found defensive medicine costs an additional $50 billion per year.[16]

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15 op. cit.

16 York Daily Record, January 20, 2002.

Economic impact

CAT scan which falls under medical imaging brings rapid diagnosis of lesions and it also brings cost along with it. Analysis in different countries show that almost 40-70% of total expenditure in hospital goes to increase in staffing managing medical technology (Tulchrisky, T.H and Elena A. Varavi Kova 2000). The United States, which is the biggest health care system in the capitalist world, is highly heterogeneous, complex and having minimum regulatory system. Investments of major MNC's at varying degrees - medical manufacturing industries, financial institutions, aero- space and tobacco companies entered in all facets of medical care. This involvement is from manufacturing of medical equipments to the ownership of medical institutions such as HMO's and MCO's, where private sector is in control of the medical care. Due to this the domestic expenditure on health rose over 30 years after 1960 from 5.3 per cent 12.2 per cent. By 1993 the health care accounted for 13.9 per cent of Gross Domestic Product.[17] The main drive for cost comes due to technological innovation: a deeply rooted desire for consumer culture where expansion of supply of new more sophisticated technology increased the cost. During 1960-90, 70 per cent of the cost goes to medical technology related spending where the growth of it was 373 per cent. This was due to medical insurance coverage and then non commercial medical research spending. The push factor (R & D industry) and pull factor (biggest capitalist market) play role in increasing the cost. In US, the cost of medical care is expected to consume over 16 per cent of the gross domestic product by 2008 at current growth. But then the number of uninsured will swell and the scope of coverage of the insured will become more obviously stratified, as medical insurance will become more burdensome for a significant proportion of Americans (Blumenthal, 2001). No plan is in place, to enhance either organized control over costs, or equity.

On the other hand various countries would control not only the cost but also the distribution of the imaging since cost comes along with its distribution. For example, though MRI availability in Japan increased from 18.6 per million population in 1995 to 24 per million population in 1996, the rates are only one-fifth and the utilization is

17 Quoted in Moran, M and Elizabeth Alexander (1997) technology, American Democracy and Health Care. British Journal of Political Science, 27(4), 573-594, p. 573.

about half that in the United States (Tulchrisky, T., H. and Elena A. Varavi Kova. 2000). In France for example health care is public activity and has strict regulations of government. Moreover health has been seen as social good unlike commodity in the US. In Canada too the focus is on universality and comprehensiveness where equity in access is emphasised. Technological availability is rather decided based on the need of a particular area. The public control over rational use of technology and equitable distribution is maintained. This is quite contrary to the US health care system which is highly heterogeneous; and here technology assessment is mostly private and government has little control, except the Office of Technology Assessment (OTA). Israel for instance adopted standards for purchases of costly medial equipment through Ministry of Health for its rational use. The table below gives the detail account of the control Israel has on various medical technologies.

Table 2.2.Standards for Acquisition of Costly Medical Equipment, Israel, 1995

Technology	Conditions	Ministry permitted use
Computerised tomography	Hospital> 300 beds	1:200,000 population
Cardiac catheterization unit (cath lab)	Hospital > 300 beds with cardiac intensive care > 5 beds	1:200,000
Nuclear magnetic resonance imaging (MRI)	Hospital >400 beds with approved radiology department + CT	1:300,000
Gamma camera	Standard in hospitals >300 beds	1:100,000
Linear accelerator	Only in ministry approved centres for radiation therapy with cobalt CT scanner units	1-3 units in each of six regional; radiation therapy centres or 1-3: 1,000,000
Lithotropters (extracoporeal)	Major hospital centre	1:1,000,000
Position emission tomography (PET)	Research purposes	1:5,500,000

Source: Adapted from Siebzehner and Shemer (1995).

In the US though HMO's and MCO's have strong incentive for cost containment, they at the same time are very active promoters of preventive medicine where technology is used extensively. The grand alliance between professionals, medical industries and medical care organisations inflate the diagnostic cost. Sukanya's study on investment in the hospitals in Chennai, has revealed that medical equipment alone constitutes about 50 to 60 per cent of their total investments (quoted in Muraleedharan, V.R

1999). In Chennai: 'non-corporate hospitals start with investing in surgical equipment. As they grow, they begin to invest in laboratory equipment or imaging equipment and later invest in intensive care and therapy'.[18]

Based on the discussion above it should be noted that medical imaging starting from ultrasound to MRI has proven cost effective and life-saving, replacing less efficient and dangerous invasive procedures. But then it will create further divide among people if rational use of technology in terms of equitable distribution based on the need rather than just economic benefits, while the socio-political assessment of technology in its usage is not taken into account. On the other hand one should have critical understanding about this "non-invasive" technology which refers not to the elimination but to the minimization of physical intervention. Question should be raised: are these non-invasive technologies truly non-invasive? Through these technologies it seems our bodies are increasingly scrutinized, recorded, evaluated, penetrated and ruthlessly appraised (by other than traditional means). MRI, PET and similar techniques have revealed our bodies in terms of hitherto unseen detail, by going further down to 'rule out' the disease at early stage in which people are being constantly kept under its surveillance by professionals. On the whole health technologies have powerful, determining effects when introduced first; but nonetheless they do not simply arrive at the health market whose needs are to be created in the society. They also produce varied effects in multicultural, multireligious and multiethnic groups. So care should be taken in applying particular technology in the society which is already heterogenic in its character; heterogeneity in terms of regional variation, class, caste, culture, language and religion.

18 quoted in Muraleedharan, V.R (1999) p. 122

Chapter 3

According to the 2001 census the population of Madurai district stands as 25, 62,279. In this Madurai city alone accounts for 11, 94, 665 which is almost 50 per cent of the district population. Manufacturing activities in the district are in the field of textiles, readymade garments, dairy, floriculture, coir units, bakery units, brick kiln and toy making. The demographic details of the district are given in table 3.1 which provides the population description, in rural and urban areas according to 2001 Census.

Table.3.1. Area and population, Madurai District

Area in Square Kilometre	*3741.73*
Population (2001 Census)	25,62,279
(a) Males	12,95,124
(b) Females	12,76,155
(c) Rural	11,29,028
(d) Urban	14,33,251
Density/S.q.k.m.	*733*

Source: Statistical Hand Book of Tamilnadu, 2001.

Health care Facilities

The district has 11 Government hospitals and 42 primary health centres. The total bed strength in the public hospitals and dispensaries are accounted as 2480. The total number of doctors employed in the public sector including Madurai Corporation is 366. The bed ratio for the population is 2759, the numbers of doctors in the district are 639 and the population per doctor is 4010.The table 2.2 shows the detail of health care facilities in the entire Madurai district.

Table 3.2 Medical and Health Care Facilities in Madurai District

Modern Medicine	Nos.
Hospitals	11
Dispensaries	18
Primary Health Centres	42
Health Sub Centres	314
Other Medical Institutions	19
Beds in Hospitals and Dispensaries	2480
Doctors	366
Nurses	1043

Source: Statistical Hand Book of Govt. of Tamilnadu, 2001. See Annexure III for PHC's location in the district.

Madurai City

Physical composition

Madurai City is one of the major cities in the southern part of Tamilnadu. It is not only the administrative capital of Madurai District but also a trade centre surrounded by number of villages where agriculture is the prime occupation. The river Vaigai divides the city into two parts. Most of the government offices and district head quarters, hospitals are situated on the Northern side of the River Vaigai while a major portion of the residential and commercial areas lie on the southern side. The southern side of river where the city centre located is highly congested. The Meenakshi Temple encompassed by the concentrically knitted rectangular Chithirai, Avani, Masi and Veli streets form the centre of the city's business activities. This area in fact forms the central zone of the present urban form of Madurai. Major functional elements such as central business area, whole sale market, temple and Thirumalai Nayakkar Mahal, head post office, central bus-stand, railway station, missionary hospital and various recreational halls are located in this zone (for details see in Annexure I &II for Madurai Administrative Map & City Map).The area north of the river consists of majority of government offices, new court buildings, corporation building, Government Rajaji Hospital, and various colleges. Recently, a newly constructed integrated bus terminus is located in the road leading to Chennai. The Town Planning Document (1992) calls this area as the administrative centre of the city. This area is less congested compared to the southern side of the river and also consists of mainly residential areas apart from government offices.

The Master Plan document of Madurai(1992) divided the city into four distinct parts viz. The four divisions are:

1. The old town, south of the river bounded by Madurai- Rameswaram railway line in the south. Anupanadi road in the east, Madurai- Madras railway line in the west.
2. The newly developed area, north of the river Vaigai.
3. The newly developed area, west of the Madurai-Madras railway line.
4. The newly developed residential area in south of Madurai-Rameswaram railway line and Madurai-Tirunelveli railway line..

Socio-economic composition

Madurai is largely a trading centre with its main economic activities centred on trading and marketing. The oldest textile mill in Madurai city is the, Harvey Mill which dates back to early the part of the British rule in the 1850s. Even then it has not developed into an industrial city. Being primarily, a trade centre, it has become the hub of marketing activities for principally trading merchandise. Thus the city attracts a huge number of villagers' everyday to its market places and trade points from the hinterlands. Because of this reason the population during the day time is invariably higher than the night population. However there is limited range of industrial activities in the city. It centres around textile and manufacturing. They are textile mills, cotton ginning factories, manufacturing transport equipments and spare parts, printing works. They are located within the Corporation limit as well as in the peripheral areas. Some of the major industrial units are located in the southern part of the river. It is one of the reasons for congestion in this area whereas in the north of the river except an Industrial Estate there is no major industrial unit. Major private industries are T.V. Sundaram Iyengar& Sons, Madura Coats, Fenner India Ltd., HI-Tec Arai and Susee Auto Ltd., which are all engaged in the production of variety of automobile goods like tyres and tubes, industrial machineries, conveyor belts, automobiles etc. 1991 Census records that the most important commodities imported in the city are pulses and the export commodity is onion. Textile occupies the most important commodity to be manufactured in the city.

Social composition

The social composition of the city has been of very intense anthropological interest. The city has attracted a large number of people from its neighbouring villages as it grew into an urban centre when the British took over the city in the middle of eighteenth century. It lured a lot of population as it offered new economic opportunities to the new migrants in trading occupations. Thus its populations swelled very rapidly and the city became a residential place for a number of caste and ethnic groups. The major ethnic group that made Madurai their residence were the Sourastras, who settled in the city during the Nayakas' rule (Paramasivam, 1985). Other caste groups were also attracted to Madurai city during its fast urbanising phase that reached its peak from the late sixties to the late 1970's. The caste groups settled in various corners of the city which was proximate to the villages that they migrated from. In the western part of the city including Jaihindu puram, Sellur and Narimedu lot of *Thevars* community came and settled. The *Thevars* are from the middle caste groups though economically they were very poor when they settled in Madurai. The eastern and north-eastern part of Madurai that has Anna Nagar and Anupanadi areas we have large number of Vellala caste members settled. In the Southern part of Madurai a large number of Nadars migrated and settled down (op.cit.). The interesting character about Madurai City is that it has a continuous flow of migrants even as the previous wave of migrants moves out of the city after acquiring some amount of economic wealth. This continuous nature of floating population has ensured that Madurai remained rural in character despite its expansiveness. Going along with the rural and rustic character of the city is also its backwardness. In comparison to even a small town that is close to Madurai city namely, Virudhunagar, the economic strength of Madurai is less, making it a relatively underdeveloped city. It has attracted along with the caste Hindu population a considerable number of Dalits from the same areas from which it drew the caste Hindus.

The main workers comprising cultivators, agricultural labourers, household industries and other workers which includes public sector, organised labourers in the factories. The details of the composition of workers are given in the table 3.3. The table shows that there is no significant change in terms of employment though the percentage of agricultural labourers reduced from 1.57 per cent to 1.19 per cent. There was increase in the other workers category- which includes life stock, hunting and plantation; mining and quarry; manufacturing other than processing, servicing and repairs in

household industry; construction; trade and commerce; transport, storage and communication and other services. The increase was from 90.14 per cent in 1981 to 93.5 in 1991. Since the industrial growth in the city is not encouraging the Government of India has ranked the district as backward and offers incentives to industries to invest in the district.

