Assessment of Health Care Service Quality and Patient Satisfaction for Permanent Pacemaker Implantation (PPI): An Empirical Study in Selected Hospital, Kolkata

Thesis Submitted By

MOITREYEE ROY

Index no.-D-7/ISLM/98/19

Doctor of Philosophy (Science)

School of Environmental Studies
Faculty of Interdisciplinary Studies, Law & Management
Jadavpur University
Kolkata, India

2024

CERTIFICATE FROM SUPERVISORS

This is to certify that the thesis entitled **"Assessment of health care service quality and patient satisfaction for permanent pacemaker implantation (PPI): An empirical study in selected hospital, Kolkata"** submitted by **Ms. Moitreyee Roy**, who got his name registered on 24th October 2019 for the award of Ph.D. (Science) degree of Jadavpur University, is absolutely based upon her own work under the supervision of Dr Subarna Bhattacharyya and Dr. Tusharkanti Patra and that neither her thesis nor any part of the thesis has been submitted for any degree/diploma or any other academic award anywhere before.

_____
(Signature of Supervisor)

Dr. Subarna Bhattacharyya
Assistant Professor
School of Environmental Studies
Jadavpur University
Kolkata 700032

_____
(Signature of Supervisor)

Dr Tusharkanti Patra
Assistant Professor
Department of Cardiology
IPGMER & SSKM Hospital
Kolkata 700020

Statement of Originality

I, Moitreyee Roy (Registration number –D/7/ISLM/98/19), registered on 24th October 2019 do hereby declare that this thesis entitled "Assessment of Health Care Service Quality and Patient Satisfaction for Permanent Pacemaker Implantation (PPI): An Empirical Study in Selected Hospital, Kolkata" contains literature survey and original research work done by the undersigned candidate as part of Doctoral Studies.

All information in this thesis have been obtained and presented in accordance with existing academic rules and ethical conduct. I declare that, as required by thesis rules and conduct, I have fully cited and referred all materials and results that are not original to this work.

I also declare that I have checked this thesis as per the "Policy on Anti Plagiarism, Jadavpur University,2019", and the level of similarity as checked by iThenticate software is 11%

Signature of Candidate: _____

Date: _____

Signature of Supervisor: (Date and seal) _____

Signature of Supervisor: (Date and seal)_____

Declaration

I hereby declare that this thesis represents my own work and has not been previously included in any thesis or any other institution for a degree, diploma or other academic qualifications. Further I have acknowledged all sources used and have cited these in the reference section.

I hereby submit the record of my observations for evaluation for the award of the degree of Doctor of Philosophy in Science.

_____

(Moitreyee Roy)

List of Publications

1. **Moitreyee Roy**, Subarna Bhattacharyya, Tushar Kanti Patra, "Satisfaction Measurement for in-hospital Services among Permanent Pacemaker Implantation Patients: A Pilot Study in Selected Hospital in Kolkata", Asian Pacific Journal of Health Sciences , Vol. 9 ,Issue 4 , October-December , 2022, pp.375-378

2. **Moitreyee Roy**, Subarna Bhattacharyya, Tushar Kanti Patra, "Evaluation of Hospital Service Quality: Permanent Pacemaker Patient Perspective", International Journal of All Research Education and Scientific Methods (IJARESM), Volume 12, Issue 6, June-2024,pp.2505-2511

3. **Moitreyee Roy**, Subarna Bhattacharyya, "Indoor air quality in a tropical city hospital and determination of respiratory infection risk of pacemaker implant patient", Aerosol Science and Engineering (ASEN), communicated- 10 July, 2024

4. **Moitreyee Roy**, Subarna Bhattacharyya, Development of frame work in relation to hospital Service, First International conference on multidisciplinary research (online mode) 2020, organized by Society for advanced multidisciplinary research and practice in collaboration with Astronomical instruments design laboratory, IEE dept. Jadavpur University, West Bengal, Kolkata

Acknowledgements

Looking back five years from now, I remember very well the first steps I undertook for thisdissertation. Personally, those five years have been intellectually challenging and enormously enriching, something I would never want to miss. The research work and the current thesis are outcomes of constant inspiration and help from a number of persons at various spheres of my association. At the heartof this extraordinary experience were the people who accompanied my way. In the name of all, some shall be mentioned.

First of all, I wouldlike to express my heartfelt gratitude and deepest regards to my supervisor, Dr. Subarna Bhattacharyya, Assistant Professor, department of Interdisciplinary Studies, Law and Management, Jadavpur University, Kolkata. The research work and the current thesis are outcomes of constant inspiration of Dr.Tushar Kanti Patra, Assistant Professor, Departement of Cardiology, IPGMER, SSKM, Kolkata. In spite of their busy schedules and even at odd hours of the day, they have always lent me a patient listening and helped me to the fullest extent.

I am grateful to the Head and Doctoral Committee members of Interdisciplinary Studies, Law and Management, Jadavpur University, Kolkata.

I am deeply in debited to Dr. Bobby Paul, Professor, All India Institute of Hygiene and Public Health, Kolkata. For providing me guidance, resources and critical suggestion during my research work.

I do not forget the inspiration and encouragement I received from Prof (Dr.) Avijit Hazra, Dean of student affairs, IPGMER, SSKMM, Kolkata.

It gives me immense pleasure to express my deep gratitude to my husband, Prof.(Dr.) Subhash Chandra Panja, for his continuous support. I could fulfill my aspiration to complete this endeavor.

I would also like to thank all my friends, Aindrila Panda, Dipanjan Gain, Saptak and Sovan Sahoo for their help and support during data collection.

I would also like to thank my then Principal, Professor Bandana Das to give me the permission of PhD. I don’t forget my colleagues for their immense encouragements.

Most importantly, I wouldn’t be at all without my parents and family members and, for this reason, I dedicate this work to them not only for their constant support. All of my well-wishers have been left unmentioned between the margins of this page. I would like to thank from the bottom of my heart one and all who have helped me to become whatever I have achieved.

Moitreyee Roy

Dedicated

To

My Daughters

Soumili & Shaileyee

Contents

Chapter2 Literature Review

List of Figures

List of Tables

Abbreviations

Chapter 1

CHCs	Community health centers
PHCs	Primary health centers
DALYs	Disability-adjusted life years
NCDs	Non communicable diseases
CVD	Cardiovascular disease
CHD	Coronary heart disease
RHD	Rheumatic heart disease
IPA	Importance-Performance Analysis
SERVQUAL	Service quality
OPDs	Outpatient departments
PPI	Permanent pacemaker implantation
IAQ	Indoor air quality
CO	Carbon monoxide
VOCs	Volatile organic compounds
PM	Particulate matter
WHO	World Health Organization
IAP	Indoor air pollution
RDD	Respiratory deposition dose

Chapter 2

PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
WTR	Willingness to recommend
UHC	Universal Health Coverage
EMR	Electronic medical record

DEA	Data envelopment analysis
FDH	Free disposal hull
IVIFS	Interval valued intuitionistic fuzzy set
MCDM	Multi-criteria decision making
ECSF	European Customer Satisfaction Framework Model
ACSF	American Customer Satisfaction Framework
PSI	Patient satisfaction index
OPD	Out -patient department
PCC	Patient-centered care
VAS	Visual analogue scale
ESRQ	Emotional stress reaction questionnaire
SEM	Structural equation model
QPC-IP	Quality in Psychiatric Care – in patient
QPC-OP	Quality in Psychiatric Care – out patient
AHP	Analytic Hierarchy Process
VIKOR	Vise Kriterijumska Optimizacija Kompromisno Resenje
TOPSIS	Technique for order performance by similarity to solution
MMR	Mixed-methods research
RSPM	Respirable suspended particulate matter
PM	Particulate matter

Chapter 3

PCA	Principal component analysis
CCU	Critical care unit
ITU	Intensive therapy unit
SPSS	Statistical Package for Social Sciences
IBM	International Business Machines

Chapter 4

IDI	In depth interview

Chapter 5

IAQ	Indoor air quality
EPA	Environmental protection act
CO	Carbon monoxide
CO_2	Carbon dioxide
NO_2	Nitrogen dioxide
SO_2	Sulphur dioxide
IAP	Indoor air pollution
CFU	Colony forming unit
ICRP	International Commission on Radiological Protection
DC	Direct contamination

Abstract

Hospitals are complex institutions where various services work together to deliver timely care and improve health outcomes. Healthcare is a fundamental and critical issue in our society, making the quality of hospital services an important focus that must meet established standards. The quality of hospital care can be categorized into two areas: technical, which pertains to diagnostic accuracy and efficiency, and functional, which relates to the manner and expressiveness of healthcare delivery. Given the complexity of hospital services, assessing their performance empirically is quite challenging.

Hospitals are supposed to be places of healing, but poor indoor air quality (IAQ) can actually increase the risk of respiratory infections for both patients, care givers and staff. The present work aims to (i) analyze the health care service quality, (ii) identify factors associated with health care service quality, (iii) explore patient satisfaction regarding service quality, (iv) determine the association between patient satisfaction and selected background information, and (v) assess selected physical environmental parameters in selected hospital, Kolkata. As death due to cardiovascular disease is prevalent in developing countries compared to other diseases, this study considers permanent pacemaker implantation patient (PPI) so that gaps in health service and patient satisfaction may be identified in view of overall development of health service.

Keeping this in mind, present study considered a comprehensive methodology with four relevant tools, viz. cause and effect (CE) diagram, service quality (SERVQUAL) Model, mixed method, and indoor air quality (IAQ) assessment. With the help of CE diagram, it was observed that there were approximately forty important factors, which were influencing quality of hospital service. In the next phase, the Pilot Study, a non-experimental purposive sampling method was used to select study participants. A cross-sectional survey was conducted with patients who were admitted to the hospital for their first PPI (Permanent Pacemaker Implantation). A semi-structured interview questionnaire, based on the SERVQUAL model, was developed to cover five key areas: tangibility, reliability, responsiveness, assurance, and empathy. Data were collected from 27 participants who had been hospitalized for at least three days in the male and female

cardiology wards. It was statistically estimated that the reliability of questionnaire was 0.89, which was statistically significant. Subsequently, the same questionnaire is updated based on expert's opinion. This final set of questionnaire may be considered for future uses. Regarding the level of patient satisfaction, the majority (55.65%) of participants reported being satisfied. However, the proportions of participants who were highly satisfied and those who were less satisfied were both relatively low, i.e. 22.22% each. The study also identified that the areas of assurance and responsiveness required further improvement from healthcare professionals to boost patient confidence.

After the pilot study, the final study was carried out based on the final set of questionnaire, which contained twenty questions. In this stage, 138 study participants were chosen through purposive sampling from three cardiology wards. Two sets of questionnaire were used for data collection. First set (i.e. Tool I) was for getting demographic data and another i.e. Tool II, was based on hospital service quality assessment. Concept of Tool II was derived from SERVQUAL model and had five distinct dimensions, viz. tangible, reliability, responsiveness, assurance, and empathy. Data regarding hospital service quality was collected in two phases. In the 1st phase, data on expectation regarding hospital service was collected within 24 Hrs. of admission for PPI and in the 2^{nd} phase, data on perception regarding same issue was collected on the 3rd day during hospitalization after PPI. In consideration of service quality, there was significant gap between the perception and expectation in the area of empathy (-0.57± 1.24) and reliability (0.56± 1.03). The mean values of perception were varied from 1.87±1.05 for empathy (i.e. lowest) to 4.13 ± 0.83 for assurance (i.e. highest). The calculated t-values showed that the difference between expectation and perception of pacemaker patient was statistically significant ($p < 0.00$) in all of the quality dimensions. From Principal Component Analysis (PCA) it was understood that assurance and responsiveness were the two important quality dimensions in hospital service. That meant both the factors had a strong influence to sustain the quality service in hospital.

Subsequently, in-depth interview (IDI) was conducted for twenty participants to collect the qualitative data on the basis of open-ended questionnaire through telephonic communications. Based on their qualitative responses, a joint display was modelled to compare with the quantitative findings. It was inferred that PPI patients were satisfied

(confirmation) in the area of tangibility, responsiveness and assurance whereas they were not satisfied (discordance) in the area of reliability and empathy.

To fulfil the objective regarding IAQ, such as PM10, PM2.5, SO_x, NO_x, microbial load, relative humidity, air velocity and temperature were measured seasonally in three wards of cardiac unit where patient got admitted to implant permanent pacemaker. On the other hand, tidal volume and respiratory rate were also documented from the hospital records to calculate respiratory deposition dose (RDD) separately for male and female patient. In this section, the results showed that the highest concentration of PM10 and PM2.5 were 65.23 and 42.82 $\mu g/m^3$ in summer; bio aerosol load was 1254 CFU/m^3 in rainy season. All data was above the standard recommended by World Health Organization. RDD_{pm10} and $RDD_{pm2.5}$ indicated the lowest particulate deposition rate in winter followed by monsoon and summer. These findings could be applicable to hospital management for developing countries located at tropical area.

The similar type of research work may be carried out for other disease conditions and hospital setup. Also, different statistical analyses like regression, multi-criteria decision making, fuzzy logic etc. These analyses offer profound insights and improvements across healthcare provision. By employing these methodologies, healthcare systems can optimize service delivery, enhance patient outcomes, and refine operational efficiencies, thereby advancing overall health services.

Keywords: Hospital Service Quality, Permanent Pacemaker implantation (PPI), SERVQUAL model, Patient satisfaction, Principal component analysis (PCA), Mixed method design, In depth interview (IDI), Indoor air quality(IAQ), PM10 and PM2.5, Bio aerosol and Respiratory deposition dose (RDD),

Chapter 1: Introduction

1.1 Introduction

Hospitals are important in our society and serve as the backbone of healthcare systems worldwide. Firstly, hospitals are the primary centres for diagnosing and treating illnesses and injuries. They house ambulatory services, a multitude of specialized departments and acute services, from emergency care to advanced surgical units, ensuring comprehensive medical attention. For catering this service efficiently, there is a need to improve and increase number of beds. As per national Health Profile 2021, India has 8,25,235 beds or 0.6 beds per 1000 population. In continuation, it has been reported that India needs 2.4 million hospital beds to reach the recommended ratio of 3 beds per 1000 people[1]. Along with this it is also necessary to increase the number of health care providers to deliver appropriate medical treatment. Nowadays in continually improving healthcare system, people are more concern about health service. Thus, not only the hospital and its infrastructures are concern but also indoor air quality is a big issue in human health. Sometimes patient's staying in hospital is prolonging due to some hospital-related matters, like improper infrastructure, lack of attention by personnel, insufficient number of personnel, locational disadvantages, lack of medical supply etc. This requires an in-depth study to analyse the hospital performance.

It is stated that human civilization is presently under the threat of a number as well as variety of disease conditions. Each of these diseases may need sometimes a special kinds of treatment with a specific set of supports. This suggests that holistic performance analysis of a hospital may not lead to a specific direction with proper suggestion. Keeping this in mind, thepresent study deals with performance analysis of hospital among permanent pacemaker patients in cardiology ward as number of cardiac patients are increasing exponentially over last few decades.

1.2 Health Care Organization

Organization is one of the basic functions of management that involves developing an organizational structure and allocating human resources to ensure the accomplishment of organizational objectives. That is why organizing refers to identifying and grouping activities in a systematic manner. Health care organizations are considered complex open system as majority of elements is interdependent on one another and individual are identified distinctly by their positions, functions and responsibilities.

Health care can be defined as the activities and treatments that help someone to move towards health and away from sickness. It can be classified as primary health care hospitals like PHCs (primary health centers), CHCs (community health centers), and secondary care hospitals like district, tertiary care hospital. The activities of hospital are divided into four major components or system, i.e., general administration, clinical, nursing, supportive and utility services. Clinical, nursing and other services are regulated by administration to control the environment of hospital. The external environment comprised of different components like economical, technological, social, and political. Besides these, there are some internal environment consists of various departments in the hospital and work cultures. According to medical service hospital, departmentation is done, i.e., emergency room, chest departments, cardiovascular, orthopedic, gastro, pediatric, oncology, geriatric etc. each department is organized in such a way so that it can run smoothly to reach the organization goal[2,3,4,5,6].Kolkata, the capital of West Bengal have health care infrastructure with some Government and private hospital. These organizations offer modern medical facilities, innovative treatments and expert care across various specialities, making Kolkata a hub for quality health care services in Eastern India.

1.3 Health Service Quality

Quality has a predominant part in our lives. People are continuously looking for quality product and services. The term “quality” is derived from Latin word “quals” meaning “what kind of” (Glare, 1963). There are some definitions of service qualitybased on its perspectives and uses. Quality has been defined as “excellence” (Peters and

Waterman,1982); "fitness for use" (Juran, 1988); "meeting or exceeding customers"(Parasuraman et al.,1985). Prasuraman*et al.* (1988) define quality of service as "the global overarching judgement or attitude relating to the overall excellence or superiority of the service," that reflects a consumer's perception of service-firm performance. Technical quality in service-providing organizations concerns diagnosis and procedures, while functional quality focuses on how services are delivered to patients[7]. Health care service is an intangible product and hence, it cannot be touched, felt, viewed and measured like any goods, whose quality can be inspected physically, viewed and measured by means of measuring instruments and gauges.

In continuation it may be stated that a healthcare service quality deals with heterogeneous characteristics as it is offered by different care providers are providing care to different kinds of patient's needs. Thus, it is difficult to define and measure quality in health sectors in widely varying socio-economic scenarios throughout the world (Joss and Kogan, 1995; Ladhari, 2009; and Stem, 2005)[8].Donabedian (1980) defined healthcare quality as "the application of medicalscience and technology in a manner that maximizes its benefit to health withoutcorrespondingly increasing the risk". As per Institute of medicine definition (2001), quality is "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge"[9].

All the above-mentioned definitions consist of three main and important elements within an organization, viz. structure, process, and outcome as shown in Fig.1. Structure encompasses to the underlying foundation of healthcare delivery, including the physical, organizational, and human resources available within healthcare settings. Process focuses on the actual delivery of healthcare services, encompassing the actions taken by healthcare providers and interactions between providers and patients. Outcomes represent the results or consequences of healthcare interventions and services on patients' health status, functional outcomes, satisfaction, and overall well-being[10].

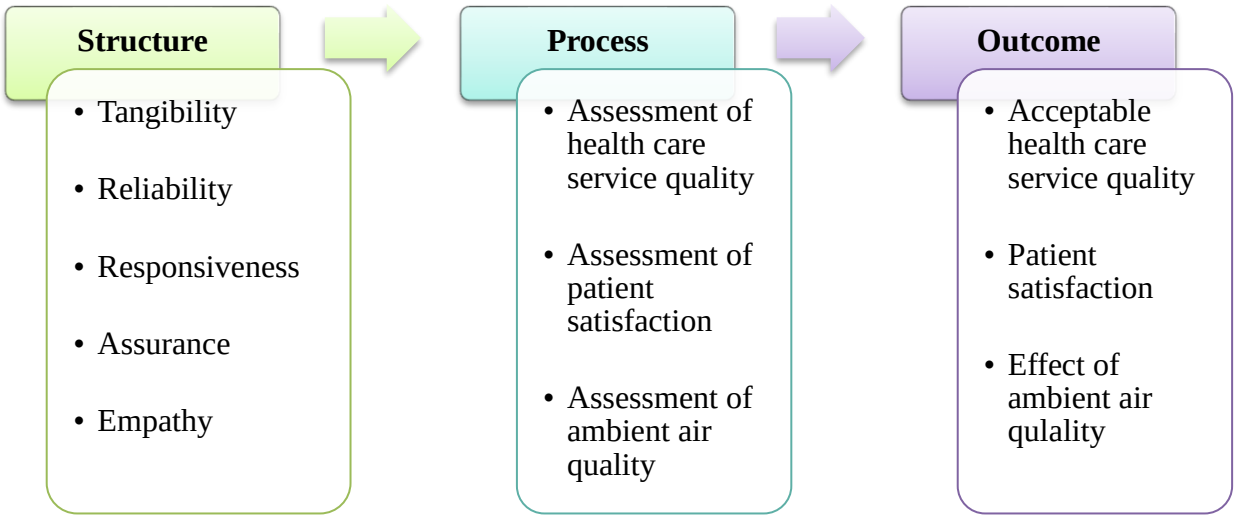

Fig. 1:Donabedian model for quality of care

It's well-known that many developing nations have primary focus on building infrastructure, improving access to technology, and controlling diseases to enhance two important health outcomes, like reducing mortality rates and disability-adjusted life years (DALYs). Addressing all these challenges is crucial but we need to focus on improving quality, increasing access, and reducing costs. There has been a tendency to overlook the aspect of healthcare service quality from the patient's viewpoint.The shortcomings in quality of care do not signify a lack of professional compassion or resources, as stated by the Institute of Medicine in 2001. Instead, they stem from knowledge gaps, improper use of available technology as highlighted by Murray and Frenk in 2000, or organizational resistance to change as noted by Berwick in 1989[11]. In India's healthcare sector, ensuring the quality of medical services is paramount for the smooth operation and sustainability of a hospital, where the range and availability of service quality is a striking feature. Maintaining high-quality medical services is not only essential for meeting the healthcare needs of the community but it is also required for upholding the reputation and credibility of the hospital. It is worth mentioned that in many developing countries, healthcare systems may face significant challenges such as limited resources, inadequate facilities, and skilled workforce shortages. As a result, the emphasis has often been on addressing these systemic issues rather than prioritizing the patient experience and perceptions of quality care. Neglecting the perspective of patients in healthcare can harm overall quality of services, involves not just clinical effectiveness but also accessibility, affordability, safety,

responsiveness, and patient satisfaction. Ignoring these aspects may result in dissatisfaction, reduced trust, and ultimately, poorer health outcomes[12,13]. Patient-oriented care is the major important area for quality service. It means to meet individual needs, preferences, and values and involving them in decision-making and promoting dignity and respect.By prioritizing these aspects of quality, hospitals can not only meet regulatory requirements and accreditation standards but also build trust and confidence among patients and the community. This, in turn, contributes to the long-term sustainability and growth of the hospital systems as a trusted healthcare provider.Once patients receive care, they judge its quality, which impacts the hospital's growth and hence, its acceptability. Medical service quality is essentially how the care they received matches up with what they expected. If it meets or exceeds expectations, patients are more likely to return and recommend the hospital[14,15].

1.3.1 Health Service Quality in Cardiovascular Disease

The transition from primarily communicable diseases to non-communicable diseases (NCDs) as the leading cause of global mortality is a significant shift in the pattern of disease burden over the last two decades. Cardiovascular disease (CVD) stands out as the foremost contributor to NCD-related deaths worldwide, comprising over 50% of such fatalities. Globally, cardiovascular diseases (CVDs) encompass a range of conditions affecting the heart and blood vessels, including), coronary heart disease (CHD strokes, rheumatic heart disease (RHD), cardiomyopathy, and other heart diseases. These collectively stand as the leading cause of death worldwide[16].

In 2001, it was estimated that there were 16 million deaths from cardiovascular disease (CVD). Among these, 13 million deaths have been occurred in low-income and middle-income countries[17].Surprisingly, despite most CVD studies being conducted in developed regions like the United States and Western Europe.The increasing incidence of cardiovascular diseases (CVDs) in India is indeed a significant concern, as it has become the leading cause of death across various demographic segments. This trend holds true across different strata of the Indian population, including rural and urban areas, economically backward and developed states, and among both men and women, spanning

all age groups from young adults to the middle-aged population.Several factors contribute to the rising burden of CVDs in India, including lifestyle changes associated with urbanization, adoption of unhealthy dietary habits, sedentary lifestyles, tobacco use, and increasing prevalence of risk factors like hypertension, diabetes, and obesity.Addressing the challenge of CVDs in India requires comprehensive public health interventions aimed at promoting awareness about healthy lifestyle choices, improving access to preventive healthcare services, ensuring affordability and availability of essential medications, and strengthening healthcare infrastructure for early diagnosis and management of CVDs. Additionally, efforts to address social determinants of health, such as poverty, education, and access to clean water and sanitation, can also play a crucial role in reducing the burden of CVDs in different segments of the Indian population[18]. By addressing these aspects, quality health services contribute significantly to reducing the burden of CVD on society, as a wholeandindividual, in particular. Quality improvement is essential for healthcare organizations aiming to stay competitive, enhance their reputation, and ensure long-term profitability.

In today's healthcare landscape, patients have numerous options when it comes to choosing a hospital where they can receive high-quality care. Many citizens are fearful of cardiovascular disease, prompting them to seek reputable hospitals that offer positive experiences through quality healthcare services.Timely intervention can significantly enhance outcomes for acute CVD, whereas delaying outcome may lead to preventable death or disability. Thus, medical promptness is a core necessity for the quality treatment of cardiovascular disease. In this regards, it may be stated that hospital service quality in relation to CVD patients starts from discharge to further admission or rehabilitation.

Before arriving at a hospital, patients should be educated about the key symptoms of cardiac disease to encourage them to seek care more quickly. Timely arrival and access to available services are crucial for patient survival. However, common barriers such as lack of awareness, acceptability, affordability, and availability can delay treatment for cardiovascular disease.

Cardiovascular patient satisfaction serves as a pivotal for measuring healthcare service quality. Through continual monitoring and improvement efforts, hospitals can elevate patient experiences, resulting in heightened satisfaction levels. Satisfied patients are more inclined to adhere to treatment plans, achieve better health outcomes, and advocate for the organization, thus fostering patient loyalty and retention.

1.3.2 Evaluation of Health Care Service

Improving quality is crucial for healthcare organizations as it helps them stay competitive, boosts their reputation, increases profits, and insurance of patient’s happiness with their care.Customers, particularly in the healthcare sector, play a pivotal role in evaluating the quality of service. In this context, patients are the primary customers, and their perceptions serve as the main indicator when assessing service quality, as noted by Cronin and Taylor in 1994. According to Zeithaml et al.'s definition from 1990, service quality is inherently tied to customer perceptions and is judged by them directly rather than by organizations themselves. Furthermore, service quality can be succinctly defined as "conformance to customer specification/requirements." This highlights how crucial it is for healthcare services to match what patients expect and want, as seen from the patients' own perspective. It ensures that quality care is always provided in a way that suits their needs and preferences.

Importance-Performance Analysis (IPA) serves as a foundational component in quality assurance within healthcare systems, providing a structured framework to evaluate current performance levels and devise strategies for enhancement. Recently, IPA has gained a significant importance as a method for assessing service quality in healthcare systems, offering a systematic approach to identifying areas in need of refinement. Moreover, IPA proves advantageous for managerial purposes by aiding in resource allocation. By highlighting areas where resources are inadequately allocated relative to their impact on consumer satisfaction, IPA guides decision-making processes. This enables healthcare managers to reallocate resources effectively, directing them towards areas with the potential to yield the most significant improvements in service quality and consumer satisfaction.In essence, IPA serves as a valuable tool for healthcare organizations seeking

to enhance their performance and meet the evolving needs of consumers. The study conducted by Dixit S. K. in 2016 highlights the evolving role of Importance Performance Analysis (IPA) in hospitals, emphasizing its integration into organizational strategies. This integration signifies a departure from simply analyzing user needs to leveraging insights that align with broader strategic objectives. This strategic shift underscores the importance of synchronizing IPA findings with the overall mission and vision of the hospital[19].

Additionally, another study conducted in 2018 demonstrates the versatility of IPA in healthcare settings by using it to set priorities for ST-elevation myocardial infarction care. This application showcases IPA's ability to inform specific clinical decision-making processes, further illustrating its value beyond traditional user perspective analysis.Moreover, IPA has been utilized extensively in assessing healthcare service quality. By evaluating attributes important to patients and correlating them with performance levels. IPA enables hospitals to identify areas for improvement and allocate resources effectively to enhance service quality.However, it's noteworthy that the application of IPA is not limited to healthcare alone. Its utility extends to various dimensions such as patients' views on service quality and the quality of services provided for patients in hospitals. This broader application demonstrates IPA's effectiveness in capturing user perspectives and guiding strategic decision-making across different sectors beyond healthcare.Overall, these studies underscore the diverse applications of IPA, highlighting its role in informing strategic priorities, improving service quality, and enhancing overall organizational performance across various domains, including healthcare[20,21,22,23].

Another tool for evaluation of service quality is the SERVQUAL model, introduced by Parasuraman and Zeithaml in 1985. According to this model, customers gauge quality by comparing their expectations with the actual performance they experience. If the customer's perception of performance exceeds their initial expectations, the service provider is deemed to have delivered quality service[24,25]. The discrepancy between perceived performance and expectations determines the level of service quality.This method underscores the importance of continuously assessing service quality by meeting or exceeding customer expectations. Healthcare providers can improve patient satisfaction by understanding and addressing these expectations, using frameworks like the SERVQUAL model to

systematically evaluate and enhance service quality, leading to better patient experiences and outcomes[26,27,28].

According to Gronroos (1984), service quality in the healthcare sector can be assessed through two dimensions: technical and functional quality. Technical quality primarily focuses on the accuracy of medical diagnoses and procedures, or adherence to professional standards. On the other hand, functional quality pertains to the manner in which healthcare services are delivered to patients, encompassing aspects like communication, empathy, and responsiveness.However, Lam (1997) argues that while technical quality is important, It may not fully reflect how patients assess the quality of their medical experiences. This concept is matched with Ware and Snyder (1975), who suggest that while technical quality holds high priority, many patients lack the knowledge or information necessary to effectively evaluate diagnostic and therapeutic interventions. Often, patients may not be equipped with the requisite information to assess technical quality due to a lack of transparency or communication from healthcare providers[29].

Evaluating service quality in healthcare is complicated because it includes both objective measures of technical skills and how patients perceive their care. To achieve comprehensive service quality, healthcare providers need to focus on both getting things right technically and ensuring patients have a positive experience throughout their care.

1.4 Patient Satisfaction

Absolutely, satisfaction with products or services is a paramount concern for every organization across various sectors, whether they refer to their recipients as clients, customers, consumers, or patients. This emphasis on satisfaction underscores the fundamental importance of meeting the needs and expectations of those who interact with a company's offerings. The study of satisfaction has indeed been explored extensively across disciplines such as sociology, psychology, marketing, and healthcare management, highlighting its multifaceted nature and broad relevance in understanding human behavior and organizational performance[30].Indeed,"patient satisfaction" has become a widely recognized and emphasized concept in the healthcare industry over the past few decades, largely due to its appropriateness and relevance in assessing the quality of healthcare

delivery. Healthcare organizations increasingly recognize the importance of not only providing effective medical treatment but also ensuring positive experiences for patients throughout their care journeys. Patient satisfaction serves as a key indicator of how well healthcare providers are meeting patient needs, expectations, and preferencesand it ultimately is contributing to better outcomes and patient-centered care. As such, it has gathered significant attention in healthcare policy, management, and research as a crucial metric for evaluating and improving healthcare services[31].

Reflecting patients' perspectives in the functioning of a health service is instrumental in enhancing service management and shaping the behaviors of health professionals. By incorporating patient feedback into decision-making processes, healthcare organizations can better tailor their policies, management procedures, and resource allocations to meet patient needs effectively. This approach also helps prioritize training needs for staff to ensure they deliver care that aligns with patient expectations and preferences.Furthermore, a higher level of patient satisfaction has significant implications for patient behavior. Satisfied patients are more likely to choose a particular health service for their care, express intentions to return to the same hospital for future needs, and adhere to recommended follow-up appointments or treatment options. This underscores the importance of cultivating positive patient experiences not only for the benefit of individuals but also for the overall success and reputation of healthcare institutions[32,33,34].

Patient satisfaction is based on different accepted dimensions, i.e. physician care, nursing care, supportive staff, operational activities and physical asset maintenance. Physician and nursingcare are the integral part of patient satisfaction. Physician care is the process of diagnosing the disease and provides adequate medical treatment; whereas nursing care is the process of providing timely and adequate medical assistance as per doctor’s order and/or prescription with their professional knowledge. Another important dimension is operational activities which include checkup procedure, admission process and maintenance of file record. Last is physical dimension, focused on developing friendly environment, well waiting room, maintaining cleanliness in washroom specially, placement of dustbin will improve patient satisfaction. [35, 36]

To achieve the specified dimensions, it is crucial to focus on service quality to enhance patient satisfaction. In practical settings, quality is often seen as superficial and subjective,

making it challenging to evaluate accurately. Parasuraman et al. (1985) describe quality as an elusive and abstract concept. It can be characterized by effectiveness and efficiency, as well as the pursuit of excellence (Huber, 2000). According to Omachonu (1990), quality comprises two interdependent components: "quality in fact" and "quality in perception." Quality in fact refers to adherence to standards and meeting one's own expectations, while quality in perception pertains to meeting customers' expectations. Quality is a strategic factor that affects the efficiency and productivity of service providers, as well as the valuation and willingness of consumers to purchase services. Therefore, it must be measured and controlled. In contemporary society, various methods are employed to assess service quality. One widely accepted approach is to measure the gap between expectations and performance, which has been extensively discussed in the literature on overall consumer satisfaction[37].

Health care sectors continuously struggle with quality achievements to satisfy the customers. According to Donabedian's framework for integrating patient perception into quality assessment, healthcare managers have incorporated patient-centered care as a central element in the healthcare mission. Managers aiming for excellence consider patient perceptions when formulating strategies for quality improvement in care. Recently, healthcare regulators have adopted a market-driven approach, using patient satisfaction surveys as a tool for enhancing overall organizational performance[38].

Laurent et al. (2006) conducted a significant study in a tertiary teaching hospital in France, aiming to gauge the opinions of clinical staff regarding the impact of in-patient satisfaction surveys on the quality improvement process through quantitative measurement. The findings were quite favorable, with 94% of respondents acknowledging that patients were indeed capable of evaluating hospital service quality, particularly across relational, organizational, and environmental dimensions. This underscores the importance of incorporating patient feedback into quality improvement initiatives within healthcare settings. [39].

From the above mentioned discussion, it has been clear that there are different methods of evaluation for the customer’s satisfaction through quantitative research. Quantitative research involves collecting numerical data that can be analyzed statistically. There are indeed various processes for evaluating customer satisfaction quantitatively. Several

studies have been conducted using mixed-method research, combining both quantitative and qualitative approaches to assess patient satisfaction. For example, M. Anastasios et al. carried out a study evaluating patient satisfaction with nursing care. The qualitative analysis of participant's comments revealed that the primary concern among patients was "perceiving nurses as weak against organizational limitations." Other recurring themes have included that nurses, being responsive to patients' needs, have been seen as expert technicians, perceived as humane and well-mannered (though with some exceptions), viewed as knowledgeable, the need for more nursing time dedicated to direct patient care, a non-professional outlook on nurses, and a sense of closeness to the nurses[40].

A cross-sectional qualitative research study aimed at identifying factors influencing patient satisfaction in orthopedic outpatient departments (OPDs). This type of research design involves collecting data from a sample of participants at a single point in time to gain insights into a particular phenomenon[41].Health service researchers emphasize patient satisfaction as a pivotal outcome indicator for assessing the quality of medical care. The degree of patient satisfaction with the doctor-patient interaction serves as a barometer of the doctor's effectiveness and competency in delivering services. To ensure patient satisfaction, doctors may maintain adequate proficiency in both technical and interpersonal skills. This entails not only possessing sound medical knowledge and technical capabilities but also demonstrating empathetic communication and a patient-centered approach.Furthermore, professionalism and ethical conduct are imperative in meeting patient expectations. Patients place trust in healthcare providers who exhibit integrity, honesty, and respect for their rights and dignity. Upholding these standards fosters a sense of confidence and satisfaction among patients.

The technical expertise of physicians encompasses several key components. It involves maintaining a sufficient level of experience to ensure proficiency, accurately diagnosing medical conditions, performing clinical procedures competently and safely, prescribing medications judiciously, and staying updated on the latest advancements in medical science. By continually refining their skills and staying abreast of developments in their field, doctors can provide high-quality care that meets the evolving needs of their patients.Keepingthisin mind , J. Aisha conducted a mixed methods study on patient satisfaction with doctor-patient interactions[42]. The study establishes a significant

association between various dimensions of the doctor-patient interaction and patient satisfaction. However, certain factors related to doctors' incompetence have been identified as contributors to patient dissatisfaction. These include instances where critical cases are handled inappropriately, leading to suboptimal outcomes. Inaccurate diagnoses, excessive reliance on medical tests without adequate clinical judgment, and instances where physical examinations are omitted also contribute to patient dissatisfaction. Furthermore, the absence of specialist doctors when needed and instances where trainee doctors engage in experimentation without adequate supervision can lead to dissatisfaction among patients. These factors highlight the importance of not only technical competence but also sound clinical judgment and adherence to best practices in ensuring patient satisfaction.Addressing these areas of concern requires ongoing professional development and training for healthcare providers, as well as effective systems for oversight and quality assurance within healthcare institutions. By addressing these challenges and promoting a culture of continuous improvement, healthcare organizations can strive to enhance patient satisfaction and deliver higher quality care[42].Thereis couple of modern medical treatment for cardiovascular problems.

