

# Health Care Innovation and Society: Social Construction of Cardiopulmonary Resuscitation (CPR) in India

**HARISH PURI GOSWAMI**

Ph.D. Scholar

Centre for Studies in Science, Technology and Innovation Policy, School of Social Sciences  
Central University of Gujarat, Gandhinagar (Gujarat) India

## ABSTRACT

This article tries to examine the area of life saving technology, specifically cardiopulmonary resuscitation (CPR) which is frequently used under the health care services all over the world. This paper evaluates the CPR on the parameters of the Social Construction of Technology (SCOT) and tries to explore how this technology has been interpreted by the various social groups namely; doctors, researchers, patient and their family members. The data are collected through the secondary sources after reviewing the literature and gathering information from the Internet. This paper attempts to answer a few questions like; how this technology CPR has been evolved, how effective it is perceived, how it has been accepted by the society, is was there any consensus and if yes then how it was achieved and so on. This paper not only enhances our knowledge of CPR but also improves our understanding of healthcare technologies.

**Key Words :** CPR, SCOT, Health Care, Innovation, Medical Technology, Device, Lifesaving

## INTRODUCTION

In India, today heart related diseases are an important cause of mortality and morbidity. More than 90% of incidents are of myocardial infarction and stroke (Gupta *et al.*, 2012). The global status of non-communicable diseases report (2011) says that during 2008 more than 2.5 million deaths occurred due to CVD and out of this two-thirds were due to Coronary Heart Disease (CHD) and one-third with stroke. CVD is under top five causes of deaths in India (Koria *et al.*, 2013). CVD, along with other non-communicable diseases, like cancers, chronic respiratory diseases, and diabetes account for about 60% of all deaths occurring in India (Trans-Integra, 2015).

When a person's heart stops due to cardiac arrest cardiopulmonary resuscitation (CPR) - a combination of techniques is used to save the life of a person. This technique includes chest compression to pump the heart to get blood circulating and to restore oxygen supply. CPR can be lifesaving first aid if it is given soon after the heart

stops.

According to L.J. Blackhall *et al.* (1999), the ethical and legal implication of decisions to withhold and withdraw life support system is always debated. To make this decision on the verge of life-end has never been easy. It becomes even more difficult when the cultural background of doctor and patient differs. The communication about issues like; the treatment, its benefits and related complications becomes difficult to pass on to the patient and family members. Cardio pulmonary resuscitation (CPR) it is a technique through which attempts are made to restore heart beats using artificial breathing, pumping up and down on the chest, giving electrical shock or drugs or through mechanical ventilation (artificial breathing machine) used by the doctors to save human life (Blackhalla *et al.*, 1999).

Day-by-day new and innovative medical technologies are penetrating the health sector to improve human life expectance with early diagnosis, less pain, shorter surgical time, reduced hospital stay and improving the overall efficiency and efficacy of the health care

system. According to Stefan Timmermans and Marc Berg (2003), “Medical technologies include the drugs, devices, and medical and surgical procedures used in medical care, and the organizational and supportive systems within which such care is provided” (Timmermans and Berg, 2003). If we look technological innovations from the patient’s point of view, then it is “either improved health or reduced suffering due to illness” (Omachonu and Einspruch, 2010).

Since, the last few decades, medical science have advanced exponentially, but still, the patient’s treatment and care depend only on the decision of the medical professionals. As a result the line of treatment, prescription of drugs, laboratory tests and diagnosis vary from doctor to doctor-as doctor changes the treatment varies. Many a time’s the expenses on drugs, laboratory tests, diagnostic services, consultation fees, and other related hospitalization costs pushes many families into the debt of poverty cycle. Even today medical care is a ‘black box’ to the majority of common men.

