Review Paper

Changing Perspectives: Should We Integrate Pharmacology in the Clinical Phase?

Badar Uddin Umar [1], Mainul Haque [2]

Abstract

Medical education has gone through tremendous evolution over the last few centuries. In the pre-Flexner and Osler era, medical education was mainly an apprenticeship-based model. After Flexner's report in 1910, medical schools were more formalized in the West and became affiliated with universities. They ran four-year undergraduate courses comprising 2 years in preclinical basic science and two years in the clinical phase. Many other countries followed the British model, with five years of undergraduate training and one year of intensive internship training in the hospital. These knowledge-laden, didactic, teacher-centered courses could not produce skilled physicians to meet the challenges and health care needs of the 21st century. That is why innovative teaching methodologies were introduced in medical schools. Problem-based learning, team-based learning, flipped classrooms, and integrated curriculum concepts were introduced.

In Bangladesh, the medical education also going through a similar transition and heading towards an integrated medical curriculum. Pharmacology being a core preclinical science, is, in fact, at the cusps of clinical education. To produce competent physicians with good prescribing competency, knowledge of drugs is essential. In this perspective, pharmacology is a unique subject that should be integrated across all phases of medical education.

Keywords: Prescription, medication errors, adverse reactions, curriculum, clinical pharmacology, therapeutics, basic science.

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"The mediocre teacher tells. The good teacher explains. The superior teacher demonstrates. The great teacher inspires." ~William Arthur Ward [1]

Background and Historical Perspectives

There have been substantial changes in medical education over the past few decades [2, 3]. Medical education is continually changing. Many changes, such as the emergence of core curricula with electives and more systematic curriculum planning, have been promoted [4]. The volume of new information and technological development necessitated the change in the modern medical curriculum as students and practitioners found deficiencies within the traditional curriculum [2]. The most significant changes in North America began after the Flexner's Report of 1910, which introduced a completely new model of medical education. Flexner had huge concern over how the medical schools were running and how the curriculum was planned. He was dissatisfied and wrote that there is "enormous over-production of uneducated and ill-trained medical practitioners." He criticized the commercialization of medical education, didactic

1. Oxford College of Arts, Business and Technology, 670 Progress Ave, Scarborough, ON M1H 3A4, Canada. Orcid ID: https://orcid.org/0000-0002-1609-6276
2. Unit of Pharmacology, Faculty of Medicine and Defence Health, Universiti Pertahanan, Nasional Malaysia (National Defence University of Malaysia), Kem Perdana Sungai Besi, Kuala Lumpur, 57000, Malaysia. Orcid ID: https://orcid.org/0000-0002-6124-7993

Correspondence: Mainul Haque, Unit of Pharmacology, Faculty of Medicine and Defence Health, Universiti Pertahanan, Nasional Malaysia (National Defence University of Malaysia), Kem Perdana Sungai Besi, Kuala Lumpur, 57000, Malaysia. Telephone: +60109265543. Email: runurono@gmail.com, mainul@upnm.edu.my.

way of teaching, and the way students used to learn "getting by heart." Based on his recommendations, reforms were made, and a university-based academic model of medical education came in. Flexner emphasized the importance of basic science knowledge to build the foundation for clinical practice [5, 6]. There was a distinct division between basic sciences and clinical education in medical schools during the post-Flexner era. Due to this barrier, students would not find relevance in what they were taught in introductory science classes [7]. Since Flexner and Osler's [5] early 1900s reported that US and Canadian medical schools have had four-year programs, divided into 2+2 years for basic sciences and clinical education.