Permanent pacemaker implantation (PPI), a minimal invasive procedure for the patient having problem with conduction system of heart, is one of the prominent surgical interventions. Through PPI procedure, patient may get recover from their symptoms for which they were unable to lead their normal life.Also, patient may survive from their restrictions before PPI and improve their physical health, emotional health and social functioning. It is also mentioned that each year 1.25 million permanent pacemakers are implanted worldwide. It is also observed that most of the PPI survivors are conscious after operation as there is a minimal chance of developing complications.If there is no complication PPI patient can stay in hospital 3-4 days approximately. During this time frame they can judge the hospital service and its gap. From the above-mentioned discussion it has been seen that there is various study for the evaluation of hospital service from different patient aspects apart from PPI patient[43,44].

1.5 Environmental Factor

Indoor air quality significantly impacts human well-being, as most people spend approximately 90% of their time indoors, primarily at home or in the workplace.[45]There are some harmful pollutants inside buildings include carbon monoxide (CO), volatileorganic compounds (VOCs), particulate matter (PM), aerosol, biological pollutants, and others are responsible for air pollution.

The air quality in hospitals presents unique challenges compared to residential and occupational environments. In addition to pollutants originating from within the hospital, contaminated airflow from the outside can further degrade IAQ in these settings. Consequently, achieving optimal air quality is vital not only for patient health but also for the efficiency and well-being of hospital staff, an aspect that is often overlooked[46].

Bioaerosols are ubiquitous, highly variable, and complex, originating from both natural and man-made sources. These airborne particles, which include living microorganisms such as bacteria, viruses, and fungi, are present in the air people inhale. Infectious bioaerosols are often extremely small (less than 5 μm), allowing them to remain suspended and viable in the air for extended periods, thus posing a significant risk of airborne infection in confined spaces. In hospitals, the presence of bioaerosols can disrupt normal activities and significantly impact indoor air quality, contributing to approximately 5% to 34% of indoor air pollution[47,48].

1.6 Need of the Study

In every healthcare sector, patients are indeed the primary customers. They are at the core of the healthcare experience, seeking care, support, and solutions for their health needs. Among them there are some patient are under medical treatment and some of them needs surgical intervention. It is worth mentioned that still now people are more fearful with the cardiac disease rather than other disease. Palpitation, difficulty in breathing, self care deficit is the worst situation in which human being cannot lead their normal life. In this situation, a pacemaker implantation may be recommended for the patients with above-mentioned symptoms. After undergoing permanent pacemaker implantation (PPI), patients

need to adhere to certain restrictions in order to lead a normal and high-quality life. Conversely, following surgery, patients may be at risk of various complications, such as infections at the surgical site, pneumonia, pleural effusion, and many more. In long run, these patients are attached with hospital support for their survival. In this context, consistent and skillfulness of service providers and infrastructural facilities of hospitals need to be analyzed in detail in order to identify essential aspects to prevent undesirable complications, as mentioned.

Keeping all the above mentioned information present study conducted to assess hospital service quality through PPI patients in cardiology ward at selected hospital Kolkata.

With considering all pertinent factors, researcher of the present study aims to assess quality of hospital service from permanent PM patients, so that the gap in terms of expectation and perception can be identified through their sensitive differentiation in the quality of care. In the present study, researchers adapted service quality (SERVQUAL) model for quality service measurements. In this study, functional quality assessment is considered to be much more accountable than technical quality. SERVQUAL model[49]is widely used instrument to measure both of the above- mentioned quality levels simultaneously by assessing five dimensions, viz. tangibility, reliability, responsiveness, assurance and empathy. Facilities, equipment and personnel of service provider's performance are evaluated through tangibility assessment. Whereas ability to provide assured service and willingness to deliver guidance to admitted patient along with prompt service are measured through reliability and responsiveness dimension assessment, respectively. Another two important dimensions are assurance and empathy. Quality can be assessing on the basis ability of care provider to motivate trust and confidence (i.e. assurance) and delivery of individualized care (i.e. empathy) is considered to be the most wanted area from patient point of view.Moreover, all the aspect of quality said in SERVQUAL model has significance for patient satisfaction. Keeping all these aspects in mind, the researcher's objective of this study is to analyze two key elements: first, the patients' expectation and second, the perceptions. To achieve this, the researcher is interested to identify the gap between perception and expectation regarding hospital service and analyze the factors responsible for quality health service.

Interview through some set questionnaire is not enough to get whole data from sample as there is a limitation in question, time frame, interviewer bias and different situation. Additionally, the interviewer's communication style can impact the willingness of participants to share their actual experiences or perspectives. To avoid all these difficulties, researcher may adopt both, the quantitative and qualitative approaches to conduct the study. In quantitative approach, the interview schedule may be completed with the help of specific set of questionnaires and the quality of service is analyzed accordingly. In qualitative strand the interview schedule may be set through some open-ended questions by telephonic conversation. Here, samples are more egger to give answer through their verbatim. From this we can get more reliable multi-dimensional information about their experience regarding hospital services. Thus, in order to get the information in all aspect the mixed method is suitable to be used to utilize the whole data for identification of service gap. Keeping this in mind, researcher is interested to integrate both the data through joint display about service quality and patient satisfaction.

Indoor air quality (IAQ) refers to the air quality within and around buildings and structures, particularly concerning the health and comfort of occupants. Adverse indoor environments can lead to air pollution. According to the World Health Organization (WHO), indoor air pollution (IAP) is responsible for approximately 3.8 million deaths annually. The composition of IAP varies significantly based on sources, emission rates, and ventilation conditions. In hospitals, the complexity of indoor air quality differs from that in residential and occupational settings, presenting unique challenges for maintaining a healthy environment. In addition to pollutants originating from within the hospital, contaminated airflow from external sources can adversely affect indoor air quality (IAQ) in healthcare settings. Consequently, maintaining desirable air quality is crucial not only for patient health but also for the well-being and efficiency of hospital staff, an aspect that is often overlooked[50].

Numerous indoor air pollutants have been identified as having detrimental effects on indoor air quality (IAQ) and human health. Among these, bio-aerosols—ubiquitous, highly variable, and complex particles—pose significant concerns. Bio-aerosols, which include living microorganisms such as bacteria, viruses, and fungi, or particles originating from living organisms, are commonly present in the air inhaled by individuals. Infectious bio-

aerosols are typically very small (less than 5 µm) and can remain suspended and viable in the air for extended periods, thereby presenting a high risk of airborne infection in confined spaces. In hospitals, the presence of bio-aerosols can disrupt normal operations and significantly impact IAQ, which may contribute to approximately 5% to 34% of indoor air pollution.

The concentrations and toxicity of particulate matter (PM) depend on their composition, shape, size, and the presence of other pollutants, as well as prevailing meteorological conditions. PM10 particles, in particular, are a major indicator of air pollution and pose a threat to all life forms. Since the onset of industrialization, PM10 has become a significant air pollutant in urban, suburban, and even rural and remote areas. Many urban cities worldwide have PM10 levels that exceed the standards set by the World Health Organization (WHO) and national regulations. Along with that elevated concentrations of pollutants such as PM2.5 particularly impact populations in megacities more severely than those in rural regions[51,52].

Understanding and managing bio-aerosols are crucial aspects of indoor air quality management. Controlling temperature and humidity levels, improving ventilation systems, and adopting effective filtration methods are essential strategies for mitigating the presence and impact of bio-aerosols in indoor spaces. By addressing these factors, efforts can be directed towards creating healthier indoor environments that minimize the potential health risks associated with bio-aerosols as well as air pollution. Not only that, longer staying of hospital and frequency of hospital admission is also extended due to hospital acquired infection from air pollution [53]. This issue affects the patient's perceived quality of hospital service. Thus, high levels of particulate matter (PM 2.5 and PM 10) and bio-aerosols can exacerbate existing cardiac conditions and pose significant health risks. By assessing these pollutants in the cardiology wards, researchers can identify potential sources of indoor air pollution and implement strategies to mitigate exposureand therefore improving the overall quality of care provided to patients.

The respiratory deposition dose (RDD) is a crucial parameter because it quantifies the actual amount of inhaled particles that deposit in different regions of the respiratory system. This information is vital for accurately assessing the potential health impacts of airborne pollutants, as it determines the exposure level within the body, rather than just the

concentration in the environment. Understanding the deposition dose helps in evaluating the effectiveness and safety of inhaled medications, ensuring they reach the targeted areas within the lungs. Additionally, it informs the development of regulatory standards and public health guidelines aimed at protecting individuals from harmful exposures.

Hence, in this present study, researchers want to evaluate the concentration of PM 2.5, PM10, bio-aerosol and RDD in cardiology wards in selected hospital, Kolkata.

1.7 Problem Statement

"Assessment of health care service quality and patient satisfaction for Permanent pacemaker implantation (PPI): An empirical study in selected Hospital, Kolkata"

1.8 Objective of Research Work

Though, patients are very much conscious nowadays and they sometimes evaluate the performance of hospital for every dimension of services. Keeping this in mind, a questionnaire is prepared based on SERVQUAL model and distributed to willing patients. The objectives of the present study are

i. To analyze the health care service quality in a selected hospital, Kolkata
ii. To identify factors associated with health care service quality in selected hospital, Kolkata
iii. To explore patient satisfaction regarding service quality in selected hospital, Kolkata
iv. To determine the association between patient satisfaction and selected background information in selected hospital, Kolkata
v. To assess selected physical environmental parameters in selected hospital, Kolkata.

1.9 Methodology

Based on the above-mentioned objectives, an overall methodology is designed and presented in Fig. 2. The comprehensive plan of work is divided into four stages, viz. stage 1-4. It contains and describes different aspects of the present study, such as research approach, research design, research variable, setting, sample, and sample technique etc., which are briefly described in following sections.

1.9.1 Research Approach

Non Experimental Research Approach

1.9.2 Research Design

Mixed method research design

- Quantitative design
- Qualitative design

1.9.3 Research Variable

Hospital service quality, patient satisfaction, indoor air pollutants

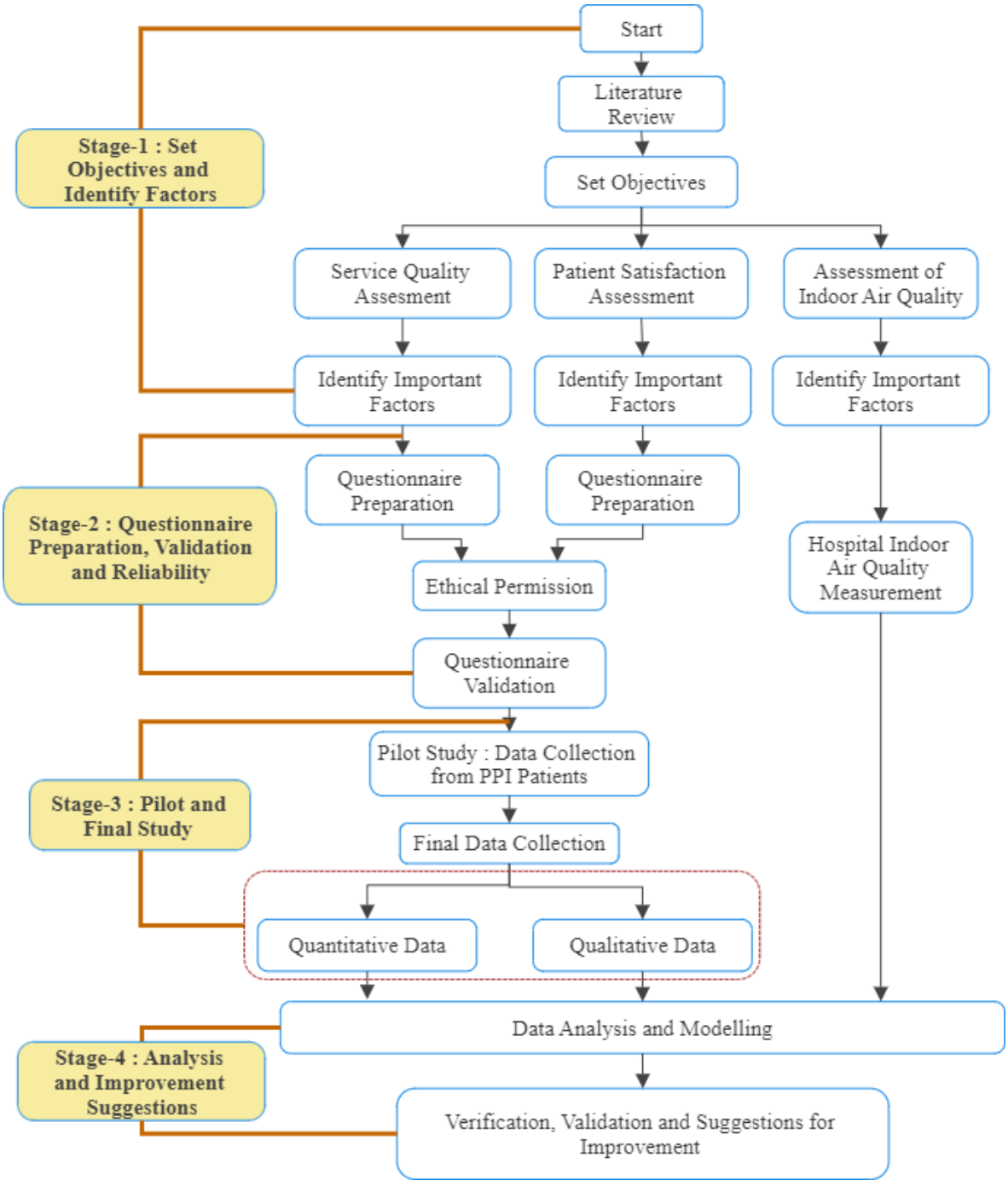

Fig. 2: Comprehensive methodology

1.9.4 Operational Definition

Hospital service quality: It is as an assessment of hospital services offered to apatient admitted for permanent pacemaker implantation and measured by SERVQUAL model.

Patient satisfaction: It represents a comparative balance between their perceptions of service delivered and expected standard they had set for the service.

1.9.5Setting: SSKM, IPGMER,The Seth Sukhlal Karnani Memorial (SSKM) is premier Government-run hospital and also known as Institute of post graduate medical education and research institute (IPGMER) in Kolkata, West Bengal. This hospital has a rich legacy of over 75 yrs, providing quality health care services.

1.9.6 Sample, Sample technique and Sample size

Permanent Pacemaker patients

Purposive sampling

Sample size**:** 27 (Pilot) and 138 (Final)

$$n = Z^2 \frac{(p)(q)}{d^2}$$

Where, Z=1.96,p=0.4,q=0.6, d=0.05

1.9.7 Assumption

- Patient's expectation and perception about hospital service varied.
- Patient's satisfaction is different in various domains.

1.9.8 Hypothesis

H1- There is an association with patient satisfaction and selected variables among PPI patients at 0.05 level of significance

1.9.9 Inclusion Criteria

- Patient admitted in only cardiology ward for permanent pacemaker implantation
- Only those are admitted 1st time in hospital

1.9.10 Delimitation

The study is delimited only one hospital to enhance feasibility and practicability of research study.

1.11 Outline of Thesis

The thesis is organized into 6 chapters. A chapter wise summery is given below.

Chapter 1: This chapter deals with various kinds of introduction regarding hospital, its function, patient as a customer of hospital, different kinds of services, hospital quality services, pacemaker patient satisfaction, evaluation of quality service and indoor air quality as a factor of patient satisfaction. It also contains objectives, a brief methodology.

Chapter 2: This chapter details about the section-wise review of literature related to study. Specifically, it is mentioned that several sections describe health care quality and patient satisfaction, which are practiced in different countries around the world. Also, several relevant methods and methodologies are also described. Finally, indoor air quality and its significance in relation to health issues are also discussed.

Chapter 3: In this chapter, the description of methodology regarding assessment of hospital service quality is mentioned. Two stages of the study are considered, viz. (i) Pilot study and (ii) Final study. In the pilot study, questionnaire, based on SERQUAL model, has been framed and checked its reliability. After validation and relevant modification, the questionnaire is followed to collect the final set of data, which was analysed to assess the health care quality in a selected hospital.

Chapter 4: This chapter describes the patient satisfaction with the help of both quantitative and qualitative data. Hence, a model with the joint display of both said data is developed. Finally, a list of ranks of different factors is identified.

Chapter 5: In this chapter, indoor ambient air quality of the said selected hospital is measured and assessed. Also, air aerosol concentration is estimated. At the final stage, respiratory deposition dose is calculated.

Chapter 6: This chapter highlights overall finding and major contributions. A comprehensive discussion of the present work with respect to other studies is also done. At the end, future scope is mentioned.

The thesis ends with a list of references.

Chapter 2: Literature Review

2.1 Introduction

A literature review is a critical evaluation and synthesis of existing scholarship on a particular topic. It serves as a foundation for understanding the current state of knowledge in a field, identifying gaps, and formulating research questions or hypotheses. In essence, it's a survey of scholarly sources (such as books, journal articles, and dissertations) that provides an overview, summary, and analysis of the key findings and arguments related to the topic under investigation. This chapter deals with literature review related to health service quality, different methods and models for patient satisfaction, mixed method analysis and indoor air quality measurement.

Search strategy and selection criteria:

We searched for science Direct, Scopus, Google Scholar, Taylor Francios, and PubMed for thisliterature review. We considered peer-reviewed original articles. The search strategies included all possible combinations of keywords/titles: “service quality”, “health care service”, “SERVQUAL”, “patient satisfaction” and “mixed method research”[54].

A total of 1,270 citations (Science direct, PubMed, Google Scholar, Scopus) were collected from a literature search about hospital service quality and patient satisfaction in which 57 duplicates records were removed and about 1000 articles were selected for screening in the early stage. Then, 348 articles were excluded after reviewing full texts. This screening process resulted in 880 articles.

The resulting data of 353 published articles are used to compile the knowledge in respect of assessment of hospital service quality, patient satisfaction and gap analysis. This analytical review would have been helped to use for identifying gaps which are potent in guiding future research[55](Fig.3).

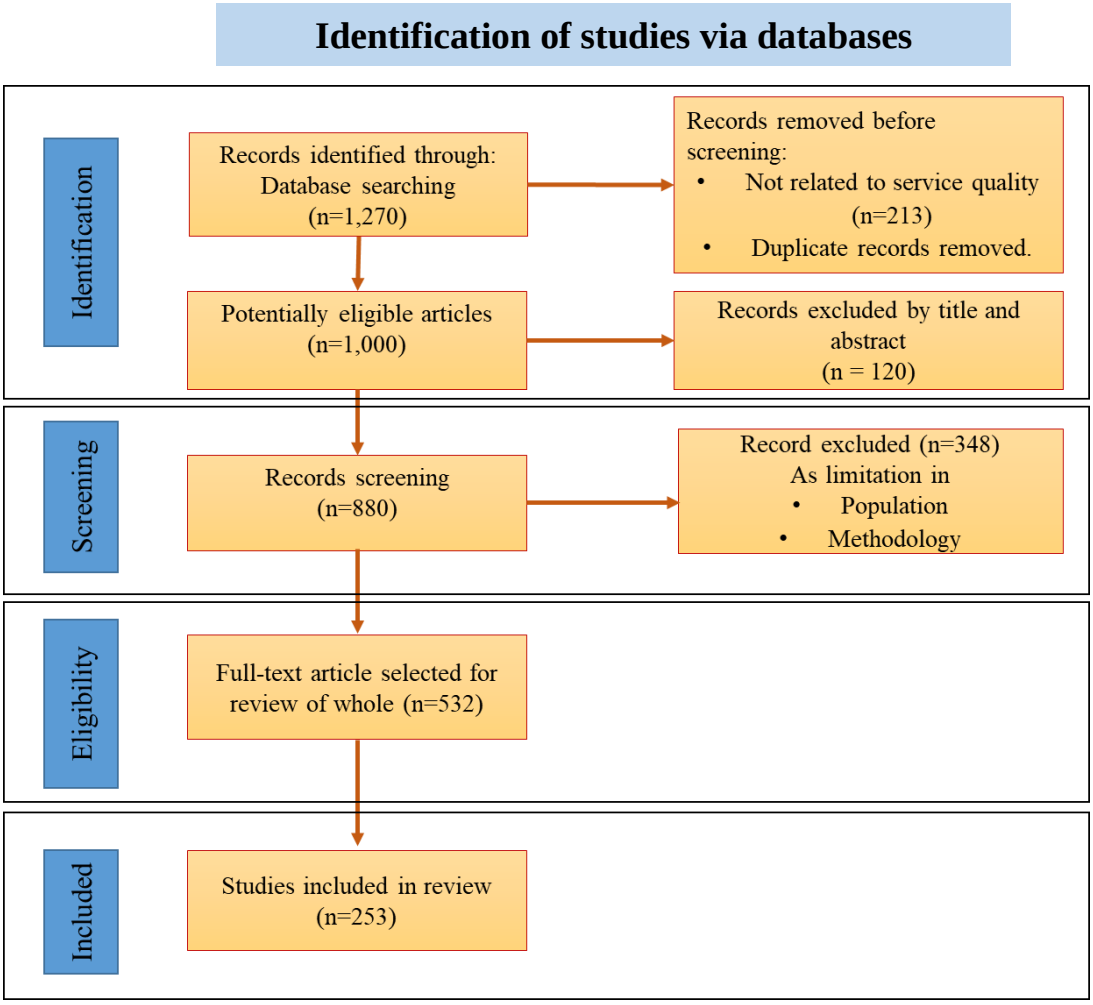

Fig.3: PRISMA flow diagram

2.2 Health Service Quality

In general, quality deals with the requirements so that customer will be satisfied. This is acceptable for both manufacturing sectors as well as service sectors. Being a service organization, health sectors always try to improve their quality for fulfilling the requirements of patient's need. It can be stated that quality creates value and is fundamental to sustainable success[56]. To achieve this, we have to analyse priorities that result in superior business performance. Quality program can be a necessary component to identify these priorities and hence, hospital operations strategy may be improved continuously [57]**.** Management may an important role in the continuous evaluation and modification of operational strategies. Thus, top-down management control system is preferable for the analysis of social impact of hospital services by integrating patients focus [58].

2.2.1 Service Quality in the World

Hospitals play an important role to keep the world healthy and safe from different disease conditions. Different nations in the world have taken initiative to enhance the quality of health service. To do so one has to analyse the present status of health system. The following sections will discuss studies on health quality, which are conducted in different countries.

In the United Kingdom,[59]study on the performance of public and private hospitals. It is observed that private hospitals treat those patients who are having less comorbidity. But otherwise there is no significant difference as far as quality and treatment are concerned. Also, there is a necessity to compare the health services in terms of quality between small and large hospitals based on the patients need, specially location of hospitals. This will minimize confusions and avoid gathering in big hospitals as both the hospitals perform well [60].

A part of one study is conducted to analyse the satisfaction level of patients with the consideration of nursing home, willingness to recommend (WTR) and optimization techniques. It is found that technical skill and knowledge of staff is the most significant factor in the questionnaire[61].

In the part of same study compared the performance with Italy and it is found that staff relationship with residents is the major contributing factor[61].

As hotel industry grows continuously in Egypt during last decade, there is a need to study their performance in terms of quality and customer satisfaction [62]. Doing so, hotel owners can identify the influential factors, which needs to be addressed to satisfy customers. Eventually, customers will be attracted and business will be flourished. In this study, SERVQUAL model has been implemented.

Public sector department is a vital and central segment of a government. They mainly cater services to the society. Thus, their day-to-day activities are monitored by the public. To address complaints and excel services, perceptions and expectations of customer are analysed with the help of SERVQUAL model. Also, the study estimated gap in service, which is needed to find key relationship between quality of service and it's dimensions within the Mauritian public service [63].

Indonesia is the country in the world, where Universal Health Coverage (UHC) program has been launched in the beginning of 2014 [64]. As it is the government-sponsored programme, it takes huge processing time to contact ministry of health, insurance company and patient party. It can also be stated that the main dimensions of hospital service quality, which are determined by discussion with ministry, accreditation commission, academicians, public hospitals, private hospitals, and patients, are human resources, process, policy and infrastructure. Thus, customers are not satisfied always. This encourages patients to believe that hospitals in Singapore offers better services compared to their own[65]. But there should be clear idea regarding the above-mentioned issue. A number of patients having wide range of age group have been asked to identify and gather proper information[66].

Academic hospitals, where students come to learn treatment procedures theoretically and practically, play an important role. In continuation, they communicate with patients to understand their problems and prescribe medication[67]. In this process, patients expect proper treatment and quality health services. With the help of properly designed questionnaire on the basis of SERVQUAL and statistical techniques, gap between service quality and patient's perception may be identified[24].Another study conducted at Kermanshah University of Medical Sciences involved 420 patients to examine the relationship between service quality and factors such as patient satisfaction, psychological commitment, and oral advocacy[68].

It is necessary to see the relationship between service quality and patient satisfaction on the basis 21 items in 5-point Likert scale. This may be done on 380 respondents. It is found that physical facilities, equipment and appearance of personnel are very important factors in Pakistan.

In hospital, quality may be assessed with help of questionnaire, which has been prepared on the basis of SERVQUAL model. The analysis is beneficial when data is collected from a sufficient number of samples. It is seen that second order factor analysis is better to adopt for analysis compared to single order factor[69]. This type of analysis may be helpful to improve the overall service quality by estimating gap of factors and dimensions.

Apart from health personnel, administration also may participate to improve the health quality. In this context, SERVQUAL model is modified to SERVPERF model to compare the performance between public and private hospitals[70]. With the help of this model, it is found that private hospitals perform better compared to public hospital in Jordan.

Similar type of study has been done in Malaysia to assess the quality of health service in private hospital based on SERVQUAL model[71]. With the help of this study, they have proposed a Scale, which is relevant for specifically in Malaysian context.

Service quality assessment may be considered as an important performance measure and the same has been applied in Durres public hospital. This is done to find out important factors so that a policy may be framed for future development in Albania [72].

Budget is a relevant component for patients. It is worth mentioned that private hospitals are located near the markets. In this way, they have optimized the cost of overall treatment of customers[73]. In contrary, it is also seen that patients may travel 1-27 additional kilometres, if the treatment offered by a hospital is adequate and reasonable[74]. The said result is obtained by collecting the data of nationwide survey on the basis of subjective and objective questionnaire.

Nowadays, one major challenge is to analyse data in view of actual requirements of patients. In this process, in-house medical staff members play an important role. After collection of data, in-house staff members analyse the data and shows results to the customers immediately[75]. Thus, patients may be more satisfied and retained by the hospital. And hence, hospitals get continuous business.

An initiative is required to be taken to identify quality dimensions of long-term care hospital. This will help improve the nation-wide health service treatment after finding out significant determinants related to organizational characteristics [76].

There is a need to compare service quality across different continents. To address this, Aiken et al. (2012) conducted a study to compare health service quality between Europe and the USA. The study evaluated patient outcomes, including overall satisfaction, satisfaction with nursing care, and willingness to recommend hospitals. It also assessed nurse outcomes such as hospital staffing, work environments, burnout, job dissatisfaction, intention to leave the job within the next few years, patient safety, and quality of care.It is observed that based on these factors, overall service quality in USA is better than Europe countries.

Li et al (2015) conducted a research work in nine cities of China to assess the quality of health services. They applied a number of statistical tools and techniques with the help of SPSS. They reported that Laibin and Guangxi have the most positive perceived service quality[77].

2.2.2 Service Quality in India

Presently, one of the largest types of organizations is health sector and it is rapidly growing in recent times. Moreover, it can involve a huge number of employees with adequate investments. In this context, these organizations may face lots of challenges. One of the important challenges in India is to conform customer's requirements, which is properly known as Service Quality. Here, patients and their relatives are continuously evaluating the quality of services. One important model, viz SERQUAL, model may also be useful to identify important factors to achieve good quality service and by this way, health sectors in India may adopted for better patient safety[78]. As it is the customer-driven market, health sectors may consider some of initiatives, such as personal-touch-in-service, humanitarian approaches and ethical values, which play a very important role for their professional excellences [79].

In general, like other studies in the World, several factors, based on five dimensions, as mentioned, are considered to develop questionnaire, which are used to collect data from outdoor and indoor patients. These data are analysed to estimate the service quality as well as patient satisfaction level [80,81,82].

2.2.3 Technical Aspects of Service Quality

Being a complex structure, hospital has to deliver timely, safe, efficient and effective health care service to customers as a conformance to the requirements. All these parameters are analysed in number of ways. One of the important ways is to estimate the technical efficiency of the system[83]. The technical efficiency may be defined as the ratio between consumed resources to provided care, which is measured by the complexity-adjusted quantity of services. In general, hospitals are continuously trying to attend a patient from the beginning, i.e. admission, to the final, i.e. discharge of a patient. Over the years it is seen lot of innovation in the field of embedded electronic devices. Hospitals are planning to implement all these technologies to medical services. This is popularly known as telemedicine. One of the challenges, in this regards, is to assess whether these technologies are really beneficial to patients or not. It is found that efficiency of a health care system may be enhanced by introduction of electronic medical record (EMR) system compared to the paper-based system[84].

Patients are also serious to know the healing environment within a hospital. This true for other medical staff members, in general, and nursing staff, in particular. Some of important parameters of technical healing environment are lighting design, different colour composition and material, and quality physical environment[85]. These environmental conditions can act as catalyst the healing of patients and nursing feel comfortable to work in those hospitals or those wards in a hospital.

2.2.4 Methods in Service Quality

Throughout the world, hospitals are generally categorised into two broad categories, viz. public and private hospitals[86]. The scope of the treatment in terms of type of disease considerations, number of beds, number of wards, availability of technical facilities etc. of these hospitals are not same. Thus, there is always a query to the patients. In this context, researchers try to compare efficiency of the performance of hospitals. One of the most acceptable tools, which is used for this comparison is SERVQUAL Model [87]. This is based on five dimensions, as mentioned already. Normally, questionnaires are prepared based on the five dimensions and distributed to

patients to assess the quality of healthcare and patient satisfaction. Hence, the gap is estimated and identify factors for improvement.

In general, data are collected to assess the quality of healthcare systems from patients most of the cases. But hospital quality management may be included to this initiative. Thus, the analysis will be a bit complex. A path analytic model may be used in this regards to explore empirically the relationship between hospital quality management and performance of service quality[88]**(Li, 1997)**. By this way, an optimized patient care system may be established. It is not always recommended to apply parametric methods, when the technical efficiency is required to be analysed. In this context, two nonparametric methods, viz. data envelopment analysis (DEA), and the FREE DISPOSAL HULL (FDH) may be useful to compute the technical efficiency of hospital [83].

Another important aspect is that subjectivity is present in the data, which are collected from patients. To address this aspect, fuzzy systems-based approach, like intuitionistic fuzzy set (IVIFS) theory, may be relevant [89]. Also different multi-criteria decision making (MCDM) techniques are useful to address the service quality dimensions and patient satisfaction[90, 91, 92,93].

2.3 Patient Satisfaction

In general, customer is the main focus to understand the level of service that is offered. This is one of the important concerns of an organization. Some techniques, like the European Customer Satisfaction Framework Model (ECSF), American Customer Satisfaction Framework (ACSF), Eleven-Factor Customer Satisfaction Model are being used to evaluate the satisfaction level of general customers [94] and SERQUAL model is being adopted for the same purpose for the patients, who come to hospital for the health service[95].Shirley and Sanders (2013) defines patient satisfaction as“the congruence between expectations and outcomes with the care received being judged against expectations that depend on variables such as education, attitudes, and prior experiences”.

The above-mentioned concepts have been applied to develop questionnaire to collect data from patients. The questionnaire consists of two parts, viz. demographic data and set of factors related SERVQUAL model. With the help of patient satisfaction index

(PSI) score, the relationship between these factors with demographic data is estimated as well as quality and satisfaction of the health service is judged [96,97]. It is also seen that patients also participate with their own interest to improve the health service. Sometimes, these initiatives are encouraged and integrated to the health service assessments [98].

In this section, patient satisfaction is discussed in different hospitals and health service conditions, such as outpatient, academic hospital, dental, oncology, respiratory, patient-cantered care, ambulatory surgical care, home care, in-patient care, and some relevant statistical methods.

2.3.1 Outpatient

Hospitals are very important organization in the society. Outdoor patients, popularly known as outpatients, take medical advices and other suggestions in the outpatient department (OPD) for any kind of basic treatment [99]. One such department is cardiology OPD, in which patient satisfaction is a vital aspect as they may come as and when required for the further necessity. Some of the more initiatives are to be taken by hospitals to satisfy patient is OPD. Some of the areas, in this context, are communication, technical quality, financial aspects, interpersonal manner, accessibility, consultation time spent during the visit, and general satisfaction [100].

Patient satisfaction is not an absolute issue. It also considers subjectivity present in the preparation of questionnaire and responses of patients. In relation to patients, some of more areas to be considered are patient perceived need, experience of health care and his expectations from health system. It is observed that in OPD, majority of patients are satisfied with the behaviour of doctors, cleanliness and ventilated waiting area, respectful staff members [101]. If this happens to a hospital; we can expect re-visits of patients. By doing so, hospitals may be competitive in the society.In this regards, it is also mentioned here that hospital needs to be careful to enhance the quality of service. It is expected that if health service quality of a hospital is enhanced, the patient satisfaction will be higher [102]. There is also required to know the satisfaction levels of younger and older patients as any person may require some kind of medication in the present world scenario. Overall it is seen that older people are more satisfied compared to younger people in out-patient hospital care [96].

2.3.2 Academic Hospital

Assessment of patient satisfaction in an academic hospital is an important issue as students, pursuing nursing degree, are to partially/fully participate in the nursing service. In this context, patients may feel mixed impression on it. Data were collected using the Newcastle Satisfaction with Nursing Scale, which comprises two subscales: the Experience of Nursing Care Scale and the Satisfaction with Nursing Care Scale[103].
doSome of the observations in this regards are skilfulness, respect to patient's privacy, feelings of patients etc.
Always these types of studies may not depend on standard tool. Sometimes, it is required to develop a new tool and/or questionnaire based on the need of the study. One such tool is core questionnaire for the assessment of patient satisfaction in academic hospitals (COPS). COPS has been applied in several Dutch academic hospitals[104].

2.3.3 Dental

In the hospital, patients in dental department require a very special, unique and individualized service. In this regards, hospitals face a number of challenges to satisfy patients. One of them is to propose a suitable framework for identifying key elements and provide a roadmap for improving dental service quality improvements[105].To address these challenges, Donabedian's structure-process-outcome model and Kano-type questionnaire may be useful to collect data by survey. With the help of these tools, analysis of data may be carried out for estimating the patient satisfaction in the dental department.

2.3.4 Oncology

Cancer patients face very high level of pains during the treatment. It is necessary to apply proper pain management procedure for them. Among different tools, American Pain Society's Patient Outcome Questionnaire may be utilised to collect data from cancer patients for the assessment of their satisfaction [106]. The nurses can play an important role for the therapeutic relationship and effective communication with patients. Patients also provided qualitative and rich data. Cancer patients also come to

the hospital as outdoor patients for regular check-up. During these visits, patients often experience reduced satisfaction due to several factors, such as lengthy waiting periods to secure a doctor's appointment, inflexibility in scheduling appointments, and extended waiting times to be seen by the doctor[107].

2.3.5 Respiratory

The self-completed questionnaire may also be useful to patients suffering from respiration disease. Koutsimpou et al (2020)developed three-stage questionnaire for these types of patients to evaluate patients' expectation, perceived quality and financial ability[108].

2.3.6 Patient-Centered Care

Sometimes, a patient needs an individualized care. This is also known as patient-centered care (PCC) or negotiated care, which emphasize focussed individualized attention to patient[109]. It is believed that PCC is the right to have values and beliefs, right to respect, dignity and care[110]**.** To achieve PCC, nurses have several significant roles, like proper interpersonal approaches and interventions, showing respect to patient's belief, values, wants, needs, and desires. Thus, PCC is treated as part of interpersonal team. This collaborative effort may improve the overall satisfaction of patient.

2.3.7 Ambulatory Surgical Patients

Yellen et al (2002) conducted a research work on two 250-bedded private hospitals from all ambulatory surgical patients scheduled for minimally invasive surgery in the state of Texas, where 63% of nurses were employed. It is evaluated that the patient satisfaction in relation to nursing care is dependent on three main aspects, viz. labelled professionally competent nursing care, interpersonal relationship with the nurse involving availability and interpersonal relationship with the nurse involving humanness**[111]**.