Today, most of high end medical technologies are innovated and manufactured in developing countries, which later gets transferred to developing countries like India. The life sustaining technology- CPR is among it. Technologies don’t have geographical boundaries specifically in the case of medical care. Any drug, instrument, technique developed outside the country rapidly penetrates the market especially the India market and since India has a huge consumer power and can generate huge profits for the manufactures. E-media has also played an important role in making these technologies acceptable to the communities. This paper evaluates CPR technology from SCOT’s perspective and explores its associated relevant social groups, how they shapes this artefact, what meanings they give, what is the nature of their interpretative flexibility, the contestations and at the end how this technology got stabilized over a period of time as the only major emergency intervention available for cardiac arrested patients across the world.

#### **Theoretical framework and its suitability:**

Philosophers use to define the relationship between science and technology as “science is about the discovery of truth, whilst technology is about the application of truth” (Pinch and Bijker, 1984). But, today social constructivist believes that this is no longer sufficient and now “science and technology have become intermixed” (Pinch and Bijker, 1984). According to Trevor J. Pinch

and Wiebe E. Bijker (1984), “the divisions between science and technology are not between the abstract function of knowing and doing. Rather, they are social.....” (Pinch and Bijker, 1984). As a result a new theory and method called Social Construction of Technology (SCOT) was developed within the field of science and technology studies, with a strong belief that technological innovations are shaped by society and has influence of culture, politics, economic arrangements and a like and therefore to understand any technology it is important to understand how that technology is embedded in its social context.

SCOT helps to understand how stabilization of an artifact amongst more than one social group occurred, how the closure was arrived, whether the controversies were resolved through a solution or the closure was achieved by redefining a new problem. Through SCOT one can describe technological artifacts by focusing on the meaning given to them by several social groups. The sociocultural and political situation of a social group shapes its norms and values, which in turn influence the meaning given to an artifact (Bijker, 1984). The most basic relevant groups associated with any technology are the users and producers of technological artifact. This can further be delineated as several sub groups like; users with different socioeconomic status, competing producers and so on. Sometimes there are also relevant groups who are neither users; nor the producers of the technology like; journalists, politicians, civil groups etc. These relevant social groups can also be further distinguished into groups based on their shared or diverging interpretations of the technology in questions. Through SCOT researchers explore how the criteria of being “the best” are defined and which group(s) participate in defining it. Who defines the technical criteria and how success is measured. Who all are included and who are excluded.

#### **Overview of sector, area, research problem:**

Technological developments have now been deeply embodied within the professional practice and inter-professional relations. During a study of the utilization of a computer system with two separate renal units by Mike Dent (2008), found that different organizational arrangements and circumstances affect the attitude and use of particular technologies in the medical field. The two renal units responded very differently to the introduction of the technology. In one unit, where there was some resistance from the nursing staff, in another

the nursing staff welcomed the system. The study showed that organizational arrangements and the boundaries between professional work and jurisdiction has profound influence on the use and exploitation of technology. In the medical field, utilization and appreciation of technology largely depend upon the relations between the hospital staffs. Their inter-professional relationships defines the implementation and exploitation of new technologies (Dent, 2008).

We often talk about technology as if it is either a blank slate, lacking any inherent nature, or a force outside of human control. The reality is more complex- hospital uses computerized databases to reduce medical errors. On the one side these data not only helps doctors to treat patients but also makes them to regain some control over the database- many a times, pressing patients to answer specific questions, on the other helps patient to assert control by insisting addressing a different set of issues to the doctor (Timmerman and Berg, 2003).

Thus, it is very necessary to understand the process through which group decides which potential technologies should be adopted- Who promotes and who benefits from it. Sometimes it is a political process and as a result harmful technologies are sometimes developed and adopted. In the medical field, once a technology enters the main stream, it becomes necessary for both doctors and consumers regardless of their cost to use it till some new technology or incremental innovation replaces it. In the medical sector, technologies are reinforced sometimes by the companies, industries, firms, corporations, government agencies, and medical associations as 'standard of care for treating' because of their vested economic interests in selling a particular technology.

