

# Assessment of Bangladeshi Interns' Knowledge of Pharmacology and Therapeutics for Prescribing

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## ABSTRACT

Every medical graduate must have the intention to prescribe rationally. It is pharmacology which teaches rational of prescribing correct drug in undergraduate medical course. Therefore many eminent medical educationists believe that pharmacology is the most essential part of the medical curriculum. Medical graduates join as interns in their respective teaching hospital immediately after graduation. Although interns work is usually under the supervision of a senior consultant but there are occasions, when they need to make their own decision. Again drug market in Bangladesh, like many other countries, is rapidly expanding. Henceforth, interns' are sometime confused to choose a drug from therapeutic choices. This study was conducted with the intention to provide some light about the knowledge of pharmacology among the Bangladeshi interns. This was a cross-sectional study conducted on Interns (n=191) of six medical schools of Bangladesh. Validated instrument was used to uptake the data. These medical schools are both government and private but Bangladesh has unique curriculum for all medical schools. Out of these 191 participants 81 (42%) rated pharmacology knowledge is good, while another 77 (40%) had average understanding. As high as 80% (152) intern population feel that undergraduate training has prepared them to prescribe safely. One hundred seventeen (61%) interns have already observed cases of adverse drug reactions in their short active clinical life. Although it is a cross sectional study with its limitations, has identified that pharmacology and therapeutics course curriculum is not enough to produce safe prescribers.

## INTRODUCTION

'Pharmacology is the backbone of Clinical Medicine (Chaurasia, 2013). Prescribing correct therapy is the essential part of physicians and therefore, adequate knowledge on drugs' efficacy, safety, cost, and convenience is important (Mohan *et al.*, 2012). Lessons in Pharmacology provide and enrich medical students' knowledge and skill about different drugs and their utility in various diseases (Upadhyaya *et al.*, 2012). Fresh medical graduates very often need to prescribe many times a day

(O'Shaughnessy, 2010). Every medical doctor needs to develop the skill to 'select' the right medicine for any disease from a very wide range of therapeutic choices (Upadhyaya *et al.*, 2012). Pharmacology should be taught aiming to produce future rational prescriber. Therefore, rational use of medicine will ensure and the most important and vital proficiency of doctors will be achieved (Rangachari, 1997; Akat *et al.*, 2012; Theodorou *et al.*, 2009). It is over decade back General Medical Council of UK made a rule that every medical doctor must have the skill to prescribe safe and effective drugs (GMC, 2003). Even then there is rising apprehension in the countries of both side of Atlantic that 'medical error' is harming lot patient's treatment (Department of Health, 2000; Institute of Medicine, 2000). Erroneous choice of drug is one of the top medical errors and as high as 2% of all hospital admission in USA is due to 'medication

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errors' with majority of paediatric patients (Leape *et al.*, 1999; Barber and Dean, 1998; Kaushal *et al.*, 2001; Barber *et al.*, 2003). In the United States, medical error results in 44,000-98,000 unnecessary deaths each year and 1,000,000 excess injuries' (Weingart *et al.*, 2000). Again these mistakes and faults are mostly due to poor prescribing skill (Leape *et al.*, 1995; Bates *et al.*, 1995). Inadequate prescribing knowledge and skill in the both developed and developing countries are also reported in numerous published articles (Palmer *et al.*, 2001; Odusanya, 2004; Oshikoya and Chukwura, 2006; Abebayo and Hussain, 2010; Otoom *et al.*, 2010; Chima *et al.*, 2012; Goswami *et al.*, 2013; Gawde *et al.*, 2013).