2.3.8 Home Care

Nowadays, families are becoming smaller in urban areas compared to rural areas throughout the world. Hence, nursing care in home is an essential requirement in urban, especially for old people. To understand this requirement, Chaves and Santos (2016) pursued a research work in Portugal to assess the satisfaction of old people, who belong to the age group between 88-98 years in urban areas. It is clear from the result that urban people are more satisfied compared to rural people in the area of relationship and communication[112].

2.3.9 In-Patient Care

When patients come to a hospital for any kind of service with admission, he/she compares the service with respect to different parameters. One such popular parameter is the nursing care[113]. Thus, nursing care play a very important role for the patient satisfaction as it is observed that nurses are present with patients round the clock. The Revised Humane Caring Scale may be used to collect data from adult patients to estimate the level of satisfaction ranging from the least satisfied to the most satisfied. Respecting patient's feeling, and communication and participation are the least and most satisfied factors in relation to nursing care, respectively.

During staying in the hospital after major orthopaedic or vascular surgery, patients suffer from postoperative pain. At this stage, proper and adequate pain management is necessary so that patients get well soon and regain confidence at the earliest. A 10-cm visual analogue scale (VAS) may be applied to set up questionnaire for the assessment of the intensity of pain [114]. The questionnaire may be distributed to both inpatients and nurses to achieve the above-mentioned objectives. It is recommended that not only nurses play the main role during inpatient pain management but also preoperative interview is to be considered as important tool to receive and give information concerning postoperative management.

Another important issue of the hospital administration is to understand whether a patient recommends their services to others in the society or not. It is one of the critical pointers to know the level of patient satisfaction and/or lever service quality provided by the hospital. Another aspect, in this context, is to explore the extent to which

satisfaction is a meaningful indicator of patient experience of the existing services[115]. The Picker Inpatient Survey questionnaire may be useful for data collection in relation to inpatient. The advantage of this questionnaire is that it may be distributed to the patients after one month of their discharges. Thus, patient may contribute significantly to improve the service quality of the hospital as they respond to questionnaire in normal condition not diseased condition.

2.3.10 Statistical Methods in Patient Satisfaction

In the process of estimating quality of service and patient satisfaction, patients' voice is to be considered with the help of a properly framed questionnaire. It is done in different hospitals in different countries under various disease conditions of patients. Thus, outcomes are widely varying. Keeping this in mind, several researchers attempt to find the relationship of patients' satisfaction with several service quality variables, like assurance, responsiveness, communication, discipline, baksheesh [11]. Apart from these variables, big five personality traits and Emotional stress reaction questionnaire (ESRQ) may also be used to develop questionnaire to capture proper response from patients [116].
It is observed that in general, each of questionnaire contains a number of influential factors. After gathering the data, one has to apply different statistical methods, like factor analysis, multiple regression, sequential multiple regression, multivariate regression, and structural equation model (SEM) etc. to establish a proper relationship[117,118]. Doing so, significant factors are identified. If these significant factors are addressed, it is suggested that overall service quality of the hospital will be improved and hence, patient will be satisfied significantly.

2.4 Methodology, Models and Methods

In this section, different methodologies, models and methods, which are used in the health service quality and patient satisfaction, are discussed.

2.4.1 Process-oriented Models

In production and service industries, the technological innovation and process-oriented contributions are two main factors to enhance profit, productivity and quality. The same types of study are also relevant for health service process[15]. In the hospital set-up, a research model may be adopted by considering process orientation as antecedent; operational efficiency, workforce conditions, and clinical quality as integral competitiveness; and financial performance, patient satisfaction as performance. In this way, strategic planning can be introduced in the hospital process to monitor the performance and to impart corrective actions for the necessary improvements. This strategy can also help us to set hypothesis.

2.4.2 Quality in Psychiatric Care (QPC) Instruments

An international Quality in Psychiatric Care (QPC) Instrument has two parts, viz.Quality in Psychiatric Care– Inpatient (QPC - IP) and Quality in Psychiatric Care – Outpatient (QPC – OP). These instruments are useful to assess the quality of inpatient and outpatient psychiatric hospitals [119]. One has to keep in mind that these instruments are to be psychologically tested with the required adequacy level.

2.4.3 Importance – Performance Analysis

In the service industry, importance-performance matrix is applied to identify the major strengths and weaknesses so that that key factors are obtained for its success. It is comprised of four quadrants, viz. (1) Quadrant I: Keep up the good work, (2) Quadrant II: Concentrate here, (3) Quadrant III: Low priority and (4) Quadrant IV: Possible overkill[120]. Doing so, internal-marketing benefit from employee perspectives is evaluated with the help of questionnaire. Hence, the result, as evaluated, can be useful to hospital managers for overall development of service.

2.4.4 SERVQUAL Model

Numerous studies are used SERVQUAL as a research instrument in both developed and developing country. The application of this model gradually expanded from business management, banking to medical care. Globally in the health care industry health needs are dynamically increased. There are enormous research work has been done in the medical science.

P. Fatma and H. N. Timothy conducted a study to assess patient satisfaction in preoperative assessment clinic (2001). Here SERVQUAL scale is used. In this study 10 dimensions i.e. tangibles, reliabilities, responsiveness, competence, courtesy, credibility, security, assess, communication and understandings the customers are used. Extended SERVQUAL model (ARTQUAL) is applied for service quality measurement by M. I. Abteen, S. Abbas and H. Ashkan. The SERVQUAL scale was used in survey involving outpatient and in-patient facility in Guangdong (2013). Here 22 items are assessed in 5 dimensions(Fig.3). The questionnaire was based on 5point Likert scale. Now a days quality assessment is a burden to all organization still research team of south of Iran explored the status of service quality through SERVQUAL survey instruments. Here mean expectation and perception score was compared and analysed[121].

In addition, research team used SERVQUAL model to test patient satisfaction in Pakistan by 6 dimensions. In Thailand, a extensive hospital service quality model was established by the help of SERVQUAL instrument. In this cross-sectional study 90 hospital was chosen as a study setting. SERVQUAL is not only surrounded in developed country, Indian researchers was also interested in this model. A. P. Madhura and I. S. Lakshmi was attempts to analyze the information systems on service quality in hospital. To do so, they were adopted the popular SERVQUAL model.

It can’t be ignored to assess the level of service quality in teaching hospital, there are few study has been done in this purpose by using SERVQUAL model[122].

2.4.4.1 Concept of SERVQUAL Instrument

Parasuraman, Zeithaml, and Berry (PZB) (1985) proposed a conceptual framework for service quality, identifying four distinct gaps on the service provider's side that can potentially impact customer perceptions of service quality.The gaps are described briefly below[123] (Fig 4.).

1. Consumer expectation – management perception gap (Gap 1): Management's misunderstanding of consumer expectations can be attributed to a deficiency in maintaining genuine customer focus.
2. Service quality specification gap (Gap 2): The management's struggle to convert customer expectations into precise service quality standards often arises from shortcomings in service design.
3. Service delivery gap (Gap 3): Lack of sufficient support for the frontline staff, who will explain the process, or frontline/contact staff performance variability.
4. External communication gap (Gap 4): Consumer expectations are shaped by the external communications of an organization.
5. These four gaps cause a fifth gap (Gap 5):The difference between customer expectations and their perceptions of the service actually received is referred to as the service quality gap.

How customers perceive service quality is determined by the extent and direction of Gap 5, which isinfluenced by the specific gaps in marketing, design, and service delivery.

Based on the above-mentioned point 5 and Figure 4, gap is estimated as follows:

Gap =Perception - Expectation

Moreover, it is calculated on each of dimensions of SERVQUAL model for each participant.

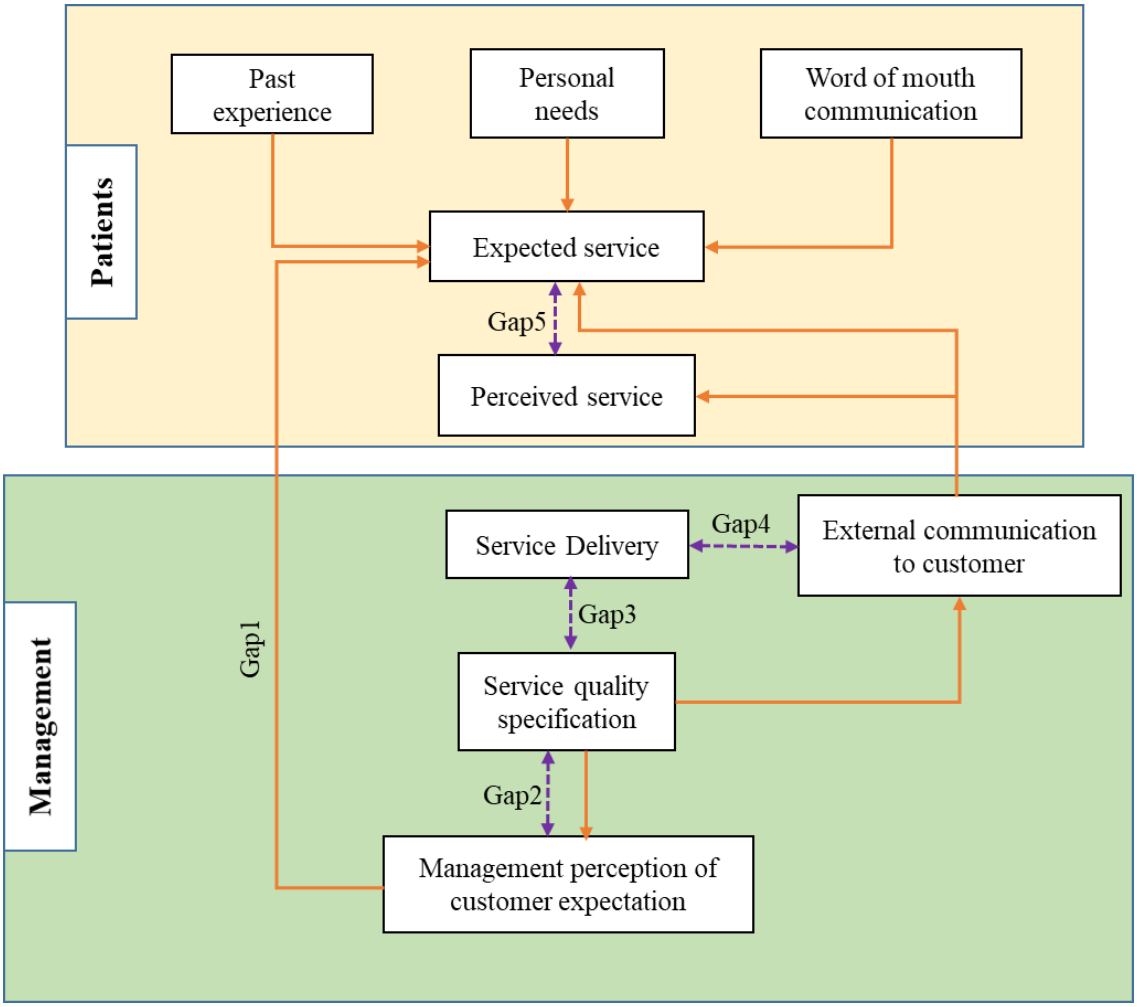

Fig.4: Gap model

2.4.4.2 Development of SERVQUAL Dimensions

The scale was developed by initially drafting approximately 100 questions to evaluate a service based on both consumer expectations and actual performance across specific attributes related to ten dimensions. Data analysis involved grouping questions that measured the same fundamental dimension, such as reliability. Factor analysis was crucial for identifying which questions related to each dimension, distinguishing those that did not correlate with any dimension, and determining the number of dimensions within the data. Questions not clearly associated with any dimension were removed. The revised scale was then administered to a second sample, and through testing, a 22-question scale was established, measuring five core dimensions—reliability, responsiveness, empathy, assurance, and tangibles—across both expectations and

performance. Thus, the final instrument comprises a total of 44 questions: 22 questions assessing expectations and 22 questions assessing performance.For further research and development of SERVQUAL model, PZB research team has found through many experiments that in the marketing service industry, the improvement of consumers' service perception mainly includes the following five aspects[124] (Fig. 5):

- Tangible: The physical structure of the equipment provided by the service, the associated service facilities and the appearance of the service personnel.
- Reliability: Service providers provide consumers with the reliability and consistency of quality services and the ability to accurately fulfill service commitments.
- Responsiveness: Service providers can provide services and responses to consumers in a timely manner.
- Assurance: Service providers build rapport with consumers and consumer trust in the services provided.
- Empathy: The extent to which service providers provide emotional care and extended emotional support to consumers.

In 1988, Parasuraman et al. finally introduced the SERVQUAL instrument, designed to measure service quality. Comprising the terms "SERV" for service and "QUAL" for quality, it's administered twice in varying forms: initially to gauge expectations and subsequently to assess perceptions.

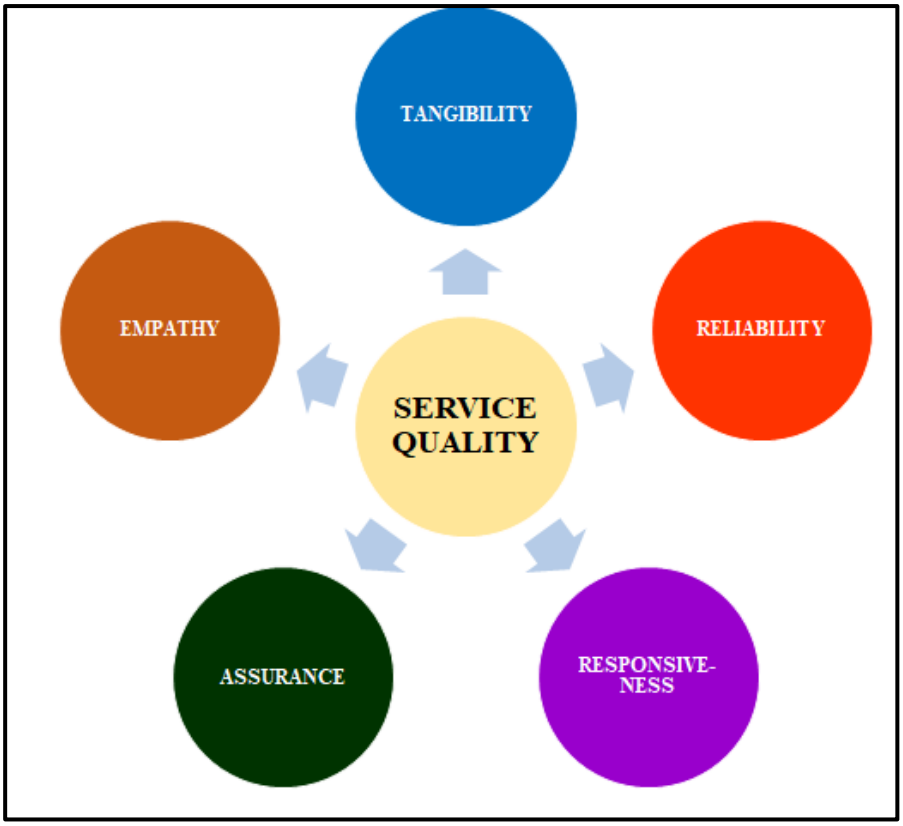

Fig. 5: SERVQUAL model

2.4.5 Path-Analytic Model

It is well known that top management play an important role for improvement of quality of an organization in long-term. It is required to know the relationship between organizational cooperation, workforce development, medical technology investment, and information/process analysis. In this context, path-analytic model may be useful to find and develop the empiricalrelationship between the above-mentioned issues and hospital service quality performance[88].

2.4.6 Six Sigma

Health information of a hospital has to be perfect as it is being used both by patient and hospital employees. In this regards, the quality of health information may influence the quality of health service. Six sigma methodologies may act as an important tool to

improve the overall quality of health information by reducing the information variances in healthcare[125].

2.4.7 Fuzzy MCDM

Healthcare quality is a pivotal performance parameter of a hospital and it is estimated based on patient's feedback on the basis of standard and non-standard tool and/or questionnaire. To develop the said tool, we normally consider a significant number of factors and parameters as mentioned previous chapter and sections in this chapter. Also, the number of respondents, i.e. sample size of the study is quiet large. It is also seen that demographical background of patients varies widely in developed and developing countries. Whenever these data are collected, subjectivity must be present and at the same time a huge number of criteria is also existent. This suggests that multi-criteria decision making tools, like Analytic Hierarchy Process (AHP), ViseKriterijumskaOptimizacijaKompromisnoResenje (VIKOR), technique for order performance by similarity to solution (TOPSIS) etc. are used to capture data from patient's feedback and identify based possible optimized factor, which are important to improve the healthcare quality [126,127,128.]

These tools may optimize patient's feedback to achieve required level of quality. To minimize subjectivity of responses, fuzzy logic and fuzzy set theory may also be associated with these tools for better trade-off[129,130.]

2.4.8 Mix Method

Mixed methods research combines quantitative and qualitative methods within a single study. Traditionally, research has been categorized as quantitative (generating numerical data) or qualitative (generating non-numerical data). Quantitative methods, such as clinical trials, have historically dominated health research. However, qualitative approaches, like interviews and focus groups, have gained acceptance in the past two decades, leading to a rise in the publication of qualitative studies.Historically, quantitative methods have been more prevalent in health research, particularly in fields like medicine and public health. However, over the past few decades, there has been a growing acceptance and appreciation for qualitative methods within the health research

community. This shift is reflected in the increasing publication of qualitative studies, demonstrating a recognition of the unique insights and perspectives that qualitative approaches can offer[131].

The integration process involved two main steps. First, qualitative variables were transformed into quantitative variables. Second, these transformed data were combined with the original quantitative data for regression analyses.

Integrating quantitative and qualitative data in mixed methods research can significantly amplify its value (Bryman, 2006; Creswell and Plano Clark, 2011). Such integration offers multiple advantages. Qualitative data can validate quantitative findings, while quantitative data can inform the selection of qualitative samples or elucidate findings from qualitative data. Qualitative inquiry can also contribute to refining quantitative instruments or interventions, and hypotheses generated qualitatively can be tested in the quantitative component of the study[132].

To facilitate comparisons between nursing practices regarding scope of practice and autonomy, a conceptual grid consisting of four quadrants was adopted from a prior study[133].

Monitoring patient experiences globally helps assess healthcare delivery and quality by reflecting on actual care received, thereby evaluating healthcare workers' performance and identifying patients' priorities in terms of quality aspects.Patient experiences serve as an essential gauge for evaluating and enhancing care quality. Healthcare organizations leverage patient feedback to drive internal quality enhancements, enabling professionals to tailor their practice and demonstrate their impact on patient outcomes[134].

Over the past decade, the interest in and application of mixed-methods research (MMR) within the nursing profession have increased significantly. The choice of research method is typically guided by the underlying paradigm and research question; however, MMR allows nurse researchers to explore and comprehend complex health processes in a more holistic manner. These methods facilitate a comprehensive and enriched understanding of a single phenomenon, providing valuable contextual insights. Nevertheless, one of the challenges of conducting MMR is effectively integrating qualitative and quantitative data to achieve a more nuanced understanding of health processes[135, 136,137].

2.4.9 Methods related to Air Quality

Indeed, the deterioration of air quality in major cities worldwide poses significant challenges to public health and the environment. Factors such as uncontrolled traffic growth, increasing urban populations, reduction in urban green spaces, and traffic emissions all contribute to the worsening air quality.Particles in the fine mode consist of primary particles from high-temperature metallurgical and combustion processes, secondary particles formed through atmospheric reactions, and a theoretically small quantity of fine particles resuspended by wind or human activities. Coarse-mode particles include windblown and road dust, pollen, spores, and some industrial particles. PM10 samples are typically dominated by coarse-mode particles in terms of mass. However, PM2.5 samples can also contain significant amounts of coarse-mode particles, particularly those from the lower end of the coarse-mode distribution (approximately 1–2.5 μm in diameter). This is especially prevalent in areas with substantial sources of resuspended dust.

The concentration and toxicity of particulate matter are influenced by various factors, including their composition, shape, size, the presence of other pollutants, and meteorological conditions. Understanding these factors is crucial for devising effective strategies to mitigate air pollution and protect public health[138].

The shift from biomass fuels to cleaner alternatives like petroleum products and electricity has been a notable trend in developed countries, accompanying the process of modernization. However, in many developing countries, households, particularly those in rural and impoverished areas, still rely heavily on simple biomass fuels such as wood for cooking and heating purposes.

Despite the availability of cleaner and more sophisticated fuels in some developing regions, factors like poverty often hinder the adoption of these alternatives. The cost-effectiveness and accessibility of biomass fuels make them a preferred choice for many low-income households.

Although the global proportion of energy derived from biomass fuels has decreased over the past century, from 50% in 1900 to around 13% in 2000, there are indications that their usage is increasing among the poor. This trend suggests that, without targeted interventions and advancements in poverty alleviation, biomass fuels will likely continue to be relied upon by impoverished communities for many years to come.

Addressing this reliance on biomass fuels requires holistic approaches that consider socioeconomic factors, access to clean energy technologies, and sustainable development goals to ensure that energy needs are met while minimizing environmental and health impacts[139].

The annual average concentration of respirable suspended particulate matter (RSPM) in major Indian cities shows fluctuating trends (Fig.6). Specifically, there is an increasing trend in RSPM levels in Delhi, Mumbai, and Kolkata, while Chennai exhibits a decreasing trend. The high levels of particulate matter in these cities are attributed to factors such as vehicular traffic, diesel/kerosene generator sets, small-scale industries, bio-massincineration, suspension of traffic dust, and the commercial and domestic use of fuel[140].

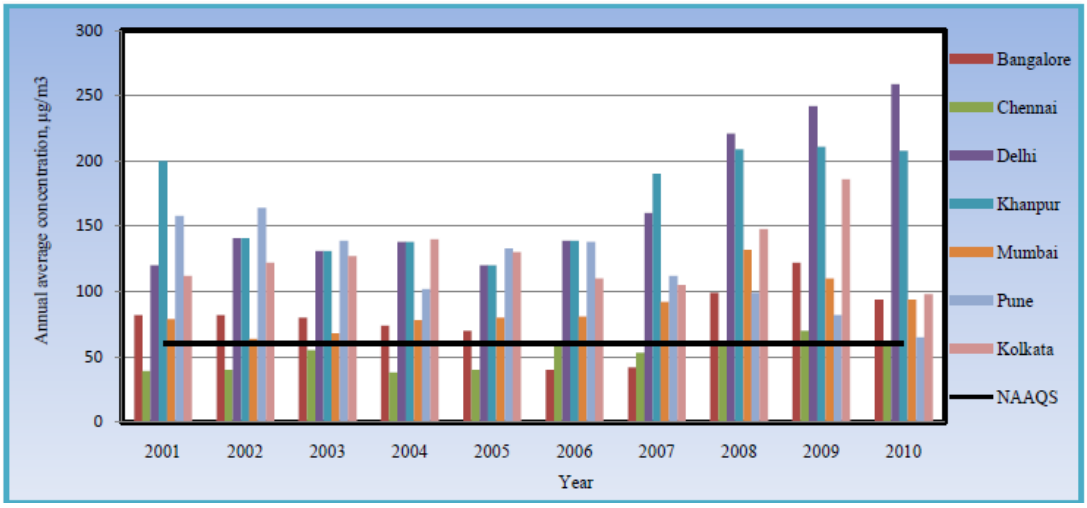

Fig.6: Concentration of RSPM in Residential and Industrial Areas in Major cities in India

Air pollution has been linked to various health issues, including acute reductions in lung function, worsening of asthma, increased pneumonia risk in the elderly, low birth weight in newborns, and increased mortality rates (Anderson, 1999; Bates, 1999; Lee et al., 2003). Additionally, long-term exposure to particulate matter (PM) has been connected to higher incidences of lung cancer and cardiopulmonary mortality (Pope et al., 2002). Clinical studies have shown that pollutants such as ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter exacerbate asthma by

increasing airway inflammation. Overall, there is substantial evidence that anthropogenic air pollution harms human health[141]

Exposure to airborne microorganisms in both occupational and residential indoor environments is linked to a variety of adverse health effects, which have significant public health implications. Indoor air quality is a critical factor influencing the health and well-being of individuals[142]. The air inhaled by people is abundantly populated with microorganisms, also known as bio aerosols. Bio aerosols are airborne particles that are either living (such as bacteria, viruses, and fungi) or originate from living organisms. Bio aerosols are ubiquitous, highly variable, and complex, with origins that can be either natural or man-made. The sampling and analysis of airborne microorganisms have garnered attention in recent years due to concerns about mold contamination in indoor environments, the threat of bioterrorism, and the associated health effects, which include infectious diseases, acute toxic effects, allergies, and cancer.

2.5 Conclusion

The literature on hospital service quality and hospital air quality assessment highlights their critical roles in ensuring patient satisfaction and health outcomes. Key dimensions of hospital service quality, such as tangibility, reliability, responsiveness, assurance, and empathy, are essential for achieving high patient satisfaction and service excellence. Effective communication, patient-centered care, continuous staff training, and the implementation of advanced technologies further enhance service quality. Concurrently, hospital air quality significantly impacts patient and staff health, with common contaminants including particulate matter, microbial agents, and volatile organic compounds. Poor air quality can lead to respiratory issues and infections, emphasizing the importance of adhering to air quality standards set by organizations like WHO. Effective control measures, such as proper ventilation, regular monitoring, and use of air purifiers, are critical. Integrating high service quality with robust environmental management strategies is necessary for holistic healthcare improvement.

Chapter 3: Hospital Service Quality

3.1 Introduction

In hospitals, the quality of healthcare services is shaped by three key groups viz. (i) patients, who receive care; (ii) health professionals, who provide direct services; and (iii) hospital management, responsible for overseeing operations. Each group defines service quality based on their roles and interests, emphasizing the need to address their concerns for effective and sustainable quality improvement. This suggests that evaluation of health quality service is a very complex task.

Hospital service evaluation is indispensable for maintaining and improving the quality of healthcare delivery for a number of reasons such as: Firstly, it serves as a compass for quality improvement initiatives within hospitals. By systematically assessing various aspects of service delivery, such as patient satisfaction, clinical outcomes, and safety measures. Hospitals can identify areas in need of enhancement and implement targeted interventions to elevate overall service quality.

Secondly, hospital service evaluation plays a pivotal role in ensuring patient satisfaction. By soliciting feedback from patients and evaluating their experiences, hospitals can gain valuable insights into patient preferences, concerns, and expectations, enabling them to tailor services to meet patient needs effectively[143].

Thirdly, evaluation facilitates the monitoring of clinical outcomes and safety standards. By tracking different metrics, such as mortality rates, infection rates, and adherence to safety protocols, hospitals can proactively identify and address potential risks to patient safety, ultimately enhancing the quality and reliability of care. Additionally, hospital service evaluation supports efficient resource allocation by providing data-driven insights into the utilization of resources and the effectiveness of care processes. Moreover, evaluation ensures compliance with regulatory requirements and accreditation standards, safeguarding the legal and ethical integrity of healthcare delivery. Overall, hospital service evaluation is indispensable for driving continuous improvement, ensuring patient satisfaction, promoting

patient safety, optimizing resource utilization, and upholding regulatory standards within healthcare institutions[144].

Keeping above mentioned areas in mind,the present study is interested to evaluate hospital service quality among PPI patient with the help of SERVQUAL model.

3.2 PPI Patient

Health care organizations are responsible to provide need-based services to the patients in both outpatient and inpatient departments.Continuoushospital quality service may enable the satisfied outcome for patients in both departments. We know that there are different kinds of patients, coming to hospital for the treatment of non-communicable and communicable diseases. But these services may vary from hospital to hospital specifically in developing country.Due to these variations, sometimes patients have to face unwanted conditions and situations. According to WHO estimation, there are 41 million cases are died annually from non-communicable disease. Among them, majority of patients i.e. 17.9 million are died annually due to cardiovascular problem[145].Cardiac diseases is leading cause of burden and death globally and it is exponentially increasing in India as well[146,147]. There are couple of modern medical treatment for cardiovascular problems. Permanent pacemaker implantation (PPI), a minimal invasive procedure for the patient having problem with conduction system of heart, is one of the prominent surgical interventions. Through PPI procedure, patient may get recover from their symptoms for which they were unable to lead their normal life[148].Although, patient may survive from their restrictions before PPI and improve their physical health, emotional health and social functioning. It is also mentioned that each year 1.25 million permanent pacemakers are implanted worldwide[149].It is also observed that most of the PPI survivors are conscious after operation as there is a minimal chance of developing complications[150,151].

It is observed that hospital service plays an important role to cure PPI patients. Sometimes, PPI patients may face some problems due to the lack of proper infrastructure and other related issues of doctors, nurses and other hospital staff members[152].

It is also mentioned that health care providers may satisfy main beneficiary on several factors, such as promptness of service, clear explanation and available information of

treatment to achieve client's emotional feelings towards health care system. However, other related issues, like cleanliness, good interpersonal relationship having broad importance to quality health, may not be ignored[7].Some of these problems regarding care and services may essentially be identified to fill up the gap within the organization and hence, the hospital may be capable to combat with competitive market. This suggests that there is a need to study the hospital service experience perceived by patients, who are able to judge or evaluate the level of hospital service during their staying in hospital.

3.3 SERVQUAL Model

Health care service and patient satisfaction are very fundamental concepts that need attention in health care service sector. In both developed and developing country, health care quality is a big challenge for any hospital. There are various conceptual models that have been establishing by different researchers for evaluation. Each model has their strength and weakness. The various service quality model is, Rater model, have five key dimensions (tangibility, reliability, responsiveness, assurance and empathy) and proposed by Valarie A. Zeithml, A. Parasuraman, and Leonard L. Berry in 1990. Kano model is another useful in gaining a thorough understanding of customer's needs. This model involves two dimensions, i.e. achievement (the horizontal axis) and satisfaction (the vertical axis). Another convenient and useful model is SERVQUAL. It is also based on five key dimensions- tangibility, reliability, responsiveness, assurance and empathy. This multidimensional instrument designed to capture customer's expectations and perceptions of a service[153,154,155].

3.4 Questionnaire Preparation

There are a large number of causes in relation to hospital operations and activities. The cause and effect diagram is useful to show the possible causes of hospital quality service. In the present study cause remuneration of hospital quality service and patient satisfaction is developed through a number of brain storming session in which all possible types of

causes are listed to show their influences on service quality. The main advantage of using such a diagram is that the process of its construction creates a better understanding of sub components involved in hospital service and their relationship. Some of the main causes are man, method, money, material and environment. The cause and effect diagram is given in Fig. 7.

It is observed that there are 40 sub-causes in total. A part of these sub-causes is used to frame the questionnaire for the present study.

Questionnaire is designed to obtained data from a group of people those are selected as a participant. It helps to collect data from large group. Questionnaire can be used in various ways, i.e. through interview, mailing to participants. In this study researcher prepared a questionnaire as a interview schedule. For this issue, extensive literature review has been done on the basis of study objectives. The present aims to develop an interview schedule rooted in the SERVQUAL framework to evaluate hospital service quality and patient satisfaction. Drawing from established studies, it's evident that SERVQUAL provides a healthy conceptual foundation for crafting such assessments. The interview schedule will focus on key dimensions including reliability, responsiveness, assurance, empathy, and tangibles. Through structured questioning, the goal is to capture insights into patients' perceptions and experiences within the hospital setting. With the help of Likert scale questions to quantify responses and incorporating open-ended inquiries for richer feedback, the researcher seeks to gather comprehensive data that can inform strategies for enhancing service quality and overall patient satisfaction[156,157].

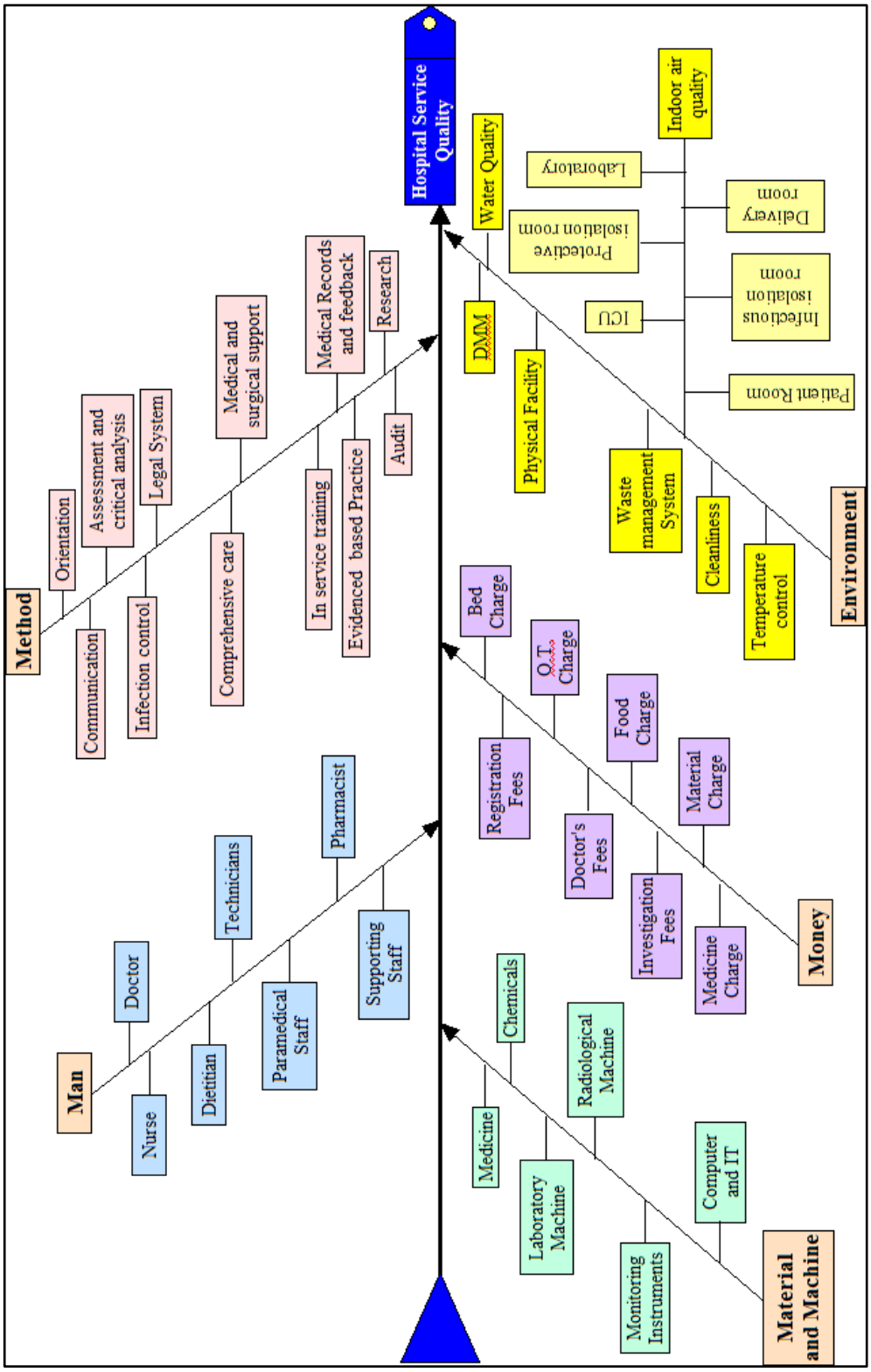

Fig. 7: Cause and effect diagram of hospital quality service

In the initial draft, a comprehensive questionnaire comprising 27 items addressing various dimensions of hospital service quality and patient satisfaction, based on the SERVQUAL framework, was developed. To ensure the validity of the questionnaire, it was disseminated to a panel of five experts for their invaluable insights, suggestions, and corrections.

Communication with the experts was conducted through a combination of email correspondence and the provision of hard copies of the questionnaire (*Appendix*). This multi-channel approach aimed to facilitate efficient and thorough review processes, accommodating the preferences and convenience of the experts.The experts were carefully selected based on their expertise and experience in relevant fields such as healthcare management, patient experience, quality assurance, and research methodologies. Their diverse perspectives and insights were anticipated to enrich the refinement process of the questionnaire, enhancing its relevance, clarity, and effectiveness as a tool for evaluating hospital service quality and patient satisfaction.

The feedback received from experts have been thoughtfully analyzed and integrated into the questionnaire, ensuring that it aligns closely with the objectives of the study and reflects the latest insights and best practices in the field. This collaborative approach underscores the commitment to rigor and excellence in research methodology, ultimately contributing to the validity and reliability of the study findings.