According to Jaklin Elliott and Ian Olver (2008), most people fears that in a medical setting "they will be subjected to unnecessary and intrusive medical intervention when near death, with enduring and undesirable consequences for themselves and their loved ones". When curative treatments are no longer available then an alternative, decisions may be needed and one such decision is the decision to initiate CPR or not orders (Elliott and Olver, 2008).

CPR is the standard default medical response to a cardiac arrest patient within a hospital. When we looked into the history of CPR we found that, a Babylonian Talmud, a sixth century collection of Jewish oral tradition, mentions that a lamb with a neck injury was saved by making a hole in the trachea, supported by a hollow reed.

Andreas Vesalius, the Belgian Anatomist quoted above conducted experiment with similar design a millennium later. In 1768, the Dutch Humanist Society was founded in which physicians and laypersons collaborated to aid a victim drowned in the waterways. In 1895, Alfred Kirstein invented Laryngoscope to aid visualization of the trachea. In mid-20<sup>th</sup> Century, Peter Safar methodically invented techniques for airway management. In a series of experiments he paralyzed volunteers with curare to demonstrate that optimal potency was achieved when the neck was extended, the mandible was supported (jaw thrust) and an oropharyngeal tube is introduced for Oxygen. The development of cuffed endotracheal tube by Sir Henry head in 1889, and the invention of low-pressure cuff by Cooper to reduce airway injuries together resulted in the modern method of securing the airway. According to Jonas A. Cooper *et al.* (2006), the earlier record reference to artificial breathing is in the old testament, in the book of kings, where the prophet Elisha restored the life of a boy through a technique that include placing his mouth on the mouth of a child, although there is a little mention of this method for another 2000 years. Mouth-to-mouth techniques are described in several 18<sup>th</sup> century sources, including one by D.J. Larrey (Cooper, Cooper and Cooper, 2006).

In 1957, The United States military adopted the mouth-to-mouth resuscitation method to revive unresponsive victims and as a result, in 1960, CPR was developed. From there onwards CPR and associated resuscitation techniques become part of medical culture. It appeared to offer a 'good death' in the circumstances of death. The history of CPR can be divided into four eras; first 1960 to 1962, where Kouwenhoven and colleagues combined closed- chest heart massage with the artificial ventilation known as CPR. Second- 1962 to 1968, era of skepticism in which CPR was challenged by investigators whose observation of hemodynamic were not in concert with the proposed mechanism of blood flow and raised questions about the effectiveness of the technique. Third era 1968 to 1976, where effectiveness was established through its wide spread use and by replacing complete the open-chest cardiac massage by CPR in every resuscitation effort. The current era 1976- present, is the era of rediscovery and refinement and with the anticipation that current era will bring new discoveries, new controversies and new challenges (Criley *et al.*, 2005).

The term CPR was first publicized in less than 50

years ago. However, resuscitation extends back to centuries with a gradual course of evolution that has been periodically impeded by the rejection of inadequate techniques, curiously slow adoption of proven interventions and even a cyclic process of abandonment and rediscoveries. Current CPR technique includes a mechanical device—a piston, for chest compression at a specified rate, compression depth, and duty cycle. The piston is located at an end of an arm that extends to the patient's chest. Additionally, this device, it is attached to a ventilation circuit for continuous CPR with minimal operator input once it is on (Halperin and Rayburn, 2005).

CPR is used to restore life to those whose heart and lungs have stopped working. In earlier times, the very notion of such resuscitation would not have made any sense to doctor or the public. Death was considered to be in god's hand, and dead was dead. But since the rise of modern medicine, doctors have struggled to find ways to restore life to those who die suddenly. This can be seen in a number of television dramas and films where doctors were shown as a hero who saves apparently dead patients through CPR. In America millions of dollars have been spent teaching the general public how to perform CPR and in outfitting community emergency response teams and hospital emergency rooms with resuscitation equipment's. Yet CPR almost never succeeds except when healthy individuals drown or are stuck by lightning. The typical person who receives CPR has at least 1% to 3% chance and probably much less—of surviving, at an estimated cost of \$500,000 per survivor. Moreover, survival may be brief and many be accompanied by severe neurological damage. As a result, emergency department doctors and emergency medical technicians overwhelming regard resuscitation as futile, so they joke, complain, or simply go through motion whenever they have to use it (Health Care Settings and Technologies, 2012).