It was reported that during the world-war-II medical course work was reduced 3 years to meet the acute shortage doctors' [8]. Traditionally, medical students were taught in large groups, where professors would lecture and passively transfer knowledge to the students and expect to retain it. The medical curriculum has observed a shift from this traditional didactic model to a more interactive model with problem-based learning (PBL), team-based learning (TBL), an integrated curriculum [9]. These alternatives to conventional didactic teaching are being increasingly implemented [10]. Case- or patient-based knowledge, shortened pre-clerkship curricula, earlier immersion in the clinical environment are some strategies adopted successfully in the US [11]. Recent decades have observed shifts towards a more integrated curriculum with centralized administrative control in the US and Canadian medical schools [12]. It has been observed that both the learners and educators liked the innovative, integrated way of teaching medicine. When basic sciences are taught in conjunction with clinical cases, student comprehension increases many folds [13]. The clinical reasoning ability of medical students builds on the basic medical sciences knowledge acquired during preclinical years [14]. Despite this, there are shreds of evidence lacking in the curriculum, especially concerning basic sciences and their relevance to clinical perspective. Students believe that the curriculum does not prepare them adequately for clinical practice [2]. In their perspective paper, Mehta et al. (2013) narrated the shortcomings of modern medical education. They expressed concerns about the way the medical students were taught in North America. Besides other goals, this publication also identified "integration of formal knowledge and clinical experiences" as necessary [15]. Curricular reforms in medical schools are required to accommodate the rapid availability of information, changing needs of the society, changing demographics, and healthcare advancements [16, 17].

Brief History of Medical Curriculum of Bangladesh

Before 1988 Bangladesh even did not have a formal medical curriculum, except having a syllabus. Then in 1988, with the guidance from WHO and UNDP, and with the help of the Centre for Medical Education (CME) developed its first national curriculum [17-19]. The new modern curriculum was introduced in 2002, divided the whole course into three phases. Phase I consisted of an initial one and half years and covered Anatomy, Physiology, Biochemistry, and basics of Community of Medicine. Phase II comprised two years and covered basic sciences like- Community Medicine, Forensic Medicine, Pathology, Pharmacology & Toxicology, and Microbiology topics. Initial clinical exposure was introduced from Phase II and Medicine & allied subjects, Surgery & allied subjects, and Gynaecology & Obstetrics were taught besides basic subjects. Phase III lasted one and half years and covered Medicine & allied subjects, Surgery & allied subjects, and Gynaecology & Obstetrics. Students were taught in the wards at the bedside. Then in 2012, a modified version of the existing curriculum was introduced by reallocating subjects and dividing the phases into four (Table 1) [17, 20-21].

Table 1: Bangladesh, MBBS Curriculum (2012) [20]

Phase	Duration (year)	Subjects	Professional MBBS Examination
Phase 1	1.5	Anatomy Physiology Biochemistry	First
Phase 2	1	Community Medicine Forensic Medicine	Second
Phase 3	1	Pharmacology and Therapeutics Pathology Microbiology	Third
Phase 4	1.5	Medicine and Allied subjects Surgery and Allied subjects Obstetrics and Gynaecology	Final

Role of Basic Sciences in Medical Education

"Basic Sciences" are the range of biomedical, behavioral, and social sciences that builds the foundation of medical knowledge. Understanding

these sciences may enable future clinicians to understand disease mechanisms and think critically to solve clinical problems and predict tests. A study conducted on medical students and graduates in Australia found that participants' basic science scores were moderately correlated with summative exams [22]. Basic sciences traditionally constituted anatomy, physiology, biochemistry, microbiology, immunology, pathology, and pharmacology. Also, genetics, molecular biology, epidemiology, biostatistics, behavioral sciences were considered foundational sciences [23]. Goldszmidt and his team, in a research paper (2012), tried to prove the importance of basic medical science in the context of clinical relevance. Biomedical knowledge is essential for learning and retaining the ability which helps clinical diagnosis [24]. North American academic training models of medical education emerged based on Flexner's Report in 1910, emphasizing basic sciences to create a foundation for clinical reasoning. According to this model, medical decision-making is based on understanding the underlying biomedical sciences and improving clinical care [25]. To complete medical education, a student needs to have a sound knowledge and understanding of basic sciences, enabling diagnostic accuracy [26]. World Federation for Medical Education (WFME), in their revised "Standards for Basic Medical Education" of 2020, has directed what to include in the curriculum. Basic biomedical sciences were mentioned as fundamentals underpinning the understanding and application of clinical sciences [27].