In spite of lot failure to ensure safe and rational prescribing, the traditional teaching of pharmacology still continues in many countries of the world including Bangladesh (Michel *et al.*, 2002; Walley *et al.*, 1994; CME, 2002; BMDC, 2012). Medical curriculum is strictly controlled by government of Bangladesh (GOB) and it is unique for every medical school of the country (CME, 2002; BMDC, 2012). Pharmacology, last almost over a decade, was taught for two years in the phase II of MBBS programme as a part of second professional examination (CME, 2002). GOB has launched a new updated version of curriculum and it is implemented from 2014. Present plan of teaching pharmacology and therapeutic will be taught for one year in phase III (BMDC, 2012). There are no other pharmacology class in rest of the curriculum plan (BMDC, 2012). In earlier curriculum, there were three professional exams but now it will be four and pharmacology will be in phase III after one year of formal teaching (BMDC, 2012; Haque *et al.*, 2012). There are multiple reports published from a number of countries that medical students have much difficulty in prescribing correct drugs (Dehghani *et al.*, 2008; Oshikoya *et al.*, 2009; Garbutt *et al.*, 2005; Oshikoya *et al.*, 2007; Dornan *et al.*, 2009; Heaton *et al.*, 2008; Wall *et al.*, 2006). Traditional didactic teaching of pharmacology often creates enormous pressure to learn very high amount of information though memorising (Michel *et al.*, 2002; Walley *et al.*, 1994; Oshikoya *et al.*, 2007; Dean *et al.*, 2002; Queneau *et al.*, 1998). Therefore in real life situation, the students suffer from under developed logical and scientific approach of prescribing, eventually leading to poor prescribing quality (Walley *et al.*, 1994; Oshikoya *et al.*, 2008; Dean *et al.*, 2002; Ryan *et al.*, 2014). Obviously poor prescribing does not ensure benefit and comfort of patient rather increases morbidity and mortality (Motamed *et al.*, 2006). Pharmacology is basic science and like many other basic subject some time both students and teachers feel it is very 'dry' in describing and interpreting concept (Bradley *et al.*, 2006). At many occasion these concept are quite complicated in early years of medical school. Henceforth, modern countries and in some neighbouring countries of Bangladesh has adopted newer more updated teaching methods with more clinical orientation and therapeutics and integration of curriculum to ensure more interest and effective teaching and learning (Michel *et al.*, 2002; Flockhart *et al.*, 2002; Orme *et al.*, 2002; Vollebregt *et al.*, 2006; MCI, 1997; Shankar *et al.*, 2005; Aronson *et al.*, 2006). These methods have

significantly changed the situation of drug use. Therefore, ensures more rational use of medicine and communities are getting more safe and effective drugs (Michel *et al.*, 2002; Flockhart *et al.*, 2002; Orme *et al.*, 2002; Vollebregt *et al.*, 2006; MCI, 1997; Shankar *et al.*, 2005; Aronson *et al.*, 2006; Shankar *et al.*, 2003; Richir *et al.*, 2008). WHO also promoting as core intervention area for rational use of medicine (WHO, 2002). Henceforth, renowned British group of scientist also reported that pharmacology training should be continued and enhanced in early years of medical doctors (Walley *et al.*, 1994).

Bangladesh introduced the National Drug Policy back in 1982 with an intention of availability of essential drugs at cheaper price and to promote rational use of medicine (RUM) (Rahman *et al.*, 1998). Even then this highly appreciated drug policy cannot ensure much improvement in RUM probably due to some errors in the said policy (Rahman *et al.*, 1998). Irrational use of drugs also been reported for private practitioners and in primary health care centres (Rahman *et al.*, 2009; Gynon *et al.*, 1994) with rare exceptions in teaching hospital like Dhaka Medical College Hospital (DMCH) and Bangabandhu Sheikh Mujib Medical University Hospital (BSMMUH) (Karim and Haque, 1995; Rahman *et al.*, 2007). The current survey has carried out to ascertain the level of knowledge of pharmacology among the Interns of Bangladesh in six different medical schools. The findings of our survey will provide us better understanding of current status of pharmacology understanding among freshly graduated physicians in Bangladesh.

## MATERIALS AND METHODS

This was a cross-sectional study conducted on Interns of Bangladesh. The study population was all (191) of six medical schools of Bangladesh. Medical schools are Bangladesh Medical College (BMC), Central Medical College (CMC), Comilla Medical College (CoMC), Eastern Medical College (EMC), Shaheed Monsoor Ali Medical College (SMAMC), Uttara Adhunik Medical College (UAMC). CoMC is state owned and rest five medical college is privately established. Bangladesh has unique curriculum for both government and private medical school (CME, 2002; BMDC, 2012).

These medical colleges are affiliated with public University. In Bangladesh by law all medical colleges must be affiliated with public University. Convenient sampling technique was used to select the sample. The period of study was August to November 2013. Data was collected using a validated instrument (Oshikoya *et al.*, 2009) which is developed on the basis of another study conducted in Scotland (Tobaiqy *et al.*, 2007). Questionnaire then was modified for Bangladeshi context. Thus it was pretested and again validated. This questionnaire has five sections. Section I is demography; section II is undergraduate pharmacology and therapeutics teaching; section III is internship training; section IV is knowledge of adverse drug reactions (ADRs); and section V is drug information references and how to improve undergraduate pharmacology and therapeutics teaching. The data was then compiled and analysed using SPSS version-16.

## RESULTS

Total 191 interns of six medical schools participated in the study. Among the sample, 31 (16%), 29 (15%), 32 (17%), 38 (20%), 44 (23%), and 17 (9%) were from BMC, CMC, CoMC, EMC, SMAMC, and UAMC medical colleges respectively. These medical schools are affiliated with either University of Dhaka (BMC, SMAMC, and UAMC) or University of Chittagong (CMC, CoMC, and EMC). Among the interns males were 82 (43%) and females were 109 (57%). One hundred thirty three (70%) internes age were between 21-25 years; 56 (29%) of them having age 26-30 years; only 2 (1%) were having age more than 35 years. Among our study population 100 (52.4%) of them graduated in 2013, 90 (47.1%) of them in 2012, and only 1 (0.5%) graduated in 2011. Our respondents already finished their medicine (107; 56%), surgery (82; 43%), obstetrics and gynaecology (99; 52%) and paediatrics (54; 28%) rotation duties.