The quality of health care is not measured solely by the number of human beings who survived. Rather, it is measured by the number of patients who live on, who live on for how long, with a sense of dignity, well-being, and worth. During an autopsy of 130 patients who died after an attempt at cardiopulmonary resuscitation (CPR), it was found that complications were occurring as a result of CPR. Further, it was found that 21% of the patients had at least one complication as a result of CPR (Bedell and Fulton, 1986).

There are controversies about the use of both

traditional and advance CPR. In traditional CPR, which is expected to be learned by every individual to save the life of a victim suffering from cardiac arrest wherever they come across such suspected cases. But, people have a fear of lawsuits if the victim dies, fear of legal action by the victim or his/her family member, fear of contracting infection through mouth-to-mouth contact, lack of knowledge and confidence, fear of injuring the victim, and whether it will relay benefit the victim or not. Under advance CPR, several drugs are used and is evaluated and reevaluated. One such drug is sodium bicarbonate. Although its use was once heavily favored, it is no longer routinely recommended unless a preexisting acidosis is present. It is now controversial as to whether sodium bicarbonate should be used at all during CPR. The use of pure alpha-agonists was suggested as early as the 1960s. Several animal studies demonstrated that the pure alpha-one agonist methoxamine was at least as efficacious as epinephrine however, a randomized human trial of witnessed cardiac arrest victims failed to show the same. There is no definitive evidence to show its superiority over epinephrine (White *et al.*, 2001).

Society's view - even when older people survive CPR, the consequences can be deleterious: broken ribs and fractured sternums, punctures of the lungs or liver, vomit in the lungs and significant pain. Those who argue for CPR in the elderly say these complications, while serious, are preferable to death. Others say quality of life can be, and often, terribly degraded (Graham, 2013).

According to a survey carried out by Leslie J. Blackhall *et al.* (1999), in America during 1999, with 800 respondents, followed by in-depth ethnographic interviews, 80 respondents revealed that there was a deep distrust towards the health care system and a fear that health care was based on one's ability to pay. Further, in conclusion, it was found that ethnicity is strongly related to attitudes toward and personal wishes for the use of life support (CPR) in the event of a coma or terminal illness, and this relationship was complex and in some cases, contradictory (Blackhalla *et al.*, 1999).

In Indian Context- in a retrospective analysis of 215 resuscitations done in a 125-bed community hospital between January 1995 and November 1997 in an Indian hospital revealed that 14.4% were alive at discharge (Rajaram *et al.*, 1999).

Then why CPR has become so widely adopted? The actual benefit of CPR according to Timmermans, is that it “takes some of the sadness of sudden death away”.

CPR allows families and allies to trust that they have done everything possible by making their loved ones into treatment as fast as possible. It also gives families and friends time to gather and recognize that dying may be imminent, and it gives medical personnel a sense of technological skills as they fight to keep their patient's body organ functioning as long as possible. CPR, thus becomes a mean, a process of making "deaths explainable, culturally acceptable, and individually meaningful, such as through pain management, 'death counseling' or the gradual removal of life support from dying patients" (Health Care Settings and Technologies, 2012). Despite all its emotional and financial costs, CPR has now become a valued and expected ritual in many of the countries including India.

Some of the scholars (death advocates), have singled out CPR as symbols of medical hubris stating that it denotes "far-reaching medicalization of the dying process" (Timmermans and Berg, 2003). The execution of CPR on critical and serious patients "cruelly prolongs their dying process ... robs... opportunity consciously to experience their last living moments and their autonomy" (Timmermans and Berg, 2003).