Table 3.3.Occupational pattern of Madurai City

Worker Classification	Number of Workers		Percentage of total workers		Percentage of total population	
	1981	*1991*	*1981*	*1991*	*1981*	*1991*
1)Cultivator	2,651	3,541	1.08	1.18	0.32	0.38
2)Agricultural labour	3,821	3555	1.57	1.19	0.47	0.38
3)Household industry (Manufacturing, Processing, and other repair services)	15,484*	6,495	6.35	2.16	1.89	0.69
4)Other Workers	2,91,886	2,80,326	90.14	93.50	26.79	29.80
5) Marginal workers	2,090	6,025	0.86	2.00	0.25	0.64
Total Employment	**2,43,932**	**2,99,942**	**100.00**	**100.00**	**29.72**	**31.89**

Source: Census of India, 1981 & 1991.

Note: (*) areas Avanipuram, Thiyarajar colony, Tirunagar, Harvey Patti, Tirupuramkundram, peripheries of Madurai city are included in 1981 census. In 1991 census, they not included. That is the reason for major variation in the workforce.

Population and Demographic details

All Municipal Corporations Madras (Chennai), Coimbatore, Madurai, Tiruchirappalli, Salem and Tirunelveli have accounted for a provisional population of 79.13 lakhs (40.34 lakh Males and 38.79 lakh Females) in the Census of India 2001. This forms 12.74% of the total provisional population of Tamil Nadu and 29.05% of the provisional urban population of the State. Madurai Corporation which has an area of 51.85 sq.km. has the population of 11,94,665. The sex ratio in Madurai is 977 for 1000 male. Among the Municipal Corporations except Chennai, Madurai with 7.30 lakh literates heads the list.[1] The city's population and its variation is given in the table 3.4. during different decades. The maximum growth rate in the city was between 1941 and 1951, which comes as 51.28 though the district urban growth stood as 30.36

[1] Source: Census 2001 (provisional).

per cent and the state urban growth was 38.70 per cent. The population after 1981 shows decline trend in the city.

Table 3.4. Population Pattern in Madurai City

Year	Total Population	Variation	Percentage Variation
1901	1,05,984	-	-
1911	1,34,130	28,146	26.56
1921	1,38,894	4,764	3.50
1931	1,82,018	43,124	31. 05
1941	2,39,144	57,126	31. 38
1951	3,61,781	1,22,637	51. 28
1961	4,24,810	63,029	17. 42
1971	5,49,114	1,24,304	29.26
1981	8,20,891	2,71,777	49.49
1991	9,40,989	1,20,098	14.63
2001	11,94,665	2,53,676	26.93

Source: Census of India 1991 & 2001.

The vital statistics for Madurai Corporation are as follows: the birth rate is 19.0 per 1000 population, the death rate is 4.3 and the Infant Mortality Rate is 40.0 per 1000 population and the Maternal Mortality Rate is 1.3 in the year 2000.[2]

Health Services

Madurai city within its Corporation limits has 226 small, medium and larger scale hospitals, out of which 65 are having 10 or more beds in its capacity[3] which includes public, private and corporate hospitals. There are four big hospitals having bed strength of more than 200 in the corporation limit which includes Government Rajaji Hospital, ESI Hospital, Christian missionary hospital and Aravind Eye Hospital. The other hospital which also have a bed strength of more than 200 situated outside corporation limit is Meenakshi Mission Research Centre and Hospital. The city has around 1700-2000 medical practitioners both specialist and general practitioners. Number of medical practitioners registered with Indian Medical Association (IMA) is

[2] Source: Corporation of Madurai.

[3] An unpublished survey conducted by the Corporation of Madurai in 2001.This may be an under estimated number . The discussion with various doctors and paramedics gives account that there are around 150 clinics having bed strength of 10. For details see Annexure-IV

around 850.[4] There are 20 Neuro Physicians in Madurai city and 10 Neuro Surgeons, out this only one is a female.[5]

Public Health Services

The Government Rajaji Hospital caters to the need of the public on the Southern parts of Madurai was started at Balarengapuram in 1976. It is attached to Madurai Medical College having with all the branches of medicine and surgery. The medical college was started in 1954. The teaching hospital serves not only the city population but also the southern part of Tamilnadu. One can see the amount of people getting treated, well beyond its capacity, in treating patients where bed occupancy rate is beyond 100 per cent and increased over the years which is 111.6 per cent in 1998 to 119.7 per cent in 2001 which is shown in the Table.3.5

Table 3.5 Statistical Annual Report for the last four years: Govt. Rajaji Hospital, Madurai

Sl. No.	Particulars	1998	1999	2000	2001
1	Total No. of Admission	76754	81547	84045	83855
2	Bed Occupancy Rate	111.6%	114.9%	116.89%	119.7%
3	Outpatients	2642888	3024755	3120430	3111729
4	Average Outpatients treated per day	7241	8287	8549	8525
5	Operations performed	38198	32005	44296	40872
6	Accident & Emergency cases	30321	30350	28857	27665
7	Total No. of communicable diseases/cases treated	5768	5558	5293	5930

Source: Govt. Rajaji Hospital, Madurai.

The table shows that there is an increase in total number of admission, out patients, treatment and operations performed by Government Rajaji Hospital. The hospital caters to the poor and needy people. Since most of the services are free, except scanning, there is swelling of patients over the years. After implementation of Structural Adjustment Programmes in the health sector people are being charged for

[4] Details had from interaction with various medical practitioners and from Indian Medical Association, Madurai Branch.

[5] Information shared in a personal conversation with neuro-surgeon who is the secretary of Indian Neurological Association, Madurai unit.

the services offered by the public hospital. Here too the scan centre is manned by Tamilnadu Medical Supplies Corporation which charges 500 for CT and 3500 for MRI (detail account is given elsewhere).

Apart from this there is one E.S.I hospital on the northern bank of river and a Government Hospital near East Madurai Railway Station. The corporation of Madurai has 17 Urban Health Posts for outreach services for immunisation programme. Out of these health posts 12 for Allopathic services, 3 for Siddha and 2 for Ayurvedic. There are 13 maternity homes having 6-7 beds and three maternity centres in the corporation limit where only delivery is done. Its services are restricted to treating out patients and are manned by a doctor. Number of medical practitioners employed by the corporation are 36. All the above facilities are under the administrative control of the City Health Officer(CHO). There are two scan centres one at *Muthusaratha* (near *kovil* street & *veli veethi)* and other at *Sellur*.[6] Ultra sonogram is done free of cost after collecting a nominal amount to meet stationary costs. The patients are referred by the maternity homes. Apart from this, there are number of Siddha and Homeopathic hospitals run by the Government and also by the private practitioners.

Private medical care

Though there are quite number of private clinics and hospitals as mentioned above, there are some major hospitals are being run in the corporation limit like Christian missionary hospital, T.V.S Hospital, and Aravind Eye Hospital. The other hospital which also has a bed strength of more than 200 and situated outside the Corporation limit is Meenakshi Mission Research Centre and Hospital. Apart from this the number of medium size hospitals and clinics are 65 includes Vadamalayan Hospital, Vikram hospitals, Jawahar hospital, Kennet Hospital and various speciality hospitals.

Corporate hospital

There is one corporate hospital in the city a unit of Apollo Group, the Apollo Speciality hospital was started in the city by 1998. Now it had grown and has various super speciality care starting with cardiology, where there are 3 full time consultants

[6] Details through various files and discussion with the Vital Statistician in the Corporation of Madurai. The details are for the year 2001-2002.

and 2 part time consultants and 3 visiting consultants. In the gynaecology department there were 2 full time consultants and in the neurology department there are 2 neuro physicians and one surgeon. Apart from these facilities they have a Trauma Care and various diagnostic facilities.

Medical Technology& its Distribution in Madurai

Distribution of Scan Centres in India

There are about 350 CT scanners all over the country with a demand of about 50 per annum. There are about 50 MRI scanners and the anticipated demand is 20 per year.[7] At present, there are scores of well-equipped departments in Government and public institutions and there are over a 100 private clinics. India currently has five Associations in the field of Radiology. They are Indian Radiology & Imaging Association (IRIA), Indian College of Radiology & Imaging (ICRI), Indian Society of Vascular & Interventional Radiology (ISVIR), Indian Society of Ultrasound in Medicine & Biology (ISUMB) and Indian Society of Neuroradiology.

Distribution in Tamilnadu

The total number of Scan Centres registered with health department so far is 2034[8] because of Pre-Natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act 1994, which came into force in Tamil Nadu with effect from 01.01.1996. For effective implementation of this Act, State, District and Taluk level Advisory Committees have been formed. The Director of Medical and Rural Health Services, the Joint Directors of Health Services and Senior Civil Surgeons / Medical Officers of the Government Taluk Hospitals have been nominated as respective appropriate authorities to implement the Act. Due to constant vigil, 79 unregistered Scan Centres have been seized and sealed. Cases have been filed against 21 Scan Centres and Judgments delivered for 16 cases convicting the offenders with fine.

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7 http://www.refindia.net/rindia/history.htm.

8 http://www.tn.gov.in/policynotes/health2003-04-3.htm- as on dec.2002

In Tamilnadu Government hospitals, Tamil Nadu Medical Supplies Corporation (TNMSC) provides CT scan and MRI facilities to the public for a fee[9] This facility is available to inpatients of the hospital where it is located as well as to any public referred by private doctors. The Corporation has established 35 CT Scan Centres in Government Hospitals and 2 MRI Scan Centres one each at Government General Hospital, Chennai and Government Rajaji Hospital, Madurai to provide scanning facility to the public for a nominal charge. TNMSC proposes to take over the maintenance of the equipments in all the Government Hospitals in order to improve their performance.

Scan Centres in Madurai District and in the City

Distribution of Scan centres

The number of scans working in the district is 118 which include rural and urban centres. The number of scans registered and was given permission to function are 106(as on 21, Nov, 2002).Cases pending in the Joint Director of Health Services (JDHS) office are 8. Applications received after November 21st 2002 till 30th March 2003 for registration are 21 in the office of JDHS who is the authority to process the sanctioning and inspection of the ultra scan centres according to prenatal and diagnostic technique act, 1994 (January 2003).[10] JDHS can inspect and cancel the approval both in private as well as public sector. Out of this there are 77 scan centres functioning in the city alone, including government, ESI, corporation, private hospitals, private clinics and diagnostic centres. In the southern part of the river Vaigai the city has the main commercial web, as described earlier. There are two bus terminuses-city service and moffussil, railway junction and most importantly the Meenakshi temple. This part of the city has 34 scan centres. On the northern side of the river, the government hospital, numerous private clinics and private hospitals are located. One of the reasons for large numbers of private clinics located on the north side is due to less congestion compared with the other side and the location of public hospital. This area has 43 scan centres outnumbering the southern side of the river.[11]

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[9] For descriptive details ... annexure V.

[10] Source Joint Director Health Services, Usilampatti, Madurai District.

[11] op.cit..

Commenting on the number of scan centres, one of the lab technicians said that, "to my knowledge there are 50-60 ultra scanning centres in Madurai city alone".

Ultra Sound Scan Centres in Madurai

The government primary health centres in the district has one ultra sonogram unit that become functional 6 months ago by Department of Public Health, Government of Tamilnadu in *Checkarurani* which is a block PHC, where the process is on for making it a 30 bedded clinic. *Elumalai (Sedapatti), Karungala kudi and Alanganallur* are the other Block PHC's where Ultra sonogram is supplied and yet to be made functional.[12] All these centres are in the administrative control of Joint Director of Medical Services, Madurai. The scan centres are also functioning in all Taluk government hospitals except *Peraiyur* where the bed strength is six and doctor strength is two. Corporation of Madurai has two ultra sound scan centres one at *Muthusaratha* (near *Kovil* street-*Veli Veethi*)- southern part of the river where the city nerve is located and other at Sellur-northern part along with the river bank, to cater the needs of people in urban area. Ultra sonogram is done free of cost after collecting a nominal amount to meet stationary need. The patients are referred by the maternity homes.[13]

The Government Rajaji Hospital located in the northern bank of river Vaigai has altogether seven ultrasound. Of the seven, ultrasound machines in the hospital one each is located in gastroenterology, obstetrics and gynaecology, paediatrics, surgical entrology and in Vascular surgery. Radiology department on the other hand has two ultra sound equipments.[14]

Computed Auxiliary Tomography (CAT) & Magnetic Resonance Imaging (MRI)

There are six CT scans in Madurai city. Among them three are located in hospitals: Apollo Hospitals, Meenakshi Medical Mission Research Hospital and Government

[12] Discussion had with the medical officer who is in charge of the medical services in the district and with Deputy Director of Health Services.