From an initial set of 27 items, the questionnaire was thoroughly and critically analyzed in a final version comprising 20 selected items. Items were evaluated based on their relevance, clarity, and ability to effectively capture the key dimensions of hospital service quality and patient satisfaction outlined within the SERVQUAL framework, viz.tangible (7 items), reliability (4 items), responsiveness (2 items), empathy (2 items) and assurance (5 items). Moving forward, the finalized questionnaire will be deployed in the research study, enabling the collection of data that will contribute to a deeper understanding of the factors influencing hospital service quality and patient satisfaction.

The sociodemographic questionnaire aims to capture key demographic variables that may influence patients' perceptions and experiences within the hospital setting. This information will provide context for the analysis of survey responses and help identify potential demographic patterns or trends in service quality perceptions. A socio demographic questionnaire has been prepared to gather baseline information about the participants. Key

demographic variables typically included in such a questionnaire may encompass (a) age, (b) gender, (c) education level, (d) occupation, (e) income level, (f) marital status, and (g) residential location. These variables offer insights into the diverse backgrounds and characteristics of the survey. Thus, the total survey questionnaire was divided into two parts, viz. Tool I (i.e. for socio-demography) and Tool II (i.e. for Perception of hospital services) and translated in Bengali language, vetted by a reputed linguistic expert (*Appendix*).

3.5 Analytical Method

An analytical method refers to a structured approach used to analyze data and draw meaningful conclusions. This involves the application of various statistical techniques to organize, summarize, and interpret data sets. Key components of an analytical method in statistics include data collection, data cleaning, descriptive statistics, inferential statistics, and the use of statistical models. These methods allow statisticians to test hypotheses, identify trends, make predictions, and determine relationships between variables.

3.5.1 Sample Size Estimation

Addressing a sample size is a practical issue that has to be resolved during planning and designing stage of the study. In any research study, it's not practical or feasible to examine the entire population. Instead, a smaller group, called a "sample," is chosen in such a way that is represent the population accurately. This sample allows researchers to draw conclusions about the larger population based on their findings. Therefore, a sample is selected from the population that is small in size but sufficiently representative to allow accurate inferences about the broader population. Defining the sample size before beginning a study is a fundamental statistical principle designed to avoid bias in result interpretation. If the sample size is too small, the results may not be generalizable to the entire population, and the study may fail to detect significant differences between test groups, potentially rendering the study unethical. Conversely, including more subjects than necessary can lead to unnecessary use of time and resources and can also be considered

unethical. The calculation of an adequate sample size thus becomes vital in any clinical study and is the process by which we calculate the optimum number of participants required to be able to arrive at ethically and scientifically effective results. This study describes the principles and methods used to calculate the sample size[158,159,160].

In this study the equation used for sample size as given below.

$$n = Z^2 \frac{(p)(q)}{d^2}$$

n = Desired sample size, Z1−α/2 = Critical value and a standard value for the corresponding level of confidence. (At 95% CI or 5% level of significance (type-I error) it is 1.96 and at 99% CI it is 2.58), P = Expected prevalence or based on previous research q = 1-p, d = Margin of error or precision. When, Z=1.96,p=0.4,q=0.6, d=0.05.

3.5.2 Reliability Testing

Reliability testing is an essential aspect of validating a questionnaire designed to assess hospital service quality and patient satisfaction based on the SERVQUAL framework. This testing process aims to evaluate the consistency and stability of the questionnaire's measurement over time and across different samples. Several methods are commonly employed to assess reliability. Internal consistency reliability, often measured using Cronbach's alpha coefficient[161,162]examines the extent to which items within the questionnaire are interrelated. A high Cronbach's alpha value indicates strong internal consistency, suggesting that the items reliably measure the same underlying construct. Test-retest reliability assesses the stability of questionnaire responses by administering the questionnaire to the same group of participants on two separate occasions and comparing their responses. Split-half reliability involves dividing the questionnaire into two halves and comparing the scores of each half to assess consistency. Inter-rater reliability is applicable when subjective judgments or ratings are involved, measuring the degree of agreement among different raters' judgments. By conducting reliability testing using these

methods, researchers can ensure that the questionnaire produces consistent and reliable results, thereby enhancing the validity and trustworthiness of the research findings.

Overall, Cronbach's alpha is a valuable tool for researchers in ensuring the reliability and validity of their questionnaire-based research, ultimately enhancing the quality and credibility of their findings. With Cronbach's alpha employed for reliability testing, the researcher ensures a rigorous evaluation of the questionnaire's internal consistency in assessing hospital service quality and patient satisfaction within the SERVQUAL framework. This statistical measure serves as a critical tool in validating the questionnaire's effectiveness by examining the extent to which its items consistently measure the targeted constructs, such as tangibility, reliability, responsiveness, assurance, and empathy.

3.5.3 Descriptive Statistics

Descriptive statistics are crucial for understanding the basic properties of data, identifying outliers, and making informed decisions about further statistical analysis or modeling. They provide insights into the frequency distribution, central tendency, measure of dispersion and measure of relationship. Here the researcher utilized all the analytical methods[163].

3.5.4 Inferential Statistics

Inferential statistics is concerned with population and uses simple data to make an inference about the population or to test the hypothesis. Along with that another statistical process under this, are regression analysis, chi square test and correlation analysis. In this study only chi square test have been used to test the hypothesis.

3.5.5 Principal Component Analysis (PCA)

Principal Component Analysis (PCA) is valuable techniques for understanding underlying factors in health service quality. PCA transforms a large dataset with many variables into a smaller set of summary indices called principal components. These components retain most

of the information from the original variables. It's particularly useful when you have many variables relative to the number of observations or when the variables are highly correlated[164,165].

3.6 Data Collection and Results

Data collection is a fundamental aspect of the present study, involving the systematic gathering of information relevant to the research questions or objectives. This process often entails employing various methods, such as surveys, interviews, or observational studies to collect primary data directly from participants.Clear and concise reporting of the results are essential anticipants. In the following section the data collection and results have been described in case of pilot study and final study.

3.6.1 Pilot Study

On each day of data collection, researcher went to Cath Laboratory and noted all the demographic information, such as name, age, name of prescribing doctor, detailed diagnosis, type of PPI and ward name. Along with this, only those patients were selected as participants, who were undergone first time with PPI. After visited to Cath Laboratory, interviewee went to each respective cardiology ward and restricted to go to CCU, ITU, if any. It is worth mentioned that only haemodynamically stable PPI patients were selected randomly as participants. From Cardiology ward, each PPI patient's data was gathered, but questions of Tool II (tangible:7 items), reliability:4items, responsiveness: 2items, empathy:2items, and assurance:5items; each of these items of total questionnaire was framed by 5-point Likert scale) were asked from those who had received at least three-day services from respective ward. At the end of the data collection by using tool I, II interviewer was started qualitative interview by using open ended questions to participants and they were allowed to provide free and frank responses about their satisfaction towards hospital services. In this way, the total data collection was completed.

Table 1: Socio-demographic information of the participants

n=27

Variable	Range	Frequency	%
AGE	35-45	3	11
	45-55	2	8
	55-65	**13**	**48**
	65-75	7	26
	75-85	2	7
GENDER	Male(M)	12	44
	Female(F)	**15**	**56**
EDUCATION	No Formal Education	7	26
	Upto Class VIII	**12**	**44**
	Class IX-XII	5	19
	Above XII	3	11
OCCUPATION	Business	7	26
	Daily Labour	6	22
	House Wife/Home Maker	**7**	**26**
	Service	6	22
	Unemployed	1	4
ECONOMIC CLASS	Upper Class	**18**	**67**
	Upper Middle Class	9	33
	Middle Class	-	-
	Lower Middle Class	-	-
	Lower Class	-	-
NO. OF VISIT TO HOSPITAL	one time	**15**	**56**
	>1 time	12	44
COST FOR VISIT	⩽1000	**11**	**41**
	1001-3000	10	37
	3001-5000	4	15
	>5000	2	7

Data was arranged and analysed by descriptive and inferential statistics. Participants background information was described through frequency (f), percentage (%), mean, standard deviation (SD), whereas SERQUAL tool was computed by mean, SD, mean % to obtain patient satisfaction. To find out the association between different demographic variables and response, Chi-Square statistics were calculated.

27 participants of this study have quite diverse characteristics. The background information is collected from each participant in terms of their age, gender, education, occupation, economic class, number of visits to hospital and cost of visit.

The summary of socio-economic data is represented in Table 1 and it shows that the majority (i.e. 48%) of participant's age were lying between the age of 55 to 65 years and more than 50% participants were female. It may also be depicted that 44% of participants hold up to class VIII standard educational-level and only 11% of them were above VIII. As far as occupation is concern, majority, i.e. 26% of participants belonged to home maker/ housewife, and maximum (i.e. 67%) participants were in the upper class in terms of economic class. It is also observed that among 27 participants, 56%of them visited hospital at the first time. It is to be kept in mind that cost of visit is an important area to be considered. Table 1 shows that majority (i.e. 41 %) participant's expenditure for first-time visit to hospital was less than or equal to Rs1000/-.

Table 2: Reliability Test

n=27

Attributes	No. of items	Cronbach's Alpha
Responsiveness	4	0.9
Empathy	3	0.86
Reliability	5	0.80
Assurance	5	0.67
Tangibility	9	0.54
Overall	**26**	**0.89**

Regarding reliability and consistency of questionnaire, a Cronbach's Alpha (α) for each dimension was computed and presented in Table 2. It is found that the estimated value for α is ranged from 0.54 to 0.9. Thus, it may be concluded that in this pilot study, internal consistency is excellent in the areas of responsiveness, empathy, and reliability and acceptable for the attributes of assurance. On the other hand, the internal consistency is poor (i.e. α=0.54) in case of tangibility. Thus, it may be decided that the questions in this dimension need to be critically analysed, framed and hence, be modified in final study. However, the overall internal consistency of the questionnaire is quite high and acceptable (0.89).

Table 3: Level of Patient satisfaction of the participants

n=27

Score: level of satisfaction	Grading	Frequency	%
⩾ 113(mean + SD)	Highly satisfied	6	22.22
85-113	Satisfied	15	55.56
<85(mean - SD)	Low satisfied	6	22.22

Here it is stated that overall scores of participants have been estimated on the basis of mean and SD. Three level of satisfaction are considered as i) highly satisfied (score≥mean+SD), low satisfied (score<mean-SD) and satisfied (i.e. area between mean±SD).

Table 3 describes that 55.56% among 27 patients are satisfied and only 22.22% are highly satisfied.

Table 4: Mean Percentage of service quality domain

n=27

	Range of possible score	Range of obtained score	Mean	SD	Mean %
Tangible	9-45	29-44	36	4.1	80
Reliable	5-25	12-25	20	3.8	80
Responsiveness	4-20	4-20	14	4.7	68
Empathy	3-15	6-15	11.9	2.97	79.5
Assurance	5-25	12-21	17	2.85	70

In the area of ranking, it is observed in Table 4 that the attributes, i.e. tangible, reliable, empathy are equally on same rank as the basis of mean % value, which is 80% whereas responsiveness and assurance are having mean percentages of 68% and 70%, respectively. It indicates that for patient satisfaction as well as quality improvement in relation to tangible, reliable, empathy is more or less equal importance but we should not ignore other attributes, i.e. responsiveness and assurance.

It is observed from Table 4 that the two area i.e. assurance and responsiveness is needs to be improved.

Table 5: Association between Selected Variable and Patient's Satisfaction

n=27

	⩽Median Score	**>Median Score**	**df**	**Chi-Sq/Yates correction Value**	**p-value**
Age					
⩽ 60	6	8	1	0.98	0.32
>60	9	4			
Gender					
M	4	8	1	2.84	0.92
F	11	4			
Education					
No Formal Education	4	3	3	0.26	0.96
Upto Class VIII	8	4			
Class IX-XII	1	4			
Above XII	1	2			
Occupation					
Employed	9	10	1	0.74	0.39
Unemployed	6	2			
Economic Class					
Upper Class	11	7	1	0.16	0.69
Upper Middle Class	4	5			
Cost for Visit					
⩽3000	14	7	1	4.73	0.29
>3000	1	5			

It is found from table 5 that H_0 is accepted and research hypothesis is rejected in this pilot study that means there is no association present with patient satisfaction and selected variables on the basis of chi square values and p values at 0.05 level of significance.

Thus pilot study has successfully demonstrated that the pre-set methodology is feasible and effective for the final study and it provides valuable validation and confidence for proceeding with the main study.

3.6.2 Final Study

The cross sectional study is conducted with PPI patients to survey quality of service provided by the hospital during their hospitalization. Non-probability purposive sampling techniques adopted to get accessible population. Based on inclusion criterion, 138 study participants has been selected by using the formula[19]of $n = Z^2 \frac{(p)(q)}{d^2}$, where Z=1.96,p=0.4,q=0.6, d=0.05. Data has been collected from two cardiology male wards and one female ward. After ethical committee permission (memo no. IPGME&R/IEC/2022/414) (*Appendix*)data has been collected from November 2022 to June 2023. Researchers have used two sets of semi structured survey questionnaire viz.(*Appendix*) (i) Tool I, based on socio-demographic data and (ii) Tool II, based on hospital service quality assessment. Tool II has been prepared by taking concept from SERVQUAL model which is having five distinct dimensions, viz. tangible (7 items, represented as T1-7), reliability (4items, represented as R1-4), responsiveness (2items, represented as Re1-2), empathy (2items, represented as E1-2) and assurance (5items, represented as A1-5). Each of these items of total questionnaire was framed by 5-point Likert scale. Data regarding hospital service quality has been collected in two phases. In the 1st phase, data has been taken within 24 hrs of admission for PPI and in the2ndphase, data has been collected on the 3rd day during hospitalization after PPI.

The purpose of two phases is to collect the data of patient expectation and patient perception about hospital service. On each day of data collection researcher went to each cardiology ward and checked the admission register to identify those patients who had taken admission for PPI. This step has been done for phase1. On the other hand, for phase 2, researcher went to Cath Laboratory and noted all the information, such as name, age, name of prescribing doctor, detailed diagnosis, type of PPI and ward name. After visited to Cath. Laboratory, interviewee went to each respective cardiology ward and did sampling

with the help of ward register. It is worth mentioned that only haemodynamically stable PPI patients were selected randomly as participants. Data has been gathered after taking informed consent (*Appendix*) from each participant. Before the time of data collection vital signs has been checked and recorded. After that, participants have been oriented about 5 point Likert scale and how to give responses against the questionnaire. At the same time, they have been allowed to give free and frank response related to each questionnaire.

After completion of data collection, data have been arranged and analysed by descriptive and inferential statistics. Participant's background information has been described through frequency (f), percentage (%). Mean, SD, t test, and PCA have been calculated to find out the factors associated with hospital service.

Collected data was entered in SPSS Statistics (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp) and Minitab (Version 19).

Table 6: Distribution of demographic variables

n=138

Demographic variables	**Frequency (f)**	**Percentage(%)**
Gender		
Male	84	60.87
Female	54	39.13
Age(yrs)		
35-50	26	18.84
51-65	58	42.03
66-80	46	33.33
81-92	8	5.8
Religion		
Hindu	108	78.26
Muslim	30	21.74
Residence		
Rural	76	55.07
Urban	62	44.93
Marrital status		
Married	116	84.06
Unmarried	12	8.7
Widow	10	7.24

Table 6 depicts that majority of the participants are male (60.87%) and 42.03% participants belong to the age group of 51-65yrs, whereas only 5.8% are with the age group of 81-92yrs.

From above mentioned table it also reveals that there are 78.26% Hindu participants and only 21.74% are Muslim. On the other hand, there are mixed category of residence of participants i.e. rural (55.07%) and urban (44.93%).There are more married participants (84.06%), compared to widow i.e. 7.24%.

n=138

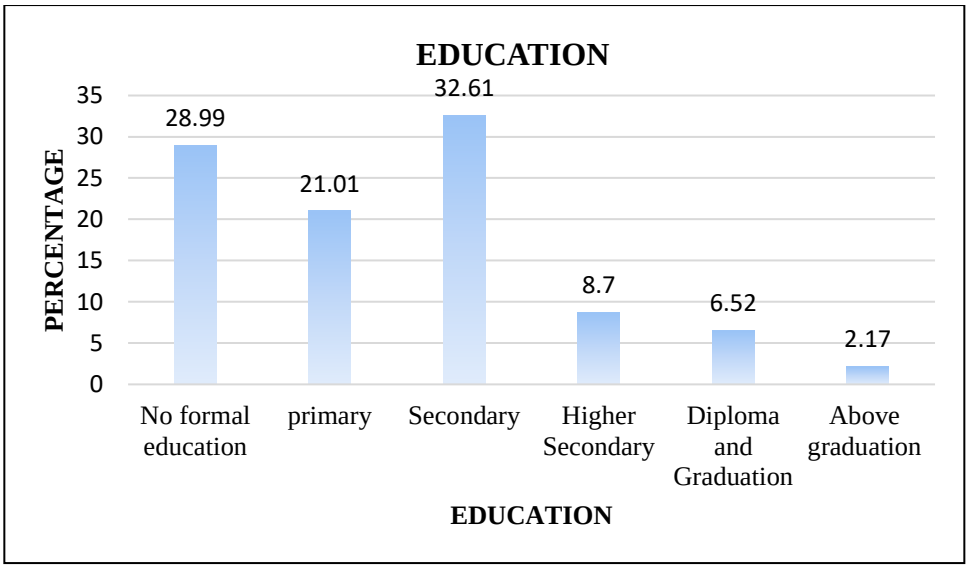

Fig.8: Percentage of Level of Education among participants

Fig 8 represents that majority of the participants (32.61%) are having secondary education and a significant number of participants (28.99%) do not have any formal education. Only 2.17% participants are belonging to the category of education level above graduation.

n=138

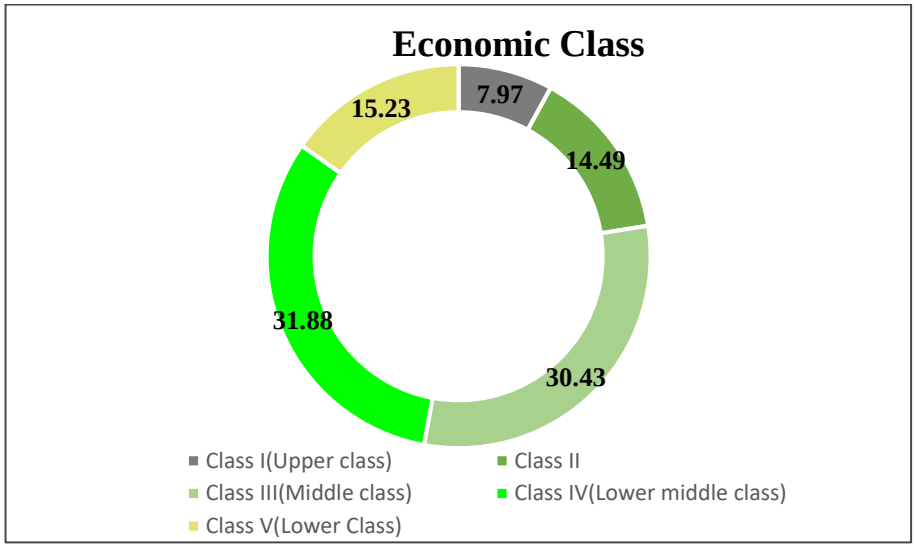

Fig.9: Percentages of economic class among participants

As per B.G.Prasad scale, 138 participants are distributed as per their economic classes. In Fig. 9 there are 31.88% participants under lower middle class and 30.43% are in middle class. Only 7.97% participants belong to upper income class.

n=138

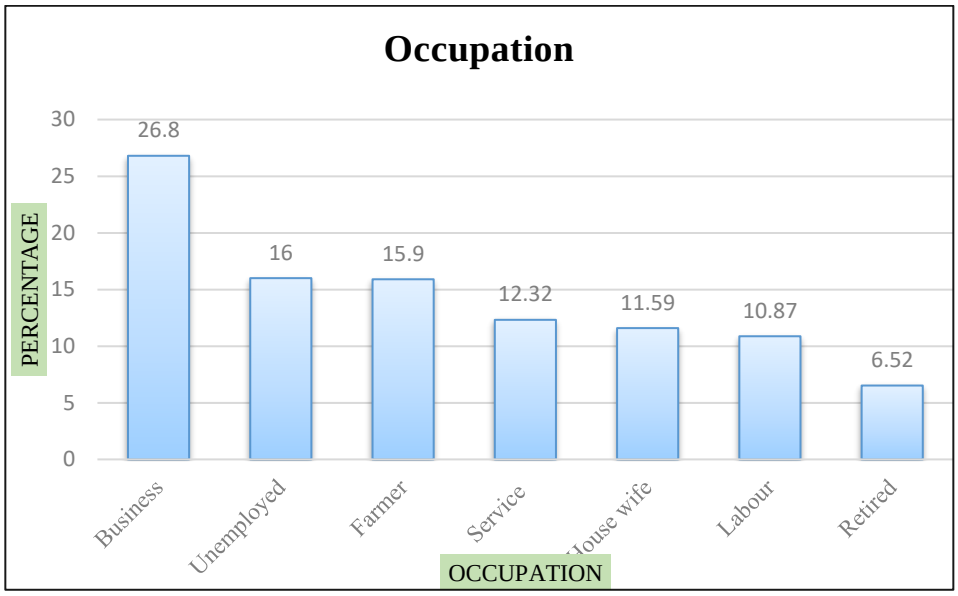

Fig. 10: Percentage of occupation status among participants

Fig.10 depicts that among 138 participants 26.8% are involved in business as an occupation. On the other hand, other distribution of occupation is mostly equal percentage i.e. 16%, 15.9%, 12.32%, 11.59%, and 10.87% are unemployed, farmer, service holder, house wife and labour respectively. Only 6.52% participates are retired.

Table 7: Service quality dimension gap score analysis

n=138

Quality Dimension	Perception (P) (Mean ± SD)	Expectation (E) (Mean ± SD)	Gap (P-E) (Mean ± SD)	t value	p value
Tangible	3.38±1.26	2.69±1.62	0.69±1.88	10.56	0.000
Reliability	3.39±0.89	2.83±0.85	0.56±1.03	25.13	0.000
Responsiveness	2.81±1.33	2.53±0.99	0.28±1.39	3.38	0.001
Assurance	4.13±0.83	2.83±0.88	1.29±1.04	32.51	0.000
Empathy	1.87±1.05	2.44±0.94	-0.57±1.24	7.63	0.000

The gap score of the responses by PPI patients is calculated on the basis of formula, presented in Chapter 2, page no. 39 and results, in this regards, is described in Table 7. Table7 explains that the mean score of perception and expectation of hospital service of pacemaker patient are closed to each other in the areas of two quality dimensions, i.e. tangible and responsiveness. There is a significant difference between the perception and expectation in the area of empathy (-0.57± 1.24) and reliability (0.56± 1.03). Table 7 also suggests that mean values of expectation are 2.83±0.88 and 2.83±0.85, for assurance and reliability respectively, whereas 2.44 ± 0.94 is the lowest mean expectation score for empathy. The mean values of perception are varied from 1.87±1.05 for empathy (lowest) to 4.13 ± 0.83 for assurance (highest). It is also mentioned that for each quality dimension, t-values are calculated. The calculated t-values show that the difference between expectation and perception of pacemaker patient is statistically significant ($p < 0.00$) in all of the quality dimensions.

Table 8: PCA for service quality dimension

n=138

Variable	Code	PC1	Rank
Assurance 2	A2	0.286	1
Assurance 1	A1	0.285	2
Assurance 5	A5	0.275	3
Responsiveness 2	Re2	0.268	4
Assurance 3	A3	0.266	5
Reliability 3	R3	0.265	6
Reliability4	R4	0.263	7(a)
Responsiveness 1	Re1	0.263	7(b)
Assurance 4	A4	0.254	8
Empathy 1	E1	0.248	9
Reliability 2	R2	0.226	10
Tangible2	T2	0.219	11
Tangible3	T3	0.217	12
Reliability 1	R1	0.189	13
Tangible4	T4	0.162	14
Empathy 2	E2	0.151	15
Tangible6	T6	0.143	16
Tangible7	T7	0.135	17
Tangible 1	T1	0.111	18
Tangible5	T5	0.046	19

PCA has been calculated on the basis of patient's perception regarding hospital service quality after experiencing services at least for three days. A number of principal components are found out. Here, PC1 carries the highest variation, which is about 38% of the total variations. The weightages of the factors of hospital service quality in PC1 is shown in the Table 8. Table 8 depicts that the importance of each variable in contribution to principal component 1(PC1). Variables with higher PC1 values and lower ranks have a

stronger influence on the first principal component, while those with lower PC1 values and higher ranks have less influence to health services. Thus, assurance 1,2,3,5(1, 2, 3, 5 denotes the different areas of assurance) variables are most relevant components to hospital service.

3.7 Conclusion

In this study, there exists a service quality gap based on patients' perspective. Negative gaps between expectations and perceptions are existed in the dimensions of empathy about service quality. Service quality needs more improvement in this area.Additionally, for a more comprehensive understanding of the patient perspective, the study suggests exploring other facets such as the contribution of indoor air quality to patient and staff well-being. Furthermore, incorporating qualitative interviews could offer valuable insights into participants' perspectives and satisfaction levels, thereby enriching the study's findings and recommendations.

Chapter 4: Patient Satisfaction

4.1 Introduction

Patient satisfaction for pacemaker patients is a critical aspect of healthcare quality, as it encompasses their experiences and perceptions throughout the entire treatment process, from diagnosis to post-implantation care. For pacemaker patients, satisfaction is influenced by the clarity of communication from healthcare providers, the thoroughness of pre-procedure education, and the support provided during recovery. These patients often have heightened concerns about the surgical procedure, device functionality, and long-term health outcomes. Therefore, effective management of their expectations, addressing anxieties, and providing comprehensive follow-up care are essential. Additionally, the technical expertise of the medical team and the reliability of the pacemaker technology play significant roles in patient satisfaction. By prioritizing these factors, healthcare providers can ensure better patient outcomes, higher adherence to follow-up protocols, and overall improved quality of life for pacemaker patients. Measuring patient satisfaction through tailored surveys and direct feedback helps in identifying specific needs and areas for improvement, ultimately fostering a supportive and reassuring healthcare environment for these patients.

4.2 Patient Satisfaction

Patient satisfaction has indeed become a crucial aspect of healthcare services in recent decades. By evaluating patient satisfaction, healthcare providers can identify areas for improvement and make positive changes to enhance the quality of care delivery. Incorporating patients' perspectives into the functioning of health services helps in better managing services and improving the behaviours of healthcare professionals. This, in turn, facilitates the development of appropriate policies and management procedures, prioritizes resource allocations, and identifies training needs.A high level of patient satisfaction has

several positive outcomes, including patients' decisions to choose a particular health service, their intention to return to a specific hospital, and their adherence to doctor's appointments and recommended treatment options.

Both national and international organizations responsible for healthcare assessments emphasize patient satisfaction as a key indicator for evaluating healthcare outcomes and determining hospital reimbursement. This underscores the significance of ensuring patient satisfaction as an integral part of healthcare service delivery[166].

Numerous research endeavors have delved into the evaluation of patient satisfaction through the application of diverse questionnaires, with subsequent data analysis employing a range of descriptive methods. These investigations serve the purpose of comprehensively understanding the multifaceted factors influencing patient contentment, thereby providing valuable insights into areas necessitating improvement within healthcare services. Quality health service and patient satisfaction are critical aspects of healthcare delivery. To establish these, qualitative research plays a pivotal role. Unlike quantitative research, which focuses on numerical data and statistical analysis, qualitative research delves into the deeper understanding of experiences, phenomena, and context. Through methods such as interviews, observations, and focus groups, qualitative research allows researchers to explore the intricacies of patients' experiences, their perceptions of care, and the contextual factors that influence their satisfaction levels. By uncovering rich insights and capturing the nuances of human experiences, qualitative research enables healthcare providers to tailor their services to better meet the needs and preferences of patients. This approach not only enhances the quality of care delivered but also fosters patient trust, engagement, and satisfaction, ultimately contributing to improved health outcomes and overall healthcare system performance[167]. Thus, mixed method analysis is the best way to establish patient satisfaction

4.3 Mixed Method Analysis

Mixed method research approaches have been continuously used by the investigators in all the spheres of research without realizing its uses. However, last two decades, mixed method design have methodologically evolved and now recognized a systematic approach to study a complex phenomenon. This method is helpful in enhancing comprehensiveness and completeness of a study results. It involves the use of qualitative and quantitative data in a single research work. It represents an alternative methodological approach, combining qualitative and quantitative research approach, which enable nurse researchers to explore complex phenomena in details. In this section researcher wants to establish the level of satisfaction through mixed method analysis[168, 169].

4.3.1 Quantitative Research

Quantitative research constitutes a fundamental approach across diverse fields, spanning from the natural to the social sciences. It revolves around the systematic collection and analysis of numerical data to reveal trends, calculate averages, evaluate relationships, and derive overarching insights. Employing statistical techniques, quantitative data analysis rigorously processes and interprets numeric data to draw meaningful conclusions. Within the realm of quantitative research, meticulously crafted research designs dictate how data will be collected and analyzed. These designs often incorporate methods such as experiments and surveys, meticulously structured to ensure accuracy, reliability, and generalizability of findings. By providing quantifiable evidence and empirical support, quantitative research underpins informed decision-making, facilitates evidence-based practice, and advances knowledge across a countless of disciplines.The purpose of quantitative research is to generate knowledge and enhance understanding of the social world. Social scientists, including communication researchers, use quantitative methods to observe phenomena and occurrences that impact individuals. This research approach focuses on studying people and is employed to gain insights into specific groups, known as

sample populations. Through scientific inquiry, quantitative research utilizes data that are observed or measured to address questions related to the sample population[170].

4.3.2 Qualitative Research

Unlike quantitative research where the information is collected in the form of number, in qualitative research data is collected in the text form. Denzin and Lincoln (2005) provide a broad definition of qualitative research as follows: "Qualitative research is a situated activity that places the observer within the world. It involves a set of interpretive and material practices that render the world visible. These practices transform the world into a series of representations, such as field notes, interviews, conversations, photographs, recordings, and memos. Qualitative researchers employ a naturalistic approach, studying phenomena in their natural settings and striving to understand and interpret them based on the meanings that individuals attribute to them." In the health care sector most of the qualitative research is based on interviews with stakeholders to develop understanding of a phenomenon which is mostly descriptive in nature. Another definition of qualitative research is given by Stewart and Filice de Barros in 2017. As per their definition– "In qualitative research, data is collected to get in depth understanding (insight) of the underlying reasons, opinions, and motivations from subjects (study participants') point of view".

In this research data is collected at a cognitive level to explore the experience of the participants. It is constructive in nature in social science. Thus the purpose of this research work to understand the phenomena. Hence choice of qualitative methods should depend on the purpose and theoretical approach adopted to understand the research[171].

4.4 Data Collection and Results

Mixed methods research was adopted for data collection and analysis. For this,20 participants of are selected purposively as study participants. Data was collected from

January 2023 to June 2023 from the cardiology ward in selected hospital, Kolkata. Data collection was completed in two phases, which are described as follows:

In the 1st phase of data collection, quantitative data was collected by face to face interview after taking consent from each participant. It was used to assess the demographic characteristics as well as respondent's satisfaction regarding hospital service during their staying at hospital. Satisfaction data was collected on the basis of 5 dimensions, viz. tangibility, reliability, responsiveness, assurance, and empathy. After that, data was analyzed by using descriptive statistics, frequency and percentage for demographic representation and for satisfaction measurement frequency, percentage, mean, standard deviation and Gap analysis were used.

In the 2nd phase of data collection, qualitative data was collected by telephonic in-depth interview (IDI) of consenting participants. This qualitative strand of the study was conducted to explore the areas of dissatisfaction from health services. Whole conversation was recorded for coding the verbatim. Coding is the basic activity undertaken in qualitative data analysis. It was done to identify of words, sentences of verbatim which was relevant for research question. Then coding was marking such similar segments of data across several transcripts of audio and descriptive sentences. Repeated cycle of coding or level of coding was done. This phase may ignore the content which is not relevant to research question. After that, data was entered in to Microsoft word and analyzed manually by using colored marked pen for thematic approach where different themes are generated. Total process was placed through convergent parallel design (Fig.11) Then the appropriate themes are placed for data integration[172,173](Table 11).Here, qualitative and quantitative findings are separately generated (Table 12) and then inference can be made on the basis of comparing findings.

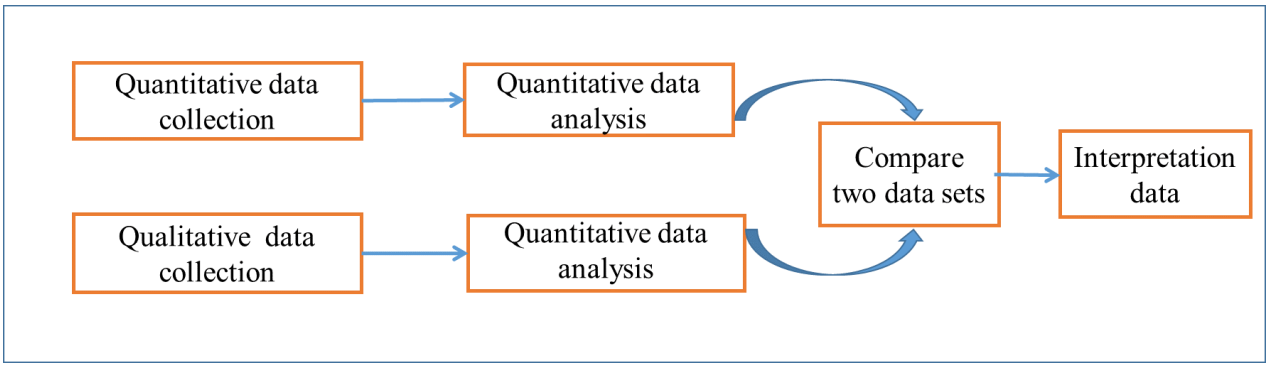

Fig.11: Convergent parallel design

Table 9: Description of demographic data n=20

Variables	Frequency	%
Age(yrs)		
35-50	3	15
51-65	9	45
66-80	8	40
Gender		
Male	13	65
Female	7	35
Religion		
Hindu	17	85
Muslim	3	15
Marrital status		
Married	17	85
Unmarried	2	10
Widow	1	5
Education		
No formal	1	5
Primary	9	45
Secondary	5	25
Higher Secondary	4	20
Diploma and	1	5
Above graduation	0	0
Residence		
Rural	10	50
Urban	10	50

Contd. Table 9: Description of demographic data

Variables	Frequency	%
Type of family		
Nuclear	10	50
Joint	10	50
No. Of family members		
<10	14	70
>10	6	30
Socio-economic status		
Class I(Upper class)	1	5
Class II	2	10
Class III(Middle class)	3	15
Class IV(Lower middle class)	7	35
Class V(Lower Class)	7	35
Occupation		
Business	7	35
Farmer	2	10
House wife	5	25
Labour	3	15
Unemployed	2	10
Retired	1	5
Service	1	5

Table 9 depicts that majority of the participants are male (65%) and 45% participants belong to the age group of 51-65yrs whereas only 15% participants are with the age group of 35-5-yrs.

It also reveals that there are 85% hindu participants and only 15% are muslim. On the other hand, there are mixed category of residence of participants i.e. rural (50%) and urban (50%) and same findings are shows in type of family, i.e. 50% nuclear and 50% belongs to joint family. Majority i.e. 70% are having total number of family member in <10.There are more married participants (85%) compared to widow i.e. 5%. Majority of the participants (45%) are having primary education and only 5% participants having diploma/graduation.

As per B.G.Prasad scale, 20 participants are distributed as per their economic classes. There are 35% participants under lower middle class and 35% are in lower class. Only 5% participants belongto upper income group.

On the other hand, distribution of occupation is varied like 35% are doing business and 25%, participants are house wife.

Table 10: Level of Patient satisfaction of the participants

n=138

Score: level of satisfaction	**Grading**	**Frequency**	**%**
> 80(mean + SD)	Highly satisfied	21	15.22
80-60	Satisfied	97	70.29
<60(mean - SD)	Low satisfied	20	14.49

It is stated that overall scores of participants have been estimated on the basis of mean and SD. Three level of satisfaction are considered as i) highly satisfied (score≥mean+SD), low satisfied (score<mean-SD) and satisfied (i.e. area between mean±SD).

Table 10 describes that majority i.e.70.29% among 138 patients are satisfied and only 15.22% are highly satisfied.