Over 97% (187) of current study population agreed that pharmacology and therapeutics were taught in their undergraduate MBBS course. Majority of the participants of the study rated that knowledge of pharmacology at graduation level is from average to excellent. Out of these 191 participants 81 (42%), 77 (40%), 15 (8%), 13 (7%), and 5 (3%) rated pharmacology knowledge is good, average, poor, excellent, and very poor respectively. Again our 80% (152) intern population feel that undergraduate training has prepared them to prescribe safely. Only 20% (39) interns have negative opinion. Same population group opted only 65% (125) that undergraduate training prepared them to prescribe rationally and rest 35% (66) interns say no. Interns identified few other factors that affect to prescribe rationally. Those are: drug-drug interactions, less confidence, newer drug selection, P drug selection, paediatric doses, patient's financial status, patient's genetic factors, restriction to prescribe, and senior guided prescription. Very interestingly 43% (83) feel that they have some specific problems with prescribing during internship and rest 57% (108) encountered no such problem. Specific problems of prescribing during internship are: drugs used in COPD, bronchial asthma, hypertension, diabetes mellitus; less chance of independent prescribing; less correlation between knowledge and clinical practice; paediatric doses; pharmaceutical insistence on prescribing; rational use of analgesics and antibiotics; varieties of brand name; varieties of clinical use of drugs.

Ninety-four percent (179) of study population interns do understand the term adverse drug reactions (ADRs) but unfortunately 12 (6%) interns do not recognise the word. Again 117 (61%) of interns have already seen cases of ADRs but 39% (74) did not seen any such case in their internship period. Among observed ADRs cases 31% (59), 16% (31), and 14% (28) need or suffered from short hospitalisation, prolonged hospitalisation, and morbidity respectively. Our respondent reported most likely causes of ADRs are 68 (36%), 19 (10%), 22 (11%), and 8 (4%) due to drug-drug reactions, medication error, idiosyncratic reactions and others (overdose) respectively. Interns agreed [71% (135)] that ADRs are avoidable. Although 29% (56) think ADRs are unavoidable. Again majority (74%, 135) of interns' opinion is

ADRs are predicable but 26% (49) interns consider that it is not. Again 72% (138) interns agreed that a good knowledge of undergraduate pharmacology and therapeutics teaching would prevent ADRs. On other hand 28% (53) intern opinion that undergraduate pharmacology has no influence to prevent ADRs. Fifty-nine percent (113) interns agreed that they have reported ADRs but rest 41% (78) did not reported. Interns reported about ADRs to Director, Drug administration (12, 6%), ADRs monitoring Committee of the Hospital (10, 5%), and Head of Department (91, 48%). Eighty one percent (154) interns agreed that they were taught how to prevent ADRs occurrence in undergraduate pharmacology and therapeutics course. In contrary only 19% (37) have opted that they did not learn to prevent ADRs in pharmacology and therapeutics coursework. Sixty-two percent (119) of interns said that they go for proper discussion and updated their knowledge and awareness about ADRs after they started their internship but rest 38% (72) viewed that they have no formal discussion about harmful effect of drugs. According to the intern, factors that influence one drug to prescribe come in following way, safety (150, 78%) is first, efficacy (95, 50%) is second, cost (72, 38%) is third, and others (2, 1%) is fourth.

Majority (147, 77%) of the respondents demanded that they routinely consult reference source for drug information. References are text books (81, 43%), Bangladesh National Formulary (BdNF) (40, 21%), British National Formulary (BNF) (9, 4%), and Industry promotional Materials (17, 9%). Finally, regarding undergraduate pharmacology and therapeutics teaching 83% (159) agreed that it should be improved in Bangladesh and rest 17% (32) say no need of any change in pharmacology undergraduate course curriculum. Study population also suggested ways for improvement of pharmacology teaching.

Those are assignment on rational prescription writing in different cases (27, 14%); more correlated or integrated teaching of basic and clinical pharmacology (44, 23%); more discussion on selection of P drugs (29, 15%); practical discussion on drug dose, duration and formulation and trade name (27, 14%); teaching of practical application of drugs in tutorial class by lectures (32, 17%). Study population of interns also listed the topics in Pharmacology and Therapeutics that need more focus and coverage in teaching and learning session. Those area they mentioned are analgesics (9, 5%), anti-diabetics (4, 2%), anti-diarrhoeals (1, 0.5%); anti-tuberculosis and anti-malarials (10, 5%); drugs for epilepsy (1, 0.5%); antihistamines and prostaglandin (PG) analogues (2, 1%); antihypertensives (6, 3%); antimicrobials (23, 13%); cancer chemotherapeutics (2, 1%); corticosteroids (2, 1%); drug dose, formulation and duration (18, 10%); drug interaction and combination (12, 6%); drug use in liver and kidney diseases (12, 6%); drug use in paediatrics and geriatrics (14, 8%); drug use in pregnancy and lactation (1, 0.5%); drug use in peptic ulcer diseases (PUD) (5, 4%); drug use in ischaemic heart disease (1, 0.5%); professional doctor-patient relationship (12, 6%); rational use of antibiotics to avoid resistance (2, 1%); rational prescribing in different cases (8, 4%); sedatives and hypnotics (5, 3%); specific use and ADRs of common drugs