[13] Discussion the researcher had with Vital Statistician, Public Health Department, and Corporation of Madurai.

[14] Through various documents and files Govt. Rajaji Hospital, Madurai.

Rajaji Hospital. All these have the latest state of art imaging facility-*spiral*, the latest and more sophisticated in the market. Others scan centres are independent diagnostic centres. They are Indian MRI, Vitra diagnostic centre, Devaki diagnostic centre-*axial* facility and KGS diagnostic centre-*spiral* facility. In the government hospital Tamil Nadu Medical Supplies Corporation (TNMSC) provides C.T. Scan facility to the in-patients of government hospital as well as any public referred by private doctors. The charge to take plain CT is Rs.350 for inpatient and Rs.500 for outpatient and Rs.700 for contrast (where liquid is injected to the scanned portion to compare the any difference with normal one) compared to Rs.1500 to 2,000 outside.[15] Of the two C.T scans in the hospital, one which was owned by the hospital is condemned and the other operated by TNMSC for charge. On the other hand the private players in the fray fix the fee for diagnosis. According to one of the technician's estimate the charge for CT scan is between Rs.1000 to 6000; contrast in CT comes about Rs.1600-3000 and MRI comes between Rs.2500 to 6000 among the private players.

All together there are 4 MRI's in Madurai city alone. One is the government centre and the remaining are privately owned centres. They are located in Government Rajaji Hospital, Indian MRI diagnostic centre, KGS diagnostic centre (both in the northern side of the river, barely 2 kilometres from the government college & hospital) and Devaki diagnostic centre (south western part of the city). Interestingly none of the private hospitals have this facility. They all depend on the private centres. All the centres except in Government Rajaji Hospital work for 24 hours on a shift basis.

The CT scan and MRI in the Government Hospital come under the administrative control of radiology department in the hospital. One C.T- which is a GE make- is under the administrative control of TNSMC though it is located in the radiology department where referrals are scanned daily. The hospital only provided the place and infrastructure. The other one (C.T) bought in 1985 which was in full control of hospital is condemned Tamil Nadu Medical Supplies Corporation (TNMSC) has installed one of its MRI machines of 1.5 Tesla at Government Rajaji Hospital, Madurai and other at Government General Hospital, Chennai TNSMC collects money and uses it for its operation. Dean of the hospital can waive patients from charging

[15] Refer to Annexure V for details.

and that too only for C.T scan alone and not for MRI. This is done based on the recommendation from the radiology professor. All together in the Government hospital the equipment costing more than one lakh are 139 out of which 114 are in the working condition, 23 are not working and 2 are in the process of condemnation.

Of the four MRI's in the city, two of the private scan centres are located in the northern side of the city where the government hospital is located, so as the private clinics, trust hospitals and Apollo a Corporate Hospital and where accumulation of clinic high and so their residence are located along with clinics. The lone one (i.e.) Devaki diagnostic centre is located just 2 kilometres away from Periyar City Bus Terminus and Aarapalayam bus terminus where western side moffussil buses come. The place is very close to kanyakumari- Dindugal bye pass road. Here too doctors practice, so too private clinics and hospitals. Since there is no competition on the southern side of the river, this centre is catering to the needs of people from the western side and also to the southern part of city people. Let us see in brief some of the diagnostic centres in the city individually.

KGS Scan Centre

KGS scan centre was established in February 2002 and the facilities offered here are MRI and CT scan only. The owner is a radiologist and has done MD in radiology. He worked for some years in Indian MRI diagnostic centre which is just adjacent to this centre. Later, he himself started the scan centre on his own. The cost of the machine was Rs.2.2 crore for MRI manufactured by siemens with a capacity of 0.2 tesla. CT scan is also manufactured by siemens and costs around 1.4crores.[16] [17]

Devaki Scan Centre

It was started functioning with a black and white scan in 1998 but soon they introduced whole body colour Doppler scan, followed by TMT, EMG and EEG with brain mapping by 2000. The whole body CT scan was introduced in 2001 and then

[16] The machines are procured through bank loan.

[17] For details see Annexure V.

MRI in 2002. Loan was borrowed from the bank to buy these equipments. The owner is a medical practitioner and has two radiologists, four radiographers and 13 PRO's and around 25 staffs. Rs.3, 500 to 5,000 depends upon the portion of body which needs for scanning.[18] One of the staff from diagnostic centre noted that to run the scan centre without profit, they daily needed at least 10-15 cases for MRI and 20-25 cases for CT scan.

Doppler Scan Centre

This particular scan centre's proprietor is a radiologist himself. His wife is the administrator and also a doctor. The other staffs include an accountant, two public relations officers, one laboratory technician, two X-ray technician and ten stenos. This centre has Vitra diagnostic facility equivalent of CAT in its capacity and diagnostic ability. For ultra sonogram they charge Rs.400 and for Echo cardiogram Rs.600-700. For Doppler of Upper Limb the charge is Rs.1000 and for Lower limb it is Rs.2000.[19]

Cost and Real Cost: A Note on Self Referral

The following details give a picture on various issues involved in the cost of medical imaging. Interviews done with medical practitioners and para- medical staff in Madurai is supported with relevance studies done elsewhere. Today diagnosis is becoming big business in India with more than 25,000 clinical laboratories carrying out around 11 lakh tests daily. A number of pharmaceutical majors, home-grown laboratory chains and foreign players have set up shop around the country in the last five years. Corporatisation of diagnostic laboratories with the entry of players operates for business reasons. Many of these diagnostic centres are also equipped to perform radiological tests (X-rays, computerised tomography or CAT scans and magnetic resonance imaging, or MRI) and cardiological (treadmill, electrocardiograms and so on) tests that lead to a more effective system of diagnosis and patient management. But then charges differ in many of these centres. With onslaught of insurance companies and private players in the fray, economic interest becomes the prime concern than people. Moreover the money spend on treatment

[18] op.cit.
[19] op.cit.

have been increasing since some of the diagnostic centres don't have trained people and merely do it as a business. The 52nd round of National Sample Survey (NSS) shows that the misuse and potential higher expenses of medical technology in private hospitals found to be very high in six states: Assam, Madhya Pradesh, Maharashtra, Orissa and West Bengal. The percentage of inpatients that had undergone diagnostic tests in private hospital is higher compared to public hospitals. The 52nd round of NSS shows that the proportion of patients who had undergone X-ray/ECG/EEG was more in private hospital than in public hospital (Dilip T.R. 2002).

One neuro surgeon who is working in the public hospital blames the companies who created this situation, "companies are the ones which create these basic attitudes and motives. MRI Company comes and gives to a person in which the machine will be in crores and he has to make money, just to repay. Thus, the way medical equipments transacted and the role of money play a major role in determining the cost of scanning. The companies have penetrated in all aspects of medical practice. MNC-instrument and drug companies are spoiling the people. In private practice you are definitely compelled to do profit making". This was also reported in one survey conducted in Bangalore, "clinical laboratories, diagnostic centres, doctors and consultants are the marketing arms of equipment manufacturers, pharmaceutical companies and diagnostic laboratories were driving the clinical testing and diagnostics market much more than medical requirements"[20]. Of the more than 25,000 clinical laboratories in India, barely a dozen are accredited with the National Accreditation Board for Testing and Calibration Laboratories (NABL), which comes under the Union Ministry of Science and Technology. NABL only regulates the use of specified colours of paint on the walls of a laboratory, air-conditioned facilities, specified maintenance standards for the machinery, norms with regard to the number of days for which samples have to be retained after tests, and, of course, specifications with regard to operating procedures. So in the absence of a well-enforced system of certification and meaningful regulatory legislation, laboratories continue to have a free hand. According to consumer protection activists, in quite a few instances patients have gone to two different laboratories and got different results for the same

[20] Frontline, Volume19-Issue23, November09-2-2002.

test because of the varied procedures, standard of operators and use of various materials for the diagnosis[21].

According to a leading doctor in Bangalore, a large number of the MRIs that are performed are not really needed. "Today, in Bangalore we have more CAT (around 20) and MRI (around six) scanners than some counties in the United Kingdom".[22] The rate which is quoted in the British Medical Journal from a new report from the National Radiological Protection Board reveals that "the rate of medical X-ray examination in the United Kingdom (per 1000 population) is less than half of that in Germany, the United States, and Estonia. And Japan has a rate three times that of the United Kingdom".[23]

Most countries, even advanced ones, use these pieces of equipment diligently. But here the only concern is to recover the cost of the equipment (an MRI scanner costs Rs.3 crores) and as quickly as possible. That is why so many MRI's and CAT scans are there without being asked for. The business part of it was shared by a surgeon who said that exploitation is happening in the name of diagnosis, "To keep the machines working. They keep doing since they invested money in hospital and equipments for that matter. They want to cover the investment, so they utilize some instrument and do tests which are unnecessary. The situation is rampant".

One neuro surgeon whom the researcher interviewed said "medical profession is a service-oriented business. You have to have both. Corporate hospitals [are] definitely for money and public hospitals [for people]. People are not bothered much about cost. For them [people] it is the matter of life and death". Though he accepts partially "hospital based labs wanted to get the margin for diagnosing but doctors never cheat the patient". He went on to protect the doctors in this issue stating that doctors are immune to such practices. But the researcher interaction with various practitioners and paramedical staff reveals that doctors both physicians and surgeons demand money for each scanned person. In fact the delivery of payment previously from diagnostic centres to the practitioners was done every week. Now it has changed. The commission now is delivered at the end of the day itself since practitioners wanted to

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[21] op.cit

[22] op.cit.

23 Ferriman, Annabel. BMJ 2001;322:384 (17 February).

finish the transaction immediately which involves monetary benefits. Similar mode of operation is reported in one of the leading magazine about the commission payment in Bangalore. Every referral that a doctor makes often means a 20 to 40 per cent commission on the amount charged to the patient by the laboratory/centre, variously called as *`interpretation charges'* (IC), *`referring charges'* or *`commission'*. The otherwise called 'self- referrals' lead to overuse of services and increasing the cost ('Self-referral is the term used to describe a physician's referral of patients to an outside facility in which he or she has a financial interest but no professional responsibility[24]). This has meant that in many a case the patient is unnecessarily sent to diagnostic centres and at least 60 per cent of all doctors take commission.[25] Similar practice has been observed in advanced countries also. Mitchell and Sunshine reported that 40 percent of physicians do self referral in Florida, USA.[26]

The commission that doctors get is being legitimised. During the field visit the researcher found that some of the doctors call the 'self-referral' monetary as Interpretation Charge (IC). It is not charged directly from the patient but from the scan centres. For example for a scan of Rs.5000/, Rs.1000/ goes a cut i.e. IC. One medical practitioner felt that it is legitimate to charge apart from getting a consulting fee. His logic is that patient might feel uncomfortable if one asks fee for reading and interpreting the scan apart from consultation charge. So doctors get money from scan centres.

One neuro surgeon said that there are doctors who go for higher modality technological investigation simply for economic reasons, since they get more commission. Previously doctors used only trial and error method in diagnosing disease now that is being put aside. The move towards sustainability for doctors comes due to application of technology. Sustainability here means getting patients. According to doctors patients feel that a good doctor is one who ordered for scan. Such belief obviously works in favour of doctors to get cut. Even some of the medical practitioners survive with it as one lab technician said, "some medical practitioners

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[24] Quoted in Muraleedharan (1999). Technology and Costs of Medical Care: Some Emerging Issues and Policy Imperatives in Barbara Harriss-White

[25] Frontline, Volume19-Issue23, November09-2-2002

[26] (op. cit)p. 116.

are surviving by sending the patients to the scan centres as patients willingly ask for scan where it is unnecessary."

In one of the leading diagnostic centres in the city the assistant manager when asked about commission offered to doctors (called as cut in the field) the assistant manager said, "it is a business there is no doubt, and we (PRO's) are agents. See there is a commission in every business and people expect to get service free of cost, any material for that matter. Discount is there in all the business. If you get one soap, one is free and one comb is free for getting 4 combs like that. Since business people want to attract customers through their tactics and for them everything is business and the retailers gains every item they sell since they get commission for it. Company push things and say if you sell this amount we offer you these things". He further stated that, there is cut involved in the process which runs around 15 to 20 percent of the total cost per scan. This statement is grossly underestimated in contrast to various other information collected.