At the same time the adoption of CPR illustrates the economic and political as well as cultural forces that underlie the social construction of technology. CPR would not have been so widely adopted if corporate had not held a vested economic interest in encouraging it. Currently in India, almost 90% of medical devices and disposables are imported. There are no specific guidelines and standards for manufacture, import or its use by the government in India and therefore this has raised concerns regarding the safety, calibration, and reliability of these medical devices. Legally manufacturers are not bound to demonstrate the effectiveness of these CPR devices and as a result "doctor depends on promotional materials provided by the manufacturers of their technology, and patients rely on the doctor's judgment" (Health Care Settings and Technologies, 2012).

The study finds that the major social groups associated with this CPR technology were namely; cardiac patients and their family members, doctors, medical device manufacturers, researchers, media and government authorities. These groups had various contestations related to the efficacy, cost effectiveness, and regulatory mechanisms of CPR. Some, group perceived CPR as advantageous in saving patient's life, some contradicted stating that there was a nexus between

industries and doctors which pressurizes them to adopt unnecessary CPR.

Initially, there was no consensus on whether CPR was beneficial or not. Each group interpreted CPR differently. Some perceived it as lifesaving technology, some as a matter of affordability, some as a matter of lawsuits, some as fear of contracting infection, some felt it an issue of attitude toward personal wishes for its use, and some as a means of satisfaction of doing everything possible for the treatment of their loved ones. To some it was a satisfaction that they fight to keep their patients live as long as possible and for some it was just a financial gain. But, slowly, all groups agreed that this is the only last option available to critically ill patients and hence engaged in rhetorical closure by agreeing to its usefulness. This led to a negotiation among these relevant social groups, build consensus and stabilized this technology-CPR across the globe along with Indian.

### **Conclusion:**

Although, studies with reveal that the overall percentage of survival rate after the use of CPR is very less, less than 3%, CPR technique is very widely used all over the world in spite of its criticism from various social groups. Today, CPR is the last option available with the doctor for saving the life of a patient. CPR is viewed as a battle against death. No doubt this may be a difficult decision for the patient and families to sanction its refusal and therefore even though being it problematic for a family to act as surrogate decision-makers; Choosing to forgo CPR means as choosing to let the patient die, with various moral evaluations of family or patient-either the patient was not worth saving, or the family did not care enough to save them and therefore they go with the decision to initiate CPR. On the other hand, letting patients make the decision without adequate resources will be unethical behavior on the part of the doctor. Although it is not for sure that CPR will be successful in restoring life, yet both doctors and patients overestimate the extent to which life can be restored in patients who suffer cardiac arrest.

Patients do not have the right to demand CPR against a medical recommendation, however in Australia, Europe and United States medical practice requires that the patient authorize do-not- resuscitate (DNR) intended to countermand the default practice in hospitals of instituting cardiopulmonary-resuscitation (CPR) on all patients experiencing cardiopulmonary arrest. Getting into the details will lead to other controversies and therefore this

issue is not reached.

In India, until and unless there are no fiscal constraints, it is the decision of the doctor who determine the appropriateness of initiating CPR or not. There is a demand to produce a protocol for all physicians, making it mandatory to discuss their decision with the patient or family and articulate the clinical base for the decision. It is well-defined from the aforementioned that the CPR technology has now been embedded in the society. In short, it is the society which constructs the technology.

Most of the studies in this field have been carried out outside India and therefore it provides an ample opportunity for the STS scholars to carry out studies on survival and death rate after undergoing CPR. SCOT provides an ideal forum to present, discuss and develop research on technology, health and illness. This study opens up several areas for future studies on CPR like; comparison of cost analysis of the patients undergoing CPR at private and public hospitals and its socioeconomic impact on its family, the psycho-social impact of CPR technology on the decision making process on the family and its long term repercussions. This paper also open up a platform for STS scholars to carry out discussions on the benefits and drawbacks of CPR technology from an Indian context.

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