



Green Hospital Concept: Its Challenges, Benefits and Focus Areas

Abu Sayed Mohammad Giasuddin

Laboratory Medicine (Biochemistry & Immunology),
Impulse Hospital, ImHS&RCLtd, Dhaka-1208, Bangladesh
and Department of Public Health, School of Health Sciences,
State University of Bangladesh (SUB), Dhanmondi, Dhaka-
1205, Bangladesh

Mohammad Shahjahan

Department of Public Health, School of Health Sciences,
State University of Bangladesh (SUB), Dhanmondi,
Dhaka-1205, Bangladesh

Nuhad Raisa Seoty

Department of Public Health, School of Health Sciences
State University of Bangladesh (SUB), Dhanmondi,
Dhaka-1205, Bangladesh

ABSTRACT

We need to understand what actually a green hospital means. The concept of 'Green Buildings' can be traced to the United Nations concerted efforts, over the years, to bring to the fore the idea of sustainability in all aspects of human development. The concept of developing sustainable green buildings received further attention with the introduction of Triple Bottom Line (TBL) approach. According to TBL approach, primary goal of designing a green building would be to reduce the use of resources such as land, water, energy and supplies. The noble idea is for the people so that who live, work, learn and heal in green buildings are healthier, happier and more productive. Therefore, a sustainable green hospital enhances patient wellbeing, aids in curative process while utilizing natural sources in efficient environment friendly manner. A green hospital chooses an environment friendly site, utilizes efficient designs, uses green building materials, thinks green during construction around a facility that recycles, reuses materials, reduces waste and produces cleaner air, reduce CO2 generation etc. The standards and strategies are developed and laid down by World Green Building Council (WGBC), US Green Building council (USGBC) and the leadership in Energy and Environmental Design (LEED) since green hospital movement began years ago. The requirements, challenges and barriers for setting up a green hospital with proper concept and design are reviewed in the present article.

Keywords: Green hospital, Green building, Hospital Design, Environmental sustainability, LEED.

INTRODUCTION & HISTORICAL BACKGROUND

The concept of 'green buildings' can be traced to the United Nations concerted efforts, over the years, to bring to the fore the idea of 'sustainability' in all aspects of human development. The first such effort made in this direction was the United Nations Conference on Human Environment, held in 1972 at Stockholm. Within the declaration of this conference it was proclaimed that,

"The protection and improvement of the human environment is a major issue which affects the well-being of people and economic development throughout the world, it is the urgent desire of the people of the whole world and the duty of all governments".^{1,2} The concept of developing sustainable green buildings received a further fillip with the introduction of Triple Bottom Line (TBL) approach, which was introduced and popularized by the green business in the mid-1990s.^{1,3} According to TBL approach, the primary goal of designing a green building should be to reduce the use of resources such as land, water, energy and supplies so that the people who live, work, learn and heal in green buildings are healthier, happier and more productive.^{1,4}

These movements, in a way, became precursors for the establishment of 'green building councils' in different countries bolstering the fact that green healthcare is inseparably connected to the global challenges of climate change, toxification, freshwater shortages and resource depletion.⁵ United States Green Buildings Council (USGBC) is one of the earliest such councils. It was established in the year 1993 and is a membership-based, non-profit organization that promotes sustainability in how buildings are designed, built, and operated. World Green Building Council (World GBC), which was formally established in the year 2002, is a coalition of national green building councils in more than one hundred countries. World GBC helps to standardize and promote green building practices across the globe through its wide membership.⁶

About 28 hospitals in the United States have Gold and Platinum LEED certifications. Kohinoor Hospital in Mumbai - a 150 bedded multispecialty hospital - became the first hospital in Asia and second in the world to achieve LEED platinum certification under Indian Green Building Council.^{1,7,8}

GREEN HOSPITAL CONCEPT

We need to understand what actually Green Hospital means. Green Hospitals are sustainable hospitals. A Green hospital is one which enhances patient wellbeing, aids in curative process while utilizing natural resources in an efficient environment friendly manner. The Green Hospital is defined as a hospital that has taken the initiative to do one or more of the following: Choose an environment friendly site, utilizes sustainable and efficient designs, uses green building materials and products, thinks green during construction around a facility that recycles, reuses materials, reduces waste and produces cleaner air, reduce CO₂ generation, etc.^{1,8,9}

'LEED' STRATEGIES

The green hospital movement began years ago following the U.S Green Building Council (USGBC)'s release of their Leadership in Energy and Environmental Design (LEED) standards for building construction (Figure-1). Although initial cost to adopt green practices might be higher but they are the best investment in healthcare facility. Green Hospital have been shown

to reduce long-term energy costs. Moreover, green hospital design has been linked to better patient outcomes and staff retention in the past few years, a number of newly constructed and renovated hospital buildings have strived for and received LEED certification. Based on LEED Strategies, therefore the concept of green hospital includes the following: Site Development, Water Efficiency, Materials, Energy Efficiency and Indoor Environment Quality.