Table 11: Findings of thematic analysis n=20

Sl. No	Codes	Categories with frequency	Theme	Mean Age (Yrs)	Male (f)	Female (f)
1	Arrangement of ward is good	Inside ward arrangement (13)	Physical setup of cardiology ward	65.08	9	4
2	Ward cleanliness is satisfactory					
3	More toilet arrangement is require	Pattern of ventilation (8)		58.63	4	4
4	Cross ventilation is good					
5	Shorter/ not so much waiting time	Duration of waiting time (17)	Waiting time in OPD	62.12	13	4
6	Longer waiting time					
7	language barrier is present	Nurses communication regarding treatment (15)	Therapeutic communication, treatment regimen and behavior	60.33	9	6
8	Purpose of medicine is not explained					
9	Few nurses communication is not so good	Limited communication regarding disease process.(11)		61.45	5	6
10	Not clear explanation about operation					
11	Nurses give medicines on time					
12	Discharge advice is not explained					
13	Dressing of PPI side is explained					
14	Doctors behavior is accepted	Behavior of staff (15)		61.6	10	5
15	Rough behavior of other supporting staff					
16	Nominal treatment cost	Total treatment cost is less (11)	Cost of hospitalization	63.36	8	3
17	Operation cost is limited	Operation is cost-effective (9)		61	5	4
18	Nurses and doctors service is satisfactory	Satisfied from nurses and doctors(18)	Patient Satisfaction	62.39	11	7
19	Treatment regimens are also satisfactory	Satisfied treatment as per cost (13)		61.23	8	5

Through thematic exploration, it is evident that participants prioritize several key aspects within their healthcare experience. Chief among these concerns is the physical setup of the cardiology ward, highlighting the importance of a comfortable and conducive environment for healing. Among 20 participants, majority, i.e. 13 participants has given their positive opinion regarding inside of Ward arrangement. This means that most of them are satisfied about physical set-up of Cardiology Ward. Additionally, waiting times in the outpatient department (OPD) emerge as a significant issue needing improvement. On the other hand, therapeutic communication, treatment regimens, and provider behaviour also stand out, underlining the necessity for clear and empathetic communication between healthcare providers and patients. Lastly, the cost of hospital services is a major concern for participants, though it is generally accepted. Despite these challenges, participants express a high level of satisfaction with the overall hospital services, appreciating the quality of care and support they receive[174].

On the other hand, most of the participants are above 60 years old, with only a few just under 60 years of age. This suggests that their perceptions regarding the services they received have a certain depth, as they are experienced and likely have encountered various healthcare services over their lifetime. Additionally, the participant group comprised a mix of both female and male patients, providing a diverse perspective on the quality of care and patient satisfaction for pacemaker recipients. This demographic insight underscores the importance of addressing the specific needs and expectations of an older, gender-diverse patient population to enhance their overall healthcare experience and satisfaction.

Table12: Findings of qualitative exploration through joint display

Descriptive Theme	Qualitative Findings	Quantitative Findings	Inferences
			CONFIRMATION
Tangibility	PM patient had good experience in terms of arrangement of ward, ward cleanliness and presence of across ventilation	In this area The overall perceived score is 3.38± 1.26, whereas the overall expected score is 2.69±1.62	PM patients are satisfied in this attribute, related to Ward environment.
	But only 11 out of 20 PM patients observation is that more number of toilet arrangement is required	Not identified in quantitative study	------
	PM patient perceived that the waiting time in OPD is quite high	Mean perception (waiting time) is 2.22±1.56 and expectation is 2.62±3.68	Hospital service has negative impact on waiting time during OPD visit
			DISCORDANCE
Reliability	Overall explanation and therapeutic communication by the primary caregiver was not understandable.	Mean perception is higher (3.39±0.89) than mean expectation (2.83±0.85)	More than 80% PM patients were below secondary level. Hence, they did not able to receive all the instructions properly. On the other hand, due to hug load of patients the health personnel explained briefly regarding treatments and disease process.

Contd. Table12: Findings of qualitative exploration through joint display

Descriptive Theme	Qualitative Findings	Quantitative Findings	Inferences
Responsiveness	Most of the patients shared positive views about their interaction with health-personnel. They received satisfactory service through night time specially for management of pain after PPI	Mean perception (2.81±1.33) is higher and dispersed than mean expectation	**CONFIRMATION** Both Qualitative and Quantitative data supports each other's in this area
Assurance	Patients don't have that much expectation regarding behaviour, etiquettes of care providers. But they are overwhelmed by their action of care.	In this area, expectation score (2.83±0.88) is less than perception score, i.e. 4.13±0.83	**CONFIRMATION** Evaluation of patients opinion (Qualitative data) and findings at quantitative value promote each other
Empathy	Patients are eager to get compassionate care during hospital stay. Nurses and doctors feed their duty empathically as per patient's perception. But patient's expectation in this area was high.	Expectation = 2.44±0.94 Perception = 1.87±1.05	**DISCORDANCE** Description of treatment protocol, disease process is the art in nursing but it is lacking in public hospital. For this, nurses and doctors are not responsible always. The hospital management must be aware to bridge the gap between number of patient and that of recruitment of doctors and nurses. Furthermore, it is true that empathy is the keyword for comprehensive treatment of any kind of patient.

From qualitative joint display it has been concluded that there is two confirmed and two discordant inferences. The confirmed inferences (Tangibility, Responsiveness, Assurance) were those in which quantitative and qualitative data were consistent with each other, whereas discordance inference (Reliability, Empathy) resulted due to inconsistency of qualitative and quantitative data. The discordance findings were identified when participants in the qualitative strand offered more negative and mixed views about in depth interview[175].

Formulation of null hypothesis: There is no association with patient satisfaction and selected variables among PPI patients at 0.05 level of significance

Table 13: Association between Selected Variable and Patient's Satisfaction

n=138

Demographic variables	Level of satisfaction		Chi sq/yates score	p value	df
	below medium	above medium			
Gender			0.004	0.949	2
Male	44	40			
Female	28	26			
Age(yrs)					
35-63	35	37	0.766	0.381	6
64-92	37	29			
Education					
Below Secondary	57	57	1.241	0.265	1
Above Secondary	15	9			
Economic class					
less than equal to middle class	54	53	0.556	0.456	1
above middle class	18	13			
Occupation			0.002	0.964	1
Non Service	33	30			
Service	39	36			

It is found from Table 13 that H_0 is accepted and research hypothesis is rejected, that means there is no association present with patient satisfaction and selected variables on the basis of chi square values and p values at 0.05 level of significance.

4.5 Conclusion

This chapter deals with the assessment of patient satisfaction through mixed-method analysis. From the findings, it is clear that the majority of participants, 70.29%, are satisfied with the services provided. The important themes identified from the thematic analysis include the cost of hospitalization, therapeutic communication, treatment regimen and behaviour, waiting times in the outpatient department (OPD), and the physical setup of the cardiology ward. The vital point of this chapter is the joint display, which allows us to conclude that experienced participants, particularly those above 60 years of age, are generally satisfied with the hospital services. This comprehensive assessment highlights the areas of strength and the aspects needing improvement, providing valuable insights for enhancing patient satisfaction in the future.

Chapter 5: Indoor Air Quality and Respiratory Deposition Dose

5.1 Introduction

Clean, fresh air is essential for maintaining good indoor air quality (IAQ) in all buildings, but it is especially crucial for hospitals and other healthcare facilities[176]. There are some harmful pollutants inside buildings include carbon monoxide (CO), volatileorganic compounds (VOCs), particulate matter (PM), aerosol, biological pollutants, and others are responsible for air pollution.

Indoor air conditions contribute greatly to human wellbeing, as most people spendaround 90% of their time indoors, mainly at home or in the workplace. According to the Environmental Protection Agency (EPA), indoor air quality (IAQ) refers to the air quality within and around buildings and structures, with particular emphasis on the health and comfort of the occupants. This indoor air may be polluted in adverse environment. According to the WHO, indoor air pollution (IAP) is responsible for the deaths of 3.8 millionpeopleannually.IAP compositions significantly depending on sources, emission rates, and ventilationconditions. A staggering statistic reveals that 3.7 million premature deaths can be attributed to air pollution, indicating the severity of the problem. Premature deaths, occurring before the average life expectancy, are a distressing consequence of the impact of air pollution[177]. The main parameters for evaluation of IAQ include pollutantconcentrations, thermal conditions (temperature, airflow, and relative humidity), light, and noise.

Conversely, the concentration of outdoor pollutants can increase and be transported indoors through ventilation systems. Daily human activities contribute to indoor air pollution (IAP) by releasing waste gases, tobacco smoke, pesticides, solvents, cleaning agents, particulates, dust, mold, fibers, and allergens. Additionally, indoor environments can foster the growth

of various microorganisms and pests, including mold, fungi, pollen, spores, bacteria, viruses, and insects such as dust mites and cockroaches. Combustion sources and cooking activities further contribute to indoor air pollution by emitting carbon dioxide (CO_2), sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO2), and particulate matter (PM)[178].

Indoor air quality (IAQ) in hospitals is uniquely complex and differs significantly from that in residential and occupational environments. In addition to pollutants originating from within the hospital, contaminated airflow from outside can further degrade IAQ. Thus, maintaining high air quality is crucial not only for patient health but also for the well-being and efficiency of hospital staff, an aspect that is often overlooked[179].Generally, exposure to particulate matter (PM) adversely affects human health and causes seven million deaths per year[180]. Fossil fuel burning, industrial emission, fungal spore, pollen are significant contributor to PM pollution in both indoor and outdoor environments[181]. Patient care activities such as nebulization treatments, wound care, can generate airborne particles such as skin flakes and shed hair. Dust from aging ceilings, walls, and flooring can become airborne, specially during maintenance activities or regular renovation work. Construction materials used for renovations may also generate PM[182]. Beside this, Outdoor PM can enter buildings through open doors and windows and once outdoor PM enters, it deposits and accumulates as indoors dust. Official works of health sectors are also using laser printer which generate PM in indoor environment. Epidemiological studies have reported associations between PM exposure and a higher risk of cardiovascular morbidity and mortality[183]. Other than PM, air born microbes (fungi, bacteria and viruses) are also present in hospital environment. Bacterial, viral and fungal infections are frequently acquired via inhalation, among them pulmonary aspergillosis and pneumocystosis still represent high disease burden[184]. for admitted patient and hospital staff. Both PM concentration and airborne microbial loads for indoor air quality monitoring and control in hospitals is currently a necessary and integral part of prevention strategies against hospital-acquired infections[185,186].

Bio aerosols are universal, highly variable, complex, natural or man-made in origin. The air inhaled by people is abundantly populated with microorganisms which are also called bio aerosols. It is airborne particles that are living bacteria, viruses and fungi. Infectious

aerosols tend to be extremely small (less than 5µm) and therefore they remain suspended and viable in the air stream over long periods of time. As a result, there is a extremely high risk of airborne infection in confined places[187]. In hospitals, the presence of bio aerosols can compromise normal activities. The impact of bio-aerosols on indoor air quality is substantial, contributing to approximately 5 to 34% of indoor air pollution[188]. The presence of bio-aerosols in indoor environments can pose health risks, as exposure to microbial elements has been associated with respiratory issues, allergies, and other adverse health effects.

PM10, a major air pollutant composed of both solid and liquid particles suspended in the air, is respirable and can penetrate deeply into the respiratory system. The concentration and toxicity of PM10 particles are influenced by their composition, shape, size, the presence of other pollutants, and prevailing meteorological conditions[189]. PM10 poses a threat to all forms of life and serves as a key indicator of air pollution. Since the onset of industrialization, PM10 has emerged as a significant pollutant in urban, suburban, and even rural and remote areas worldwide. Many urban centers have PM10 levels that exceed the standards set by the World Health Organization (WHO) and national regulations (WHO 2016). The elevated concentration of pollutants such as PM2.5 will affect substantially more people in megacities than in rural regions.

Effective ventilation and air quality management are crucial in mitigating these risks and maintaining a safe healthcare environment. Hospital buildings may be regarded as dynamic environments affected by season, weather conditions, indoor ventilation system design and operation, intrusion of moisture, outdoor microbial load and the number of occupants, visitors and human activities. These factors may be associated with conditions for microbial growth. Achieving satisfactory IAQ in hospitals is thus a challenge for health care professionals, hospital managers and engineers. Studies conducted in countries like Pakistan, Iran, and Turkey have shown that bio aerosols can enter the body through ingestion and consumption, influencing human well-being[190]. According to different research conducted in Finnish hospitals, poor IAQ has a particularly negative effect on employees of the hospital, though the study did not focus on the risk of health hazards for patient, visitors, staff. The health quality of all people attached with hospital is necessary for proper management of hospital indoor environment[191].

Therefore, the study aims to assess the PM10, PM2.5, NOx, SOx, and microbial load at three wards of a city hospitals of the densely populated and highly polluted megacity Kolkata, India, with emphasis on the indoor climatic condition of the hospitals with seasonal variations. Using the data, respiratory deposition dose (RDD) will be determined which may suggest patient wise management priorities for hospital management. This is the first study in a hospital of tropical country and the results will be beneficial for policymakers in developing the indoor air quality guidelines and designing management frameworks of the hospital indoor environment, especially in developing countries.

5.2 Methodology

The present study was conducted to monitor both air quality and bio aerosol concentration at three different cardiology wards in a selected hospital Kolkata. Data on PM2.5, PM10, $Sox_,$ NO_x and bio aerosols were collected in three seasons. The description of the respective sampling locations is displayed in Fig 12 and Table 14.

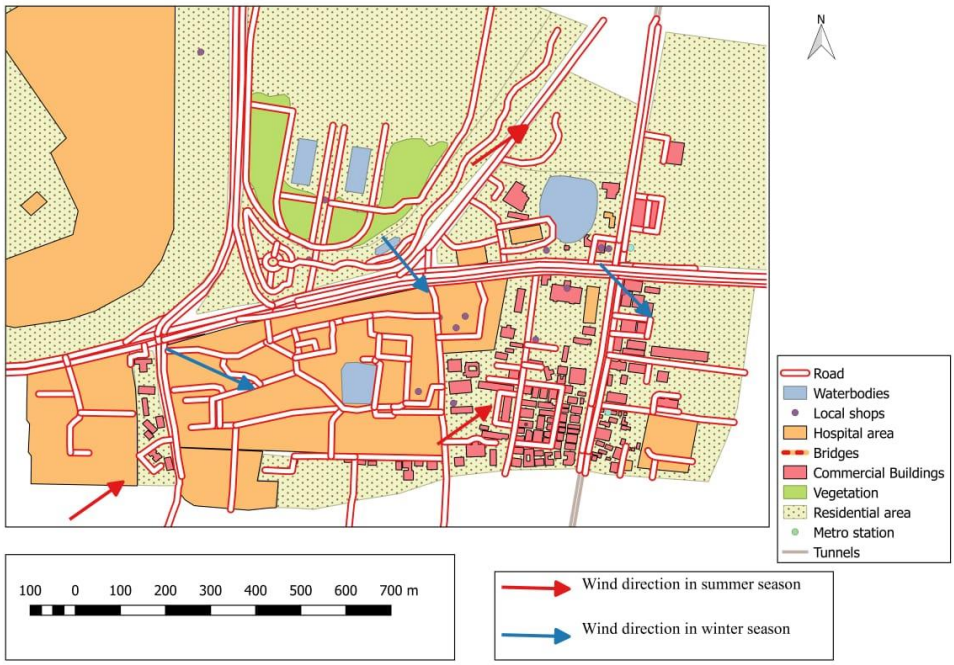

Fig 12: Location of city hospital and nearby roadways

Table14: Characteristics of hospital environment

Name of ward	No. of patient	No. of others members	Area of ward	No. of total windows open	Type of ventilation
Male 1	41	10	40*35*15 ft.	9	Natural
Male 2	15	10	17*35*15 ft.	6	
Female	41	15	40*35*15 ft.	9	

5.2.1 Measurement of Air Quality and Bio-aerosol Concentration

The measurement of PM 2.5 and PM10 were performed by using Temtop 200 air quality monitor (Fig.13), handheld monitor able to measure PM2.5, PM10, carbon dioxide, and formaldehyde and temperature and humidity. The instrument was kept on a height approximately 1meter from the ground. This device is running on the principle of laser technology detecting the particulate matters[192].SO_x, and NO_x was measured according to West-Gacke method and Jackob and Hocheiser modified method respectively[193]. The impinge samples were kept in ice boxes and analyzed spectrophotometrically (model LT-291). Here **Envirotech Handy Sampler** APM 821 was used to measure sample SO_x, and NO_x (Fig.14)

Fig. 13: Temtop 200

Fig. 14: Envirotech Handy Sampler APM 821

The Andersen two-stage viable (microbial) particle sampler (2-STG) was developed for monitoring bioaerosols.(Fig.15) It is a multi-orifice, cascade impactor with 400 holes per stage, drawing air at a flow rate of 28.3 L min-1. The different stages separate the airborne particles in size fractions[194]. For this study air sampling was done on Rose Bengal Agar Medium (HiMedia, Mumbai, India) at one meter height from the ground. The sampler was operated for fifteen minutes at the site in duplicate and an average was taken. The level of airborne fungal spores is usually expressed in terms of colony forming unit per cubic meter (CFU/m^3). For this atmosphere CFU/$m^3$is calculated by using equation given by with some modification. Colony forming unit per cubic meter (CFU/m3) is calculated from the following equation:

Colony Forming Unit (CFU) = $\frac{1000P}{RT}$CFU/m3

Where P is the number of colonies counted on the sample plate after correction by using positive hole conversion table provided by Andersen (1958), T is the duration of the test in min (10min.), and R is the air-sampling rate in Liters/min (28.3 L min-1)[195]

Fig. 15: Anderson's two stage air sampler

In this study, the water from an oxygen humidifier was collected in a sterile container to examine its bacterial content. To isolate the bacteria present, Mueller Hinton (MH) agar media was used in petri dishes. After the collection of the water sample,100µl was spread evenly over the surface of the MH agar plates. These plates were then incubated for a period of 24 hours at an 37^0C temperature conducive for bacterial growth.

Following the incubation period, the plates were observed inside the laminar airflow to facilitate a sterile environment and to prevent any external contamination. The colonies that developed on the agar surface were counted to estimate the bacterial population present in the water sample[196].

5.2.2 Estimation of RDDs

The RDD values are calculated using Equation (*ii*), which is mentioned below. The calculation

is adopted from the International Commission on Radiological Protection (ICRP; 1994) as well as from previous studies[197].

RDD of PM (size, i; in µg/min) = $(VT \times f) \times DFi \times PMi$ --------(*ii*)

where VT is the tidal volume (m3/breath), f denotes breathing frequency (breaths /minute), and DFi is the deposition fraction of a size fraction 'i' is the diameter for $PM_{2.5}$ is 2.5 µm and PM_{10} it is 10 µm PM_i = Mass concentration in different size ranges. The DF for total deposition was calculated using Eq. (*iii*), given by Hinds[198,199,200,201,202].

$$DF = IF\ (0.058 + \frac{0.911}{1+\exp(4.77+1.485\ lndp)} + \frac{0.943}{1+\exp(0.508-2.585\ lnd_p)}).....(iii)$$

$$IF = 1 - 0.5(\frac{1}{1+0.00076d_p^{2.8}}) \quad .....(iv)$$

IF is the inhalable fraction used by the ICRP model, and the *VT* and *f* values adopted in thisresearch is primarily determined by a person's physical activity and gender (Hinds, 1999). The different tidal volumes and breathing frequencies used in the calculations are shown in TableS1 (Appendix)

5.3 Results and Discussion

The study has been initiated for assessing indoor air quality data (Fig.19,20,21 and Table 17) of three wards of cardiology unit of a city hospital having tropical climate. The city Kolkata is thickly populated[203]and highly polluted[204] metropolis and capital of State West Bengal India, where millions of people come daily for their work and also use the public health care system available in state managed hospital. The present studied hospital is actually catered near about 20 Lakhs patient at outdoor patient department (OPD) in a particular year[205].

The present study was conducted to assess seasonal variations in air quality and bioaerosol levels. The findings indicate minimal variation in CO_2 concentration (Fig.16), with the highest level recorded at 661.92 μg/m³ in male 2 during the summer season. The highest temperature was observed in the summer season, reaching 90^0F (Fig.17).The highest humidity level, 90 μg/m³, was recorded in the monsoon season (Fig.18). Conversely, there was no significant seasonal variation in aldehyde concentration, which remained consistently low (Table 16).

The highest concentration of PM 2.5 was focused at summer in female ward followed by male 1 and male 2. The values are measured as 42.82, 34.78, and 22.88 μg/m^3 respectively. In the monsoon season, the lowest concentration of PM 2.5 (8.63 μg/m^3) was observed in the female ward, contrasting with other seasons. In winter highest concentration of PM 2.5 has been observed in male 2 ward followed by male 1 and female ward as shown in Fig19.

It is observedthat all the data in relation to PM 2.5 are higher than the recommended standard level of PM 2.5 by WHO i.e. 5 μg/m^3.These calculated highest values are seen in summer season and lowest values were observed in winter season. It is known that when the air near the ground is warm(summer) it moves upwards taking with the anthropogenic pollutants from industry, transportation etc. whereas in the winter the air near the earth surface is much cooler so the atmospheric turbulence is lower, causing lower dispersion of pollutants[15].This can be explained that the studied ward of the city hospital has well ventilation facilities (Table 14 and Fig. 12) and there were no HAVC air filter that can eliminate the PM coming from ambient environment. The ambient environment is polluted and pollution varies seasonally with meteorological parameter[206].

The same trend has been observed in case of concentration of PM 10. The highest concentration of PM 10 was focused at summer in female ward followed by male 1 and male 2 i.e. 65.23, 53.37, and 34.42μg/m^3 respectively. In the monsoon season, the lowest concentration of PM10 (13.54 μg/m^3) was observed, unlike in other seasons. In winter highest level of PM 10 was observed in male 2 ward followed by male 1 and female ward as shown in Fig.20. The concentration of PM 10 in summer was higher than the recommended standard level of PM 10 by WHO i.e. 39μg/$m^3$and rest of the value were lower than standard.

The variation in PM concentration between the three wards can be explained by activities that take place inside the hospital, such as routine dusting and floor cleaning, as well as the room's location in relation to traffic. The studied ward of the hospital is naturally ventilated and located almost center of the city, where lots of traffic congestion takes place. It is well established that, an area near a road, the air inside naturally ventilated buildings are more contaminated than the outside air[205]. The seasonal variation in pollutant concentration among male and female ward can be explained that during summer the wind direction from south west to north east, whereas at winter it comes from north west to south east direction. At summer specially all the windows of female and male ward usually open and the position of the female ward is southern direction, which encourage the entry of pollutant more than the male ward (Fig.12). Both in monsoon and winter most of the windows were closed during the sampling period which probably the cause of decreasing pollutant load (Fig.19,20).

The SOx concentration (17.36μg/m^3) in the hospital indoor environment in summer season (Fig.21) probably because of biomass or garbage burning in around the city hospital. Previous investigation has helped to established the idea that, elevated concentration of SOx where combustion derived man made pollution contributing about 60 % of fine particles at Kolkata followed by transportation sector (from vehicular emissions), coal base industries, food stall and open biomass burning[206]. The higher NOx concentration at winter was probably due to atmospheric inversion frequently found at city Kolkata.

The data of total microbial load assessed in this study specially in male 2 and female ward during monsoon (1254 CFU/m^3) was quite high (Table 17), which is because of higher relative humidity level in Kolkata (ranging 60-92%).It was clearly depicted that the concentration of bio aerosol are quite higher throughout the year compare to the standard set by WHO is 500 CFU/m^3

Usually, the window of those wards was closed during our sampling and the air movement was very less. The dampness in the indoor air encourages the growth of air borne bacterial particles, fungal spores, and hyphae (Fig. 22,23,24), which enter into the lung and infect the patient, healthcare providers and hospital staff and they supposed to be susceptible to respiratory tract infection, particularly during the winter and monsoon seasons. In the present study, moreover, we examined the water, present in the humidifier connected to oxygen cylinder, were also contaminated with bacteria (Fig.25). This incidence can be considered as direct contamination (DC. This particular DC, however, not harms the care givers, staff of the hospital rather the patient is much more vulnerable to their respiratory illness[207].

The RDD data taken from the patient of summer season had evidence to deposit more particulate matter than other two seasons (Fig. 26,27). The box whisker distribution of both RDD_{pm10} and $RDD_{pm2.5}$ indicated the lowest particulate deposition rate at winter followed by monsoon and summer. The RDD depends on the VT and f of the equation (*ii*) and patient record (*Appendix*)informed that VT and f did not vary so much for the PPI patient in the particular hospital. The mean value of VT for male and female was 0.69±0.25 and 0.46±0.24ml/Kg respectively and the f values varied 16±2 and 13±3 (beat/min) for male and female respectively (Table S2).

Table: 15 WHO reference of air pollutants

Pollutants	Concentration-WHO standard
CO_2	1800 µg/m^3
PM 2.5	5 µg/m^3
PM 10	39 µg/m^3
NO_2	40 µg/m^3
SO_2	20 µg/m^3
Bio aerosol	500 CFU

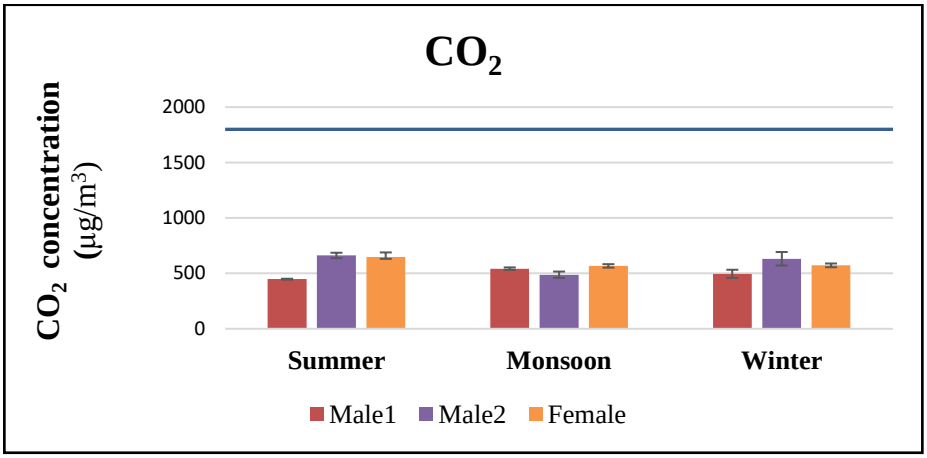

Fig.16: Concentration of CO_2

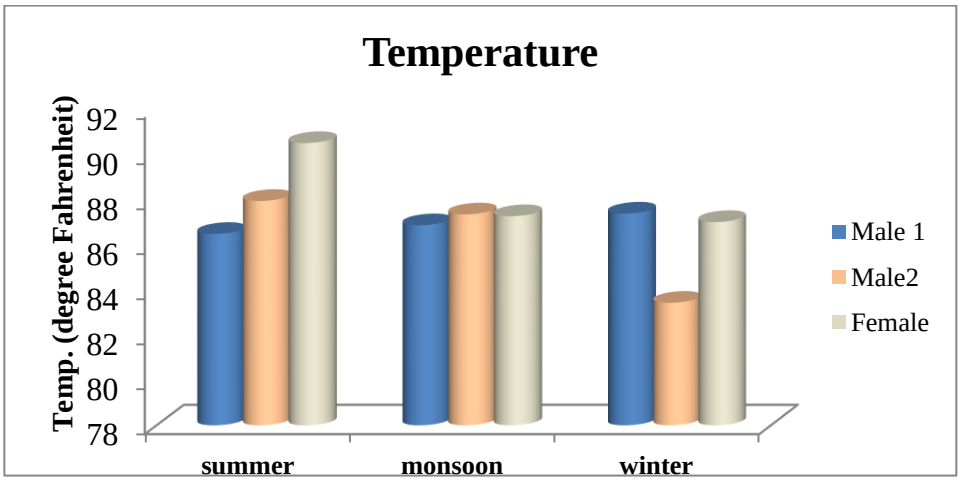

Fig.17 : Temp. measurement

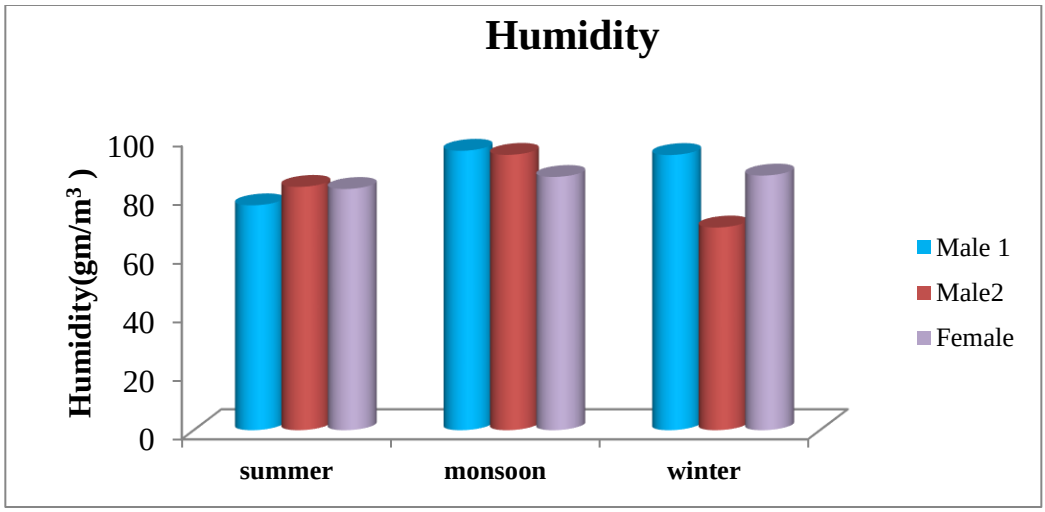

Fig.18: Humidity

Table 16: Concentration of aldehyde

	Summer	Monsoon	Winter
Male 1	0.033±0.11	0.001±0.000	0.001±0.000
Male2	0.0012±0.0005	0.001±0.000	0.014±0.002
Female	0.001±0.0004	0.004±0.005	0.004±.0.005

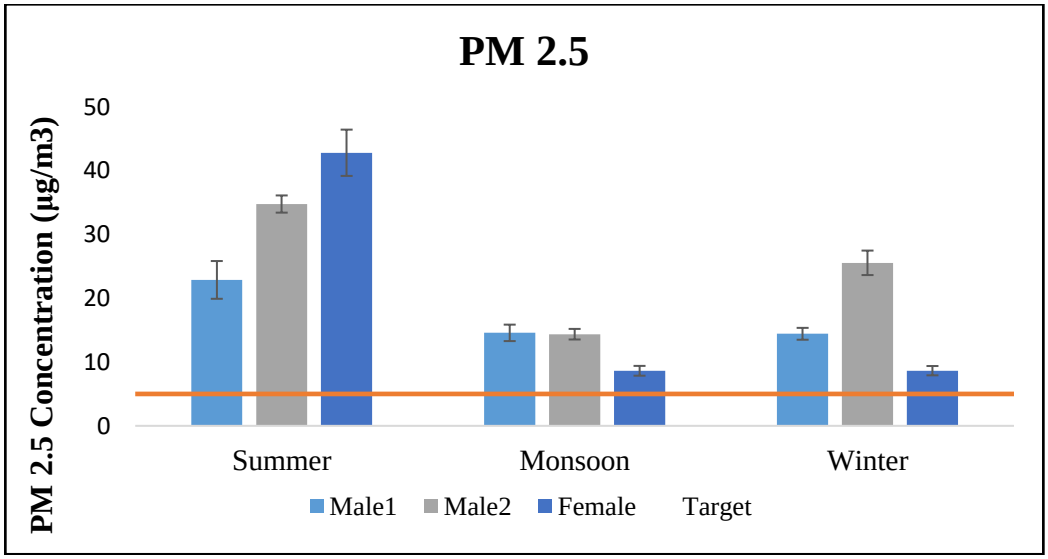

Fig. 19: Concentration of PM 2.5

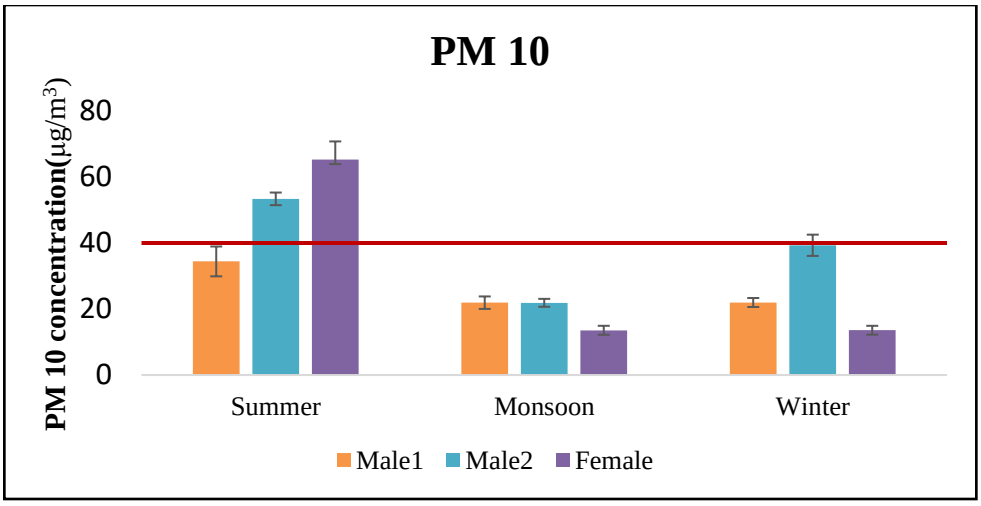

Fig. 20: Concentration of PM 10

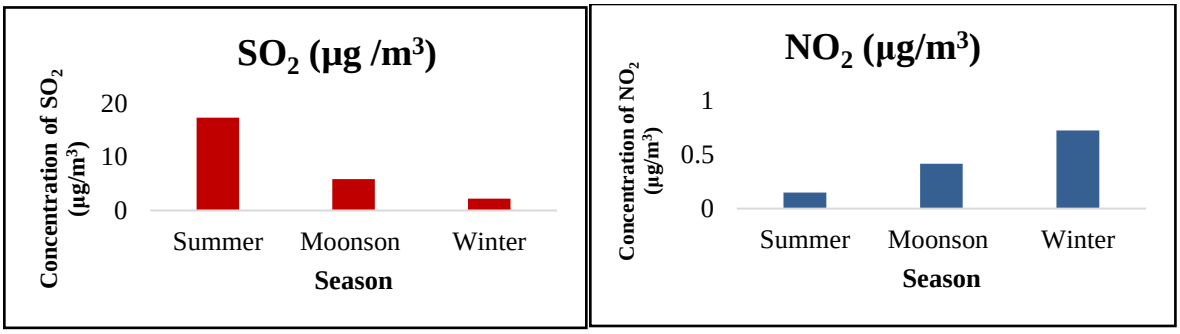

Fig. 21: Concentration of SO_2 and NO_2

Table 17: Bio aerosol concentration (CFU)

Season	Ward	CFU/m3
Summer (May)	Male 1	172
	Male 2	252
	Female	93
Monsoon (July)	Male 1	429
	Male 2	804
	Female	1254
Winter (Nov)	Male 1	436
	Male 2	829
	Female	778