(9, 5%). Our study respondents have listed the drugs that they can prescribe comfortably without supervision (Table 1). Further they listed another group of drugs that interns are reluctantly prescribe to children, elderly, pregnant women or people with renal/ liver impairment (Table 2).

**Table 1:** List of drugs that interns would comfortably prescribe without supervision.

Drugs	Frequency Per Total Respondents (N=191)	Percentage (%)
Antimalarials	6	3.1
Vitamins and Minerals	162	84.8
Antibiotics	85	44.5
NSAIDs	120	62.8
Drugs for peptic ulcer	153	80.1
Diuretics	33	17.3
Antihistamines	123	64.4
Laxatives	118	61.8
Anti-asthma inhaler	40	20.9
Sedatives	67	35.1
Antiemetics	117	61.3
Insulin and oral Anti-diabetic drugs	26	13.6
Vaccines	37	19.4
Anticonvulsants	20	10.5
Aminophylline	13	6.8
Corticosteroids	14	7.3
Opioids Analgesics	21	11.0
Antidepressants	40	20.9
Cytotoxics	2	1.0
Anti-TB drugs	28	14.7
Antipsychotics	14	7.3
Anti-Parkinson's drugs	9	4.7
Immunosuppressants	2	1.0
Digoxin	0	0

**Table 2:** List of drugs that interns would reluctantly prescribe to children, elderly, pregnant women or people with renal/ liver impairment.

Drugs	Frequency Per Total Respondents (N=191)	Percentage (%)
Antimalarials	21	11.0
Vitamins and Minerals	61	31.9
Antibiotics	62	32.5
NSAIDs	60	31.4
Drugs for peptic ulcer	72	37.7
Diuretics	23	12.0
Antihistamines	73	38.2
Laxatives	60	31.4
Anti-asthma inhaler	27	14.1
Sedatives	37	19.4
Antiemetics	66	34.6
Insulin and oral Anti-diabetic drugs	14	7.3
Vaccines	17	8.9
Anticonvulsants	21	11.0
Aminophylline	11	5.8
Corticosteroids	18	9.4
Opioids analgesics	15	7.9
Antidepressants	24	12.6
Cytotoxics	15	7.9
Anti-TB drugs	20	10.5
Antipsychotics	20	10.5
Anti-Parkinson's drugs	14	7.3
Immunosuppressants	20	10.5
Digoxin	16	8.4

## DISCUSSION AND CONCLUSIONS

The main mass of the study population agreed that their knowledge of pharmacology and therapeutics is from average (40%), good (42%), and excellent (7%) which is quite similar with findings of Nigeria (Oshikoya *et al.*, 2009). Although there were multiple report of irrational prescribing (Rahman *et al.*, 1998; Ivy *et al.*, 1998; Baqui *et al.*, 1998; Rahman *et al.*, 1999; Momen *et al.*, 1999; Das and Rahman, 2010). It is possible as because pharmacology course in MBBS programme in Bangladesh only taught mainly theoretical pharmacology and almost no practical prescribing skill is taught in MBBS course (CME, 2002; Heaton *et al.*, 2008; Oshikoya and Bello, 2008; Tobaiqy *et al.*, 2007; Das and Rahman, 2010). Furthermore same population group (Table 2) identified a long list of medicines for paediatric, geriatric, pregnancy and lactation, and also patient with impaired with renal and liver function that they are reluctant to prescribe. This also similarly not properly taught in their course curriculum as like in many other countries (CME, 2002; Parmar and Jadav, 2006; Oshikoya *et al.*, 2008b). Unfortunately newly launched curriculum for the whole nation does not have such programme for the development of prescribing skill (BMDC, 2012). This is worth to mention that Bangladesh has a unique curriculum for whole country irrespective of state control medical school or private or for different universities (CME, 2002; BMDC, 2012). Curriculum solely dependent on instructive teaching methodology student need to memorise more than to evaluate critically and develop understanding. Therefore it is very often difficult to replicate and utilise their knowledge in clinical settings (Oshikoya *et al.*, 2009). Interns' of study population more than half (61%) observed ADRs. These ADRs are mainly due to drug-drug interactions, medication errors, and idiosyncratic reactions. In consequence Bangladeshi patients need to stay longer time in hospital and increased morbidity. No study respondents have observed death due to ADRs. This finding has much similarity with other studies both unindustrialized and modern countries (Oshikoya *et al.*, 2009; Levy *et al.*, 1980; Mannesse *et al.*, 2000; Mjörndal *et al.*, 2002; McDonnell and Jacobs, 2002; Pirmohamed *et al.*, 2004; Patel *et al.*, 2007; Oshikoya *et al.*, 2007; Thiesen *et al.*, 2013).