Critical thinking and decision-making in the clinical context are based on basic science knowledge. Students with a deeper foundation of basic sciences are better prepared to address uncommon, complex clinical situations [23]. Traditionally, basic sciences were taught in didactic, extensive group lecture sessions emphasizing rote memorization. Delivery mainly was unidirectional, and learning was passive. Disciplines tried to emphasize their subjects and expect the students would give more importance to them. The students would find the correlation between the primary and clinical parts of the information being learned. This lack of integration made learning very difficult on the students' interest [28]. Authors of medical education research found many redundancies, content gaps, unrelated essential science topics to clinical skills, and deemphasized biopsychosocial issues in the undergraduate curriculum. There were deficiencies of horizontal and vertical integration between basic sciences and clinical sciences [29].

What is Integrated Curriculum?

An integrated curriculum connects the basic sciences with the clinical sciences by correlating, emphasizing, and establishing links [30]. It is defined as "education that is organized in such a way that it cuts across subject-matter lines, bringing together various aspects of the curriculum into the meaningful association to focus upon broad areas of study" [6]. Through integration, the teaching matters are organized to promote interrelation or unification of subjects frequently taught in separate academic courses or departments.[31] Integration creates a bridge within the basic sciences, between basic sciences and clinical science, and humanities and biopsychosocial subjects with the former two [29]. It helps the medical graduate put the basic and clinical information and knowledge in context, have a holistic picture of the patient, and devise the treatment plan effectively [31, 32]. Finnerty (2010) also believed that foundational sciences should be introduced as early as possible across the curriculum and incorporated throughout the length of the curriculum. As well the essential science elements should be made clinically relevant [23]. In an integrated curriculum, the course is organized and classified by organ systems rather than departments. Students get exposure to clinical knowledge besides basic science knowledge and build a context [33].

According to adult learning theory, adult students learn mostly independently, and it is self-directed learning. An effective learning environment is needed, and the students need to be engaged, encouraging them to learn comfortably. Through a curriculum, the educational idea could be expressed into practice. So, a curriculum is basically "all the planned learning experiences of a school or educational institution" [34]. Integrated Curriculum breaks down the basic and clinical sciences barrier. It promotes the flow of knowledge and acquisition of skills in future physicians, where the knowledge is transmitted in actual clinical experiences. As well it does not deemphasize the basic sciences. The materials are synchronously presented to the students facilitating better understanding and retention of basic concepts in clinical science [35]. The McMaster University of Canada is one of the first to introduce this type of curriculum in medicine, which became extensively practiced and widespread across the globe in later decades [35]. Various educational organizations like-

the Association of American Medical Colleges (AAMC), the General Medical Council (MGC) in the United Kingdom, the Association of Faculties of Medicine of Canada, the Australian Medical Council (AMC), and the Inquiry on Medical Education in Sweden have recommended: "integrated medical curriculum" in medical schools [35]. The medical students well appreciate integrated learning [36]. A study conducted in India on year 2 medical students found that combined learning sessions were appreciated as they elevated students' critical reasoning skills and self-directed learning attitudes [28].

How does the Integrated Curriculum Works?

Sir William Osler's view regarding clinical education is reflected through his famous quote, "To study the phenomenon of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all" [37]. This view supports the integration of medical education. This distinctly innovative and new curriculum initially had a couple of different models. Discrete topics were integrated over the course length like ethical studies and clinical skills incorporated in the first-year courses, integrating one approach or clinical experience into a single unit, using preclinical and clinical preparatory courses, and integrating early clinical exposure into the earlier stages of medical education [35].