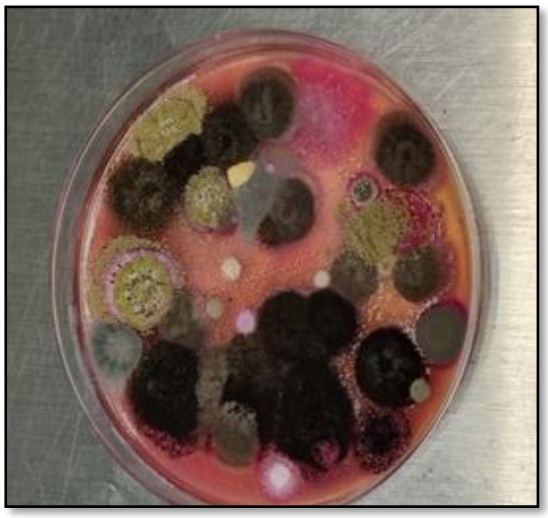

Fig. 22: Colonies in Summer

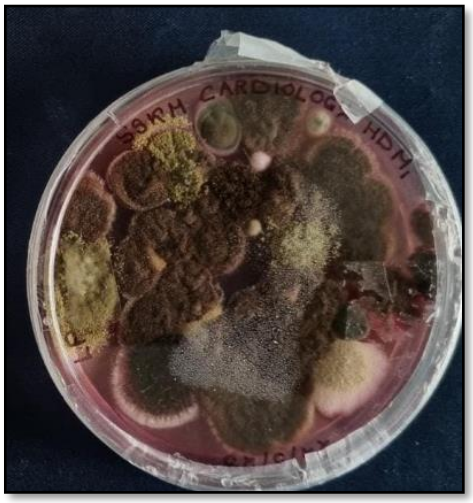

Fig. 23: Colonies in monsoon

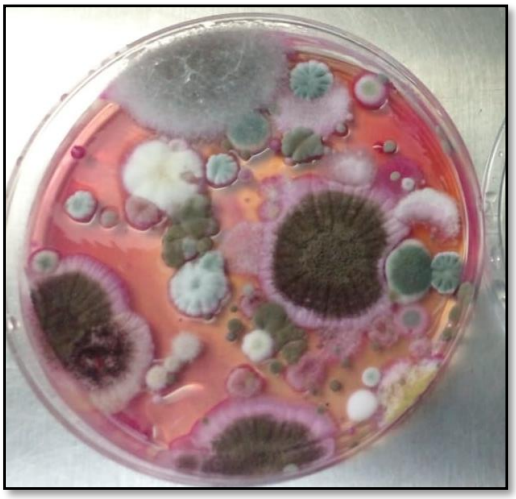

Fig. 24: Colonies in winter

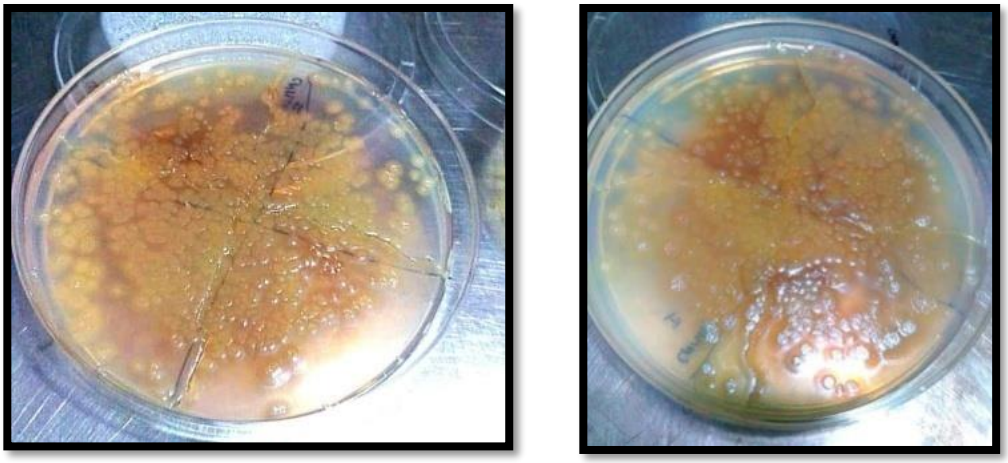

Fig.25: Colonies in Humidifier water

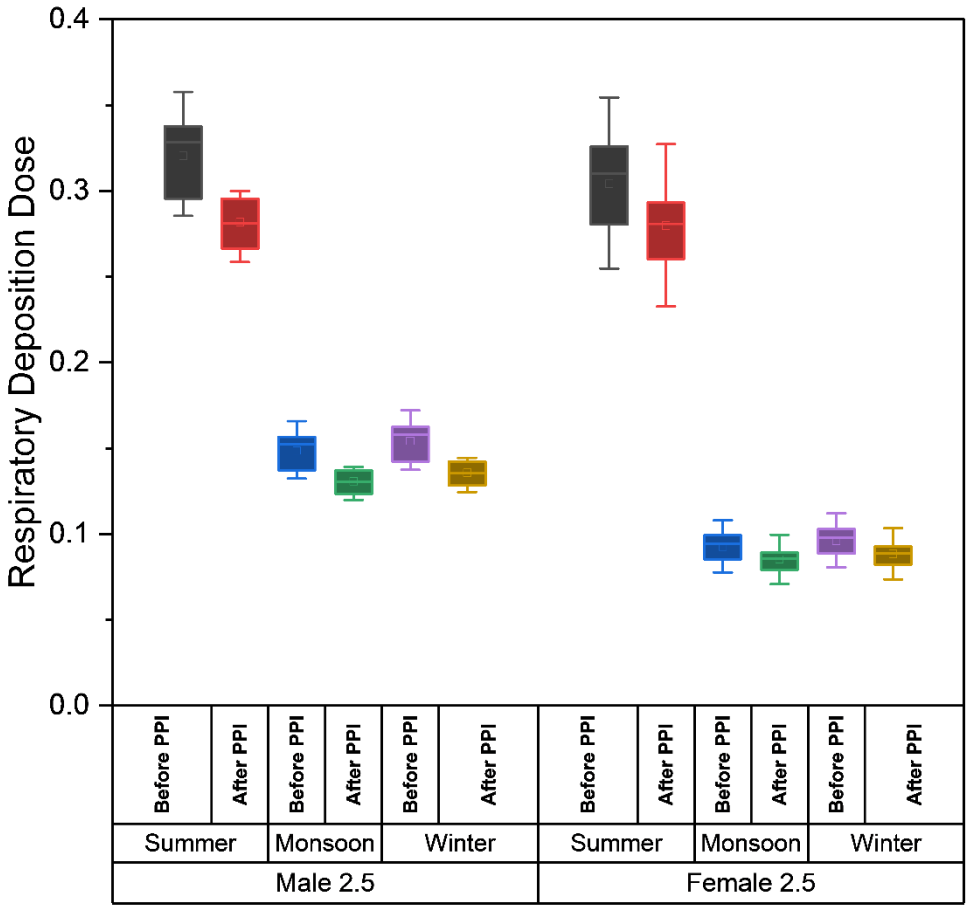

Fig. 26: RDD 2.5

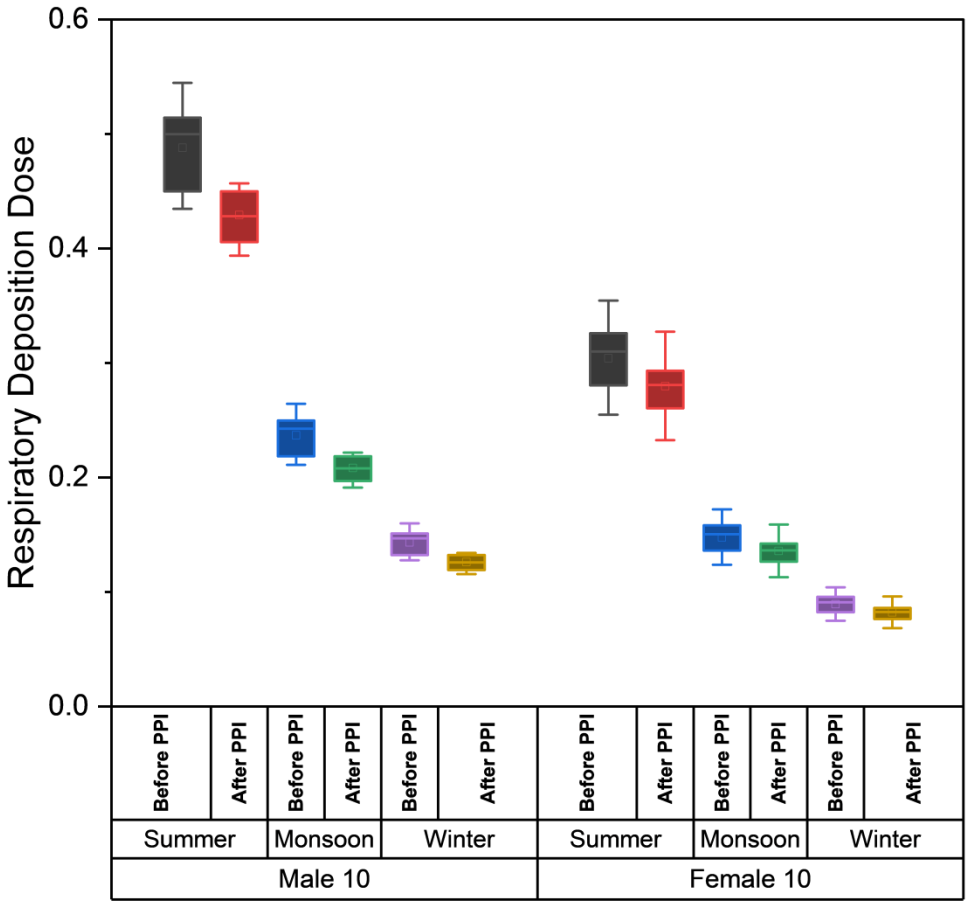

Fig.27: RDD 10

5.4 Proposed Process for IAQ Improvement

To address the impact of indoor air pollution (IAP) on both patients and caregivers and improve service quality and patient satisfaction, policymakers and administrators can adopt the following proposed process (Fig.28)

In input section, indoor air quality is considered in which the data is generated to reveal the seasonal variation of air pollutant including bio aerosol. Variation of the same is influenced by the outdoor air quality and ventilation of the ward. To clarify the input section, a few activities are incorporated in process section. By focusing on these inputs, policymakers and administrators can gain a comprehensive understanding of the current state of indoor

air quality within the healthcare facility and identify areas where intervention is needed to improve IAQ and promote the health and well-being of patients and care providers.

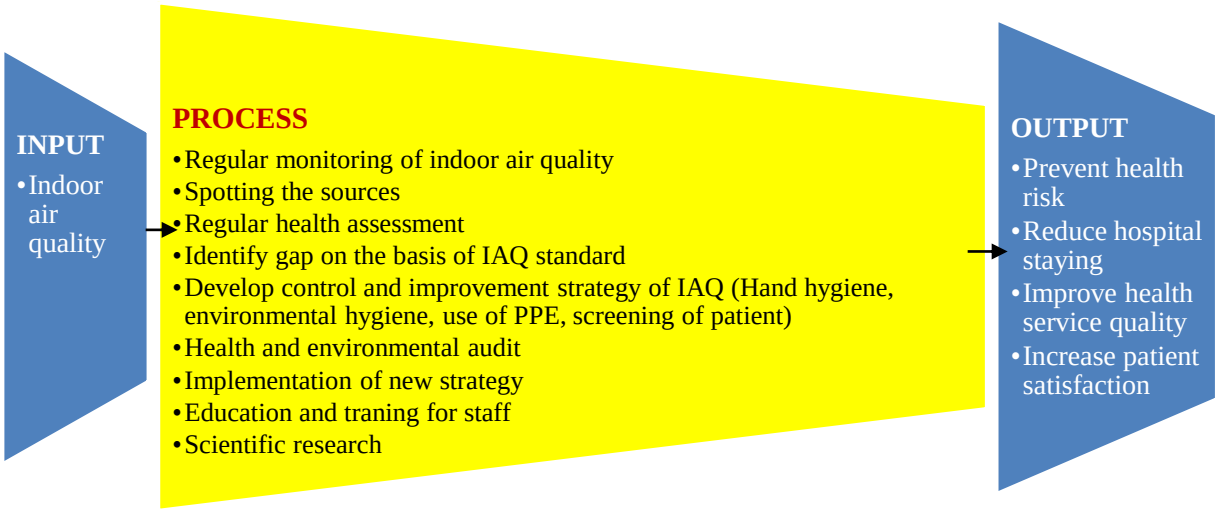

Fig.28: Process for IAQ improvement

In the next section, different processes are to be performed for achieving the best outcometo reduce hospital acquired infections.Regular monitoring of IAQ is essential in healthcare settings to ensure that the patients and staffs can breathe safe and healthy air. This involves continuous assessment and measurement of various chemical pollutants and contaminants present in the indoor environment such as particulate matter, SO_2, NO_2, CO_2, volatile organic compounds. Moreover, air born biological particles such as bacteria, fungican cause respiratory infections, severe headache, muscle ache, blurred vision etc. Researcher has observed that there is limited evidence of IAQ monitoring in cardiology wards. That is why there is a lacking to find out any deviations w.r.t. acceptable standards and take appropriate actions to mitigate potential health risks.Spotting the sources of indoor air pollution is crucial for effective mitigation efforts. Healthcare facilities must identify and address the specific sources of indoor air pollutants, which may include emissions from medical equipment, cleaning products, or building materials of surrounding area. In the current situation, several sources of indoor air quality (IAQ) issues have been observed. These include open dust bins, inadequate toilet facilities, accumulation of dust on windows, fans, and furniture, presence of insects within wards, unclean humidifier water, and occasional lapses in hand hygiene practices. Moreover,

Fig.24 illustrates that in cardiology ward the average growth of microbes in oxygen humidifier water is $2.74*10^4$ CFU/ml which is notably high. When oxygen sources are used microbes may enter the lung through respiration. Specially, those patient receiving nebulization through bronchodilator are prone to develop respiratory infection through humidifier water. Hence each of the above mentioned factors contributes to the potential spread of airborne contaminants and pathogens and hence increasing the risk of infections among patients and healthcare workers. It may also affect patient satisfaction and health care service. On the other hand, regular health assessments for both patients and staff are essential for detecting any adverse effects related to exposure to indoor air pollution. These assessments typically involve daily physical examinations, including monitoring blood pressure, temperature, pulse, and conducting lung auscultation to evaluate any signs of respiratory issues. By regularly monitoring these vital health indicators, healthcare professionals can promptly identify if any potential health concerns arising from exposure to indoor air pollutants. Early detection allows for timely intervention and appropriate management, helping to mitigate the risk of respiratory problems and other health issues associated with poor indoor air quality.Developing a comprehensive control and improvement strategy for IAQ is essential for mitigating indoor air pollution and promoting a pollution free healthy environment. This may also include measures such as promoting hand hygiene, enhancing environmental cleanliness, using personal protective equipment, and implementing screening protocols for patients. By addressing these factors, healthcare facilities can minimize the risk of indoor air pollution and improve the overall quality of care provided.Irrespective of all these precautions, health and environmental audits may help to assess the effectiveness of implemented control measures and identify areas for further improvement.Afterthat the implementation ofstrategies for IAQ improvement is critical for explaining policy into action. By effectively executing planned interventions and protocols, healthcare facilities can achieve measurable improvements in indoor air quality and enhance patient and staff satisfaction.Another important area is education and training for staff. There is some occasional training program in hospital on various topic to educate staff. But integrating education about indoor air quality (IAQ) into training programs are lacking which can greatly enhance staff awareness and understanding of the potential health risks associated

with poor airquality.It ensures the successful implementation of IAQ improvement strategies.By investing in research initiatives, healthcare facilities can contribute to the development of evidence-based strategies for IAQ management and future policy and decisions can be aimed at promoting a healthier indoor environment

Implementing the recommended protocols has led to a significant reduction in overall health risks for both patients and healthcare professionals, as depicted in the outcome section of Fig.28. This suggests an improvement in overall health quality, leading to greater patient satisfaction. With lower levels of airborne particles and bioaerosols, coupled with enhanced ventilation and cleanliness measures, the hospital environment becomes safer and more conducive to healing. As a result, patients experience improved outcomes and are more likely to feel satisfied with the care they receive.

5.5 Conclusion

The present study examines IAQ concerning the concentration of PM 2.5, PM 10, SO_2, and NO_2 in cardiology wards, at selected hospital, Kolkata. Findings reveal that PM 2.5 concentrations consistently exceed WHO standards across all seasons, while PM 10 levels surpass the standard only during summer. Additionally, seasonal bioaerosol levels range from 172-1254 CFU/m^3. In response, a new and comprehensive IAQ improvement strategy is proposed to enhance overall environmental health and service quality. Implementation of this strategy is anticipated to foster satisfaction among patients and healthcare providers by creating a more comfortable indoor environment.

The similar kinds of study may be conducted to other hospitals and residential buildings at Kolkata so that a data base with respect to the above-mentioned pollutants may be developed. The data base, as developed, will be useful to minimize effect of said pollutants. Moreover, it can act as reference of IAQ research in other regions and countries.

Chapter 6: Conclusion, Discussion and Future Scope

6.1 Introduction

The research work undertaken to address several issues on health service quality, patient satisfaction and air quality assessment. The main focus of this research is to study the hospital service performance where patients are the main customer of hospital. To explore this, researcher adopted a mixed method analysis and find out the lacuna. Not only that environmental factors may play a significant role on health. Indoor air quality assessment is performed to address those factors. This chapter summarizes the findings and conclusions of research work undertaken. Also, mentioned in this chapter are the specific contributions of the research work and the areas wherein future research work needs to be carried out.

6.2 Major findings of study

Overall, need and background of the present study is mentioned as follows:

(i) In essence, the research in the field of hospital quality is needed mainly because of it is primarily needed to ensure that healthcare facilities consistently provide safe, and efficient and effectivecare to patients. By conducting rigorous research, healthcare providers and policymakers can identify areas for improvement, implement evidence-based practices, and ultimately enhance the overall quality of care delivered in hospitals. This research helps in monitoring and improving patient outcomes, reducing medical errors, enhancing patient safety, optimizing resource utilization, benchmarking against industry standards, complying with regulations, and ultimately, improving the overall patient experience within healthcare settings.

(ii) To identify several shortcomings, a critical literature review was conducted to examine existing models and methodologies related to quality of service, patient satisfaction,

and ambient air quality. This process involved thoroughly analyzing previous research and publications to pinpoint gaps, limitations, and areas where current approaches may fall short in addressing these crucial aspects of healthcare delivery. Through this review, researchers aim to uncover opportunities for improvement, refinement, and development of more effective strategies that can enhance overall service quality, improve patient satisfaction levels, and ensure optimal ambient air quality within hospital environments.

(iii) It is felt that comprehensive modelling of SERVQUAL by Parasuraman is having relevant parameter to identify the existing services and gap. With the help of this methodologies, researchers prepare a self-structured questionnaire. By interview technique, it is applied for selected participants and finally is analysed by descriptive and inferential statistics.

(iv) In view of the above- mentioned requirements, a mixed method model is adopted to assess pacemaker patient satisfaction. In this section, several findings are made like, coding, thematic analysis, joint display and association between patient satisfaction and their demographic profile. Thematic analysis provided insights into qualitative aspects of satisfaction, while quantitative analysis is required to be allowed for statistical validation and exploration of demographic influences. The joint display has been facilitated a comprehensive presentation of findings, integrating qualitative themes with quantitative results to offer a holistic view of factors impacting patient satisfaction with pacemaker services.

(v) Environmental effects are an essential component in relation to the hospital quality service. In order to develop comprehensive methodologies, IAQ has been assessed followed by estimation of respiratory deposition dose. This approach aims to understand and mitigate the impact of indoor air pollutants on the health and well-being of hospital occupants, thereby enhancing overall service quality.

In relation to the above-mentioned background, major findings are described in the following sections:

(i) The study's findings reveal several key demographic characteristics of 138 participants. The majority of the participants are male (60.87%), with a significant proportion (42.03%) belonging to the age group of 51-65 years

(ii) The study's findings highlight the educational background of the participants, revealing that the majority (32.61%) have attained secondary education. A significant portion of the participants (28.99%) do not have any formal education, indicating a considerable level of educational disparity.

(iii) The study's findings reveal that a notable portion of participants (31.88%) fall under the lower middle class, while 30.43% belong to the middle class.

(iv) Among the 138 participants, the study finds that 26.8% are involved in business as their occupation. The distribution of other occupations is relatively even, with 16% being unemployed, 15.9% farmers, 12.32% service holders, 11.59% housewives, and 10.87% laborers. Only a small portion i.e. 6.52%, are retired. This distribution highlights a diverse range of occupational backgrounds among the participants.

(v) The study's findings on the perception and expectation of hospital services among pacemaker patients reveal that the mean scores for perception and expectation are close in the areas of tangibles and responsiveness. However, there is a significant difference between perception and expectation in the areas of empathy (-0.57 ± 1.24) and reliability (0.56 ± 1.03. The calculated t-values demonstrate that the difference between the expectation and perception of pacemaker patients is statistically significant ($p < 0.00$) across all quality dimensions.

(vi) The study identifies the importance of various variables in their contribution to the first principal component (PC1). Variables with higher PC1 values and lower ranks have a stronger influence on PC1, thereby having a greater impact on health services. The analysis reveals that the assurance variables 1, 2, 3, and 5 (representing different aspects of assurance) are the most relevant components contributing to hospital service quality. These assurance variables are key factors in evaluating and improving the overall quality of hospital services for pacemaker patients.

(vii) In mixed method analysis, among 20 participants, male is (65%), with 45% belonging to the age group of 51-65 years. Educationally, 45% of participants have primary education. According to the B.G. Prasad scale, 35% of participants fall into the lower middle class, 35% into the lower class. In this study, three levels of satisfaction were considered: highly satisfied (score $\geq$ mean + SD), low satisfied (score $<$ mean - SD), and satisfied (scores between mean $\pm$ SD). Table 8 reveals that the majority of patients

(70.29%) are satisfied, while 15.22% are highly satisfied. This data is based on a sample of 138 patients.

(viii) Through thematic exploration, it is evident that participants prioritize several key aspects within their healthcare experience. Chief among these concerns is the physical setup of the cardiology ward, highlighting the importance of a comfortable and conducive environment for healing. Therapeutic communication, treatment regimens, and provider behaviour also stand out, underlining the necessity for clear and empathetic communication between healthcare providers and patients. Lastly, the cost of hospital services is a major concern for participants, though it is generally accepted. Despite these challenges, participants express a high level of satisfaction with the overall hospital services, appreciating the quality of care and support they receive.

(ix) On the other hand, most of the participants are above 60 years old, with only a few just under 60 years of age. This suggests that their perceptions regarding the services they received have a certain depth, as they are experienced and likely have encountered various healthcare services over their lifetime. Additionally, the participant group comprised a mix of both female and male patients, providing a diverse perspective on the quality of care and patient satisfaction for pacemaker recipients. This demographic insight underscores the importance of addressing the specific needs and expectations of an older, gender-diverse patient population to enhance their overall healthcare experience and satisfaction.

(x) The highest concentration of PM 2.5 was focused at summer in female ward followed by male 1 and male 2. The values are measured as 42.82, 34.78, and 22.88 $\mu g/m^3$ respectively. The same trend has been observed in case of concentration of PM 10. The highest concentration of PM 10 was focused at summer in female ward followed by male 1 and male 2 i.e. 65.23, 53.37, and 34.42$\mu g/m^3$ respectively. It is observed that all the data in relation to PM 2.5 are higher than the recommended standard level of PM 2.5 by WHO i.e. 5 $\mu g/m^3$.

(xi) The highest concentration of $SO_2$was i.e.17.36 $\mu g/m^3$in summer season, whereas in same season the concentration of NO_2 was negligible

(xii) In this present study it was estimated that the concentrations of bio-aerosols was highest (1254 CFU/m^3) during monsoon in female ward followed by in winter (829 CFU/m^3) and summer (252CFU/m^3)

6.3 Discussion

The findings of the present study compared to some of previous studies need to be analyzed for describing critical contributions. In view of this, a brief discussion on different aspects of the present study is mentioned in the following sections.

6.3.1 Discussion with other study: Health service quality

In their cross-sectional study, Bahadori et al. (2014)[208] investigated the quality of services provided to patients with chronic kidney disease. Their demographic findings showed a predominance of male participants (59.2%), with a majority (60.9%) being older than 45 years, and a low percentage (12.5%) having an academic degree. These demographic characteristics align with those observed in the current study, where most participants are male (60.87%), a significant portion (42.03%) falls within the 51-65 years age group, and only 6.52% hold a diploma degree.

Regarding patient expectations and perceptions, Bahadori et al. reported negative gap scores across all dimensions of service quality i.e. tangibility (-0.29 ± 0.51), reliability (-0.34 ± 0.35), responsiveness (-0.36 ± 0.42), assurance (-0.42 ± 0.42), and empathy (-0.52 ± 0.48). Similarly, the present study also identifies a negative gap score, particularly in the area of empathy (-0.57 ± 1.24).

L. T. Linimol and B. Chandrachoodan Nair (2016) highlighted in their study that the health service gap scores were negative in the areas of reliability (-0.79), assurance (-1.33), and empathy (-1.24), while positive gap scores were noted in tangibility (0.23) and responsiveness (0.04).

In contrast, the present study shows positive gap scores in all areas except empathy, i.e. tangibility (0.69 ± 1.88), reliability (0.56 ± 1.03), responsiveness (0.28 ± 1.39), assurance

(1.29 ± 1.04), and empathy (-0.57 ± 1.24). The commonality in the negative gap score for empathy in both studies indicates that participants' expectations in this area consistently exceed their perceptions of the service received.

These findings suggest that healthcare managers should prioritize improvements in empathy, alongside other dimensions of service quality, to enhance patient satisfaction and care outcomes.

6.3.2 Discussion with other study: Patient Satisfaction

Satish Kumar Saginela et al. conducted a study to assess the satisfaction levels of outpatients attending outpatient departments, examining various facets of patient satisfaction such as general satisfaction, communication, interpersonal lrelations,technical quality, financial aspects, doctor consultation time, and accessibility and convenience. Their findings indicated that patients who were generally satisfied and also satisfied with accessibility and convenience rated their overall experience as very good. Those satisfied with communication, technical quality, doctor consultation time, and financial aspects rated their satisfaction as good. Meanwhile, patients satisfied with interpersonal relations rated their overall satisfaction as fair. The study noted that only one patient expressed overall poor satisfaction, and this outlier was excluded from the analysis[209].

In the present study, patient satisfaction was measured in terms of tangibility, reliability, responsiveness, assurance, and empathy. These dimensions align with the components used by Saginela et al., covering similar aspects of patient experience. The results of the current study show that a significant majority of participants (70.29%) reported being satisfied, with an additional 15.22% indicating they were highly satisfied. This comparison underscores that both studies, despite using different terminologies and frameworks, highlight the multifaceted nature of patient satisfaction and the importance of various service quality aspects in achieving high levels of patient contentment.

Arvind Sharma, P. K. Kasar, and Richa Sharma conducted[210] a study to assess patient satisfaction with hospital services from the outpatient department, focusing on various aspects of the patient experience. They reported that 78% of patients were satisfied with the consultant's behavior, 64% were satisfied with the behavior of nurses and paramedical

staff, and 84% were satisfied with the behavior of class 3 and class 4 workers. Additionally, 47% of patients gave a good general remark over their hospital experience, and 94% would recommend the hospital to friends and family. This study aligns with our findings, as the interview questions in our research were based on similar areas described by Sharma et al. The only difference lies in the way these aspects of patient satisfaction are described. Despite the variation in description, both studies emphasize the importance of various dimensions of patient interaction and service quality in determining overall patient satisfaction.

6.3.3 Discussion with other study: Indoor air quality

AzraKenarkoohi conducted a study[211] to assess indoor air quality (IAQ) in different Intensive Care Units (ICUs), finding that the levels of PM2.5 varied from 12.90 to 17.40 μg/m³, while the concentration of PM10 ranged from 22.93 to 41.37 μg/m³. In contrast, the present study focused on the concentration of PM2.5 and PM10 across different seasons. During summer, PM2.5 levels varied from 22.88 to 42.82 μg/m³, in monsoon from 8.63 to 14.58 μg/m³, and in winter from 8.65 to 25.56 μg/m³. The findings for PM10 showed that in summer, concentrations ranged from 34.42 to 65.23 μg/m³, in monsoon from 1.13 to 21.92 μg/m³, and in winter from 13.58 to 39.31 μg/m³. These results indicate that while Kenarkoohi's study reported relatively consistent levels of particulate matter within ICUs, the present study demonstrates significant seasonal variation in PM2.5 and PM10 concentrations, with higher levels observed during summer and lower levels during the monsoon season.

Santosh Kotgire conducted a study[212] on the bioaerosol assessment of indoor air in various hospital wards, including medicine, ICU, NICU, surgery, and ENT, with samples taken in the morning and evening. Specifically, in the Intensive Coronary Care Unit (ICCU), the colony-forming units (CFU) were found to be 1048 CFU/m³ in the morning. In contrast, the present study focused on the seasonal variation in CFU counts. The results showed a range of 93-1254 CFU/m³, indicating that bioaerosol levels fluctuate significantly with seasonal changes. This comparison highlights that while Kotgire's study provided a snapshot of bioaerosol levels at specific times of the day, the present study offers a broader view of how these levels vary across different seasons.

6.4 Comprehensive Discussion

Hospital service quality encompasses various elements that directly impact patient care and satisfaction. High-quality hospital services ensure timely and effective medical interventions, clear communication between healthcare providers and patients, and a supportive environment conducive to healing. In this study service quality negative gap is identified in the area of empathy (i.e. -0.57±1.24), whereas PPI patients are having positive experience regarding service in case of other service areas. Moreover, there arecontinuous improvement in service quality required in different areas likes empathy, responsiveness, reliability and so on. It not only enhances patient outcomes but also fosters trust and confidence in healthcare institutions. Thus, prioritizing and maintaining superior service quality remains paramount in delivering optimal healthcare experiences.

Patient satisfaction among pacemaker recipients is highly influenced by service quality. Satisfaction levels (70.29%) are linked to medical competence, effective communication, efficient administration, and facility comfort. Indoor air quality also plays a critical role, as clean air reduces infection risks, especially important for pacemaker patients.In mixed method design, the same findings have been inferred regarding patient satisfaction. Therefore, ensuring comprehensive and compassionate hospital services is crucial for enhancing the satisfaction and well-being of pacemaker patients.

Hospital indoor air quality plays a critical role not only in maintaining a healthy environment for patients and staff but also in influencing pacemaker patient satisfaction[213,214]. High indoor air quality contributes to a comfortable and safe recovery environment, promoting better outcomes and patient satisfaction. The present study also infers that hospitals prioritize indoor air quality assessments (lowest PM2.5-8.65μg/m^3, lowest PM10-13.54 μg/m^3), bio aerosol measurements (highest is 1254 CFU/m^3) and maintenance demonstrate a commitment to patient well-being among pacemaker patients and their families. Therefore, infection hazards risk i.e. the chances for developing respiratory and other infections will be reduced. Therefore, integrating robust indoor air quality management into hospital service protocols is essential for ensuring both the health and satisfaction of all patients, including those with specialized medical needs like pacemaker recipients.

6.5 Scope of further work

Though a number of relevant issues of Health Service, Patient satisfaction and indoor air quality have been investigated by the author, any study of this level opens up new opportunities and scopes to carry out similar studies in future. Hence, possibility of research in this area may be vast. However, based on experience and research in this area, the author identifies the following important areas or issues which need further research:

1. In order to generalize the health service, some other types of hospitals, like private, semi-private, Nursing Homes, etc. may also be considered in the similar conditions with the help of questionnaire.
2. Moreover, in view of different disease conditions, some more health issues, like renal patients, diabetic patients, post-surgical patient etc. may be deliberated so that a set of generic factors may be identified for more satisfaction of patients.
3. In order to model the hospital quality and patient satisfaction, other advanced statistical techniques, multi-variate regression, tree-based methods, factor analysis etc. may also be adopted.
4. To correlate indoor air quality (IAQ) with the diseases, more IAQ factors, like bacteria, dust etc. may be considered.

References

1. Carrión-Camacho MR, Marín-León I, Molina-Doñoro JM, González-López JR. Safety of permanent pacemaker implantation: A prospective study. J Clin Med. 2019;8(1):1–11.
2. Glickman SW, Baggett KA, Krubert CG, Peterson ED, Schulman KA. Promoting quality: The health-care organization from a management perspective. Int J Qual Heal Care. 2007;19(6):341–8.
3. Chauhan S, Clinic N, Aeri B. Prevalence of cardiovascular disease in India and its. Int Jounal Sci Res. 2017;Volume3(March):1–5.
4. Sharma JK, Narang R. Quality of healthcare services in rural India: The user perspective. Vikalpa. 2011;36(1):51–60.
5. Chokshi M, Patil B, Khanna R, Neogi SB, Sharma J, Paul VK, et al. Health systems in India. J Perinatol. 2016;36(s3):S9–12.
6. Celermajer DS, Chow CK, Marijon E, Anstey NM, Woo KS. Cardiovascular disease in the developing world: Prevalences, patterns, and the potential of early disease detection. J Am Coll Cardiol. 2012;60(14):1207–16.
7. Narang R. Measuring perceived quality of health care services in India. Int J Health Care Qual Assur. 2010;23(2):171–86.
8. Mosadeghrad AM. Healthcare service quality: Towards a broad definition. Int J Health Care Qual Assur. 2013;26(3):203–19.
9. Peabody JW, Taguiwalo MM, Robalino DA, Frenk J. Improving the Quality of Care in Developing Countries. Inst Med. 2001;Chapter 70(Berwick 1989):1293–308.
10. Moore L, Lavoie A, Bourgeois G, Lapointe J. Donabedian's structure-process-outcome quality of care model: Validation in an integrated trauma system. J Trauma Acute Care Surg. 2015;78(6):1168–75.
11. Andaleeb SS. Service quality perceptions and patient satisfaction: A study of hospitals in a developing country. Soc Sci Med. 2001;52(9):1359–70.

12. Löfgren A, Åkesson O, Johansson J, Persson J. Hospital costs and health-related quality of life from complications after esophagectomy. Eur J Surg Oncol. 2021;47(5):1042–7.

13. Lee D, Kim KK. Assessing healthcare service quality: a comparative study of patient treatment types. Int J Qual Innov [Internet]. 2017;3(1):1–15. Available from: http://dx.doi.org/10.1186/s40887-016-0010-5

14. Liu A, Guo X, Liu T, Zhang Y, Tsai SB, Zhu Q, et al. A GRA-Based Method for Evaluating Medical Service Quality. IEEE Access. 2019;7:34252–64.

15. Cleven A, Mettler T, Rohner P, Winter R. Healthcare quality innovation and performance through process orientation: Evidence from general hospitals in Switzerland. Technol Forecast Soc Change [Internet]. 2016;113:386–95. Available from: http://dx.doi.org/10.1016/j.techfore.2016.07.007

16. McAloon CJ, Osman F, Glennon P, Lim PB, Hayat SA. Global epidemiology and incidence of cardiovascular disease [Internet]. Cardiovascular Diseases: Genetic Susceptibility, Environmental Factors and their Interaction. Elsevier Inc.; 2016. 57–96 p. Available from: http://dx.doi.org/10.1016/B978-0-12-803312-8.00004-5

17. Peterson ED, Roe MT, Delong ER, Lytle BL, Brindis RG, Smith SC, et al. Association Between Hospital Process Performance and Outcomes Among Patients With Acute Coronary Syndromes. 2006;295(16).

18. Ferreira DC, Marques RC. Do quality and access to hospital services impact on their technical efficiency? Omega (United Kingdom) [Internet]. 2019;86:218–36. Available from: https://doi.org/10.1016/j.omega.2018.07.010

19. Dixit SK. Integration of importance-performance analysis into the strategy of hospitals. Int J Healthc Manag [Internet]. 2017;10(3):178–83. Available from: https://doi.org/10.1080/20479700.2016.1241036

20. Aeyels D, Seys D, Sinnaeve PR, Claeys MJ, Gevaert S, Schoors D, et al. Managing in-hospital quality improvement: An importance-performance analysis to set priorities for ST-elevation myocardial infarction care. Eur J Cardiovasc Nurs. 2018;17(6):535–42.

21. Zarei E, Bagheri A, Daneshkohan A, Khodakarim S. Patients' views on service quality in selected Iranian hospitals: An importance-performance analysis. Shiraz E Med J. 2020;21(8):1–7.

22. Ghorbani Z, Faraji-Khiavi F, Jahanbani E, Dindamal B. The Importance-Performance Analysis of the Quality of Services Provided for Patients in Hospitals Affiliated to Ahvaz Jundishapur University of Medical Science. Heal Technol Assess Action. 2021;5(1):1–9.

23. Afandi D, Arini M. Importance-Performance Analysis of Clinical Forensic Services Quality at Bhayangkara Hospital Pekanbaru, Indonesia. Malaysian J Med Sci. 2024;31(1):103–13.