"The flood of new drugs in recent years has provided many dramatic improvements in therapy, but it has also created an equal number of problems. Not the least of these is the 'therapeutic jungle', the term used to refer to the combination of the overwhelming number of drugs, the confusion over nomenclature and the associated uncertainty of the status of many of these drugs" (Gilman *et al.*, 1985). The situation also exist in Bangladesh as there are more than 1100 generics and every year 50 to 60 new drug molecule is entering country's drug market (Salam *et al.*, 2013). Thus 'drug explosion' also exist in least developed country like Bangladesh (McGettigan *et al.*, 2001). Even though new options open many therapeutic advantages for patients in many areas where there were no treatment options available in earlier period, but it are reported that this 'therapeutic jungle' actually does not promote rational drug use (McGettigan *et*

*al.*, 2001). There are multiple reports of irrational prescribing due to such opulent range of therapeutic options (Hogerzeil, 1995; Donoghue and Tylee, 1996; Laumann and Bjornson, 1998; Nyquist *et al.*, 1998; Liu *et al.*, 1998; Strauss *et al.*, 1999). Majorities (77%) of respondents are checking references before prescribing which is extremely good habit and promote rational prescribing. This is may be due to that they are working in teaching hospital and under proper supervision with log book. This finding is also at par with other studies (Oshikoya *et al.*, 2009; Oshikoya, 2006). It is reported "Pharmaceutical manufacturers spend vast sums of money on promotion, including sales representatives, samples, advertisements in broadcast and print media, and sponsorship of educational events and conferences. In the USA alone, almost US\$21 billion was spent on promotion in 2002. Developing countries sales representatives are frequently the only source of drug information" (Norris *et al.*, 2005). The recent figure of expenditure regarding promotion in alone in USA is much higher and it is \$ 27 billion (Cegedim Strategic Data, 2012). There are multiple reports even from neighboring countries that pharmaceutical companies' influences medical doctors to promote their products even they adopt unethical means also (Akandel and Aderibigbe, 2007; Rohra *et al.*, 2007; Oshikoya *et al.*, 2011; Narendran and Narendranathan, 2013; Goyal and Pareek, 2013). But our study found only 9% of the interns' uses pharmaceutical promotional materials for drug information, which is a very highly praiseworthy attitude in Bangladesh. Although it is possible as because they are interns thus reasonably highly supervised in a teaching hospital and there is another cause that as because the research were conducted by their teachers thus they were cautious to answer they use frequently pharmaceutical promotional materials for drug information.

Eighty-three percent of the study respondents feel retrospectively that Pharmacology and Therapeutics course should be improved to ensure rational prescribing. They have suggested some means for improvement and also identified a number of area. This outcome is correspondingly quite comparable with a number of studies done in European countries and Canada (Heaton *et al.*, 2008; Tobaiqy *et al.*, 2007; Han and Maxwell, 2006; Franklin *et al.*, 2007; Fijn *et al.*, 2002, Qayyum *et al.*, 2012). Although majority of the interns' demanded they are competent enough to prescribe safely (80%) and rationally (65%). Furthermore same study population has identified at least 12 areas they have specific problems which include chronic obstructive pulmonary disease, bronchial asthma, hypertension, diabetes mellitus, rational use of analgesics and antibiotics, paediatric doses, duration of drugs. They also made a long list of drugs they are quite reluctant to prescribe. Therefore, it is unlikely that Bangladeshi interns have developed enough skill of good prescribing for their rest of the life within one year of training in hospital placement.

Despite limitation of this cross sectional study, this study identified that pharmacology and therapeutics course curriculum is not enough to produce safe prescribers. Therefore, there is an urgent need of modifying Pharmacology course curriculum. The concerned medical educationist must be aware of the situation and

start thinking of a way to teach medical students on how to improve prescribing quality in Bangladesh, and initiate a well-designed prospective study to identify more preciously the problems of prescribing. Such understanding and implementation will yield better choice of drugs for the consumers of Bangladesh.