There are many ways of integrating basic science into clinical years. Two important ones are- (i) program-level interventions and (ii) clerkship-level interventions. In the former Case-based, interactive, small group sessions are used alongside standardized patient encounters or simulations to integrate fundamental concepts into clinical experience. The second strategy adopts teaching methodologies like-lectures, case-based learning (CBL), team-based learning (TBL), flipped classroom, and problem-based learning (PBL). Integration is achieved through nesting or infusion, collaborative teaching, complementary programming. This approach pairs clinical exposure with a relevant essential science discipline so that the contents are thoroughly dispersed throughout the exposure. Effective collaboration of clinical scientists and primary science teachers is a prerequisite [11]. Appropriate weightage is given to distinctive learning objectives and discernments fundamental to each discipline. Substantial design suppleness is achieved by including additional learning activities in each block. For example, physical examination can be learned using standardized patients in small group sessions [38]. To begin an integrated session; first, a case is reviewed, then a hypothesis is generated, followed by a discussion of the rationale and interpretation of laboratory data or results. Last but not least, a differential diagnosis is discussed considering the classification of disease. Using organ slides, tissue sections, and microscopic slides, a pathologist can discuss the pathophysiology of the disease. A clinical pharmacologist then uses the "Pharmacology Mental Algorithm" to discuss pertinent pharmacological perspectives of each case. Rational therapeutic interventions are then taught systematically [38]. Medical educationists are interested in both vertical and horizontal integration in the medical school curriculum. Multidisciplinary integration using a case-based approach is an appropriate method of learning. Students can actively participate and learn clinical reasoning when clinical relevance is introduced during a discussion of a basic science topic. This enhances knowledge acquisition, and diagnostic competency of medical students is fostered too [22, 38].

'Integrating pharmacology into the teaching of medical students is not easy.' Teaching pharmacology is primarily irrelevant to clinical practice. Medical schools are not the only repository of knowledge, and learning does not cease with graduation. Lifelong learning is of great value.[39] Integration could be vertical, horizontal, or both vertical-horizontal—vertical integration bridges basic sciences with clinical sciences. Some critical aspects of integration are- early clinical experience, clinician-scientist partnerships, and incorporation of sciences in the later years of the course. Vertical integration attaches basic and clinical sciences besides the socio-humanistic and population health sciences, leading to a broader notion of teaching and learning medicine [7].

Integration and Bangladeshi Perspective

The medical education in Bangladesh is based on a century-old colonial model divided into disciplines and delivered through lectures, where students are not focused. It is teacher-centered, examination-driven, and hospital-based [17-19]. There has been a lot of criticism of medical education in Bangladesh as it failed to produce capable practitioners. Deficiencies in the Bangladeshi medical curriculum were felt long ago by the experts [18, 40]. Suggestions were made to rewrite the pharmacology curriculum to accommodate the basic principle of rational drug therapy and concepts of essential drugs in a community-oriented design. This would better prepare the countries to be physicians prescribe confidently and logically [40]. In

his Editorial Message, Sayeed (2010) [41] expressed concerns and suggested that an integrated curriculum could be a good solution [41]. Despite a well-developed medical education system, Bangladesh faces challenges, especially in modern teaching-learning methodologies [42].

One unique quality of Bangladesh's medical curriculum is one nationwide curriculum [17, 43]. Introducing and implementing a new curriculum like "Integrated Medical Curriculum" faces a challenge [44]. Zumwalt and Domingues, in 2019, argued that integration of basic science into clinical education is challenging. This is primarily due to the lack of clinical exposure of the primary science educators, who are not clinicians or doctors. In Bangladesh, this is not the fact. In Bangladesh, most of the basic science educators are medical graduates with adequate clinical exposure and skills. So, integrating basic science with clinical science will not be very difficult for them. A few weeks of training exposing them to different educational methodologies would prepare them well [30]. Bangladesh is presently transitioning towards a new integrated curriculum through its "Curriculum for Under-graduate Medical Education in Bangladesh–Updated 2020," based on integrated, need-based, core & optional, problem-based, community-oriented, community-based principles & competency-based curriculum focusing on the disciplines [45].