The commission is not a fixed amount and it varies. As one paramedical staff puts since there is no fixed amount, the charge may vary depends upon number of cases per day particular doctor refers or the centre gets in general. Apart from that how much money goes for IC, kind of material used in the diagnosis and type of machine also determines the commission.

Based on the interaction with the staff of various diagnostic centres the following details of the costs for diagnosis are worked out (which may vary across time and doctor) the commission that doctors receive is shown in brackets. X-rays cost around Rs.150 -200; ultrasound Rs.350 (Rs.100); CT scan Rs.2000 (Rs.1000); MRI for full study Rs.5, 750 (Rs.2000 -3000) and for limited portion of the body Rs.3500 (Rs.1500). The cut or IC comes to around 30-40 per cent for each scan for the doctors who refer patients. It may go up to 60 per cent depending upon the doctor's experience and popularity, number of referrals. To run the business without profit, daily needed at least 10-15 cases for MRI and 20-25 cases for CT scan are needed. One of the lab technicians said, "throat cut competition among the doctors and diagnostic centres results in stabilising the rate". His observation shows that doctors very well are in consonance with the business of scan where he said that some

medical practitioners are surviving by sending the patients to the scan centres they willingly ask for scan though it is not required.

Researcher observation in Madurai collaborates with the Bangalore survey which shows that most of the hospitals, if not all; pays commissions for tests like CT scans and MRI's. They also insist that their doctors and consultants refer patients only to in-house diagnostic establishments. While the costs vary greatly at different laboratories for the same tests, the rates are sharply above what they should be. Krishnaswamy, who worked for 19 years at Mumbai's Jaslok Hospital, admitted that a blood test, which costs a laboratory just Rs.6, costs the patient at least Rs.40. [27]

The scan centre which needs to sustain the business, an assistant manager of a scan centre said, "We need at least a minimum of 350 CT cases and 150 MRI cases per month to sustain and repay the loans. Sometimes for some complicated cases the centre offers 85% discount when recommended by the doctors. The CT machine may cost anywhere between Rs.40 lakhs to Rs.2 crore and MRI from Rs.1.5 to Rs.3 crore. Since lot of money is involved, it has to be run like business". Though one does not prefer this kind of system where business takes priority over health of a patient. Further he added "one cannot avoid and do away with it".

As one of the lab technicians said "you cannot run the show for long time if you will not provide expertise and affordability in the field" [affordability here means keeping the fee low and at the same time maximum commission for the practitioner]. There is always extra burden that a patient carries because of the cost where business involved which has the sole motive to earn. But we cannot do away with that". His *mantra* is, "without competition one may have to lose standard and when a person wants to do it based on his or her values standard is lost." He seeks to convey "in a competitive environment it is only through application of newer technologies that one can stay ahead in the competition and attract many referrals from the physicians. If one were to do these businesses for values by keeping the cost low by adhering to old technologies then one may have to lose the business."

[27] Frontline, Volume19-Issue23, November09-2-2002.

Doctors clearly play a role in deciding the cost. If the doctors decide to help the patient they might waive the commission that they would normally collect from the scan centres, as one neuro surgeon puts, "sometimes we talk to the concerned CT person then they will do it free of cost and they will give us the report." The other practitioner who is an obstetrician and gynaecologist told that sometimes the poor are being given concessions since they are the proprietors of the scan centre.

The doctors in Madurai not only highlight a need for clinical diagnosis but also they suggest that charge is less than Western countries. The neuro surgeon from Apollo had elaborated the benefits of specialist treatment. The list includes saving time, money, energy. Another cardiologist said, "Technology is very easy, very much simplified, very accurate and very precise. You exactly know what it is. Only thing is that the cost has gone up. But we have to pay a price to get quality." Where he tells that one has to pay a price to get the fruits of benefit. He did not feel that this cost structure will any way affect the people who cannot afford rather he compared the treatment in any foreign countries compared to India. He says, "ECG in Madurai costs Rs.500, but in Australia it costs $500. It is cheap. We make it up by doing in numbers, if I do an angiogram I get Rs.2000 and in Australia I get $2000." The young neurologist who is practising in corporate hospital of the view that new innovations and latest machines has to come in his view with cost and no one can avoid it, which will subside in time, and so medical imaging and the diagnostic cost. For him initial high exorbitant cost doesn't matter until one gets the fruit of the advancement.

Conclusion

The city of Madurai which is located in the southern part of Tamilnadu has its significant in terms of educational and health care facilities, trade and commerce, agriculture and manufacturing industries. With the increasing floating population in the day time and in night it caters to the need of surrounding villages. Being called as 'temple city' it has four big hospitals having bed strength of more than 200 in the corporation limit which includes Government Rajaji Hospital, ESI Hospital, Christian Medical Mission and Aravind Eye Hospital along with number of private and trust hospitals cater to the medial care of the city. Number of scan centres ultrasound, CT scan and MRI in the city shows that the increase is due to large number of medical practitioners and presence of private clinics. As 52nd round of NSSO pointed out the

diagnostic techniques, increased out of pocket expenses which are higher in urban private medical care compared to rural areas. Also the large number of floating population as explained previously along with the public hospital presence with medical college made diagnostic centres profitable in their venture as private hospitals. Presence of a public hospital, lesser congestion, well connected transport facilities and residential areas of the practitioners are the reasons why northern part of the city has more scanning centres compared to the southern side of the city. The business of scanning made the practitioners totally dependent on it for their practice, in getting the commission. The practitioners legitimised the very transaction of commission as 'interpretation changes' and earning precedes patient's care. The hand in glove of doctors' involvement is evidently seen through this commission transaction which will also alter the practice and influence the decision making process of the practitioners.

Chapter 4

ROLE OF MEDICAL TECHNOLOGY IN CLINICAL PRACTICE: PERCEPTION OF DOCTORS IN MADURAI

Demographic details of the Medical Practitioners

In Madurai city within the Corporation limit, the researcher could only interview thirteen practitioners due to unwillingness of the practitioners to give time. In spite of the researcher's repeated visit he could able to get only thirteen respondents out of thirty two practitioners. Of the thirteen practitioners 6 are in working in corporate hospital. The breakup of six practitioners who work in includes 2 neurology specialists (one neuro physician and one neuro surgeon), two cardiologists and one cardio thoracic surgeon and one gynecologist. There were five medical practitioners interviewed from the government hospital which included one neuro surgeon, three neurologists and one cardiologist. One neuro surgeon who is practicing independently is also interviewed and so one gynecologist who is the retired professor from the government medical college. All together in the sample, there were four neurologists, three neuro surgeons, three cardiologists, one cardio thoracic surgeon and two gynecologists.

In the sample, five medical practitioners belong to backward caste and three belong to upper castes who practice both in government sector and corporate sector. There are five practitioners who belong to backward caste. Among them two are practicing in neuro field: one each in public and corporate sector, two are cardiologist practicing in public and private sector and one gynecologist in corporate sector. All eleven medical practitioners interviewed were relatively young falling in the age group of 32 to 50. In the sample there were seven practitioners whose spouse is also engaged in the same profession. This chapter accounts the details of the interview with the medical practitioners. Analysis is substantiated based on the literature available and then by taking the interview held with the medical practitioner in Madurai.

Doctor Patient Relationship

A practicing gynaecologist with Apollo hospital, over four decades of experience accepts the fact that technology changes the medical practice in relation to the patient. Technology in her view nowadays comes in between the doctor and the patient; a crucial deciding factor in the course of treatment. She comments, "supposing if we tell them a line of treatment, the patients used to say we are the best judge and we do what is best for them. But now the trend has changed and so we are also changed. Now we tell them you decide. We explain different modes of treatment available for the particular disease and we also tell them the advantages, disadvantages, risk of particular procedure. Then we give choice to the patient". But how far the patients are being informed; given freedom to choose treatment and doctors answering uncomfortable questions from the patients are highly questionable because though the patient is explained about the course of the treatment and choice of technology to be used, patient leaves the deciding process to the medical practitioner as he is being constantly reminded by the fact that he may not be good in deciding the right course of treatment compared to the medical practitioner. As a neurologist who was trained in NIMHANS puts it, "there are doctors who believe that if a patient asks any reason, he or she has been branded as a trouble maker and want to get rid of him/ her".

Medical imaging has not only changed the course of training but also it has becomes an inter-mediatory between doctor and patient where it further impersonalise the treatment patient receives. A neuro surgeon explained that some of his patient's had this experience when they visited USA. Patients according to him "were referred to a machine for diagnosis rather than clinical examination; a personal touch of the physician. Doctors in the US just feed the details in the computer without personally examining the patients and prescribe the medicines". He described the patient's account as, "the doctors in US never touch; they just ask questions; type answers in the computer; compile the answers and after some time they tell the disease and prescribe medicine". Though this kind of practice is not very much prevalent in India it is fast catching in the tertiary hospitals especially in the corporate hospitals. One case in the corporate hospital, Madurai is evident to this. A pregnant woman, who felt uneasiness, is sent for ultrasonogram without clinical examination where it was detected that the foetus died. According to the senior gynaecologist the scan was ordered by the fresh,

young gynaecologist with out clinical examination. She further states, "Patient's anxiety and unnecessary wastage of resources could have been avoided if proper clinical examination was done. Nowadays youngsters with out clinical examination go straight for imaging".

Barring two practitioners, rest of them feel that doctor-patient relationship has changed. This was echoed by a neuro surgeon, a consultant in a private hospital also. "Doctor-patient relationship changed into 'doctor-technology-patient' relationship. The relationship is there always. Medical imaging made patients happier with the newer non-invasive modalities since no pain and the diagnosis is very easy, very simple". Pickstone (2000) calls this increasing reliance and intervention of technology as 'techno-medicine'.

As discussed in the previous chapters technology has not only changed the course of medical practice but also the services offered to the people. Indiscriminate use of technology by doctors and by hospitals in the name of better diagnosis and treatment. A government servant and a consultant in one of the leading trust hospital said, "some doctors (General Practitioners) ask the patients, after finishing all the investigations to go to specialist or to a corporate hospital. All the investigations were done outside (scan centres) for obvious reasons and the corporate hospital admits them. They also send the patient straight to CT/MRI without examining which part is necessary". Though he deplored the unethical practice of corporate hospital still he admired and adopted corporate model of hospital care in delivering the latest technology.

As one government neurologist in Govt. Rajaji Hospital, Madurai and also consultants in various hospitals accepted the fact that doctors were being influenced by promises of private companies, he stated, "promoting unethical practice and commercial aspects are there but for that you cannot blame the doctors. I am not supporting doctors, but overall the moral courage, and ethical commitment from the doctors is definitely declining. In the US they call these practices as referrals and they are institutionalised. It comes so easy for these people who quote saying, 'see! US is doing why not we'?. So we adopt bad things from US. It has penetrated in all aspects of medical practice. Multinational drug companies and instrument industry are spoiling the people".

Moreover according to most of the medical practitioners, medical imaging reduced unnecessary procedures and risk. For example, a gynaecologist in a corporate hospital opined "earlier unnecessary termination of pregnancy and unnecessary anaesthesia ... so much risk ... that risk is saved now, so it is highly useful. It is useful to confirm pregnancy, to find out gestation period. It is also very useful to diagnose any abnormality where you cannot detect by clinical examination. Now there is three and four dimension advanced Ultrasound, which would give more information about any abnormality".

The same view is shared by a neurologist and a cardiologist. A neuro surgeon in a corporate hospital said, "we could plan out the surgery and can avoid unnecessary risks and procedures since imaging helped in locating the symptom. MRI imaging for example, helps lot in focusing towards surgical planning without causing much damage to the brain". Though he said imaging helped in lot many things still he held the view that clinical diagnosis is most important. He admits the importance and inevitable nature of technology in clinching the diagnosis, but it is not technology alone rather clinical skills blended with technological inputs helps the practice. This idea is echoed like, "still clinical diagnosis is the most important thing. If clinical diagnosis is wrong imaging will also be wrong. One has to be totally oriented towards history taking...one needs to take history of the patient completely, examining him/her thoroughly. For neurological patients' clinical examination is must. At the end of clinical diagnosis few different diagnoses can be identified. At this point imaging aids in choosing the diagnosis or clinching the diagnosis. So clinical medicine is very important. Clinical medicine or history taking in examination is a must. Only then you can go for or arrive at the diagnosis and know where exactly the problem is. Examination is just to support your clinical views, and imaging is to clinch the final diagnosis or confirm the diagnosis". He further stated that technology is the vital tool for the diagnosing the disease early, effective intervention, we could now have the disease intact, more accurate, lesser complications and less mortalities.