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## REFERENCES

- Adebayo ET, Hussain NA. Pattern of prescription drug use in Nigerian army hospitals. *Ann Afr Med*, 2010; 9(3): 152-8. Available from <http://dx.doi.org/10.4103/1596-3519.68366> (Accessed on 1<sup>st</sup> December 2014)
- Akande TM, Aderibigbe SA. Influence of drug promotion on prescribing habits of doctors in a Teaching Hospital. *Afr J Med Med Sci*, 2007; 36(3): 207-11. Published by College of Medicine, University of Ibadan, Ibadan, Nigeria. Available from <http://www.ncbi.nlm.nih.gov/pubmed/18390058> (Accessed on 1<sup>st</sup> February 2014)
- Akat PB, Karande VB, Murthy MB, Burute SR. Interns opinion on 'bedside pharmacology clinics' and its incorporation in undergraduate curriculum. *J Pharmacol Pharmacother*, 2012; 3(1): 56-8. Available from <http://dx.doi.org/10.4103/2F0976-500X.92519v> (Accessed on 10<sup>th</sup> January 2014)
- Aronson JK, Henderson G, Webb DJ, Rawlins MD. A prescription for better prescribing. *BMJ*, 2006; 333: 459. Available from <http://dx.doi.org/10.1136/bmj.38946.491829.BE> (Accessed on 1st February 2014)
- Bangladesh Medical & Dental Council (BMDC). 2012. Curriculum for Undergraduate Medical Education in Bangladesh – Updated 2012. Dhaka 1000. Bangladesh. 1-393. Available at [www.bmdc.org.bd](http://www.bmdc.org.bd)
- Baqi QBOF, Begum ZA, Begum HA, Chowdhury SAR. Prescribing Pattern for Watery Diarrhoea of Graduate and Non-Graduate Medical Prescribers in Rural Bangladesh. *Bangladesh J Physiol Pharmacol*, 1998; 14(2): 31-2. Available from <http://dx.doi.org/10.1097/00005176-199808000-00107> (Accessed on 1<sup>st</sup> February 2014)
- Barber N, Rawlins M, Dean Franklin B. Reducing prescribing error: competence, control, and culture. *Qual Saf Health Care*, 2003; 12 (Suppl 1): i29-i32. Available from [http://dx.doi.org/10.1136/qhc.12.suppl\\_1.i29](http://dx.doi.org/10.1136/qhc.12.suppl_1.i29) (Accessed on 12th January 2014)
- Barber ND, Dean BS. The incidence of medication errors and ways to reduce them. *Clinical Risk*, 1998; 4: 103-6.
- Bates DW, Cullen DJ, Laird N, Petersen LA, Small SD, Servi D, Laffel G, Sweitzer BJ, Shea BF, Hallisey R, Vliet MV, Nemeskal R, Leape LL, Bates D, Hojnowski-Diaz P, Petrycki S, Cotugno M, Patterson H, Hickey M, Kleefield S, Cooper J, Kinneally E, Demonaco HJ, Clapp MD, Gallivan T, Ives J, Porter K, Thompson BT, Hackman JR, Edmondson A. Incidence of adverse drug events and potential adverse drug events. Implications for prevention. ADE Prevention Study Group. *JAMA*, 1995; 274(1): 29-34. Available from <http://dx.doi.org/10.1001/jama.274.1.29> (Accessed on 10<sup>th</sup> January 2014).
- Bradley E, Bradshaw C, Nolan P. Nurse lecturers' observations on aspects of nurse prescribing training. *Nurse Educ Today*, 2006; 26(7): 538-44. Available from <http://dx.doi.org/10.1016/j.nedt.2006.01.008> (Accessed on 1<sup>st</sup> February 2014)