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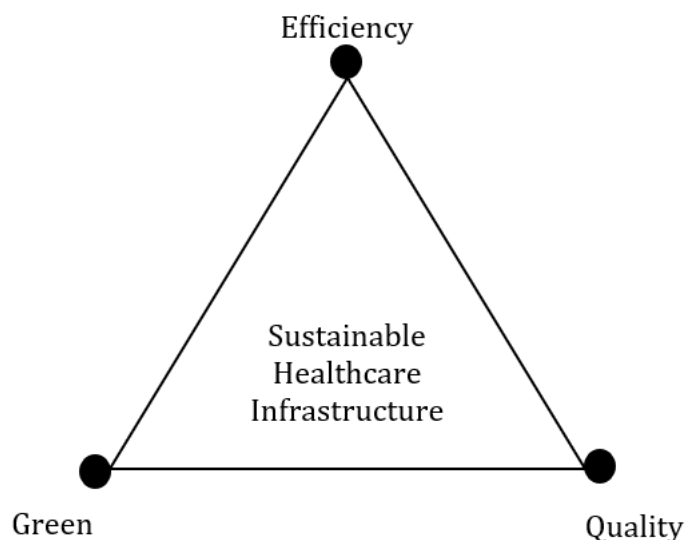


Figure-1: LEED Strategies ^{6,7}

GREEN INITIATIVES: CHALLENGES & BARRIERS

The key challenges for Green Initiatives are: Lack of awareness amongst the healthcare fraternity, no push from the Architects/Project Consultants, apprehension about the incremental cost. No recognition/incentives to motivate, resistance (additional work) from the shop floor, perceived as a cost centre /no marketing value. The different barriers to green health facilities/green hospitals are as follows: System redundancy – Requirement of secondary and tertiary backup systems to ensure that operations do not cease during emergencies; Regulatory compliance - Health and safety regulations and building codes prevent hospitals to adopt sustainable practices; Operational hours - Health facilities function uninterruptedly throughout the year; Infection control – Hospitals require strict infection control protocols which often run counter to sustainability practices; Ventilation rates – More frequent air changes are required in a hospital as compared to other commercial office spaces; Accreditation and licensing demands – Compliance with central, state and accreditation standards might prevent facilities to make environmentally sound choices; Intense energy and water use – Healthcare uses 2.1 times more energy per square foot than commercial buildings, and hospitals typically use 80 -150 gallons of water per bed per day; High-volume waste stream – About 0.5 Kg of hazardous waste is generated per bed per day; Chemical use - Hazardous chemicals used to clean and disinfect, sterilize equipment, treat certain diseases and for

laboratory research and testing can be toxic and hazardous; Life cycle – Exteriors of hospital buildings can last long, but interiors require renovations every few years.^{8,9}

A survey conducted by Health Facilities Management (HFM) in collaboration with the American Society for Healthcare Engineering (ASHE) and the Association for the Healthcare Environment (AHE) in 2013 identified many barriers/challenges that prevent hospitals from adopting environmentally sustainable practices; the top five among them are: competing investment or spending priorities, inadequate staffing for initiatives, underfunded operations and maintenance budgets, perceived higher costs over traditional materials or systems and time limitations.^{1,9}

BENEFITS OF GREEN BUILDING

Although external appearance of both look alike and functionality same, fundamental differences exist between the two. Green building helps conserve natural resources and concerned for human comfort, indoor environment and productivity. The benefits of green building are the following: Tangible benefits are 'Energy saving: 40-50%, water saving: 20-30%' and intangible benefits are 'All good aspects associated to green: Better indoor ambience, day lighting and view improved health and productivity'.^{1,9,10,11}