There is clear difference in the view put forth by the previous doctor from the paediatric surgeon who is a government servant. He opined that nowadays imaging techniques has become a part of clinical skills. He said medical imaging is, "now included in clinical medicine... not only for diagnosis but as part of clinical medicine...

Not that we don't have clinical acumen but we want to substitute our clinical knowledge through systematic approach. By imaging we have covered clinical want or skills not only for diagnosis but also for conclusion". He also viewed, "technology supports the profession and it never undermines the profession and dictates doctor. Technology is important but it will never replace the clinical practice. Any scientific advancement is an addition, for the growth of profession. It is not going to affect the profession. On the contrary it is more useful than the previous one... And it has never won over me".

A cardiac surgeon in Apollo also echoed in similar line and said that, technology becomes inevitable in the clinical practice which changed the clinical practice easier, "It has totally revolutionized the practice. Now I don't treat any patient without the help of technology. It has become non invasive, so accurate in diagnostic and therapeutic side. Today one can intervene in heart related complications with angioplasty and arrest the block without surgery. I would not have dreamt of this technique earlier. Completely non-surgical, non-somatic". He said that it has even changed the bedside medicine by shortening the stay in the hospital "in 80's hundred of diagnosis and a month of bed. The patient walks next day, where they used to be in the bed for one month". A move from bed side medicine-'clinical medicine' into 'techno-medicine' as Pickstone (2000) said.

The techno medicine has become integral part of biomedicine that it has clearly taken over the clinical medicine as one neurologist working in a private hospital felt, "clinical skill is very important but then as you know technology clearly, clearly overtaken the skills. Even in cardiac catheterisation- angioplasty in 1986 only the experts with big names could do it. Today with so many advances in technology any body can do the surgery-nil risk. I feel the technology clearly over taken the skill; you don't need to be really skilled in doing the practice".

Medical imaging not only changed the practice into more technological oriented as doctors pointed out. It also put people into regime as de Swaan mentions in Lupton, D (1990). To rule out disease at early stage as explained by a cardiologist practicing in a corporate hospital. He felt that technology could bring down the disease and mortality pattern, through preventive medicine, a routine technological investigation on life style diseases. He stated "surely technological intervention in treating disease will bring

down morbidity and mortality which is high. But this combined with preventive medicine; in a sense everyone should undergo diabetic checking, blood pressure checking, preventive medicine is very important".

At another level a leading gynaecologist opined, "The mode of delivery and the mode of treatment completely transformed. Since the abnormalities are ruled out in the early days". Moreover she felt that adverse effects got reduced much because of technological usage. "Ultrasound is needed and necessary in our practice. It is very useful for diagnosis, in terms of management of patient. No adverse effect for mother or foetus".

The neurologist who is also government doctor is of the view that technology is for patient betterment, always for good and it plays crucial role to know the magnitude of the disease. For him technology is inevitable. In judging the problems clinical skills are useful but to confirm it technology is necessary, "Technology is always for the betterment of the patient as well as to enable the doctor to make the diagnosis easier. Technology is always for good. After X-ray was incorporated in the medical practice, what were missing previously in the diagnosis could be detected now. Take for example TB, it would be impossible to know the magnitude of that disease if this technology was not available. By clinical knowledge I can see the external appearance of the patient and with some other technical expertise like clinical information we can some what judge the problem in particular part of the body. But then to confirm the suspect inside we need some methods or investigative procedures. At that time technology plays a crucial role. I would say that it cannot be removed from medical practice. It will be there and always". In his view technology is an aiding tool and can never replace the clinical skills and clinical knowledge. Through his observation one can see the level of importance that technology has created and focussed the doctors to realise the importance. He opined, "it will aid to improve the expertise in diagnosis and not the clinical knowledge. All the techniques and technology is only helping tools. For example, spanner is the helping tool to do work but hand should be there. The hand can never be replaced, but you can replace the spanner". This means that technology is a tool used by doctors and it cannot replace the clinical skill or practice. He also acknowledged the fact that even technology can go wrong one need to understand it by taking on the account of its yield, "As a clinician, his or her judgement depends on use

of it and its yield... Some times the technology can misinterpret and misread. If a particular technology turns out to be more successful than for its failures it will be found useful. So it depends on all factors".

This neuro surgeon in a corporate hospital also opined that imaging has shrunken the time doctors spend with patients. It has made the practitioners to go for scanning immediately without proper examination. Practitioners, who are having lot of patients, do not have time to spend with patients to take history and examination. Therefore the minute they see few symptoms they go for imaging immediately, a next modality, to confirm diagnosis. So it is a kind of short cut towards confirmation of diagnosis where you may miss a lot. Good history taking with clinical examination combined with imaging will be 99% right. Otherwise taking few words from the patients and then immediately go for imaging one may be only 50% right".

Technology also changed the practice of gynaecologist, as observed from one of the leading gynaecologist in Madurai. Technological diagnosis becomes routine in the clinical practice. "Previously, we used to take scan occasionally now within 3 months of pregnancy, then after 30 weeks, then at the time of delivery". The notice in her clinic also witness to change of practice and reliance of clinicians on technology. It reads, "*Necessary to scan in 8, 20, 36 weeks for the pregnant women*".

Evidence Based Medicine

As discussed earlier technology which changed 'clinical medicine into more techno-medicine' bring various new practices along with it. One of it is Evidence Based Medicine (EBM). The trend towards EBM and its narrow view of therapeutic management evolved as a reaction to the inappropriate use of tests and therapies; also vivisection of body into various parts. It promotes the use of scientific methods in clinical decision making. Thus all medical actions of diagnosis, prognosis and therapy should be based upon solid numerical evidence based on the best of the clinical epidemiologic research (Vandenbroucke, 1996). This account of rationing medical technology and mechanist view negatively impacts doctors and patients alike. Doctors fear of loss of autonomy in taking clinical decisions, comes to fore with this development. Sackett et. al. (1996: 72), while giving account of the nature of EBM, go to great lengths to convince the clinicians that they still would consider importance and

take the decisions. 'External clinical evidence can inform, but never replace, individual clinical expertise, and it is this expertise that decides whether the external evidence applies to the individual patient at all and, if so, how it should be integrated into a clinical decision' . Some of it are discussed below is based on the interview.

A senior gynaecologist who is practicing in the corporate hospital said "the clinical practice is changed from speculation and moving closer to evidence based one. Previously only by listing the patients' symptoms and other examinations through clinical practice we used to diagnose and sometimes we think it won't be correct also. We say we presume it is pregnancy we don't say it for certain".

A neurologist, medical practitioner in Govt. Rajaji Hospital told that in the era of evidence based medicine one needs to prove that the symptom is there for treatment. But then he felt that decisions cannot be taken based on evidence alone. Clinical practice cannot be totally erased. He quipped, "It is era of evidence based medicine so even though you might find the symptom though clinically, you have to produce the evidence. People now cannot take practitioner word alone especially after imaging... Though it appears like the importance of clinical medicine is reduced; it can never be suspended".

EBM though gives good account about the disease pattern; help to choose correct diagnosis. One has to look into the risk it creates. Patients are being treated in mechanical parts leaving behind the social determinants of health. Data collected through powerful computers may not be applicable to particular patient due to variations in terms of cultural, environmental, healthcare facilities differences (Mant, D 1999). So the analysis becomes difficult and complex for diagnosis and treatment.

Defensive Practice

Medical practice which used clinical understanding, to diagnose and determine the complexities of the body got sea change due to medical imaging. The changes that EBM brought, as discussed in the previous section, led lay people to access the details about the diagnosis to an extent. This coupled with consumer movement made the medical practice to come under the purview of consumer act so practitioners are under pressure to know the symptom and at the same time to defend themselves in the court

of law. In USA for instance, due to increased consumer law suit against physicians they sometimes practice what is called "defensive" medicine. Physicians thinking not only of the patient's well-being, and the wise use of medical resources, but also of how they can avoid a subsequent law suit. This also leads to overuse of technology. It happened mainly because of heterogeneity in health care services and less intervention of the government. Whereas in Canada the government controls the accessibility and distribution of medical technology, physicians are far more careful when they ordered tests, far more likely to avoid ordering unnecessary investigations.

The challenge to medicine comes from various quarters. Doctors increasingly challenged by institution like court and also through cinema and other visual media which sometimes depicts the medical practice in a negative way. This also forces medical practitioners to go for defensive practice. Because anybody can go and sue the doctor, since people are being sometimes negatively informed. As a cardiologist in corporate hospital said, "even the entertainment industry depicts in a negative way so doctors in order to prove themselves are doing. On the other hand doctors had to practice defensive medicine. If one say I go by clinical diagnosis and do only minimum test patients and subsequently miss out some, the same patient can go to court and ask why did not you do this test. It had happened and is happening. So even doctors are doing a bit of defensive practice".

Not only that alone. Hospital reputation and of the doctor is also important in going for defensive practice. As he said, "Suppose I prescribe a test, a limited one pertaining to that, which I saw deemed fit for the patient, in the process I miss something. Tomorrow if he/she has some problem by undergoing another test and found positive, then name of the hospital and medical practitioner would be affected. One cannot be sure which patient would go to court and who would not, despite your good work".

On the other hand as one neurosurgeon working in public sector expressed, "Medicine is a complex field where the technology is a tool to assist and to determine doctor's judgement. Earlier people believed in doctors now it is not so. Patients think and equate the doctors with person who uses spanner, *meaning for example, rectifying the machine where the mechanic knows where the repair is and where to correct it.* But medicine is such a complex field that cannot be comparable to any other profession. Lack of this

knowledge made people to go for litigation which ultimately made doctors to go for unnecessary investigations".

A neuro surgeon put forth his view that unnecessary practices and investigations become rampant mainly, "due to consumer forum. For example, earlier to remove one's teeth in the dental clinic a person needed only Rs.70 (Rs.50 for diagnosis and Rs.20 for consultation fee). Now due to consumer act and establishment of forum various unnecessary procedures are carried out. Since doctors don't want to be blamed for leaving out a procedure or investigation, it has become complicated so the charge goes up to Rs.500 for taking blood pressure, fitness test and other investigations. When there is chance for a patient to go for consumer forum, doctors use various procedures to protect themselves. Medical practitioners go for procedures for confirmation. Increase in procedures sometimes led in to exploitation". The potential risk compelled doctors to go for defensive medicine, which also cost patients economically. Doctors opined that since they can be sued in the court for inefficient treatment, they are forced to administer number of tests.

As mentioned above over use of technology or over investigation had come from defensive practice at one hand and influence of industry who promotes the equipment on the other. There are only two practitioners felt the increasing amount of investigation for commercial benefits. A neurologist from a corporate hospital placed the fact that over investigation increased over the years. "I feel that nowadays there is tendency to over investigate things. This may be due to influence of various professional bodies, medical equipment industry, business lobby had over the doctors in deciding the use of technology in their clinical practice is important. But still "ultimately I agree that it is the clinician who takes decision, through his own experience; final deciding authority rests with the practitioner". So he felt that it depends on individual doctor who decides at what point give importance to technology over clinical skill or the other way round.

Since the practice involves name and reputation the practitioners did not want to take chance by damaging the reputation and practice. So clinical practice had an impact because of this defensive practice where more of procedural and defensive argument comes in rather than of therapeutic worth. The practice also increases the cost for the patient since various administrative and procedural features are involved. Nationwide

study done in USA by the Quarterly Journal of Economics found defensive medicine costs an additional $50 billion per year[1]. This is evident in India too where 52nd round of NSS shows that patients who take in the private medial establishment pay more since the percentage of inpatients who had undergone diagnostic tests in private hospital is higher compared to public hospitals. And India is not too far from USA where there is highly unregulated medical care and use of medical imaging.

To put together in a nutshell the practice of defensive medicine and the degree of diagnostic uncertainty becomes a part of the "admission ritual." Because of litigation additional tests are ordered to find the diagnostic accuracy. This was done with the view that further tests may decrease the level of this uncertainty, as well as help to formulate a more meaningful prognosis. Tests ordered as part of the admission ritual, till discharge. This admission rituals become establish benchmarks to measure patients' progress. Doctors order tests to protect themselves from litigation, to decrease diagnostic uncertainty in difficult cases, and as a first-pass assessment of general bodily functions (Nahm, F.K. D., 2001).