- Cegedim Strategic Data, 2012 U.S. Pharmaceutical Company Promotion Spending (2013). Available from [http://www.skainfo.com/health\\_care\\_market\\_reports/2012\\_promotional\\_spending.pdf](http://www.skainfo.com/health_care_market_reports/2012_promotional_spending.pdf). (Accessed on 31<sup>st</sup> January 2014)
- Centre for Medical Education (CME). 2002. Curriculum for Under-graduate Medical Education in Bangladesh. CME 2002. Dhaka, Bangladesh.
- Chaurasia RC. Pharmacology exercise for undergraduate: MLNMC model. *Int J Basic Clin Pharmacol*, 2013; 2(4):495-7. Available from <http://dx.doi.org/10.5455/2319-2003.ijbcp20130828> (Accessed on 1st January 2014)
- Chima IE, Obidiya OS, Abraham CVM. Evaluation of Drug Use and Patient Care Practices in a Referral Health Facility in Yenagoa, Bayelsa State, Nigeria. *Continental Journal of Pharmaceutical Sciences*, 2012; 6 (1): 10-6. Available from [http://www.wiloludjournal.com/ojs/index.php/cjpharm/article/view/671/pdf\\_255](http://www.wiloludjournal.com/ojs/index.php/cjpharm/article/view/671/pdf_255) (Accessed on 14th December 2013)
- Das AK, Rahman MS. Prescribing vitamins at primary health care level: Exploration of facts, factors and solution. *Bangladesh J Pharmacol.*, 2010; 5(2): 92-7. Available from <http://dx.doi.org/10.3329/bjp.v5i2.7146> (Accessed on 1<sup>st</sup> February 2014)
- Dean B, Schachter M, Vincent C, Barber N. Prescribing errors in hospital inpatients: their incidence and clinical significance. *Qual Saf Health Care*, 2002; 11(4): 340-4. Available from <http://dx.doi.org/10.1136/qhc.11.4.340> (Accessed on 1<sup>st</sup> February 2014)
- Dean B, Schechter M, Vincent C, Barber N. Causes of prescribing errors in hospital inpatients: a prospective study. *Lancet*, 2002; 359(9315): 1373-8. Available from [http://dx.doi.org/10.1016/S0140-6736\(02\)08350-2](http://dx.doi.org/10.1016/S0140-6736(02)08350-2) (Accessed on 1st February 2014)
- Dehghani M, Pourafzali M, Ebrahimzadeh A. Teaching Minimum Learning Essentials to Orthopedic Interns in Isfahan University of Medical Sciences. *Iranian Journal of Medical Education*, 2008; 7(2): 437-42. Available from [http://ijme.mui.ac.ir/browse.php?a\\_code=A-10-2-302&slc\\_lang=en&sid=1](http://ijme.mui.ac.ir/browse.php?a_code=A-10-2-302&slc_lang=en&sid=1) (Accessed on 1st February 2014)
- Department of Health. An organisation with a memory. Report of an Expert Group on Learning from Adverse Events in the NHS. London: The Stationery Office, 2000. Available from [http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digitalassets/@dh/@en/documents/digitalasset/dh\\_4065086.pdf](http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4065086.pdf) (Accessed on 10th January 2014)
- Donoghue JM, Tylee A. The treatment of depression: Prescribing patterns of anti-depressants in primary care in the UK. *Br J Psychiatry*, 1996; 168(2): 164-8. PMID: 8837905 Available from <http://bjp.rcpsych.org/content/168/2/164.full.pdf+html> (Accessed on 1<sup>st</sup> February 2014)
- Dornan T, Ashcroft D, Heathfield H, Lewis P, Miles J, Taylor D, Tully MP, Wass V. An in depth investigation into causes of Undergraduate prescribing education prescribing errors by foundation trainees in relation to their medical education – EQUIP study. 2009. Available from [http://www.gmc-uk.org/FINAL\\_Report\\_prevalence\\_and\\_causes\\_of\\_prescribing\\_errors.pdf\\_28935150.pdf](http://www.gmc-uk.org/FINAL_Report_prevalence_and_causes_of_prescribing_errors.pdf_28935150.pdf) (Accessed on 1st February 2014)
- Fijn R, Van den Bemt PMLA, Chow M, De Blaeij CJ, De Jong-Van den Berg LTW, Brouwers JRB. Hospital prescribing errors: epidemiological assessment of predictors. *Br J Clin Pharmacol*, 2002; 53(3): 326-31. Available from <http://dx.doi.org/10.1046/j.0306-5251.2001.bjcp1558.doc.x> (Accessed on 1<sup>st</sup> February 2014)
- Flockhart DA, Usdin Yasuda S, Pezzullo JC, Knollmann BC. Teaching rational prescribing: a new clinical pharmacology curriculum for medical students. *Naunyn Schmiedebergs Arch Pharmacol*, 2002; 366(1): 33-43. Available from <http://dx.doi.org/10.1007/s00210-002-0559-5> (Accessed on 1<sup>st</sup> February 2014)
- Franklin BD, O'Grady K, Paschalides C, Utley M, Gallivan S, Jacklin A, Barber N. Providing feedback to hospital doctors about prescribing errors; a pilot study. *Pharm World Sci*, 2007; 29(3): 213-20. Available from <http://dx.doi.org/10.1007/s11096-006-9075-x> (Accessed on 1<sup>st</sup> February 2014)