Problems with Integrated Curriculum

Like many other reforms, the integrated curriculum also faced resistance from many groups, especially teachers [7, 46]. On occasions, departmental resistances are enormous as integration requires eliminating departmental barriers. Interdepartmental cooperation in running interdisciplinary courses is at the cusps of integration. Traditionally our faculty members are too discipline limited and specialized in only one discipline, making them reluctant to participate in the integration process [29]. Sometimes, the organizational culture, values, and attitudes are challenged and become difficult to change. It is more prominent with schools having teacher-centered perspectives. Teachers in those schools believe that small group learning focusing on social discussions and deemphasizing lectures would cause a cut out of many important topics [7]. Designing an appropriate assessment of education is another challenge [29, 47]. Lack of resources, willingness to change and lack of understanding may make the integration process challenging [29, 31]. Skepticism towards a new system, the inadequacy of the system, the inflexible attitude of teachers, extra workload, administrative and other costs, and too many exams are some mentionable downsides [46]. "Change without a difference" is another concern. If the curriculum is not need-based and structured without examining student needs, it will fail. Both students and teachers will struggle with the implementation of such a curriculum [7].

Why Pharmacology?

Before we answer this question, let's try to answer what pharmacology is? Pharmacology is defined as "the study of substances that interact with living systems through chemical processes, especially by binding to regulatory molecules and activating or inhibiting normal body processes" [48]. The word emerged from the ancient Greek words *pharmakon* (meaning 'drug') and *logia* (meaning' knowledge of'). So, pharmacology is the knowledge of drugs [49]. It embraces the knowledge of history, source, physical and chemical properties, compounding, biochemical and physiological effects, mechanism of action, absorption, distribution, biotransformation, excretion, and therapeutic and other uses of drugs [50, 51]. The paraclinical subject is a crucial subject required by the students for later clinical application [52]. As Aronson defines, clinical pharmacology includes all aspects of the study and use of drugs in humans [53]. A pharmacologist has traditionally taught medical students the practical or applied aspects of drug therapy. Students learn about the medications, pharmacokinetics, pharmacodynamics, and balanced prescribing to maximize and minimize harm by learning pharmacology [53, 54].

Besides, a clinical pharmacologist also contributes to the new drug development process, application of new therapeutics, and determination of beneficial and harmful effects of drugs [55]. Clinical pharmacologists historically conduct clinical trials.[54] Pharmacology is taught in the pre-clinical phase of medical education. In Bangladesh, it was introduced in the year III-IV [56]. Many other South Asian countries also follow the same model. In India, pharmacology and CPT are taught in the second year. However, it is expected to be integrated throughout the clinical years of Year III-V [57]. In the US and Canada, pharmacology is taught in year 2 of the 4-year extended medical schooling [58]. Pharmacology prepares a clinician with the prescribing skills and empowers to prescribe rationally, minimizing patient harm [19, 43, 59].

Another critical perspective for choosing

pharmacology is because the authors hailed from Bangladesh and originally were pharmacologists and clinicians working in Bangladeshi medical schools as pharmacology educators.

Importance in Attaining Good Prescribing Skill Against the Global Background of Irrational Prescribing

Quality healthcare has been gaining importance for the last few decades [60], and there was a campaign going on at the global level to have universal healthcare (UHC) for all [61]. According to the World Health Organization (WHO), UHC means "all individuals and communities receive the health services they need without suffering financial hardship." This can be achieved through strong primary health care (PHC) approach. WHO's 1948 Constitution declared health as a fundamental human right [61]. To ensure this right, the healthcare providers need to act and ensure the safety of the medication [62]. Prescription skills develop through a deep understanding of principles of clinical pharmacology besides the ability to judge risks and benefits of drugs. The poor prescription may cause medication errors and harm the patient [63-65]. Rational prescription is defined as "using the right drug for the right patient at the right time in the right dose and manner of administration, at affordable cost and with right information" [66, 67]. WHO commented that "more than half of all medicines are prescribed, dispensed or sold inappropriately, and that half of all patients fail to take them correctly" [68]. The appropriateness of prescribing can be measured using several indices. Choosing the correct indication, dosing, direction of use, drug-drug interaction consideration is important ones [69]. There have been global concerns over the increasing rates of harm related to medications [70].