The promise of Technology and its risk

On the other hand these interventions also produce risk as reported by the practitioners in Madurai. Such an incident is reported by a neuro surgeon who is working in the government hospital, "now patients are no longer treated as human beings but as object; a material to make money". The objectification of body is being explained by him through one case where "one doctor met with the accident; liver got wounded badly which was diagnosed by imaging. Nobody wanted to conduct a surgery. The dilemma of whether to go for surgery or not, at last killed him. Nobody touched him; they were all afraid that they might get bad name if the surgery failed. That doctor was left without any intervention and subsequently died in the 3rd day. This might not have happened previously where there is no application of imaging in clinical practice. The surgeons or the professor himself would have gone for exploratory surgery".

Other risk that technology brings also explained by a cardiologist in a corporate hospital. He admits "technology has got its own risk and problems because one cannot

[1] *York Daily Record, January 20, 2002.*

be sure of which technology has risk. The risk factors and probability of misadministration of patient in using the technology based medicine cannot be do away with". Since technology gives so many benefits, "there will be always probability *[probability of having risk]* and you cannot avoid it. When you are treating 1000 patients' two patients may die in the process of treatment, so we cannot say which patient is going to die. We can only say probably...! For example, every day we are subjecting 6 patients for TMT (treadmill treatment). In the last two years two patients almost collapsed, near death condition. But we saved them we don't know when and who would collapse and die. We have to tell everyone that modality of treatment has got some potential risk. We cannot say who will have problem, who will not. Nobody can say this is definite test. Each mode of treatment and modalities has got own its risk which you have to accept. So technology has got its own problem". The opinion or attitude only reveals that at one level practitioners are willing to get the credit when there is a success in the treatment with the help of technology.

There are number of practitioners shared importance of rational usage of technology to avoid risk. Two of them need to be explained in detail. Firstly, a neurologist as a practicing full timer in Apollo Orient hospital viewed technology with clinical practice that the practitioner should understand in his practice that he is using particular technology with clinical understanding –know the disease pattern to apply technology properly. He opined, "For any thing the most important aspect is that is not just the technology it is the man behind it. One should know technology properly and should have basic understanding of the diseases. Because one has to utilize the technology at the optimal level. So without proper clinical understanding, patient time, money, energy and resources will be wasted. Technology is quite important to tell us the diagnosis. But one should understand that it should be optimally utilized in the clinical context". Moreover he said "overuse of technology comes without basic questions asked. For example, what is this test for? Why it is done? What result expected out of it and how that result will be used in taking therapeutic decision? That decision should be made prior to embarking on a test and should be discussed with the patient and plan should be made". Secondly, another neuro surgeon working in the same corporate hospital shared, "I decide the treatment for the patient easily. (i.e.) I put myself in patient's position and decide (if I am a patient what will I do)".

As a Cardiologist and a government servant, this practitioner opined that in using technology doctor should have a basic understanding of disease. For that clinical examination is necessary in applying the technology. He said, "if you are not able to come any conclusion regarding any disease, patient condition, and then you put all the technology which is available you and still you may not come to any conclusion. So you should form a base line diagnosis for any disease or differential diagnosis based upon your clinical examination".

Technology not only changed the clinical practice but also the way doctor should behave. A paediatric neuro surgeon who is a government servant is all praise about the corporate concept of hospital, which is in terms of providing latest technology to the people. He said, "future of medical care lies with the corporate concept of medical care where one gets the sophisticated medical care, very fast, in a short time". But then sophisticated technology not only gives fast diagnosis but also changed the role of doctors in USA as discussed in the previous chapter. It has changed doctors in USA from medical practitioners into medical administrators or medical managers (rationalisers). These managers work for the hospital management, usually an MNC, which is involving development and dissemination of technology in the market- and not for the patient benefit. These managers as discussed earlier give their loyal to the management for more profit.

Specialist Intervention

A young neurosurgeon in a private hospital opined, "young practitioners didn't have difficulty in applying and adapting themselves. They know how to surf the net and they know what the latest technology is. Probably practitioners who are new to all these modalities may find it hard to cope with". This shows that change of medical training where today's students learn more about procedures rather clinical skills.

Various studies also account the change in practice with the rise in technology. The growing understanding of the human body, the enormous amount of knowledge that must be assimilated in the process and the trend toward super-specialization, physical examination skills are no longer taught or learned well during training (Mangione, S. and L. Z. Nieman 1997; Zoneraich, S. and D. H. Spodick 1995). Students now are increasingly taught to interpret paperwork (ordering and interpreting complex tests, and

the like). So clinical skills are often de-emphasized. Physicians, time spent with each patient is decreasing. And technology is glamorized to a certain extent, but at the expense of the traditional history and physical examination. Thus, students have less time to learn the clinical skills, teachers have less time to teach and overall physicians have less time to observe.

Phoon (2000) raised the issue of technology which creates super specialities. Technology is advancing and creates super-specializations. Technological advancement especially medical imaging creates multiple and relatively small specialities. For example, in paediatric cardiology, there are "micro specialties" and in non-invasive imaging (echocardiography), interventional cardiac catheterization, rhythm disturbances (electrophysiology), intensive care, and so forth. All subspecialities have developed their own special technological tools. Very often, the technology does not benefit generalists directly, but only sub specialists who are not holistic. This will in fact create not more comprehensive tests, but just the reverse, toward more and more specialized tests and more and more complexities.

A neurosurgeon from corporate hospital also advocated what the studies show above that specialist interventions are necessary. Since they are the legitimate users of medical imaging is echoed in his response. Technology in this way had created the boundaries each specialist to play within. He said "try, not for imaging first, go for speciality and referrals first and let the specialist decide what to do. You do not know where to go. Medical practitioners should stick to their allied specialities. They should not try to leap forward and manage other specialty. You may say since there are so many specialities people cannot afford, fine. Patients who can afford I think should be referred to the specialist and they (specialists) can choose the modalities of treatment".

Interpretation and Analysis is subjective

The practitioners should also understand the limitations of the technology. With most machines today, both the acquisition and interpretation of it depends on operator's skill and knowledge and on patient physical characteristics. One study has reported that despite advancing technology from the 1960s through the 1980s, the rate of wrong diagnosis has not been reduced (Goldman, L., et al.1983). Since interpretation of physician is vital, test result must have an interpretation by a physician in the

context of a patient's history and physical examination. In such a context the role of physician cannot be duplicated by any machine (or it would be very difficult), nor can one eliminate these inaccuracies

One of the senior gynaecologists working in corporate hospital, Madurai is of opinion that, "technological diagnosis is highly useful and no one would dispute about it. But then one should have clinical diagnosis while applying technology because, "ultra sonogram may sometimes miss certain things also. Since it depends upon the experience of the technician and type of equipment".

The cardiologist working in Apollo, Madurai also shared the similar view, along with other things clinical adeptness of doctor and machine, the technical competence of the technician who operates are vital in analysing and preparing the final report. He opined, "since the machines are operator dependent, how it is operated is quite important. Especially in ultra sonogram, CT and MRI interpretation is important. Some times machine incidentally picks up something, which may be wrong. For certain incidental findings you need not clinically correlate; these are all obvious things and only for certain doubtful things you have to correlate with your clinical understanding. Because what machine reads and technician reports might be wrong".

You can see the difference of opinion on age wise in their outlook on the development of technology, the youngster felt no new changes since from his student days onwards he has been socialised in to the use of technology on the other hand middle and elderly are clearly see the change of treatment and practice in their field. The practitioner who is a cardio surgeon in the corporate hospital, view over the period made both advantages and disadvantages, the advantages in a sense are more patients are benefited because of it wide spread costing less and also some profited out of it by misusing the availability.

Conclusion

This chapter brings out various themes which has changed the course of medical practice. The move towards EBM results in complete surrender to technology rather than encompassing all the aspects of clinical diagnosis. This created risk for patients at one level and on the other hand make doctors to go for more sophisticated technology.

Through this people are being brought into the treatment fold even if they don't have any complaints. Disease needs to be ruled out at the all time through use of technology which also increased the cost of medical care. The increase in cost is recorded in the 52nd round of NSS. Technology not only made practitioners to go for objective analysis but also engage in defensive medicine just to keep themselves away from the complications of consumer act. For that too patients ought to go for certain regimented treatments and pay the cost for that. Over all medical imaging made doctors from high touch into high tech where techno medicine eclipsed clinical medicine.

Conclusion

CONCLUSION

The study examines the place of medical technology in health services in relation with biomedicine and its practice. With this understanding it attempts to analyse of medical imaging in medical imaging has made in medical practice and the possible impact for public health. In order to know the changing nature of medical practice practitioners across specialities practicing in public, private and corporate sectors were interviewed in Madurai city. The city has got quite a number of private clinics, private hospitals (mid and large size), government teaching hospital and corporate hospital. Corporation of Madurai survey in 2001 numbered the presence of clinics, hospitals (public and private) as 226. Together with this presence of large number of practitioners helped in the increase of scan centres. Scan centres in Madurai increased in after 1995, even public and private hospitals deployed high tech machines, after 2000.

The introduction of Medical imaging of course has changed the role of public hospitals in giving health care. Although to an extend induction and constant up gradation of technology gives faster and accurate diagnosis, it increased the cost also. The rational usage of technology which is absent in India results in misuse of technology. There is no government regulation based on equitable distribution, real need of the particular locality based on epidemiological priorities as in other developed countries. People, especially poor are the victim for the increase in cost of medical care. Since most of the, who come to public hospitals are poor, the inability to pay the cost for medical imaging sometimes lead them into unpayable debt. The interest of manufacturing company (i.e.) medical – industrial complex also contributed to the increasing cost. The adoption of particular technology was made not out of epidemiological requirements but based on commercial interest.

In continuation with the issues analysed in the last chapter this section generalises the issues medical practitioners deliberated over the role of medical imaging, and the possible implication for medical practice. The discussion ends with stating the need for social, political understanding of technology not only on economic side alone. The need of the society should be given paramount importance which is a public health concern.

Interviews with different specialists in Madurai reveal that technological improvement in health moved medial practice from 'clinical based medicine to techno medicine'. The shift was rapid especially after the use of medical imaging in medical practice. This at one hand made practitioners to move the patients into impersonal intervention where personal touch is lost. The loss of personal touch has made the patients to be considered as objects. Medical care which is focussing mainly on super speciality care and urban areas fast catching this type of medical care. The patients lost the 'high touch' of medical practitioner and have gone into to 'high tech' offered by the technological artefacts. The change in clinical medicine was put forth by various practitioners, across specialists at various levels: importance of clinical skill reduced, clinical medicine replaced by the technological skill based medicine, clinical skill is overtaken by technology, clinical skill no longer given importance in education and technological opinion becomes inevitable in spite of good clinical skill.

At the same time miniscule of practitioners across age, ranging from corporate hospital to public hospital, felt that clinical medicine is important and that cannot be replaced by technology. Technology in their view is just a tool used in medical practice. Some practitioners felt that the physical examination as a screening tool is still effective: a skilled clinician is highly accurate and decides the course of treatment. They claim that technology cannot replace clinical practice. Most technology cannot even diagnose common problems, like chicken pox or eczema. To perform such "simple" tasks, technology will need to see with minute detail into the body. In this respect, it cannot simply "replace" physical examination. Imaging can be so powerful that even to see minor "anomalies" it ends up in doing more testing.

All practitioners of course, accepted that they correlate patient's clinical presentation with test results. So in their view, technology cannot hope to replace a physician's clinical impression. In one sense the clinical expertise is not entirely lost. Medical practitioners though felt change in clinical practice due to technology, at the same time recognises the inevitable nature of technology in their practice.

On the other hand, complete reliance on technology as some surgeons used in their practice led in to mechanical analysis of patient's body. It divides the body into various

parts through the help of more sophisticated technology. In the process it eliminates the physical examination- as happened in the corporate hospital where a pregnant woman is scanned before clinical examination. And this complete reliance on technology would take away a key element of control in the physician's practice of medicine. It also eliminates the human touch where the technology becomes the deciding factor by dissecting the body.

The 'high tech' practice apart from changing bed side medicine brings various other issues. One such issue would be risk for the patients as Lupton (1996) said, since patients are not sure of when correct diagnosis is made in spite of the technological interventions. For example, people's faith in medicine loosened due to false positive and false negative diagnosis and that makes them psychologically sick and it produced risk on the patients. This also put pressure on doctors to go for routine and more tests.