FOCUS AREAS FOR GREEN HOSPITAL DESIGN

Special interest and main focus areas in Green Hospital are site selection, lighting, indoor air quality, green house-keeping, clean and green interior building materials, gardens and landscape, medical waste management, disposal of pharmaceuticals, sound reduction, etc as noted down: Site Selection: What should we look out for? A virgin like location which puts the least pressure on the environment, clean air, clean water, clean soil, biodiversity is not disturbed; Lighting: Hospital design should maximum day light, optimize artificial lighting requirement, light that enhance proper and true to life vision, should be soothing to eyes; Benefits of Day Lighting and Views in Hospital: Positive effect on patients, reduces stress level of employees, combats seasonal affective disorder or winter depression, improves facilities overall operational efficiency; Design Aspect: In the design of a Green Hospital, special points to be considered are: (i) Energy conservation, (ii) Water conservation, (iii) To enhancement of natural lighting, (iv) Indoor air quality, (v) Outdoor fresh air equivalent, (vi) Mitigation of heat island effect by air affect green roof and wall gardens using insulators, rapid cooling technology and optimum air conditioning, (vii) Greenhouse keeping, (viii) Garden and landscape, (ix) Cleaning and green interior building, (x) Sound reduction, (xi) Medical waste reduction and disposal; Mitigation of Heat Island Effect: Creating green roofs, roof top gardens, use high-reflect roofing, insulators, rapid cooling technology, optimum air conditioning; Green House Keeping: Products and services that reduce the health and environmental impacts compared to similar products and services used for the same purpose, not just chemicals; It includes various components such as: chemicals, parking space, entrance matting, micro-fiber, recycling and waste reduction, water and energy conservation, liners, procedures, training, work loading and scheduling, communications, recycle programmes /waste reduction/ conservation, equipment and custodial hardware, filters, paper, ice milder, pest management; Clean and Green Interior Building: Patient and staff are exposed to a host of pathogenic germs and toxin that enter the hospital through the medium of large number of infected patients. Ensure the property of repelling or resisting growth of the pathologic germs and bacteria in interior surfaces: Use copper based interior materials for touch surfaces in hospital. Thus, sick building /building

related illnesses can be avoided using indoor or flooring that do not emit/absorb/release indoor pollutants such as VOC and dust; Garden and Landscape: An aesthetic delight that promotes wellness of patients in hospital are garden and landscape. Research studies showed that recuperation from stress is faster and complete when patients are exposed to natural settings than any other of built environment; Sound Reduction: Noise is a well-documented source of pollution in healthcare settings. Research finds that in hospital that reduced noise level led to better patient satisfaction, sleep improvement, and lowered blood pressure. Among other things, one should do the following: Provide building occupants with a healing environment free of noise, locating patient rooms away from any source of noise, quite air-conditioning, insulation in the walls that prevent noise; Medical Waste Reduction and Disposal: Reduce and eliminate the use and improper disposal of chemical hazard and toxic materials within the healthcare facility to safeguard the health of building occupants including patient. The waste produced in the course of healthcare/medical activities carries a higher potential for infection and injury than any other type of waste.

It is essential to have safe and reliable method for its handling. Improper handling of healthcare/medical waste many have serious public health consequences and a significant adverse impact on the environment. Therefore, compliance to adequate and appropriate waste disposal processes should be carried out and compliance to them are vitally important for patients as well as healthcare workers and from public health point of view.^{3,9,10,11,12} In this respect Government of Bangladesh (GOB) and PRISM Bangladesh, a private enterprise, have developed guide-line regarding disposal of healthcare/medical waste produced daily in all the healthcare service institute/corporate hospitals in the country.^{1,13,14,15,16}

STRATEGIC PLAN OF ACTION

Quality is defined as conformance to the requirements of users or customers and the satisfaction of their needs and expectations. When faced with pressures for both cost reduction and quality improvements, healthcare institutions and other industries implement a process termed total quality management (TQM).^{17,18}