Inappropriate prescribing is on the rise ans one of the primary causes of drug-related harms [71-74]. The cost of medication error-related damage is tremendous. These errors are common both in developed and developing countries. The quality of prescription assessed by surveys in the past was not encouraging. Various types of inconsistencies were revealed through those studies. This problem exists both in the developed world and developing countries [75, 76]. Besides physical and mental harm, it affects the user in many ways, including – economic burden, prolonged hospitalization, inappropriate polypharmacy, and antimicrobial resistance [77]. A systematic review of the main factors leading to the irrational prescription of medicine found that inadequate knowledge, training, and inexperience are some crucial factors leading to inappropriate medication [78]. Knowing how to prescribe drugs rationally is essential for every doctor to ensure patient safety [79], which many experts consider a core competency [80]. Proper education on the pathophysiology of diseases and pharmacology of drugs can enable students to prescribe rationally, which could be measured by assessing their knowledge and skills [68-70]. Prescribing is not a process of matching lists of symptoms to lists of drugs; instead, it requires strong analytic skills a strong foundation of CPT [65]. The best way to acquire optimal prescribing skills is through educational and managerial interventions. When done at an early level of education, it can improve medical graduates' knowledge and awareness and promote rational prescribing [81].

Students and Interns Perception regarding Prescribing Skill around Globe

Writing a prescription is one of the core competencies a junior doctor or medical graduate will acquire from medical school. This prepares them to prescribe drugs rationally and safely [82, 83]. Good prescribing improves patient care by balancing the harm and benefit to the patient. Prescription data can be used to assess the quality of prescribing [81, 84]. Learning how to prescribe medicine prudently is a challenging task at the undergraduate level. This is because medical knowledge has expanded exponentially recently, causing the students to learn an endless list of drugs and their pharmacology and clinical use [63]. There is plenty of evidence establishing the lack of prescription competencies of medical students and their dissatisfaction with the poorly designed CPT curriculum [63, 85-87]. A study on postgraduate doctors from India also found negative opinions regarding CPT education at the undergraduate level as it failed to prepare them thoroughly to prescribe competently. [59] (Upadhyaya et al., 2012) Acquiring prescription skills is central in preventing prescription errors and reducing ADRs [86]. Students showed a general lack of preparedness, self-confidence, knowledge, and skills in prescribing rationally [86, 88]. Studies found significant numbers of prescription errors made by junior doctors across the globe [89-91]. Improved CPT teaching could boost the student confidence in prescribing drugs and eliminate the risk of patient harm [92]. The students perceived small group teaching as the best strategy to learn prescription writing skills [93].

Irrational prescription is a regular practice in Bangladesh and other Southeast Asian countries [94-96]. A study conducted on YEAR III-V Bangladeshi

medical students revealed that students of all years suffered from a lack of confidence in choosing the right drugs for prescription and a lack of knowledge in the proper selection of medicines like antimicrobials [56]. Inappropriate prescribing is a crucial contributor to the emergence of antimicrobial resistance (AMR) globally. AMR is the cause of morbidity, mortality, and rising healthcare costs, but in high-income and low- and middle-income countries (LIMCs) [97]. A survey of prescription writing skills of Pakistani house offices working in dental hospitals was deficient [98]. Evidence of inadequacies from India and other southeast Asian countries is also abundant [99, 100]. There are opposite perspectives too. Studies also showed that Indian junior physicians and medical students possess adequate knowledge and attitudes of prescribing medicines [101]. Bangladeshi interns also expressed a positive attitude towards pharmacology knowledge and preparation for prescribing safely in a survey [43].

Adverse Drug Reactions and Role of Pharmacology

With the increasing use of prescription drugs, adverse drug events (ADEs) are challenging the US healthcare system [102]. About 3%-7% of all hospitalizations in the US and 5-8% of hospital admissions in the UK are due to ADRs [103, 104]. The 12 prescriptions were written for each member of the population. The cost of medicines was more than £ 7 billion per year (13% of the total budget) [1]. Medication errors (MEs) [105], adverse drug reactions (ADRs) [106], and drug-drug interactions are significant causes of morbidity and mortality and are of great public health concern [107]. Ample and working knowledge of basic and clinical pharmacology is of primary significance to empower medical graduates to prescribe drugs and curtail MEs and ADRs assertively [108, 109].