24. Mohebifar R, Hasani H, Barikani A, Rafiei S. Evaluating Service Quality from Patients' Perceptions: Application of Importance–performance Analysis Method. Osong Public Heal Res Perspect [Internet]. 2016;7(4):233–8. Available from: http://dx.doi.org/10.1016/j.phrp.2016.05.002

25. Fitriati R, Rahmayanti KP. "Government Support in Triple Helix Collaboration to Provide Health Service Delivery: Case Study Government Hospital in Bengkulu Hospital." Procedia - Soc Behav Sci [Internet]. 2012;52:160–7. Available from: http://dx.doi.org/10.1016/j.sbspro.2012.09.452

26. Punnakitikasem P, Buavarapor N, Maluesri P, Leelartapin K. Health Care Service Quality: Case Example of a Hospital with Lean Implementation. POMS 23 rd Annu Conf Chicago, Illinois, USA April 20 to April 23, 2012 [Internet]. 2012;2–6. Available from: http://www.cmmu.mahidol.ac.th/research/index.php/conferences?view=publication&task=show&id=289

27. Moran A, Forouzanfar M, Sampson U, Chugh S, Feigin V, Mensah G. The epidemiology of cardiovascular diseases in sub-saharan Africa: The global burden of diseases, injuries and risk factors 2010 study. Prog Cardiovasc Dis [Internet]. 2013;56(3):234–9. Available from: http://dx.doi.org/10.1016/j.pcad.2013.09.019

28. Pagidipati NJ, Gaziano TA. Estimating deaths from cardiovascular disease: A review of global methodologies of mortality measurement. Circulation. 2013;127(6):749–56.

29. Kalaja R, Myshketa R, Scalera F. Service Quality Assessment in Health Care Sector: The Case of Durres Public Hospital. Procedia - Soc Behav Sci [Internet]. 2016;235(October):557–65. Available from: http://dx.doi.org/10.1016/j.sbspro.2016.11.082

30. Newsome PRH, Wright GH. A review of patient satisfaction: 1. Concepts of satisfaction. Br Dent J. 1999;186(4):161–5.

31. Williams B, Coyle J, Healy D. THE MEANING OF PATIENT SATISFACTION: AN EXPLANATION OF HIGH REPORTED LEVELS. Soc Sci Med. 1998;47(9):1351–9.

32. Batbaatar E, Dorjdagva J, Luvsannyam A, Amenta P. Conceptualisation of patient satisfaction: A systematic narrative literature review. Perspect Public Health. 2015;135(5):243–50.

33. Pascoe GC. Patient satisfaction in primary health care: A literature review and analysis. Eval Program Plann. 1983;6(3–4):185–210.

34. Rahmqvist M. Patient satisfaction in relation to age, health status and other background factors: A model for comparisons of care units. Int J Qual Heal Care. 2001;13(5):385–90.

35. Naidu A. Factors affecting patient satisfaction and healthcare quality. Int J Health Care Qual Assur. 2009;22(4):366–81.

36. Chahal H, Mehta S. Modeling patient satisfaction construct in the Indian health care context. Int J Pharm Healthc Mark. 2013;7(1):75–92.

37. Niemi-Murola L, Pöyhiä R, Onkinen K, Rhen B, Mäkelä A, Niemi TT. Patient Satisfaction with Postoperative Pain Management-Effect of Preoperative Factors. Pain Manag Nurs. 2007;8(3):122–9.

38. Antonovsky A. The Structure and Properties of the Coherence Sense. Soc Sci Med [Internet]. 1993;36(6):725–33. Available from: https://pdf.sciencedirectassets.com/271821/1-s2.0-S0277953600X02523/1-s2.0-027795369390033Z/main.pdf?X-Amz-Security-Token=IQoJb3JpZ2luX2VjELb%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJHMEUCIQDGAItPZKHX4aMiikQ%2BO4HtSBFbLz4BPKwp5OanG%2B7vzwIgZhzttiXzF

39. Abrahamsen Grøndahl V, Hall-Lord ML, Karlsson I, Appelgren J. Exploring patient satisfaction predictors in relation to a theoretical model. Int J Health Care Qual Assur. 2013;26(1):37–54.

40. Merkouris A, Papathanassoglou EDE, Lemonidou C. Evaluation of patient satisfaction with nursing care: Quantitative or qualitative approach? Int J Nurs Stud. 2004;41(4):355–67.

41. Jalil A, Zakar R, Zakar MZ, Fischer F. Patient satisfaction with doctor-patient interactions: a mixed methods study among diabetes mellitus patients in Pakistan. BMC Health Serv Res. 2017;17(1):1–13.

42. Waters S, Edmondston SJ, Yates PJ, Gucciardi DF. Identification of factors influencing patient satisfaction with orthopaedic outpatient clinic consultation: A qualitative study. Man Ther [Internet]. 2016;25:48–55. Available from: http://dx.doi.org/10.1016/j.math.2016.05.334

43. Naveed RT, Albassami AM, Ahmad N, Moshfegyan M. Patient Satisfaction through modified SERVQUAL Model. Pacific Bus Rev Int [Internet]. 2019;11(7):96–106. Available from: https://www.researchgate.net/publication/332604927

44. Akdag H, Kalayci T, Karagöz S, Zülfikar H, Giz D. The evaluation of hospital service quality by fuzzy MCDM. Appl Soft Comput J [Internet]. 2014;23:239–48. Available from: http://dx.doi.org/10.1016/j.asoc.2014.06.033

45. Božić J, Ilić P, Ilić S. Indoor air quality in the hospital: The influence of heating, ventilating and conditioning systems. Brazilian Arch Biol Technol. 2019;62(May).

46. Wilson AM, Salloway JC, Wake CP, Kelly T. Air pollution and the demand for hospital services: A review. Environ Int. 2004;30(8):1109–18.

47. Carlson KJ, Eisenstat SA, Ziporyn T. The Impact of Air Quality on Hospital Spending. The Women's Concise Guide to Emotional Well-Being. 2021. 224–243 p.

48. Scherer G. Biomonitoring of inhaled complex mixtures - Ambient air, diesel exhaust and cigarette smoke. Exp Toxicol Pathol. 2005;57(SUPPL. 1):75–110.

49. Berry LL, Parasuraman A, Zeithaml VA. SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. J Retail. 1988;64(1):12–40.

50. Wang Z, Zhou Y, Zhang Y, Huang X, Duan X, Chen D, et al. Association of change in air quality with hospital admission for acute exacerbation of chronic obstructive pulmonary disease in Guangdong, China: A province-wide ecological study. Ecotoxicol Environ Saf [Internet]. 2021;208(November 2020):111590. Available from: https://doi.org/10.1016/j.ecoenv.2020.111590

51. Kenarkoohi A, Noorimotlagh Z, Falahi S, Amarloei A, Mirzaee SA, Pakzad I, et al. Hospital indoor air quality monitoring for the detection of SARS-CoV-2 (COVID-19) virus. Sci Total Environ [Internet]. 2020;748:141324. Available from: https://doi.org/10.1016/j.scitotenv.2020.141324

52. Ramphal L, Suzuki S, Mccracken IM, Addai A. Improving Hospital Staff Compliance with Environmental Cleaning Behavior. Baylor Univ Med Cent Proc. 2014;27(2):88–91.

53. Eckelman MJ, Sherman J. Environmental impacts of the U.S. health care system and effects on public health. PLoS One. 2016;11(6):1–14.

54. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Int J Surg. 2010;8(5):336–41.

55. Kamioka H. Preferred reporting items for systematic review and meta-analysis protocols (prisma-p) 2015 statement. Japanese Pharmacol Ther. 2019;47(8):1177–85.

56. Berry LL, Parish JT, Dikec A. Creating value through quality service. Organ Dyn [Internet]. 2020;49(3). Available from: https://doi.org/10.1016/j.orgdyn.2019.04.002

57. Butler TW, Leong GK. The impact of operations competitive priorities on hospital performance. Health Care Manag Sci. 2000;3(3):227–35.

58. Malmmose M, Kure N. Putting the patient first? The story of a decoupled hospital management quality initiative. Crit Perspect Account [Internet]. 2021;80(xxxx):102233. Available from: https://doi.org/10.1016/j.cpa.2020.102233

59. Moscelli G, Gravelle H, Siciliani L, Gutacker N. The effect of hospital ownership on quality of care: Evidence from England. J Econ Behav Organ [Internet]. 2018;153:322–44. Available from: https://doi.org/10.1016/j.jebo.2018.05.009

60. Gaughan J, Siciliani L, Gravelle H, Moscelli G. Do small hospitals have lower quality? Evidence from the English NHS. Soc Sci Med. 2020;265.

61. Barsanti S, Walker K, Seghieri C, Rosa A, Wodchis WP. Consistency of priorities for quality improvement for nursing homes in Italy and Canada: A comparison of optimization models of resident satisfaction. Health Policy (New York) [Internet]. 2017;121(8):862–9. Available from: http://dx.doi.org/10.1016/j.healthpol.2017.06.004

62. Saghier NM El. Managing Service Quality : Dimensions of service quality : a study in Egypt. 2013;1(September):82–9.

63. Munhurrun P R, Bhiwajee S D L, "Service quality in the public service", International Journal of Management and Marketing Research 3(1), 2010, pp. 37-50

64. Handayani PW, Hidayanto AN, Sandhyaduhita PI, Kasiyah, Ayuningtyas D. Strategic hospital services quality analysis in Indonesia. Expert Syst Appl [Internet]. 2015;42(6):3067–78. Available from: http://dx.doi.org/10.1016/j.eswa.2014.11.065

65. Budiwan V, Efendi. The Understanding of Indonesian Patients of Hospital Service Quality in Singapore. Procedia - Soc Behav Sci. 2016;224(August 2015):176–83.

66. Peprah AA, Atarah BA. Assessing Patient's Satisfaction using SERVQUAL Model: A Case of Sunyani Regional Hospital, Ghana. Int J Bus Soc Res [Internet]. 2014;4(2):133–43. Available from: http://thejournalofbusiness.org/index.php/site/article/view/404

67. Shafii M, Rafiei S, Abooee F, Bahrami MA, Nouhi M, Lotfi F, et al. Assessment of Service Quality in Teaching Hospitals of Yazd University of Medical Sciences: Using Multi-criteria Decision Making Techniques. Osong Public Heal Res Perspect. 2016;7(4):239–47.

68. Safari Y, Mohammadi Cheshmeh-Kaboodi A, Yousefi B. The data on the quality of services, satisfaction, psychological commitment and oral advertising in clinical centers in Kermanshah. Data Br. 2019;23:23–6.

69. Wiguna AA, Widyatami LE, Cnawp RP. Consumer Satisfaction and Trust As Determinants of. 2023;12(03):437–45.

70. Ahmad Zamil AM, Areiqat AY, Tailakh W. The Impact of Health Service Quality on Patients' Satisfaction over Private and Public Hospitals in Jordan: A Comparative Study. Int J Mark Stud. 2012;4(1).

71. Butt MM, de Run EC. Private healthcare quality: Applying a SERVQUAL model. Int J Health Care Qual Assur. 2010;23(7):658–73.

72. Kalaja R, Myshketa R, Scalera F. Service Quality Assessment in Health Care Sector: The Case of Durres Public Hospital. Procedia - Soc Behav Sci. 2016;235(October):557–65.

73. Hehenkamp B, Kaarbøe OM. Location choice and quality competition in mixed hospital markets. J Econ Behav Organ. 2020;177(160364472):641–60.

74. Avdic D, Moscelli G, Pilny A, Sriubaite I. Subjective and objective quality and choice of hospital: Evidence from maternal care services in Germany. J Health Econ [Internet]. 2019;68:102229. Available from: https://doi.org/10.1016/j.jhealeco.2019.102229

75. Shieh JI, Wu HH, Huang KK. A DEMATEL method in identifying key success factors of hospital service quality. Knowledge-Based Syst [Internet]. 2010;23(3):277–82. Available from: http://dx.doi.org/10.1016/j.knosys.2010.01.013

76. Kim J, Han W. Improving Service Quality in Long-term Care Hospitals: National Evaluation on Long-term Care Hospitals and Employees Perception of Quality Dimensions. Osong Public Heal Res Perspect. 2012;3(2):94–9.

77. Kalid N, Zaidan AA, Zaidan BB, Salman OH, Hashim M, Albahri OS, et al. Based on Real Time Remote Health Monitoring Systems: A New Approach for Prioritization “Large Scales Data” Patients with Chronic Heart Diseases Using Body Sensors and Communication Technology. J Med Syst. 2018;42(4).

78. Mohanan M, Hay K, Mor N. Quality of health care in India: challenges, priorities, and the road ahead. Health Affairs. 2016 Oct 1;35(10):1753-8.

79. Chakraborty R, Majumdar A. Measuring consumer satisfaction in health care sector : the applicability of SERVQUAL. J Arts, Sci Commer [Internet]. 2011;2(4):149–60. Available from: http://www.researchersworld.com/vol2/issue4/Paper_17.pdf

80. Ramanujam PG. Service quality in health care organisations: A study of corporate hospitals in Hyderabad. J Health Manag. 2011;13(2):177–202.

81. Ravichandran D, Kaneswaran K. A Study on Service Quality Gap between State and Private Hospitals in Trincomalee. Indian J Appl Res. 2016;6(12):155–8.

82. Mohan R, Kumar KS. A study on the satisfaction of paitnets with reference to hospital services. ZENITH Int J Bus Econ Manag Res [Internet]. 2011;1(3):15. Available from: www.zenithresearch.org.in

83. Naidu A. Factors affecting patient satisfaction and healthcare quality. Int J Health Care Qual Assur. 2009;22(4):366–81.

84. Ferreira DC, Marques RC. Do quality and access to hospital services impact on their technical efficiency? Omega (United Kingdom) [Internet]. 2019;86:218–36. Available from: https://doi.org/10.1016/j.omega.2018.07.010

85. Ayaad O, Alloubani A, ALhajaa EA, Farhan M, Abuseif S, Al Hroub A, et al. The role of electronic medical records in improving the quality of health care services: Comparative study. Int J Med Inform [Internet]. 2019;127(January):63–7. Available from: https://doi.org/10.1016/j.ijmedinf.2019.04.014

86. Oi-Zhen S, Weng-Wai C, Yu-Tian T. Quality of healing environment in healthcare facilities. J Teknol. 2015;74(2):101–8.

87. Camilleri D, O’Callaghan M. Comparing public and private hospital care service quality. Int J Health Care Qual Assur. 1998;11(4):127–33.

88. Chang BL, Kao HO, Lin SJ, Yang SH, Kuo YW, Jerng JS. Quality gaps and priorities for improvement of healthcare service for patients with prolonged mechanical ventilation in the view of family. J Formos Med Assoc. 2019;118(5):922–31.

89. Li LX. Relationships between determinants of hospital quality management and service quality performance - A path analytic model. Omega. 1997;25(5):535–45.

90. Tuzkaya G, Sennaroglu B, Kalender ZT, Mutlu M. Hospital service quality evaluation with IVIF-PROMETHEE and a case study. Socioecon Plann Sci [Internet]. 2019;68(April):100705. Available from: https://doi.org/10.1016/j.seps.2019.04.002

91. Kahraman C, Büyüközkan G, Ateş NY. A two phase multi-attribute decision-making approach for new product introduction. Inf Sci (Ny). 2007;177(7):1567–82.

92. La Fata CM, Lupo T, Piazza T. Service quality benchmarking via a novel approach based on fuzzy ELECTRE III and IPA: an empirical case involving the Italian public healthcare context. Health Care Manag Sci. 2019;22(1):106–20.

93. Liu KFR, Lai JH. Decision-support for environmental impact assessment: A hybrid approach using fuzzy logic and fuzzy analytic network process. Expert Syst Appl [Internet]. 2009;36(3 PART 1):5119–36. Available from: http://dx.doi.org/10.1016/j.eswa.2008.06.045

94. Todd L. Accepted manuscript Development Accepted manuscript. 2015;0121(June):1–33.

95. NGUYEN TTN. Gender Differences in Determinants of Customer Satisfaction in Beauty and Cosmetic E-commerce. J Asian Financ Econ Bus. 2020;7(10):811–22.

96. Vogus TJ, McClelland LE. When the customer is the patient: Lessons from healthcare research on patient satisfaction and service quality ratings. Hum Resour Manag Rev [Internet]. 2016;26(1):37–49. Available from: http://dx.doi.org/10.1016/j.hrmr.2015.09.005

97. Rahmqvist M, Bara AC. Patient characteristics and quality dimensions related to patient satisfaction. Int J Qual Heal Care. 2010;22(2):86–92.

98. Peprah AA, Atarah BA. Assessing Patient's Satisfaction using SERVQUAL Model: A Case of Sunyani Regional Hospital, Ghana. Int J Bus Soc Res [Internet]. 2014;4(2):133–43. Available from: http://thejournalofbusiness.org/index.php/site/article/view/404

99. Otani K, Herrmann PA, Kurz RS. Patient satisfaction integration process: Are there any racial differences? Health Care Manage Rev. 2010;35(2):116–23.

100. Saginela SK, Madri AK, Desu RM, Bola VR. Assessment of Satisfaction Levels of the Outpatients Attending Outpatient Departments in a Quaternary Care Hospital. Int J Res Found Hosp Healthc Adm. 2020;7(2):91–8.

101. Chandra D. Reducing Waiting Time of Outdoor Patients in Hospitals Using Different Types of Models: A Systematic Survey. Int J Adv Res Innov. 2015;3(1):1–10.

102. Downey-Ennis K. Patient satisfaction. Int J Health Care Qual Assur. 2011;24(3):196–7.

103. Dr. R. Venkatesh DSR. An Empirical Study of the Factors Influencing Quality of Healthcare and Its Effects on Patient Satisfaction. Int J Innov Res Sci Eng Technol. 2015;04(02):54–9.

104. Kol E, Arıkan F, İlaslan E, Akıncı MA, Koçak MC. A quality indicator for the evaluation of nursing care: determination of patient satisfaction and related factors at a university hospital in the Mediterranean Region in Turkey. Collegian. 2018;25(1):51–6.

105. Kleefstra SM, Kool RB, Veldkamp CMA, Winters-Van Der Meer ACM, Mens MAP, Blijham GH, et al. A core questionnaire for the assessment of patient satisfaction in academic hospitals in the Netherlands: Development and first results in a nationwide study. Qual Saf Heal Care. 2010;19(5).

106. Chang WJ, Chang YH. Patient satisfaction analysis: Identifying key drivers and enhancing service quality of dental care. J Dent Sci. 2013;8(3):239–47.

107. Panteli V, Patistea E. Assessing patients' satisfaction and intensity of pain as outcomes in the management of cancer-related pain. Eur J Oncol Nurs. 2007;11(5):424–33.

108. Pini A, Sarafis P, Malliarou M, Tsounis A, Igoumenidis M, Bamidis P, et al. Assessment of patient satisfaction of the quality of health care provided by outpatient services of an oncology hospital. Glob J Health Sci. 2014;6(5):196–203.

109. Koutsimpou P, Gourgoulianis KI, Economou A, Raftopoulos V. Data on expectations, perceived quality, satisfaction with hospital care and financial ability of patients who suffer from acute and chronic respiratory diseases, in Central Greece. Data Br. 2020;30(February 2016).

110. Wolf DM, Lehman L, Quinlin R, Zullo T, Hoffman L. Effect of patient-centered care on patient satisfaction and quality of care. J Nurs Care Qual. 2008;23(4):316–21.

111. Keatinge D. Negotiated care--fundamental to nursing practice. Collegian. 1998;5(1):36–42.

112. Yellen E, Davis GC. Patient Satisfaction in Ambulatory Surgery. AORN J. 2001;74(4):483–6.

113. Chaves C, Santos M. Patient Satisfaction in Relation to Nursing Care at Home. Procedia - Soc Behav Sci. 2016;217:1124–32.

114. Goh ML, Ang ENK, Chan YH, He HG, Vehviläinen-Julkunen K. A descriptive quantitative study on multi-ethnic patient satisfaction with nursing care measured by the Revised Humane Caring Scale. Appl Nurs Res [Internet]. 2016;31:126–31. Available from: http://dx.doi.org/10.1016/j.apnr.2016.02.002

115. Niemi-Murola L, Pöyhiä R, Onkinen K, Rhen B, Mäkelä A, Niemi TT. Patient Satisfaction with Postoperative Pain Management-Effect of Preoperative Factors. Pain Manag Nurs. 2007;8(3):122–9.

116. Jenkinson C, Coulter A, Bruster S, Richards N, Chandola T. Patients' experiences and satisfaction with health care: Results of a questionnaire study of specific aspects of care. Qual Saf Heal Care. 2002;11(4):335–9.

117. Abrahamsen Grøndahl V, Hall-Lord ML, Karlsson I, Appelgren J. Exploring patient satisfaction predictors in relation to a theoretical model. Int J Health Care Qual Assur. 2013;26(1):37–54.

118. Xiao H, Barber JP. The effect of perceived health status on patient satisfaction. Value Heal. 2008;11(4):719–25.

119. Kitapci O, Akdogan C, Dortyol İT. The Impact of Service Quality Dimensions on Patient Satisfaction, Repurchase Intentions and Word-of-Mouth Communication in the Public Healthcare Industry. Procedia - Soc Behav Sci. 2014;148:161–9.

120. Nassour I, Hester C, Yopp A, Zureikat A. Survival outcomes of pancreatic cancer resection using the robotic approach: A nationwide comparison to open surgery. Hpb [Internet]. 2020;22:S181. Available from: https://doi.org/10.1016/j.hpb.2020.04.740

121. Markazi-Moghaddam N, Kazemi A, Alimoradnori M. Using the importance-performance analysis to improve hospital information system attributes based on nurses' perceptions. Informatics Med Unlocked. 2019;17.

122. Parasuraman A, Zeithaml VA, Berry LL. A Conceptual Model of Service Quality and Its Implications for Future Research. J Mark. 1985;49(4):41.

123. Kulašin D, Fortuny-Santos J. Review of the SERVQUAL concept. 4th Res Conf with … [Internet]. 2005;9–12. Available from: http://www.quality.unze.ba/zbornici/QUALITY 2005/021-Q05-005.pdf

124. Ghobadian A, Speller S, Jones M. Ghobadian1994.Pdf. 1994;11(9):43–66.

125. Seth N, Deshmukh SG, Vrat P. Service quality models: A review. Vol. 22, International Journal of Quality and Reliability Management. 2005. 913–949 p.

126. Ratnaningtyas DD, Surendro K. Information Quality Improvement Model on Hospital Information System Using Six Sigma. Procedia Technol. 2013;9:1166–72.

127. Lupo T. A fuzzy framework to evaluate service quality in the healthcare industry: An empirical case of public hospital service evaluation in Sicily. Appl Soft Comput J [Internet]. 2016;40:468–78. Available from: http://dx.doi.org/10.1016/j.asoc.2015.12.010

128. Chang TH. Fuzzy VIKOR method: A case study of the hospital service evaluation in Taiwan. Inf Sci (Ny) [Internet]. 2014;271(March):196–212. Available from: http://dx.doi.org/10.1016/j.ins.2014.02.118

129. Kalid N, Zaidan AA, Zaidan BB, Salman OH, Hashim M, Albahri OS, et al. Based

on Real Time Remote Health Monitoring Systems: A New Approach for Prioritization “Large Scales Data” Patients with Chronic Heart Diseases Using Body Sensors and Communication Technology. J Med Syst. 2018;42(4).

130. Singh A, Prasher A, Kaur N. Assessment of hospital service quality parameters from patient, doctor and employees’ perspectives. Total Qual Manag Bus Excell [Internet]. 2020;31(13–14):1467–86. Available from: https://doi.org/10.1080/14783363.2018.1487283
131. Zimmermann HJ. Fuzzy set theory. Wiley Interdiscip Rev Comput Stat. 2010;2(3):317–32.
132. Tariq S, Woodman J. Using mixed methods in health research. JRSM Short Rep. 2013;4(6):204253331347919.
133. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs - Principles and practices. Health Serv Res. 2013;48(6 PART2):2134–56.
134. Royal Australian College of General Practitioners, Nursing P. Australian Primary Health Care Australian General Practice Network Charting New Roles for Australian. 2008;(December).
135. R.A. K, B.B. de B, A.L. F, D.M. D. How nurses and their work environment affect patient experiences of the quality of care: a qualitative study. BMC Health Serv Res [Internet]. 2014;14:249. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L603325377%0Ahttp://dx.doi.org/10.1186/1472-6963-14-249
136. Younas A, Pedersen M, Tayaben JL. Review of Mixed-Methods Research in Nursing. Nurs Res. 2019;68(6):464–72.
137. Bressan V, Bagnasco A, Aleo G, Timmins F, Barisone M, Bianchi M, et al. Mixed-methods research in nursing – a critical review. J Clin Nurs. 2017;26(19–20):2878–90.
138. Robinson P. Designing and Conducting Mixed Methods Research. Aust N Z J Public Health. 2007;31(4):388.
139. Mukherjee A, Agrawal M. World air particulate matter: sources, distribution and health effects. Environ Chem Lett. 2017;15(2):283–309.

140. Bruce N, Perez-padilla R, Albalak R. Bruce, Perez-Padilla, _ Albalak_2000_"Indoor Air Pollution in Developing Countries_A Major Environmental and Public Health Challenge.pdf. 2000;78(9).

141. Hosamane SN, Desai GP. Urban Air Pollution Trend in India - Present Scenario. Int J Innov Reseach Sci Eng Technol. 2013;2(8):3738–47.

142. Wilson AM, Salloway JC, Wake CP, Kelly T. Air pollution and the demand for hospital services: A review. Environ Int. 2004;30(8):1109–18.

143. Kaplan HC, Brady PW, Dritz MC, Hooper DK, Linam WM, Froehle CM, et al. The influence of context on quality improvement success in health care: A systematic review of the literature. Milbank Q. 2010;88(4):500–59.

144. Batalden PB, Davidoff F. What is "quality improvement" and how can it transform healthcare? Qual Saf Heal Care. 2007;16(1):2–3.

145. Gupta R, Mohan I, Narula J. Trends in Coronary Heart Disease Epidemiology in India. Ann Glob Heal [Internet]. 2016;82(2):307–15. Available from: http://dx.doi.org/10.1016/j.aogh.2016.04.002

146. Chauhan S, Aeri BT. Prevalence of cardiovascular disease in India and it is economic impact- A review. 2013;3(10):1–5.

147. Asadi-Lari M, Packham C, Gray D. Patients' satisfaction and quality of life in coronary artery disease. Health Qual Life Outcomes. 2003;1:1–7.

148. Polikandrioti M. Patient Perceptions and Quality of Life in Pacemaker Recipients. J Innov Card Rhythm Manag. 2021;12(12):4769–79.

149. Carrión-Camacho MR, Marín-León I, Molina-Doñoro JM, González-López JR. Safety of permanent pacemaker implantation: A prospective study. J Clin Med. 2019;8(1):1–11.

150. Udo EO, Zuithoff NPA, Van Hemel NM, De Cock CC, Hendriks T, Doevendans PA, et al. Incidence and predictors of short- and long-term complications in pacemaker therapy: The FOLLOWPACE study. Hear Rhythm [Internet]. 2012;9(5):728–35. Available from: http://dx.doi.org/10.1016/j.hrthm.2011.12.014

151. Helder MRK, Schaff H V., Hanson KT, Thiels CA, Dearani JA, Daly RC, et al. Patient Experience After Cardiac Surgery: Identifying Areas for Improvement. Ann Thorac Surg [Internet]. 2019;107(3):780–6. Available from: https://doi.org/10.1016/j.athoracsur.2018.09.049

152. Ellenbogen KA, Wood MA, Shepard RK. Delayed complications following pacemaker implantation. PACE - Pacing Clin Electrophysiol. 2002;25(8):1155–8.

153. Shi Z, Shang H. A review on quality of service and servqual model [Internet]. Vol. 12204 LNCS, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). Springer International Publishing; 2020. 188–204 p. Available from: http://dx.doi.org/10.1007/978-3-030-50341-3_15

154. Teng CI, Ing CK, Chang HY, Chung KP. Development of service quality scale for surgical hospitalization. J Formos Med Assoc [Internet]. 2007;106(6):475–84. Available from: http://dx.doi.org/10.1016/S0929-6646(09)60297-7

155. Padma P, Sai LP, Rajendran C. A comprehensive framework for measuring service quality perceptions of patients: A case of Indian hospitals. 5th Int Conf Serv Syst Serv Manag - Explor Serv Dyn with Sci Innov Technol ICSSSM'08. 2008;(1991):2–7.

156. METHODS OF DATA COLLECTION : QUESTIONNAIRE AND SCHEDULE Author (s): K . D . Gangrade Source : Journal of the Indian Law Institute , OCTOBER-DECEMBER 1982 , Vol . 24 , No . 4 Published by : Indian Law Institute Stable URL : http://www.jstor.com/stable/43. 1982;24(4):713–22.

157. Aithal A, Aithal PS. Development and Validation of Survey Questionnaire & Experimental Data – A Systematical Review-based Statistical Approach. SSRN Electron J. 2020;

158. Sharma S, Mudgal S, Thakur K, Gaur R. How to calculate sample size for observational and experiential nursing research studies? Natl J Physiol Pharm Pharmacol. 2019;10(0):1.

159. Das S, Mitra K, Mandal M. Sample size calculation: Basic principles. Indian J Anaesth. 2016;60(9):652–6.

160. Bhalerao S, Kadam P. Sample size calculation. Int J Ayurveda Res. 2010;1(1):55.

161. Espa S, Rodríguez MM, González-ramírez AR. Allergologia et immunopathologia Sample size calculation. Allergol Immunopathol (Madr) [Internet]. 2016;42(5):485–92. Available from: http://dx.doi.org/10.1016/j.aller.2013.03.008

162. Tavakol M, Dennick R. Making sense of Cronbach's alpha. Int J Med Educ. 2011;2:53–5.

163. Agbo AA. Cronbach's Alpha: Review of Limitations and Associated Recommendations. J Psychol Africa. 2010;20(2):233–9.

164. Finsterer J. Annals of Internal Medicine. Ann Intern Med. 2022;175(8):W81.

165. Jollife IT, Cadima J. Principal component analysis: A review and recent developments. Philos Trans R Soc A Math Phys Eng Sci. 2016;374(2065).

166. Singh H, Dey AK, Sahay A, Sholeh M, Chalidyanto D, Sadeghi M, et al. Understanding patient satisfaction and loyalty in public and private primary health care on m er ci al us e on on om m er ci al us e on ly. Inq (United States). 2021;12(1):1195–214.

167. Nguyen T, Nguyen H, Dang A. Determinants of patient satisfaction: Lessons from large-scale inpatient interviews in Vietnam. PLoS One [Internet]. 2020;15(9 September):1–17. Available from: http://dx.doi.org/10.1371/journal.pone.0239306

168. Desborough J, Bagheri N, Banfield M, Mills J, Phillips C, Korda R. The impact of general practice nursing care on patient satisfaction and enablement in Australia: A mixed methods study. Int J Nurs Stud. 2016;64:108–19.

169. Guetterman TC, Fetters MD, Creswell JW. Integrating quantitative and qualitative results in health science mixed methods research through joint displays. Ann Fam Med. 2015;13(6):554–61.

170. Halder R, Paul B, Banerjee A, Das R, Sengupta T. Functional Status of the Elderly and their Rehabilitation Needs: A Mixed-Method Study in a Slum of Kolkata, West Bengal. Siriraj Med J. 2023;75(1):20–8.

171. O'Neill BJ, Dwyer T, Reid-Searl K, Parkinson L. Nursing staff intentions towards managing deteriorating health in nursing homes: A convergent parallel mixed-

methods study using the theory of planned behaviour. J Clin Nurs. 2018;27(5–6):e992–1003.

172. R.A. K, B.B. de B, A.L. F, D.M. D. How nurses and their work environment affect patient experiences of the quality of care: a qualitative study. BMC Health Serv Res [Internet]. 2014;14:249. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L603325377%0Ahttp://dx.doi.org/10.1186/1472-6963-14-249

173. Sengupta T, Paul B, Banerjee A, Das R, Halder R. Chronic musculoskeletal pain among elderly individuals in a rural area of West Bengal: A mixed-method study. Malaysian Fam Physician. 2023;18:1–10.

174. Nooraie RY, Thompson B, D'Silva C, Zenlea I, Tabatabaee M, Aghaei AM. A fused mixed-methods approach to thematic analysis of personal networks: Two case studies of caregiver support networks. Netw Sci. 2021;9(2):236–53.

175. Younas A, Inayat S, Sundus A. Joint displays for qualitative-quantitative synthesis in mixed methods reviews. Res Methods Med Heal Sci. 2021;2(3):91–101.

176. Božić J, Ilić P, Ilić S. Indoor air quality in the hospital: The influence of heating, ventilating and conditioning systems. Brazilian Arch Biol Technol. 2019;62(May).

177. Cabo Verde S, Almeida SM, Matos J, Guerreiro D, Meneses M, Faria T, et al. Microbiological assessment of indoor air quality at different hospital sites. Res Microbiol. 2015;166(7):557–63.

178. Shajahan A, Culp CH, Williamson B. Effects of indoor environmental parameters related to building heating, ventilation, and air conditioning systems on patients' medical outcomes: A review of scientific research on hospital buildings. Indoor Air. 2019;29(2):161–76.

179. Wilson AM, Salloway JC, Wake CP, Kelly T. Air pollution and the demand for hospital services: A review. Environ Int. 2004;30(8):1109–18.

180. Schmidt O. Characteristics and identification of indoor wood-decaying basidiomycetes. Fundamentals of mold growth in indoor environments and strategies for healthy living. 2011.

181. Human Exposure to Pollutants via Dermal Absorption and Inhalation.

182. Baurès E, Blanchard O, Mercier F, Surget E, le Cann P, Rivier A, et al. Indoor air quality in two French hospitals: Measurement of chemical and microbiological contaminants. Sci Total Environ [Internet]. 2018;642:168–79. Available from: https://doi.org/10.1016/j.scitotenv.2018.06.047

183. Kim IS, Yang PS, Lee J, Yu HT, Kim TH, Uhm JS, et al. Long-term fine particulate matter exposure and cardiovascular mortality in the general population: a nationwide cohort study. J Cardiol. 2020;75(5):549–58.

184. Ledoux MP, Herbrecht R. Invasive Pulmonary Aspergillosis. J Fungi. 2023;9(2).

185. Taushiba A, Dwivedi S, Zehra F, Shukla PN, Lawrence AJ. Assessment of indoor air quality and their inter-association in hospitals of northern India—a cross-sectional study. Air Qual Atmos Heal [Internet]. 2023;16(5):1023–36. Available from: https://doi.org/10.1007/s11869-023-01321-4

186. Bonadonna L, Briancesco R, Coccia AM, Meloni P, La Rosa G, Moscato U. Microbial air quality in healthcare facilities. Int J Environ Res Public Health. 2021;18(12).

187. Carlson KJ, Eisenstat SA, Ziporyn T. The Impact of Air Quality on Hospital Spending. The Women's Concise Guide to Emotional Well-Being. 2021. 224–243 p.

188. Scherer G. Biomonitoring of inhaled complex mixtures - Ambient air, diesel exhaust and cigarette smoke. Exp Toxicol Pathol. 2005;57(SUPPL. 1):75–110.

189. Wang Z, Zhou Y, Zhang Y, Huang X, Duan X, Chen D, et al. Association of change in air quality with hospital admission for acute exacerbation of chronic obstructive pulmonary disease in Guangdong, China: A province-wide ecological study. Ecotoxicol Environ Saf [Internet]. 2021;208(November 2020):111590. Available from: https://doi.org/10.1016/j.ecoenv.2020.111590

190. Nasir ZA, Colbeck I, Sultan S, Ahmed S. Bioaerosols in residential micro-environments in low income countries: A case study from Pakistan. Environ Pollut [Internet]. 2012;168:15–22. Available from: http://dx.doi.org/10.1016/j.envpol.2012.03.047

191. Kumar P, Singh AB, Arora T, Singh S, Singh R. Critical review on emerging health effects associated with the indoor air quality and its sustainable management. Sci Total Environ [Internet]. 2023;872(November 2022):162163. Available from: https://doi.org/10.1016/j.scitotenv.2023.162163

192. Verde, S. C., Almeida, S. M., Matos, J., Guerreiro, D., Meneses, M., Faria, T., Viegas, C. (2015). Microbiological assessment of indoor air quality at different hospital sites. Research in microbiology, 166(7), 557-563.

193. Chakraborty A, Sharma M, Abhay RK. Colonial imprints in contemporary urban livability: an inter-ward analysis of Kolkata. GeoJournal [Internet]. 2023;88(1):543–59. Available from: https://doi.org/10.1007/s10708-022-10606-7

194. Kumar, P., Singh, A. B., Arora, T., Singh, S., Singh, R. (2023). Critical review on emerging health effects associated with the indoor air quality and its sustainable management. *Science of The Total Environment, 872*, 162163.

195. Iqbal MM, Shafiq M. Indoor air quality monitoring in metropolitan city Lahore: Using handheld devices. *J Air Pollut Heal* 2023; 8: 435–452.