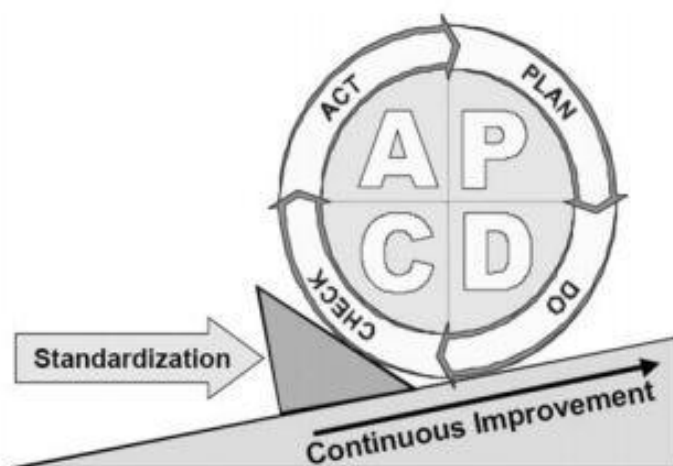


Figure-2: Plan, Do, Check & Act (PDCA) Cycle.¹⁹

Adoption of the scientific method of PDCA (Plan, Do, Check, Act) cycle is the appropriate way for achieving TQM objectively in a healthcare set up (Figure-2).^{19,20} These would ensure high

quality patient care to their satisfaction in a hospital. Donabedian proposed to use the triad of Structure, Process and Outcome in evaluating quality of medical care. He defined “Structure” as the settings, qualifications of providers and administrative systems through which care takes place; “Process” as the components of care delivered; and “Outcome” as recovery, restoration of function and survival. These concepts remain the foundation of quality assessment today and Donabedian Model for health care quality i.e. Structure ->Process -> Outcome was accepted universally.^{21,22,23,24} And a Green Hospital is in ideal situation to achieve TQM through these important steps in the institution.^{19,20,24}

GREEN HOSPITAL PERSPECTIVES IN BANGLADESH

Some of the larger hospitals in Bangladesh are BSMMU Hospital Dhaka; Dhaka Medical College Hospital; Chittagong Medical College Hospital; United Hospital Dhaka; Bangladesh Specialised Hospital Dhaka; Apollo/Evercare Hospitals Dhaka; Impulse Hospital Dhaka; Labaid Specialised Hospital Dhaka; Square Hospitals Ltd Dhaka; Popular Hospital Dhaka; Ibn Sinha Hospital Dhaka; Bangladesh Eye Hospital; Imperial Hospital Chittagong; ZH Sikder Women’s Medical College Hospital Dhaka; Uttara Adunnic Medical College Hospital Dhaka; Bangladesh Medical College Hospital Dhaka; Medical College For Women & Hospital Dhaka; Central Hospital Dhaka and many others. Unfortunately, so far very few published information is available about their status relevant to Green Hospital concept.^{25,26,27}

However, an unpublished cross-sectional (qualitative & quantitative) study titled “Green Hospital: Perspective in the Selected Private Hospitals of Dhaka City” was conducted in 2013 by Akter et al at Dhaka, Bangladesh.²⁸ A total of 08 (eight) private hospitals (>100 bedded) of Dhaka City were selected purposively according to the feasibility of the study and brought out some basic information regarding compliance to green hospital concept. By area occupied for the hospital building, only two hospitals were found using >1000 sq. ft per bed capacity. Almost all of the 08 study hospitals reused their building structure and used energy saving bulbs and lights. None of these hospitals were found to have carbon dioxide sensors to measure indoor air quality. In one of the hospitals, energy consumption (unit) per month per bed was far higher than the other hospitals due to its vast area, park and green ways. In terms of energy and water usage efficiency of these hospitals, generally encompassing the use of solar-energy, mechanical-ventilation, energy-used cooling system, use of solar panel, and recycling of waste water, only two of those hospitals were found using solar energy for indoor lighting. Regarding medical waste management efficiency, all the 08 studied hospitals had adequate space for storage of hazardous waste and those hospitals were found to perform segregation of their wastes according to government rules for internal management. After evaluating all the qualitative and quantitative analyses, it was concluded that only two of those hospitals fulfilled >50% and the rest of the hospitals, i.e. six of them, fulfilled <50% only of the issues related to Green Hospital concept. More recently one study was conducted about status of quality and compliance to inpatient quality indicators (IQIs) and patient safety indicators (PSIs) in a selected private (corporate) hospital in Dhaka city.^{29,30,31} The quality indicators, IQIs and PSIs, developed by Agency for Healthcare Research and Quality (AHQR) USA, TQM and PDCA cycle are important processes to ensure “Reliable Quality Health/Medical Care Services At Affordable Cost” by a corporate hospital.^{17,18,19,24,31} The findings of the study at Dhaka indicated that the hospital concerned did not yet fully achieved required quality status to the level of a Green Hospital.²⁹ However, the investigators suggested that it would be possible for these hospitals to achieve the ‘Green Hospital Status’ in the near future if TQM, PDCA Cycle, IQIs and PSIs are

strictly implemented and followed up regularly. The investigators recommended that this type of studies on Green Hospital Concept should be extended systematically to other hospitals to evaluate and establish each of the issues of Green Hospital Concept adequately and perfectly.^{25,26 28,29}

GREEN HOSPITALS IN USA, UK, EU, CANADA, AUSTRALIA, NEW ZEALAND, INDIA & OTHER COUNTRIES

Many corporate hospitals in the above-mentioned countries fulfill the criteria of Green Hospital concept to consider them as Green Hospitals. However, the details i.e. their name, address, picture, etc are outside the scope of the present review article.