Furthermore, understanding the importance of medication-related harm and its burden, WHO has unveiled the third global patient safety challenge, "Medication Without Harm," in March 2017. Among other factors, this program also identified physician incompatibility to prescribe appropriately as a vital challenge [110]. Knowledge of CPT enables the medical student to make therapeutic decisions, understanding and analyzing the risk and benefit of the drugs rationally [50]. There have been concerns over the ability of fresh graduates to prescribe medicines safely and effectively [55, 108, 111-114]. An Audit Commission report also investigated this aspect of the undergraduate medical course and found inadequacies among doctors [115]. Fresh medical graduates and undergraduate medical students were found to have poor confidence in prescribing certain drugs and showed inadequate knowledge of CPT and necessary prescribing skills [80, 109, 111, 113]. Prescription errors are widespread among fresh graduates, which is in part due to inadequate knowledge of drugs, disease conditions, patient history, and allergy [116]. In a study, Bangladeshi Intern doctors were found to have good pharmacology knowledge and confidence in their prescribing skills [43]. Prescription can reflect the quality of medical education and the physician's competency [117].

Place of Pharmacology in Medical Curriculum

In Bangladesh, India, and Pakistani medical curriculum, traditionally pharmacology used to be taught in the second phase or professional of MBBS [118]. Presently, in Bangladesh, Pharmacology and Therapeutics is taught in the third phase, Pathology and Microbiology, which is suggested to be moved to the second phase again in an integrated new curriculum [119].

While designing the clinical pharmacology and pharmacotherapy curriculum, it should be kept in mind that it meets the practical needs of future doctors, enabling them to prescribe rationally, overcoming many influences of the workplace, including patient demand, peer pressure, and pharmaceutical company promotions [120]. The undertaking of clinical pharmacology and therapeutics (CPT) is 'to improve the care of patients by advocating safe and effective use of medicines and evaluating and introducing new therapies [121]. The GMC in 1993 published 'Tomorrow's Doctors' which greatly influenced UK medical curricula. But it was deficient because of little specific guidance on the management of diseases and use of drugs.[2] Since CPT emerged as a discipline in the 1960s [53], excessive emphases were put on factual information, basic science, with little or no focus on patient-centered activities [2]. Poor coordination across courses and an artificial division between preclinical & clinical learning were among other limitations. Teaching methodology focused on excessive didactic lectures with no Problem Based Learning (PBL) opportunities. The GMCs document 'Tomorrow's Doctors,' 1993 recommended changes in medical the structure and contents of medical education by reducing substantial burden, incorporating PBLs, and developing skills for enduring learning. Learning outcomes in the form of knowledge, skills, and attitudes were to be refined. Being criticized and finding the gaps, GMC revised 'Tomorrow's Doctors'

in 2002, where essential guidance is to produce graduates adequately prepared to prescribe drugs [2].

Conclusion

Medical education evolved through tremendous changes from the nineteenth century to today's twenty-first century. We have experienced medical teaching changing from apprenticeship model to didactic lecture-based, large group model to small group problem-based model and later to an integrated model of teaching and learning. In the integrated curriculum, students get exposure to basic science concepts parallel to clinical sciences. This helps them find the context of what is taught, enhances comprehension, facilitates clinical reasoning, and improves patient care. Medical education has become expensive, and the knowledge base has expanded tremendously in recent days. So, change in the way medical education used to be delivered has to be brought. Pharmacology is a crucial paraclinical science based on understanding the principles of drug action on the body and disposal of the drugs by the body. Proper pharmacology knowledge is essential for a new prescriber to think critically before prescribing, increasing benefit and minimizing harm. Bangladesh should bring changes in its traditional way of medical education by introducing an integrated curriculum. This curricular change will bring positive change to our medical education and the overall healthcare system of the country.

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