This brings another topic Evidence Based Medicine (EBM) where practitioners rule out the disease at early and early stage. Here, people are always treated as carriers of disease. Also EBM do not consider the account of social, political and economic considerations of health but focussing only on disease pattern. So the disease is analysed in a mechanist pattern. Doctors under the rubric of finding better diagnosis and faster solution, go far evidence based medicine. This requires setting in certain regimented procedures which is unnecessary for particular diagnosis and treatment. It also leads into defensive medicine since practitioners have to defend and assure about the diagnosis. Doctors in order to be on the safer side they administer various tests to defend themselves as well as to keep away the complications of Consumer Act.

Practitioners in general did not mention explicitly about the IC or cut that they are getting from scan centres. The 'self referrals' as Muraleedharan (1999) mentioned is prevalent in developed countries increased cost and unnecessary practice. The cut or commission from scan centres in Madurai is also one of the reasons for doctors going for more tests due to financial benefits. Some even survive their practice through 'self referrals'.

At the one hand evidence based treatment make the person body into mechanist, on the other hand patients are used purely for economic benefits by the medical practitioners.

Patient becomes a commodity to be utilised by the medical practitioners and diagnostic centres. Even, Mechanic,D (2001) while analysing the CAT scan in US records that expensive decisions are made out of habit, convenience, a desire for information interesting to know even if it will nor affect care, or because there are economic incentives encouraging a large volume of such procedures.

Though technology based services are required for correct diagnosis one needs to take account of the importance of particular technology, whether that is required or not. Advanced or high technology have to be adopted taking account of felt and real need of the population in particular country along with the resources for health care. Adoption should be based on social understanding, equal distribution and access. Distribution and cost for the diagnosis across countries comes from their deep rooted ideology whether health is taken as commodity or right. In the US health care is highly heterogeneous, less control of Government and health is viewed as commodity. The escalation of cost due to diagnostic technology was mainly by the private health care providers. Most of them who happen to be the production of the diagnostic equipment escalate the cost for economic benefits. Though there are various innovative technological facilities available in the US, the cost of diagnosis is quite expensive compared to neighbouring Canada where health care is considered as right of the people rather than a private good and control over the distribution and cost of health care by the Government. In Israel and France, too government has control over the distribution and the concentration of scan in particular place.

One should not neglect the fact that this is not simply a commercial relationship between the doctor and the patient, but it is reflective of the social relationships in a larger society. So looking at this relationship merely as a commercial one, unmediated by the societal factors, would make for a flawed and incorrect analysis of the situation. Financial interests of individual practitioners and the entire medical-industrial complex on the whole made patients into consumers of medical care. At the same time, biomedicine through medical system reinforces the existing social relationships. This is demonstrated through social control exerted by medical professionals through use of technology. So analysis combined with the social control that takes place at the micro-level of doctor -patient relationship along with the larger political economic interest can

help in developing a more accurate analysis of the role played by technology vis-à-vis health and illness in a society.

One should be very cautious in adopting technology in India. Since India's private health care is highly unorganised, having little or no control of government in adoption of technology. More super speciality care in urban areas by for-profit hospital care and more investment public sector in urban centres neglecting the rural areas accounts the need for rational use of technology like in Israel and Canada. Since, unequal investment further brings gap in an already divided society.

More over at one hand, the state funding in health care is declining over a period of time especially after Structural Adjustment Programme making people to pay for their services. On the other hand government funds tertiary care hospitals which are in the urban areas to employ sophisticated technology. This lower and imbalance the public health systems where importance is given to urban hospitals once primary health centres, which needs lower technology. The recommendation of WHO also should be taken into account in employing the diagnostic technology. It states that 80 per cent of diagnostic technology (i.e) Basic Radiological Units is low cost, effective. This can be employed and performed in a low cost and can be operated and maintained by training local people. Highly sophisticated technology also encourages highly specialised medical practitioners rather than graduate doctors who are enough to engage most of the disease pattern in India. The above said lopsided development has various consequences to public health where technological interventions are given importance over social, political and economic factors; urban centres gives priority over rural side and mechanists understanding rather than interpersonal interventions.

Health technologies are employed in the society, where the different providers are considered as experts and the patients are the (passive) subjects of interventions and care. So for adoption of technology in particular society one should have sociological understanding as Evan Willis (1997) suggested .It has five features which needs to be taken cared off: (1) the social context in which technology is used; (2) the mutual relationship between society and technology; (3) the career of a given technology; (4) the stakeholders involved (patients, professionals, the state, and industry); and (5) the values embedded in scientific and medical knowledge.

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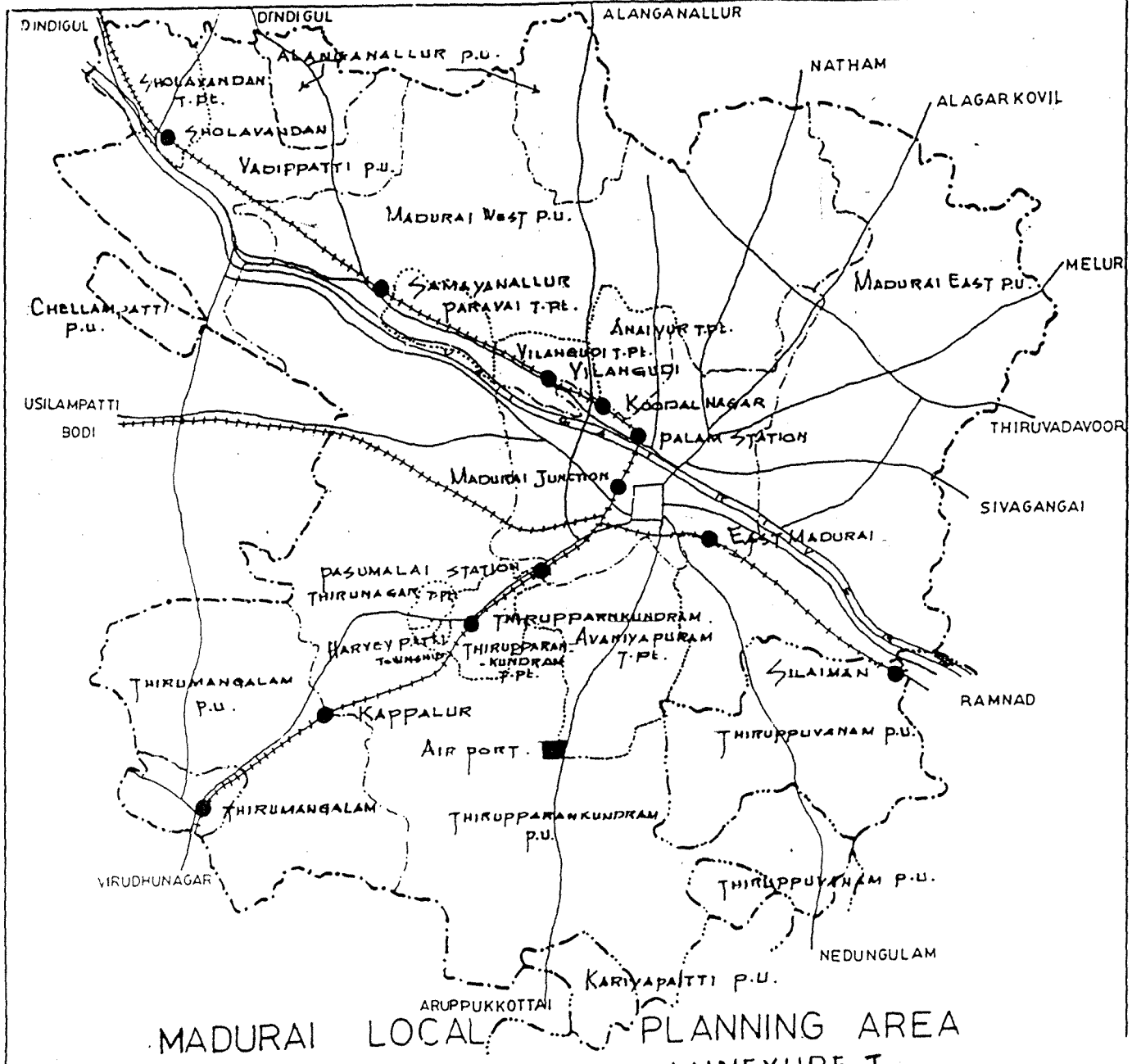
Annexures

ANNEXURE-1



MADURAI LOCAL PLANNING AREA
ANNEXURE I

MASTER PLAN

ADMINISTRATIVE UNITS

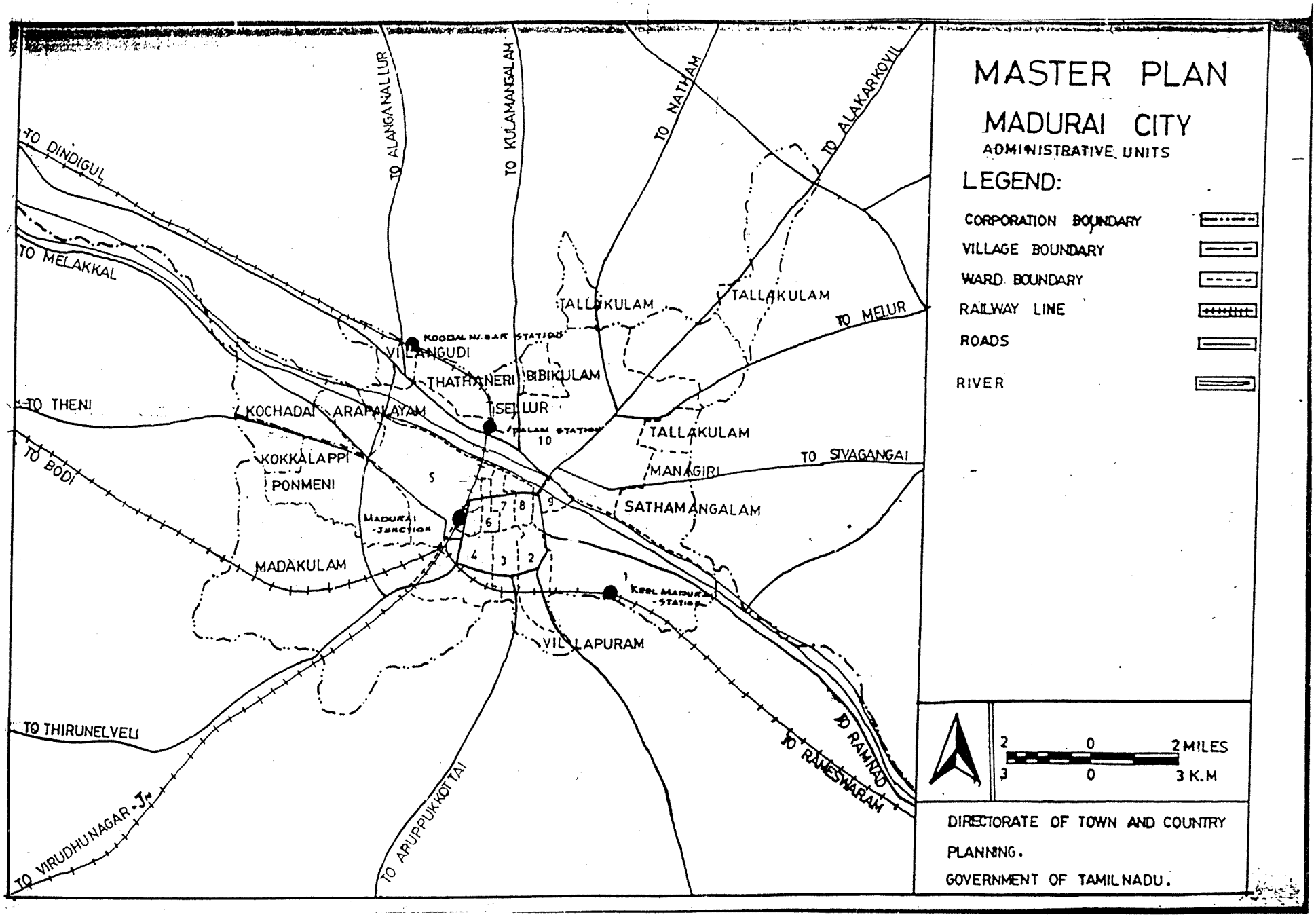
LEGEND

- LPA BOUNDARY
- CORPORATION BOUNDARY
- ROADS
- RAILWAY LINE
- RIVER
- DISTRICT BOUNDARY
- PANCHAYAT UN. BOUNDARY
- MUNICIPAL BOUNDARY
- TOWN PANCHAYAT BOUNDARY