196. APHA Intersociety Committee. Methods of Air Sampling and Analysis. 1st edition. Washington, DC. 1977

197. Fatima S, Ahlawat A, Mishra SK, Soni VK, Guleria R. Respiratory Deposition Dose of PM2.5 and PM10 Before, During and After COVID-19 Lockdown Phases in Megacity-Delhi, India. Mapan - J Metrol Soc India. 2022;37(4):891–900.

198. Hinds WC. Aerosol technology. Vol. 5, Packaging Magazine. 2002. 29 p.

199. Abhijith K V., Kumar P. Evaluation of respiratory deposition doses in the presence of green infrastructure. Air Qual Atmos Heal. 2021;14(6):911–24.

200. Mishra SP, Karmakar T. Anthropocene Air Quality Impact on the Kolkata People. Adv Res. 2024;25(3):50–68.

201. Salma I, Balásházy I, Winkler-Heil R, Hofmann W, Záray G. Effect of particle mass size distribution on the deposition of aerosols in the human respiratory system. J Aerosol Sci. 2002;33(1):119–32.

202. Gupta SK, Elumalai SP. Size-segregated particulate matter and its association with respiratory deposition doses among outdoor exercisers in Dhanbad City, India. J Air Waste Manag Assoc [Internet]. 2017;67(10):1137–45. Available from: https://doi.org/10.1080/10962247.2017.1344159

203. Hussein T, Al-Abdallat A, Saleh SSA, Al-Kloub M. Estimation of the Seasonal Inhaled Deposited Dose of Particulate Matter in the Respiratory System of Urban Individuals Living in an Eastern Mediterranean City. Int J Environ Res Public Health. 2022;19(7).

204. Maltare NN, Vahora S, Jani K. Seasonal analysis of meteorological parameters and air pollutant concentrations in Kolkata: An evaluation of their relationship. J Clean Prod [Internet]. 2024;436(December 2023):140514. Available from: https://doi.org/10.1016/j.jclepro.2023.140514

205. Pritchard JN. The influence of lung deposition on clinical response. J Aerosol Med Depos Clear Eff Lung. 2001;14(SUPPL. 1).

206. Hofmann W. Modelling inhaled particle deposition in the human lung-A review. J Aerosol Sci [Internet]. 2011;42(10):693–724. Available from: http://dx.doi.org/10.1016/j.jaerosci.2011.05.007

207. Williams RO, Carvalho TC, Peters JI. Influence of particle size on regional lung deposition - What evidence is there? Int J Pharm [Internet]. 2011;406(1–2):1–10. Available from: http://dx.doi.org/10.1016/j.ijpharm.2010.12.040

208. Peabody JW, Taguiwalo MM, Robalino DA, Frenk J. Improving the Quality of Care in Developing Countries. Inst Med. 2001;Chapter 70(Berwick 1989):1293–308.

209. Saginela SK, Madri AK, Desu RM, Bola VR. Assessment of Satisfaction Levels of the Outpatients Attending Outpatient Departments in a Quaternary Care Hospital. Int J Res Found Hosp Healthc Adm. 2020;7(2):91–8.

210. Sharma A, Kumar Kasar P, Kasar PK, Sharma R, Patient SR. Patient satisfaction about hospital services. A study from the outpatient department of tertiary care hospital, Jabalpur, Madhya pradesh, India. Artic Natl J Community Med [Internet]. 2014;5(2):199–203. Available from:

https://www.researchgate.net/publication/287216440_Patient_satisfaction_about_hospital_services_a_study_from_the_outpatient_department_of_tertiary_care_hospital_jabalpur_madhya_pradesh_india

211. Kenarkoohi A, Noorimotlagh Z, Falahi S, Amarloei A, Mirzaee SA, Pakzad I, et al. Hospital indoor air quality monitoring for the detection of SARS-CoV-2 (COVID-19) virus. Sci Total Environ [Internet]. 2020;748:141324. Available from: https://doi.org/10.1016/j.scitotenv.2020.141324

212. Eckelman MJ, Sherman J. Environmental impacts of the U.S. health care system and effects on public health. PLoS One. 2016;11(6):1–14.

213. Dubey K, Verma S. (2024) Source apportionment of fine aerosol particles of water-soluble and carbonaceous species measured in semi-urban (Kharagpur) and megacity (Kolkata) atmospheres over the eastern Indo-Gangetic plain: Chemical characterisation, relative abundance and anthropogenic contributions. *Science of The Total Environment* 932:170795.

214. Mishra SP, Karmakar T (2024) Anthropocene Air Quality Impact on the Kolkata People. *Advances in Research* 25(3):50-68

Institute of Post Graduate Medical Education & Research
244, A.J.C. Bose Road, Kolkata – 700020.
IPGME&R Research Oversight Committee
(Institutional Ethics Committee)

Memo No. IPGME&R/IEC/2022/414

Date: 15.09.2022

Ms. Moitreyee Roy
PhD Scholar
Faculty of interdisciplinary studies,
law & management, Jadavpur University
and Associate Professor
Neotia Academy of Nursing, Kolkata

Dear Ms. Roy,

A meeting of the Institutional Ethics Committee of IPGME&R, Kolkata, was held on 03.09.2022 at 12:00 Noon in the Office of the Dean, IPGME&R, Kolkata. In this meeting the members considered the revised protocol related to your project:

Assessment of health care service quality and patient satisfaction for permanent pacemaker implantation (PPI) implantation: an empirical study in selected hospital, Kolkata.

The following additional documents were scrutinized

- Informed consent documents in English.
- Informed consent documents in Hindi.
- Informed consent documents in Bengali.
- Pilot study report.

After deliberations and review the committee took the following decision regarding your project:

Approved

Kindly note the following points:

- We understand that the Co-Investigators for your project are Dr. Subarna Bhattacharya, Assistant Professor, School of Environmental Studies, Jadavpur University, and from IPGME&R, Dr. Tushar Kanti Patra, Assistant Professor, Cardiology.
- We further understand that your study does not have any commercial sponsor.
- Permission for the study, in its present for, will remain valid for 3 years for data collection.

It is placed on record that the decision regarding your proposal was unanimous and therefore did not require any voting procedure. List of members who attended this meeting is provided on the next page. Members absent have reviewed the same documents and have not sent any note of dissent or objection regarding your proposal. It is also recorded that neither you nor any other member of your research team participated in the decision-making process.

Additional points, if any, mentioned on Page 2 are also to be noted.

Continued on Page 2

Institute of Post Graduate Medical Education & Research
244, A.J.C. Bose Road, Kolkata – 700020.
IPGME&R Research Oversight Committee
(Institutional Ethics Committee)

Continued from Page 1

Additional points to be noted

- Clinical trials must be registered prospectively with Clinical Trials Registry India (CTRI).
- The Committee expects that any amendments to the Study Protocol, Informed Consent documents or other relevant documents would be brought to its notice.
- A brief project completion report is to be submitted to the IPGME&R Research Oversight Committee. If project duration exceeds 1 year from commencement, a brief annual progress report should also be submitted.
- IPGME&R Research Oversight Committee is registered with Central Drugs Standard Control Organization (CDSCO), Government of India, in consonance with Rule 122D of the revised Drugs & Cosmetics Rules 1945 – Registration No. ECR/35/Inst/WB/2013/RR-19. It functions in accordance with New Drugs and Clinical Trials Rules 2019 under the Drugs & Cosmetic Act and Indian Council of Medical Research (ICMR) guidelines.

List of institutional ethics committee members who attended the meeting on 03.09.2022

SN	Name & role in the committee	Gender	Designation
1	**Prof. Amal Kanti Das** [Basic Medical Scientist]	Male	Professor, Dept. Pharmacology, IPGME&R
2	**Prof. Bijay Kumar Majumdar** [Clinician]	Male	Consultant Plastic Surgeon; Former Head, Department of Plastic Surgery, IPGME&R
3	**Prof. Biman Kanti Ray** [Clinician]	Male	Professor, Dept. Neurology, Bangur Institute of Neuroscience, IPGME&R
4	**D. Amal Kumar Santra** [Basic Medical Scientist] ACTING CHAIRPERSON	Male	Scientist, Formerly of Department of Gastroenterology, IPGME&R
5	**Prof. Bobby Paul** [Public Health Expert]	Female	Professor, Dept. of Preventive & Social Medicine, All India Institute of Hygiene & Public Health, Kolkata
6	**Dr. Sananda Pati** [Clinician – Pediatrician]	Female	Assistant Professor, Department of Pediatrics, IPGME&R
7	**Mr. Debdut Mukherjee** [Legal expert]	Male	Advocate, Calcutta High Court
8	**Mr. Arunangshu Shekhar Jana** [Social worker]	Male	Social worker, Mahendraganj, Dist. South 24 Parganas
9	**Dr. Nila Majumdar** [Lay person]	Female	Bengali teacher, Kolkata
10	**Prof. Avijit Hazra** [Pharmacologist & Member secretary]	Male	Professor, Department of Pharmacology, IPGME&R

Avijit Hazra 15/09/2022

Dr. Avijit Hazra – Member Secretary
IPGME&R Research Oversight Committee

LETTER SEEKING CONSENT TO VALIDATE RESEARCH TOOL

To,
Name:_____
Designation:_____
Name of the college:_____ Date:

Respected Sir/Madam,

This is for your kind information that, I, Moitreyee Roy, PhD scholar, School of environmental studies, Jadavpur University, Kolkata, want to submit a research project to you for the purpose of validation of questionnaire of following research project.

My research topic is "**Assessment of health care service quality and patient satisfaction for Permanent pacemaker implantation (PPI): An empirical study in selected Hospital Kolkata".**

May I request you to give your valuable opinions regarding self structured questionnaire.

Here I have enclosed with:

- Objectives of the study
- Operational definitions of the study
- Hypothesis of the study
- Tools
- Criteria checklist

Thanking you, in anticipation

Yours faithfully

Moitreyee Roy

LIST OF VALIDATORS

1. Dr. Sujay Deb- Medical Director, Desun Hospital and Cancer Institute
2. Dr. Avijit Hazra, Professor, Dept. of Pharmacology , SSKM, Kolkata
3. Mrs. Dolly Biswas- Chief Nursing Officer, Fortis hospital, Kolkata 107
4. Mr. Sudip Dey- Head -Quality Accreditation and Academics, Institute of Neurosciences,
   State Chairperson-Consortium of Accredited Healthcare Organisations (CAHO)-West Bengal.

PROPOSED TOOL

Tool I

Background Information

Purpose: To collect background information of the participants.

- Code no : Date : _____

1) Age in years _____
2) Gender _____
3) What is your religious belief? _____
4) What is your marital status? Unmarried / Married / Widow / Divorced / Separated
5) Up to which class have you studied? _____
6) From what type of residence do you belong? Rural / Urban
7) Which type of family you belong to? Nuclear / Joint / Other _____
8) How many members are there in your family? _____
9) What is your monthly family income? _____
10) Economical Class _____ [Researcher will calculate]
11) What is our occupation? ----------

Tool II: Questionnaire on Assessment of Hospital ServiceQuality and Patient Satisfaction

(BASED ON SERVQUAL MODEL)

Participants are requested to listen the statements carefully and kindly give their expectation level regarding hospital service before hospitalization. Investigator will put a (√) mark against 1-5 Likert scale or write down the stated answer.

1 – Strongly dissatisfied	2 – Dissatisfied	3 – Neutral
4 – Satisfied	5 – Strongly satisfied	

Sl. No.	Statements	Score				
		1	2	3	4	5
Tangibles (Physical Facility, Waiting time, Food, and Personnel)						
1	How far location of hospital is convenient?					
2	How much appealing the overall infrastructure in hospital?					
3	How much overall cleanliness is maintained in hospital?					
4	How much facilities are available in the waiting area?					
5	How long do you wait to meet doctor at OPD?	> 60 min	>45 to < 60 min	>30 to < 45 min	>15 to < 30 min	< 15 min
6	What is the status of air ventilation in ward?					
7	How is the quality of food served in hospital?					
Reliability(ability of performance of health care personnel)						
8	How much the care givers are interested to solve your problem?					
9	How much politeness is present within staff member?					
10	How mental support are you getting from hospital care givers?					

11	How do doctor explain you about PPI?					
Responsiveness (willingness of health care provider to help patient)						
12	How do duty nurses explain you during any investigation?					
13	How much do you expect the explanation of operation after PPI?					
Assurance(knowledge and courtesy of medical staff that will buildup patient confidence)						
14	How do you rate the friendly behavior of doctors?					
15	How do you rate the friendly behavior of Nurses?					
16	How do you rate the friendly behavior of other staff members?					
17	How much are you confident about doctor's treatment?					
18	How much are you confident about treatment of duty Nurses?					
Empathy (Individual attention to patient)						
19	How do you rate the explanation about medication and its side effects by care givers?					
20	How do you rate the explanation about 'Dos and Don'ts' after PPI by care givers?					

ব্যাক্তিগত তথ্য সংগ্রহের জন্য মুখোমুখি আংশিক কাঠামোগত সাক্ষাৎকার

টুল ১

বিভাগ ক – ব্যাকগ্রাউন্ড তথ্য

উদ্দেশ্য : অংশগ্রহণকারীদের ব্যাক্তিগত তথ্য সংগ্রহ করা

নির্দেশাবলী : অংশগ্রহণকারীদের প্রশ্নটি মনোযোগ সহকারে শোনার জন্য এবং সঠিক তথ্য দেওয়ার জন্য অনুরোধ করা হচ্ছে। তদন্তকারী সঠিক উত্তরটি নথিভুক্ত করবেন।

কোড নম্বর : **তারিখ :**

১) আপনার বয়স কত ? _____

২) লিঙ্গ : পুরুষ / মহিলা _____

৩) আপনার ধর্মীয় বিশ্বাস কি ? _____

৪) আপনার বৈবাহিক অবস্থা কি ? অবিবাহিত / বিবাহিত / বিধবা / বিচ্ছিন্ন _____

৫) আপনি কোন শ্রেনী পর্যন্ত পড়াশোনা করেছেন ? _____

৬) আপনি কোন ধরনের বাসস্থানে অন্তর্গত ? শহর / গ্রাম _____

৭) আপনি কোন ধরনের পরিবারের অন্তর্গত ? অনুপরিবার / যৌথ পরিবার / অন্যান্য _____

৮) আপনার পরিবারে কতজন সদস্য ? _____

৯) আপনার পরিবারে রোজগার কত ? _____

১০) অর্থনৈতিক শ্রেনী _____

১১) আপনি কি কোন পেশার সাথে যুক্ত ? হ্যাঁ / না ____ হ্যাঁ হলে উল্লেখ করুন _____

টুল ২: হাসপাতালের গুনগত মান

(SERVQUAL মডেল ভিত্তিক)

বিভাগ ক

উদ্দেশ্য : উত্তরদাতার কাছ থেকে SERVQUAL মডেল ভিত্তিক সম্পর্কে মতামত জানা । হাসপাতালে ভর্তির আগে তাদের কি মতামত ।

নির্দেশ : অংশগ্রহণকারীদের অনুরোধ করা হচ্ছে যে বিবৃতিগুলো বলা হবে, সেগুলো শুনে সঠিক মতামত দেবার জন্য ।

প্রতি বিবৃতির উত্তর ১ – ৫ এর মধ্যে হবে ।

১ = দৃঢ়ভাবে অসম্মতি ২ = অসম্মতি ৩ = নিরপেক্ষ
৪ = সম্মত ৫ দৃঢ়ভাবে সম্মত

ক্রমিক সংখ্যা	বিবৃতি	স্কোর				
		আগে			পরে	
১	হাসপাতালের অবস্থান আপনার কাছে কতটা সুবিধাজনক বলে আপনি মনে করেছিলেন ?					
2	হাসপাতালের কাঠামো কতটা আকর্ষনীয় বলে মনে করেছিলেন ?					
৩	সামগ্রিকভাবে হাসপাতালের পরিস্কার পরিচ্ছন্নতা কতটা ভালো বলে ধারনা ছিল ?					
৪	অপেক্ষা করার জায়গায় কতটা সুযোগ সুবিধা থকবে বলে আপনি মনে করেছিলেন ?					
৫	ও পি ডি ভিজিটের সময় কতক্ষণ অপেক্ষা করতে হবে বলে ভেবেছিলেন?					
৬	হাসপাতালের ওয়ার্ডে কতটা ভালো বায়ু চলাচল হবে বলে আপনার ধারণা ছিল ?					
৭	কতটা গরম খাবার সরবরাহ করা হবে বলে আপনি মনে করেছিলেন ?					
৮	যারা কেয়ার দিচ্ছেন তারা কতটা আন্তরিক ভাবে আপনার কোনো সমস্যার সমাধান করবে বলে ধারনা ছিল ?					

৯	আপনি ও আপনার পরিবার স্টাফদের কাছ থেকে কতটা নম্র ব্যবহার আশা করেছিলেন ?					
১০	পুরো হাসপাতালের সার্ভিস থেকে মানসিক ভাবে আপনি কতটা সপোর্ট পাবেন বলে মনে করেছিলেন ?					
১১	আপনার বোধগম্য হবার মতো করে ডাক্তারবাবুরা পেসমেকার নিয়ে বোঝাবেন বলে আপনি মনে করেছিলেন ?					
১২	যে কোনো রক্ত পরীক্ষা / প্রসিডিওর এর আগে ডিউটি নার্সরা কতটা ব্যাখ্যা করবেন বলে আপনার ধারনা ছিল?					
১৩	পেসমেকার বসানোর পর অপারেশন কেমন হয়েছে এটা ডাক্তারবাবুরা কতটা ব্যাখ্যা করবেন বলে আপনার ধারনা ছিল?					
১৪	ডাক্তারবাবুরা আপনার সাথে কতটা বন্ধুত্বপূর্ন ব্যবহার করবেন বলে আপনি মনে করেছিলেন ?					
১৫	ডিউটি নার্সরা আপনার সাথে কতটা বন্ধুত্বপূর্ন ব্যবহার করবেন বলে আপনি মনে করেছিলেন ?					
১৬	অন্যান্য স্টাফেরা আপনার সাথে কতটা বন্ধুত্বপূর্ন ব্যবহার করবেন বলে আপনি মনে করেছিলেন ?					
১৭	ডাক্তারবাবুদের চিকিৎসায় আপনি কতটা আত্মবিশ্বাস পাবেন বলে ধারনা ছিল ?					
১৮	নার্সিং স্টাফেদের সেবায় আপনি কতটা আত্মবিশ্বাস পাবেন বলে ধারনা ছিল ?					
১৯	আপনি কি কি ওষুধ খাবেন এবং তার পার্শ্বপ্রতিক্রিয়া সম্পর্কে কতটা পরিষ্কার ভাবে বোঝানো হবে বলে আপনি মনে করেছিলেন ?					
২০	অপারেশনের পর আপনি কি কি করবেন এবং করবেন না সেই তথ্যগুলি কতটা বলা হবে বলে মনে করেছিলেন ?					

বিভাগ খ

উদ্দেশ্য : উত্তরদাতার কাছ থেকে হাসপাতালের গুনগত মান সম্পর্কে মতামত জানা। হাসপাতালে পেসমেকার বসানোর পর মতামত জানা।

নির্দেশ : অংশগ্রহণকারীদের অনুরোধ করা হচ্ছে যে বিবৃতিগুলো বলা হবে, সেগুলো শুনে সঠিক মতামত দেবার জন্য।

প্রতি বিবৃতির উত্তর ১ – ৫ এর মধ্যে হবে।

১ = দৃঢ়ভাবে অসম্মতি ২ = অসম্মতি ৩ = নিরপেক্ষ
৪ = সম্মত ৫ দৃঢ়ভাবে সম্মত

ক্রমিক সংখ্যা	বিবৃতি	স্কোর				
		১	২	৩	৪	৫
১	হাসপাতালের অবস্থান আপনার কাছে কতটা সুবিধাজনক ?					
2	হাসপাতালের কাঠামো আপনার কাছে কতটা আকর্ষনীয় ?					
৩	হাসপাতাল কতটা পরিস্কার পরিচ্ছন্নতা ?					
৪	রুগিদের অপেক্ষা করার জন্য কতটা সুবিধা আছে ?					
৫	ও পি ডি যতবার দেখাতে এসেছেন কতক্ষণ মোটমুটি অপেক্ষা করতে হয়েছিল ?					
৬	হাসপাতালের ওয়ার্ডে কতটা ভালো বায়ু চলাচল হয়?					
৭	হাসপাতালের কতটা গরম খাবার সরবরাহ করা হয় ?					
৮	স্টাফরা কতটা তাদের কথা রাখার চেষ্টা করেন ?					
৯	আপনি ও আপনার পরিবার স্টাফদের কাছ থেকে কতটা নম্র ব্যবহার পান ?					
১০	পুরো হাসপাতালের সার্ভিস থেকে মানসিক ভাবে আপনি কতটা সপোর্ট পাচ্ছেন ?					
১১	অপারেশনের আগে ডাক্তারবাবু আপনাকে পেসমেকার নিয়ে কতটা বুঝিয়েছিলেন ?					

১২	যে কোনো রক্ত পরীক্ষা / প্রসিডিওর এর আগে ডিউটি নার্সরা কতটা ব্যাখ্যা করেন ?					
১৩	পেসমেকার বসানোর পর অপারেশন কেমন হয়েছে এটা ডাক্তারবাবুরা কতটা ব্যাখ্যা করেছিলেন ?					
১৪	ডাক্তারবাবুরা আপনার সাথে কতটা বন্ধুত্বপূর্ন ব্যবহার করেন ?					
১৫	ডিউটি নার্সরা আপনার সাথে কতটা বন্ধুত্বপূর্ন ব্যবহার করেন ?					
১৬	অন্যান্য স্টাফেরা আপনার সাথে কতটা বন্ধুত্বপূর্ন ব্যবহার করেন ?					
১৭	ডাক্তারবাবুদের চিকিৎসায় আপনি কতটা বিশ্বাস করেন ?					
১৮	নার্সিং স্টাফেদের সেবায় আপনি কতটা বিশ্বাস করেন ?					
১৯	আপনি কি কি ওষুধ খাবেন এবং তার পার্শ্বপ্রতিক্রিয়া সম্পর্কে কতটা পরিষ্কার ভাবে বোঝানো হয়েছে ?					
২০	ছুটির পর আপনি বাড়িতে কি কি কাজ করবেন না --এসব আপনাকে কতটা বোঝানো হয়েছে ?					

Proforma – Consent for Observational Studies

Part I

Information to participants

1. **Title of the study**:
"Assessment of Health Care Service Quality and Patient Satisfaction: An Empirical Study in Selected Hospitals, Kolkata, West Bengal"
2. **What is the purpose of this study?**
To assess the health care quality and patient satisfaction in selected hospital, kolkata
3**. Why have I been chosen?**
Satisfy study conditions
4**. Do I necessarily have to take part?**
Your participation in this study is voluntary; you may decline at any time without penalty and without loss of benefits to which you are otherwise entitled.
5**. What happens during the study / What do I have to do? (the procedures, such as answering a questionnaire, which the participant will have to undergo)**
Investigator will collect data by interview schedule and questionnaire for assessing the level of hospital service and patient satisfaction. The interview session will take approx. 20-30 minutes per participants.
6. **What are the possible benefits of taking part?**
After participation in the study the level of hospital service and patient satisfaction will be evaluated. In future, we may improve the hospital quality services with the help of the result.
7. **Are there any possible disadvantages of taking part?**
There is no potential risk and discomfort of the study.
8. **Will my taking part in this study be kept confidential?**
All data, obtained during the course of the study, will be kept confidential and will be accessible only to the investigators.
9. **What will happen to the results of the study?**
If the result of the study are published, you will be referred to by number or initials but not by name so as to protect your identity.
10. **Any other information relevant to participation in the study.**
Finally, please note that you can withdraw from the study at any point of time without stating any reasons**.**

- Contact for further information. (the name designation and contact numbers of Principal Investigator and Co-Investigators)

Ms. Moitreyee Roy
Research Scholar, School of Environmental Studies, Jadavpur University
Associate Professor,Neotia Academy of Nursing
Mobile no- 9874192715 Email : moitreyee2@gamil.com

Part 2
Informed Consent Form

Informed consent form

"**Assessment of Health Care Service Quality and Patient Satisfaction: An Empirical Study in Selected Hospitals, Kolkata, West Bengal**"

Subject's: Name: _____ Initials _____ Age _____ Sex _____

Please tick in here if you agree

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions. [ ]
2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without having to give a reason, and without my rights and privileges being affected. [ ]
3. I understand that my data would be kept confidential but individuals authorized by the Principal Investigator, the ethics committee of the institute where the study will be conducted and government regulatory authority will have access to my records both in respect of the current study and further research that may be conducted in relation to it. Even if I withdraw, I agree to this access. However, I understand that my identity will not be revealed and confidentiality of information will be maintained. [ ]
4. I agree not to restrict the use of any data or results that arise from this study for academic purpose. [ ]
5. I agree to voluntarily take part in the above study. [ ]

Signature / Thumb impression of the subject: _____

Date: _____ Place: _____

Study investigator's name: _____

Study investigator's signature: _____ Date: _____ Place: _____

Mandatory where subject has provided thumb impression:

Signature of the witness: _____

Date: _____ Place: _____

Name & Address of the witness: _____

_____

Relation to the subject, if any: _____

অংশ 1

অংশগ্রহণকারীদের তথ্য

1. অধ্যয়নের শিরোনাম:
"স্বাস্থ্য পরিচর্যা পরিষেবার গুণমান এবং রোগীর সন্তুষ্টির মূল্যায়ন: নির্বাচিত হাসপাতালগুলিতে একটি অভিজ্ঞতামূলক গবেষণা, কলকাতা, পশ্চিমবঙ্গ"
2. এই গবেষণার উদ্দেশ্য কি?
কলকাতার নির্বাচিত হাসপাতালে স্বাস্থ্যসেবার মান এবং রোগীর সন্তুষ্টি মূল্যায়ন করা
3. কেন আমাকে নির্বাচিত করা হয়েছে?
অধ্যয়নের শর্ত পূরণ করুন
4. আমাকে কি অগত্যা অংশ নিতে হবে?
এই গবেষণায় আপনার অংশগ্রহণ স্বেচ্ছাসেবী; আপনি যেকোন সময় শাস্তি ছাড়া এবং সুবিধার ক্ষতি ছাড়াই প্রত্যাখ্যান করতে পারেন যার আপনি অন্যথায় যোগ্য।
5. অধ্যয়নের সময় কি ঘটে / আমাকে কি করতে হবে? (প্রক্রিয়া, যেমন একটি প্রশ্নাবলীর উত্তর দেওয়া, যা অংশগ্রহণকারীকে অতিক্রম করতে হবে)
তদন্তকারী হাসপাতালের পরিষেবার স্তর এবং রোগীর সন্তুষ্টি মূল্যায়নের জন্য সাক্ষাত্কারের সময়সূচী এবং প্রশ্নাবলীর মাধ্যমে ডেটা সংগ্রহ করবেন। সাক্ষাত্কারের সেশনটি প্রায় সময় নেবে। প্রতি অংশগ্রহণকারীদের 20-30 মিনিট।
6. অংশ নেওয়ার সম্ভাব্য সুবিধাগুলি কী কী?
গবেষণায় অংশগ্রহণের পর হাসপাতালের সেবার স্তর এবং রোগীর সন্তুষ্টি মূল্যায়ন করা হবে। ভবিষ্যতে, আমরা ফলাফলের সাহায্যে হাসপাতালের মান উন্নত করতে পারি।
7. অংশ নেওয়ার কোন সম্ভাব্য অসুবিধা আছে কি?
অধ্যয়নের কোন সম্ভাব্য ঝুঁকি এবং অস্বস্তি নেই।
8. এই গবেষণায় আমার অংশগ্রহণ কি গোপন রাখা হবে?
অধ্যয়নের সময় প্রাপ্ত সমস্ত ডেটা গোপনীয় রাখা হবে এবং শুধুমাত্র তদন্তকারীদের কাছে অ্যাক্সেসযোগ্য হবে।
9. গবেষণার ফলাফল কি হবে?
অধ্যয়নের ফলাফল প্রকাশিত হলে, আপনাকে নম্বর বা আদ্যক্ষর দ্বারা উল্লেখ করা হবে কিন্তু আপনার পরিচয় রক্ষা করার জন্য নাম দ্বারা নয়।
10. অধ্যয়নে অংশগ্রহণের জন্য প্রাসঙ্গিক অন্য কোনো তথ্য।
পরিশেষে, অনুগ্রহ করে মনে রাখবেন যে আপনি কোনো কারণ না জানিয়ে যে কোনো সময়ে অধ্যয়ন থেকে প্রত্যাহার করতে পারেন।

- আরও তথ্যের জন্য যোগাযোগ করুন। (প্রধান তদন্তকারী এবং সহ-তদন্তকারীদের নাম উপাধি এবং যোগাযোগের নম্বর)

Ms. মৈত্রেয়ী রায়

রিসার্চ স্কলার, স্কুল অফ এনভায়রনমেন্টাল স্টাডিজ, যাদবপুর বিশ্ববিদ্যালয়

সহযোগী অধ্যাপক, নেওটিয়া একাডেমি অফ নার্সিং

মোবাইল নম্বর- 9874192715 ইমেইল: moitreyee2@gmail.com

অংশ ২

সম্মতি ফর্ম

সম্মতি ফর্ম

"স্বাস্থ্য পরিচর্যা পরিষেবার গুণমান এবং রোগীর সন্তুষ্টির মূল্যায়ন: নির্বাচিত হাসপাতাল, কলকাতা, পশ্চিমবঙ্গে একটি অভিজ্ঞতামূলক গবেষণা"

বিষয়ের: নাম: _____ আদ্যক্ষর _____ বয়স _____ লিঙ্গ _____

আপনি একমত হলে এখানে টিক করুন

1. আমি নিশ্চিত করছি যে আমি উপরের অধ্যয়নের তথ্য পত্রটি পড়েছি এবং বুঝেছি এবং প্রশ্ন জিজ্ঞাসা করার সুযোগ পেয়েছি। [ ]

2. আমি বুঝতে পারি যে অধ্যয়নে আমার অংশগ্রহণ স্বেচ্ছায় এবং আমি তা কোনো কারণ ছাড়াই যে কোনো সময় প্রত্যাহার করতে পারবেন, এবং আমার অধিকার এবং সুযোগ-সুবিধা প্রভাবিত না করে। [ ]

3. আমি বুঝতে পারি যে আমার ডেটা গোপন রাখা হবে কিন্তু ব্যক্তিগত প্রধান তদন্তকারী, ইনস্টিটিউটের নীতিশাস্ত্র কমিটি দ্বারা অনুমোদিত যেখানে গবেষণা পরিচালনা করা হবে এবং সরকারী নিয়ন্ত্রক কর্তৃপক্ষ বর্তমান গবেষণার ক্ষেত্রে উভয় ক্ষেত্রেই আমার রেকর্ডে অ্যাক্সেস থাকবে এবং এটি সম্পর্কিত আরও গবেষণা পরিচালনা করা যেতে পারে। আমি প্রত্যাহার করলেও, আমি এই অ্যাক্সেস সম্মত. তবে বুঝতে পারছি আমার পরিচয় হবে না প্রকাশ করা হবে এবং তথ্যের গোপনীয়তা বজায় রাখা হবে। [ ]

4. আমি এই থেকে উদ্ভূত কোনো ডেটা বা ফলাফলের ব্যবহার সীমাবদ্ধ না করতে সম্মত [ ]

5. আমি স্বেচ্ছায় উপরোক্ত গবেষণায় অংশ নিতে সম্মত। [ ]

অংশগ্রহণকারীর স্বাক্ষর/আঙুলের ছাপ:_____

তারিখ: _____ স্থান: _____

অধ্যয়ন তদন্তকারীর নাম: _____

অধ্যয়ন তদন্তকারীর স্বাক্ষর: _____ তারিখ: _____ স্থান: _____

বাধ্যতামূলক যেখানে অংশগ্রহণকারী আঙুলের ছাপ দিয়েছেন:

সাক্ষীর স্বাক্ষর: _____

তারিখ: _____ স্থান: _____

সাক্ষীর নাম ও ঠিকানা: _____

_____

অংশগ্রহণকারীর সাথে সম্পর্ক, যদি থাকে: _____

CERTIFICATE FOR VALIDATION FOR TRANSLATING TOOLS FROM ENGLISH TO BENGALI

TO WHOM IT MAY CONCERN

This is to certify that bengali version of semi structure interview schedule of following dissertation is checked and validated by me and language is appropriate.

The dissertation entitled **'Assessment of health care service quality and patient satisfaction for Permanent pacemaker implantation (PPI): An empirical study in selected Hospital, Kolkata'** under Faculty Council of Interdisciplinary Studies, Law and Management in the School of Environmental Studies, Jadavpur University is Conducted by Moitreyee Roy, PhD research scholar.

Name of the validator:

Signature with date:

Qualification:

Designation:

Seal/stamp:

CERTIFICATE FOR VALIDATION FOR TRANSLATING TOOLS FROM BENGALI TO ENGLISH

TO WHOM IT MAY CONCERN

This is to certify that english version of semi structure interview schedule of following dissertation is checked and validated by me and language is appropriate.

The dissertation entitled **'Assessment of health care service quality and patient satisfaction for Permanent pacemaker implantation (PPI): An empirical study in selected Hospital, Kolkata'** under Faculty Council of Interdisciplinary Studies, Law and Management in the School of Environmental Studies, Jadavpur University is Conducted by Moitreyee Roy, PhD research scholar.

Name of the validator:

Signature with date:

Qualification:

Designation:

Seal/stamp:

Table S1 Data of tidal volume(ml/Kg) and respiratory rate(no/min) for the studied patient

Tidal volume (Vt)				
	Male		Female	
Sl NO	Before PPI	After PPI	Before PPI	After PPI
1	0.7	0.67	0.52	0.47
2	0.7	0.66	0.47	0.44
3	0.7	0.67	0.47	0.47
4	0.7	0.67	0.51	0.45
5	0.69	0.66	0.52	0.47
6	0.69	0.66	0.47	0.45
7	0.66	0.66	0.48	0.44
8	0.69	0.67	0.52	0.43
9	0.71	0.66	0.46	0.46
10	0.71	0.68	0.49	0.45
11	0.66	0.66	0.49	0.44
12	0.7	0.68	0.52	0.48
13	0.69	0.66	0.47	0.43
14	0.66	0.67	0.46	0.48
15	0.66	0.68	0.47	0.47
16	0.69	0.67	0.51	0.42
17	0.7	0.68	0.5	0.43
18	0.68	0.66	0.48	0.42
19	0.67	0.67	0.48	0.47
20	0.7	0.68	0.51	0.43
21	0.71	0.67	0.48	0.42
22	0.66	0.68	0.48	0.45
23	0.7	0.67	0.5	0.46
24	0.66	0.66	0.48	0.43
25	0.68	0.67	0.51	0.48
26	0.69	0.67	0.47	0.46
27	0.69	0.66	0.47	0.44
28	0.68	0.67	0.48	0.43
29	0.66	0.67	0.5	0.48
30	0.68	0.67	0.51	0.42

Respiratory rate (f)				
	Male		Female	
Sl NO	Before PPI	After PPI	Before PPI	After PPI
1	18	15	16	16
2	18	15	14	15
3	15	14	14	14
4	17	15	15	14
5	16	14	16	14
6	18	16	15	15
7	18	14	13	16
8	17	16	13	14
9	17	16	16	16
10	18	15	15	13
11	17	16	15	13
12	18	14	16	14
13	17	15	13	16
14	16	16	13	16
15	18	15	13	13
16	15	16	15	16
17	15	14	15	14
18	18	16	13	15
19	16	16	16	13
20	17	15	15	15
21	15	15	16	16
22	16	14	15	14
23	18	15	15	13
24	18	14	13	16
25	15	14	15	15
26	17	16	15	14
27	15	16	14	15
28	16	15	14	16
29	16	14	14	15
30	16	16	15	13

Thesis

ORIGINALITY REPORT

11%
SIMILARITY INDEX

PRIMARY SOURCES

1	link.springer.com Internet	259 words — 1%
2	www.mdpi.com Internet	215 words — 1%
3	listens.online Internet	150 words — < 1%
4	mafiadoc.com Internet	124 words — < 1%
5	Mi Aie Lee, Young-Hee Yom. "A comparative study of patients' and nurses' perceptions of the quality of nursing services, satisfaction and intent to revisit the hospital: A questionnaire survey", International Journal of Nursing Studies, 2007 Crossref	102 words — < 1%
6	creativecommons.org Internet	95 words — < 1%
7	ijcs.ro Internet	81 words — < 1%
8	Santosh Kotgire, Rabia Akhtar, Ajit Damle, Sufia Siddiqui, Hira Padekar. "Bioaerosol assessment of	78 words — < 1%