CONCLUSIONS

In conclusion, the benefits achieved by Green Hospital are increased fresh air ventilation, regular CO₂ monitoring, better indoor quality, 20-40% energy saving, solar hot-water generation, 35-40% water saving, good day lighting, healing benefits for patients, patient recovery faster. The management of healthcare/medical wastes effectively should be a crucial component of environmental health protection. It should become an integral feature of healthcare service and thus protecting the health of patients, health workers and the general public. Ideally, appropriate and adequate strategic plan of action be developed, implemented, evaluated and monitored its effectiveness regularly adopting PDCA (Plan, Do, Check, Act) cycle. It can therefore be concluded with a special statement: Let the healthcare/medical wastes of "the sick" not contaminate lives of "the healthy". Some studies and expert opinion suggested that none of the big hospitals in Bangladesh fulfill the international criteria for consideration to the status of Green Hospital. As the Green Hospital design and concept have several patient oriented benefits, concerned authorities of both government and private sectors in Bangladesh should concentrate and put meticulous efforts towards design aspects based on Green Hospital Concept sooner than later in the near future.

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References

- [1] Dhillon VS, Kaur D. Green hospital and climate change: Their interrelationship and the way forward. *Journal of Clinical and Diagnostic Research* 2015 Dec; 9(12): LE01-LE05. Doi: 10.7860/JCDR/2015/13693.6942. Available from: https://www.Researchgate.net/publication/287260904_Green_Hospital_and_Climate_Change_Their_Itterrelationship_and_the_Way_Forward. (Retrieved 2021 September16).
- [2] Sohn BL. The Stockholm declaration on the human environment. *The Harvard International Law Journal* 1973; 14(3): 423-515.

- [3] Berkovics D. *Alternative Management Observatory*. Oxford: Capstone Publishing, 1999. Available from: http://appli6.hec.fr/amo/Public/Files/Docs/148_en.pdf. (Retrieved 2018 July 18)
- [4] Kumai S, Kumar R. Green hospital – A necessity and not option. *Journal of Management Research and Analysis* 2020 April-June; 7(2): 46-51. Available from: <http://doi.org/10.18231/j.jmra.2020.010>. (Retrieved 2021 September 16).
- [5] Guenther R, Vittori G. *Sustainable Healthcare Architecture*, Second Edition; Hoboken, New Jersey, USA: John Wiley & Sons, Inc.; 2013.
- [6] Wikipedia contributors. Green Building Council [Internet]. Wikipedia. The Free Encyclopedia; 2015 Feb 26, Available from: http://en.wikipedia.org/w/index.php?title=Green_Building_Council&oldid=648908264.
- [7] Herman. 28 Hospitals with Gold or Platinum LEED Certification. *Becker's Hospital Review*. [Internet] 2012. Available from: <http://www.beckershospitalreview.com/lists/28-hospitals-with-gold-or-platinum-leed-certification.html>.
- [8] Health Care Without Harm. Global green and healthy hospitals. Available from: <https://www.greenhospitals.net/about-hcwh>. (Retrieved 2021 September 11).
- [9] Burmahi B, Hoppszallem S. Shades of green: Slow but steady progress on road to sustainability. *Healthcare facility management*. 2013 July. Available from: <http://www.hfmmagazine.com/articles/367-shades-of-green>. (Retrieved 2021 August 12).
- [10] Joseph JM, Pyngrope BB, Jose R, Aranha D, D'Souza P. Study on awareness of “Go Green Hospital Initiative” among healthcare personnel with a view to prepare an informal leaflet. *Journal of Public Health Policy and Planning* 2019; 3(2): 18-21.
- [11] Houghton J. Five Deming principles that help healthcare process improvement, July 2018. *Health Catalyst*. Available from: www.healthcatalyst.com/insights/5-deming-principles-for-healthcare-process-improvement/. (Retrieved 2018 June 17).
- [12] Giasuddin ASM, Khurshid N, Seoty NR. Importance of compliance to quality management of healthcare/medical waste: A review. *International Journal of Medical Science & Clinical Invention* 2020; 7(2): 4751-4756
- [13] Park K (Editor). *Hospital Waste Management*, Park's Textbook of Preventive Medicine. Twenty Fourth Edition: Jabalpur, India: M/S Banarsidas Bhanot Publishers: 2017: 826-831.
- [14] The waste hierarchy. <https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/warr-strategy/the-waste-hierarchy>. (Retrieved 2018 June 21).
- [15] PRISM Bangladesh Foundation. *Medical Waste Management Programmes*. <http://pbf.org.bd/programs/Medical-Waste-Management>. (Retrieved 2018 July 12).
- [16] Government of Bangladesh. *Medical Waste Management Guideline, 2015-2016*; Directorate General of Health Services (DGHS), Ministry of Health & Family Welfare (MOHFW), Dhaka, Bangladesh.
- [17] World Health Organization. *Definition, Classification and Function of Hospital*. Available from: <http://www.slideshare.net/zulfiquer732/definition-classification-and-function-of-hospital>. (Accessed 2019 March 25).
- [18] *Toolkit for Using the AHRQ Quality Indicators. How to Improve Hospital Quality and Safety: Introduction to the Toolkit for Using the AHRQ Quality Indicators*. Available from:

- <http://www.ahrq.gov/sites/default/files/wysiwyg/professionals/systems/hospital/toolkit/combined/combined.toolkit.pdf>. (Accessed 2019 January 10).
- [19] United Nations Industrial Development Organization (UNIDO) & Japanese Standards Associations (JSD). A Roadmap to Quality: An e-Learning Manual for Implementing Total Quality Management Vol. 1: Vienna: UNIDO, 2007; 2-7 & 15-19. Available from: http://www.unido.org/sites/default/files/2009_04/A_roadmap_to_quality_volume_1_0.pdf. (Accessed 2019 March 04).
- [20] Giasuddin ASM, Rahman MA, Islam ANMS, Yasmin N. Quality management of diagnostic laboratories in a corporate hospital: An overview. *International Journal of Medical Science & Health Research* 2020; 4(3): 86-95.
- [21] Donabedian A. Evaluating the quality of medical care. *Milbank Quarterly* 2005; 83(4): 691-729.
- [22] Donabedian A. The seven pillars of quality. *Arch Path Lab Med* 1990 Nov; 113(ii): 1115-18.
- [23] Donabedian A. The quality of care. How it can be assessed? *JAMA* 1988 Sep; 260(12): 1723-28.
- [24] Ayanian JZ, Markel H. Donabedian's lasting framework for health care quality. *The New England Journal of Medicine* 2016 July; 375(3): 205-207.
- [25] Rosenberg CE. *The Care of Strangers: The Rise of America's Hospital System*, Basic Books, New York, 1987-2013.
- [26] World Green Building Council. What is green building? <https://www.worldgbc.org/what-green-building>. (Accessed 2018 September 12).
- [27] Singh A, Jain A. Green hospitals-slide share. <http://www.slideshare.net>. (Accessed 2021 September 14).
- [28] Akter Y. Green Hospital: Perspective in the selected private hospitals of Dhaka city. A dissertation submitted in partial fulfillment of the requirements for the degree of MPH at Department of Public Health, School of Health Sciences, State University of Bangladesh (SUB), Dhanmondi, Dhaka-1205, Bangladesh in April 2013.
- [29] Giasuddin ASM, Shahjahan M, Seoty NR, Hossain S. Status of quality and compliance to inpatient quality indicators and patient safety indicators in a selected private (corporate) hospital at Dhaka city Bangladesh. *Bangladesh Medical Res Counc Bull* 2023 Aug; 49(2): 98-112.
- [30] AHQR Quality Indicators TM Inpatient Quality Indicators (Accessed 2019 February 27). Available from: www.qualityindicators.ahrq.gov/Downloads/Modules/IQI/V50/TechSpecs/IQI_Technical_Version50.zip.
- [31] AHQR Quality Indicators TM Patient Safety Indicators (Accessed 2019 February 27). Available from: www.qualityindicators.ahrq.gov/Downloads/Modules/PSI/V50/TechSpecs/PSI_50_updates_techspecs.zip.