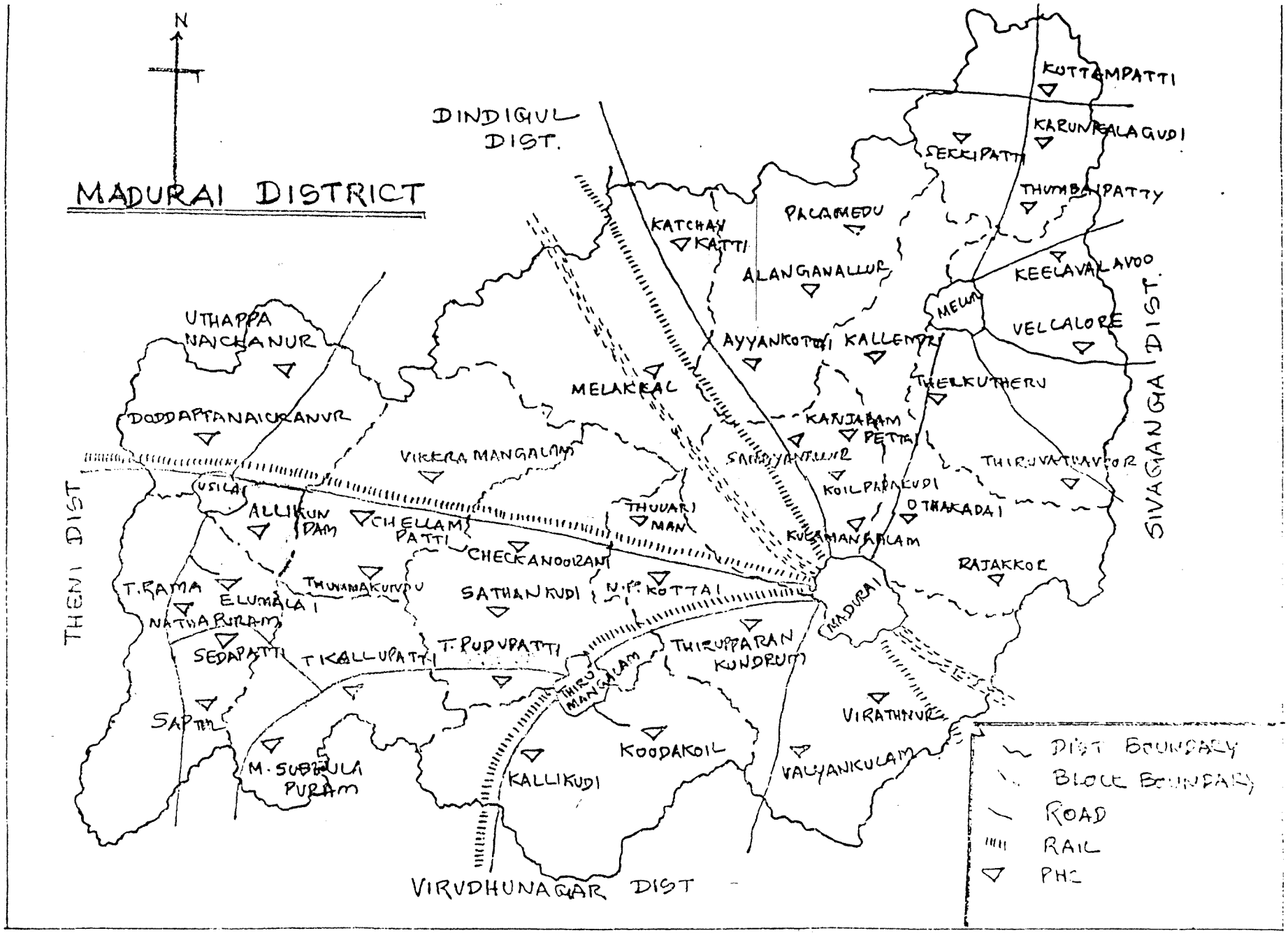
2 0 2 MILES
3.2 0 3.2 KM

DIRECTORATE OF TOWN AND COUNTRY PLANNING GOVERNMENT OF TAMILNADU

DTCP	M	
MR	MP	


MASTER PLAN
MADURAI CITY
ADMINISTRATIVE UNITS
LEGEND:
CORPORATION BOUNDARY
VILLAGE BOUNDARY
WARD BOUNDARY
RAILWAY LINE
ROADS
RIVER
2 0 2 MILES
3 0 3 K.M
DIRECTORATE OF TOWN AND COUNTRY PLANNING.
GOVERNMENT OF TAMILNADU.
TO DINDIGUL
TO MELAKKAL
TO THENI
TO BODI
TO THIRUNELVELI
TO VIRUDHUNAGAR
TO ALANGANALLUR
TO KULAMANGALAM
TO NATHAM
TO ALAKARKOVIL
TO MELUR
TO SIVAGANGAI
TO RAMNAD
TO RAMESWARAM
TO ARUPPUKKOTTAI
VILANGUDI
THATHANERI
BIBIKULAM
SELLUR
KOCHADAI
ARAPALAYAM
KOKKALAPPI
PONMENI
MADAKULAM
MANAGIRI
SATHAMANGALAM
VILLAPURAM
TALLAKULAM
TALLAKULAM
TALLAKULAM
MADURAI JUNCTION
KOODAL N. BAR STATION
KOOL MADURAI STATION
1
2
3
4
5
6
7
8
9
10

ANNEXURE II



ANNEXURE III MAP OF PHC IN MADURAI DISTRICT

ANNEXURE IV

LIST OF HOSPITALS AND NURSING HOMES (WARD-WISE) HAVING 10 BEDS AND ABOVE

Sl.No.	Ward No.	Name of the Hospital	No. of Beds
1.	2	S.S. Hospitals	25
2	4	Thilak Hospital	11
3	6	Jawahar Hospital	42
4		Apollo Orient Hospital	45
5		A.R. Hospital	36
6		Madurai Kidney Centre	28
7		City Hospital	55
8		Taj Nursing Home	35
9		P.S.V. Nursing Home	24
10		S.K. Nursing Home	15
11	7	Arther Asirvatham Hospital	15
12		Sumathi Hospital	15
13		J.J. Hospital	10
14		Senbagam Hospital	36
15		Rajeev Hospital	10
16		Vikram Hospital	20
17		Aravind Eye Hospital	200
18	8	Anita Nursing Home	18
19	9	Shanmuga Nursing Home	15
20		Subasrida Hospital	12
21	10	Selvam Nursing Home	12
22	12	O.N.R. Corporation Hospital	10
23	13	Booma Nursing Home	20
24		Vadamalayan Hospital	30

Sl.No.	Ward No.	Name of the Hospital	No. of Beds
25		T.V.S Hospital	15
26		Ananatha Priya Hospital	12
27		Fenn Hospital	15
28		Sundaram Scan	10
29	14	Annai Hospital	15
30	20	Sellur Corporation Hospital	12
31	21	Aruldosspuram Corporation Hospital	10
32		E.S.I Hospital	209
33	23	Kalaivanar Corporation Hospital	16
34	24	Avvai Janaki Nursing Home	15
35	27	Thembavani Hospital	25
36	29	Nalini Clinic	10
37		Navamani Prabhakaran Hospital	----
38	30	Railway Hospital	23
39		Grace Kennet Hospital	----
40		Quality Care Hospital	24
41		Grace Nursing Home	16
42	33	Harly Ram Hospital	20
43		Lady Wellington Corporation Hospital	10
44		Ganesh Hospital	10
45	35	Karpagam Hospital	20
46		Thangaraj Hospital	16
47	37	Sivakasi Nadar Hospital	10
48	43	Devasakayam Anthoniyammal Hospital	12
49	44	D.T.P. Corporation Hospital	20
50		Chandra Clinic	10
51	45	Kulanthai Yesu Hospital	15
52		Kamatchi Sundaram Hospital	12
53	46	Christian Mission Hospital	200

Sl.No.	Ward No.	Name of the Hospital	No. of Beds
54		Sarkar Hospital	10
55	48	Jeya Clinic	10
56		Kanagaraj Clinic	10
57	49	Munichalai Corporation Hospital	12
58	49	Pandiyaraj Hospital	30
59	51	Kiruba Clinic	10
60	54	R.I. Corporation Hospital	32
61		Bagavathi Hospital	23
62		Santhosh Clinic	12
63		Sivajothy Nursing Home	10
64	55	Guna Sundari Bose Hospital	42
65	68	N.S. Hospital	19
66	69	Karuna Hospital	10

Source: Compiled from the data collected by the Public Health Department, Corporation of Madurai(2001)

ANNEXURE V

DETAILS OF CAT & MRI DIAGNOSTIC CENTRES IN MADURAI CORPORATION

S.No.	Centre/Hospital	CT		MRI		Management
		Machine	*Fee*	*Machine*	*Fee*	
I	KGS Diagnostic Centre (estd.2002)	Type: Spiral Company: Siemens Cost: Rs. 1.4 Crore	Brain and Chest - Rs 2450 Abdomen - Rs 2950	Type: 0.2 tesla Company: Siemens Cost: Rs. 2.2 Crore	Full study (whole body) - Rs 5750 Single study (any single portion) - Rs.4500 - 5500	Owner cum Radiologist - 1 Manager - 1 Assistant Manager - 1 Marketing Wing(PRO) - 6 Radiographers - 5 Receptionist - 3 Office Assistants - 3
II	Devaki Scans and Diagnostic Private Limited (estd.1998) [1]	Type: Axial Company: Siemens Cost: NA	For any single part - Rs. 2000	Type: 0.2 Tesla Company: Siemens	Full study - Rs 5750 Single Study - Rs 3500	Owner is a medical practitioner Radiologist - 2 Radiographer - 4 PRO's - 13 Other staffs - 25
III	Indian MRI Centre (estd.1996)[2]	Type: Axial Company: Hitachi Cost: NA	Brain - Rs 2000 Sinuses - Rs 700 Abdomen - Rs 3000	Type: 0.2 Tesla Company: Siemens	Full study – NA Single study - Rs 4500	Radiologist - 1 Radiographer - 1 PRO's - 2
IV	Vita Scans (estd. 1990) [3] Closed	Type: Company: Hitachi Cost: NA	Not Available	NA	NA	NA

S.No.	Centre/Hospital	CT		MRI		Management
		Machine	*Fee*	*Machine*	*Fee*	
V	Apollo Orient Hospital	Type: Axial Company: NA	Single portion - NA Whole body - NA	Not available	Not Available	Radiologist - 1 Radiographer - 1
VI	Government Rajaji Hospital	Type: Axial Company: Siemens	In patient - Rs 350* Out patient - Rs 500*	Type: 1.5 Tesla Company: Siemens	(A) Brain, Cervical Lumbar, Abdomen, Thoracic, Pelvis, MRCP Plain - Rs 3500 Contrast - Rs 5000 (B) Knee, Hip, Joint, Shoulder, Wrist (i.e. small/limited area) Plain - Rs 2500 Contrast - Rs 4000	Manned by TNMSC Radiographer - 4 Radiologist - 4

Notes:

(1) This centre has other diagnostic facilities like Mammography, ECG, EEG, Computerised ECG and advanced X-ray.

(2) It is a part chain of diagnostic centres established in Tamil Nadu. Another one is in Salem. This centre was the first one to include CT scan facility in South Tamil Nadu.

(3) This centre has chain of diagnostic centres in Tamil Nadu and Kerala. Owner is not a medical practitioner. They have closed down due to poor patient turn out and heavy competition

(*) Rs 150 extra if it is contrast

Source: Primary Survey

ANNUXURE VI

SCHEDULE

The interviews were conducted with a schedule touching upon relevant themes branching out towards various points thereby bringing the opinion of medical practitioners on the rubrics such as their general understanding on medical technology.

- Changes medical imaging brought in clinical practice and the relationship between clinical skill and medical imaging and the implication of it in clinical practice.
- Role of technology in their medical practice especially medical imaging.
- Probable cost medical imaging created- social, economic and physician skill
- Limitations, usefulness and success rate of technology especially medical imaging in diagnosing disease and diagnosis.
- Ethical issues and dilemmas in applying technology.
- Professional and corporate influence while using technology.

Apart from this, medical practitioner social background in terms of age, sex, caste, parent's occupation, spouse occupation and education are also collected.