- Garbutt JM, Highstein G, Jeffe DB, Dunagan WC, Fraser VJ. Safe medication prescribing: training and experience of medical students and house-staff at a large teaching hospital. *Acad Med*, 2005; 80(6): 594-9. Available from <http://dx.doi.org/10.1097/00001888-200506000-00015> (Accessed on 1st February 2014)
- Gawde SR, Shetty YC, Pawar DB. Knowledge, attitude, and practices toward ayurvedic medicine use among allopathic resident doctors: A cross-sectional study at a tertiary care hospital in India. *Perspect Clin Res*, 2013; 4 (3): 175-80. Available from <http://dx.doi.org/10.4103/2229-3485.115380> (Accessed on 10<sup>th</sup> January 2014)
- General Medical Council. *Tomorrow's Doctors*. London: GMC; 2003. Available from [http://www.gmc-uk.org/TomorrowsDoctors\\_2003.pdf\\_39262074.pdf](http://www.gmc-uk.org/TomorrowsDoctors_2003.pdf_39262074.pdf) (Accessed on 11th January 2014)
- Gilman AG, Goodman LS, Rall TW, Murad F. 1985. *Goodman & Gilman's The Pharmacological Basis of Therapeutics*. 7<sup>th</sup> Ed. McGraw-Hill Medical Publication Division. New York.
- Goswami N, Gandhi A, Patel P, Dikshit R. An evaluation of knowledge, attitude and practices about prescribing fixed dose combinations among resident doctors. *Perspect Clin Res*, 2013; 4(2): 130-5. Available from <http://dx.doi.org/10.4103/2229-3485.111797> (Accessed on 10<sup>th</sup> January 2014)
- Goyal R, Pareek P. A Review Article on Prescription Behaviour of Doctors, Influenced By The Medical Representative In Rajasthan, India. *IOSR Journal of Business and Management*, 2013; 8(1): 56-60. Available from <http://www.iosrjournals.org/ccount/click.php?id=5229> (Accessed on 1<sup>st</sup> February 2014)
- Guyon AB, Barman A, Ahmed JU, Ahmed AU, Alam MS. A baseline survey on use of drugs at the primary health care level in Bangladesh. *Bull World Health Organ*, 1994; 72(2): 265-71. Available from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2486537/pdf/bullwho00413-0083.pdf> (Accessed on 1<sup>st</sup> February 2014)
- Han WH, Maxwell SR. Are medical students adequately trained to prescribe at the point of graduation? Views of first year foundation doctors. *Scott Med J*, 2006; 51 (4): 27-32. Available from <http://dx.doi.org/10.1258/rsmstmj.51.4.27> (Accessed on 1<sup>st</sup> February 2014)
- Haque M, Yousuf R, Abu Bakar SM, Salam A. Assessment in Undergraduate Medical Education: Bangladesh Perspectives. *Bangladesh Journal of Medical Science*, 2013; 12(4): 357-63. Available from <http://dx.doi.org/10.3329/bjms.v12i4.16658> (Accessed on 1<sup>st</sup> February 2014)
- Heaton A, Webb DJ, Maxwell SR. Undergraduate preparation for prescribing: the views of 2413 UK medical students and recent graduates. *Br J Clin Pharmacol*, 2008; 66(1): 128-34. Available from <http://dx.doi.org/10.1111/j.1365-2125.2008.03197.x> (Accessed on 1<sup>st</sup> February 2014)
- Hogerzeil HV. Promoting rational prescribing: an international perspective. *Br J Clin Pharmacol*, 1995; 39(1): 1-6. Available from <http://dx.doi.org/10.1111/j.1365-2125.1995.tb04402.x> (Accessed on 1<sup>st</sup> February 2014)
- Institute of Medicine. *To err is human: building a safer health system*. Report of the Committee on Quality of Health Care in America, Washington: National Academy Press, 2000. Available from <http://wps.pearsoneducation.nl/wps/media/objects/13902/14236351/H%20To%20Err%20Is%20Human.pdf> (Accessed on 10th January 2014)
- Ivy R, Baqui QBOF, Begum HA, Chowdhury SAR. Prescribing Pattern of Drug Use during Pregnancy in Teaching Hospitals at Dhaka City. *Bangladesh J Physiol Pharmacol*, 1998; 14(2): 53-4.
- Karim A, Haque M. Study of the Extent and Pattern of the Use of the Analgesics and Antibiotics during Operation in the Surgical and Gynaecological Units of a Teaching Hospital. *J Dhaka Med Coll*, 1995; 4(2): 85-8.
- Kaushal R, Bates DW, Landrigan C, McKenna KJ, Clapp MD, Federico F, Goldmann DA. Medication errors and adverse drug events in pediatric inpatients. *JAMA*, 2001; 285(16): 2114-20. Available from <http://dx.doi.org/10.1001/jama.285.16.2114> (accessed on 11<sup>th</sup> January 2014)
- Laumann JM, Bjornson DC. Treatment of Medicaid patients with asthma: Comparison with treatment guidelines using disease-based drug utilisation review methodology. *Ann Pharmacother*, 1998; 32: 1290-

4. Available from <http://aop.sagepub.com/content/32/12/1290.full.pdf> (Accessed on 1<sup>st</sup> February 2014)
- Leape LL, Bates DW, Cullen DJ, Cooper J, Demonaco HJ, Gallivan T, Hallisey R, Ives J, Laird N, Laffel G, Nemeskal R, Petersen LA, Porter K, Servi D, Shea BF, Small SD, Sweitzer BJ, Thompson BT, Vliet MV, Bates D, Hohnowski-Diaz P, Petrycki S, Cotugno M, Patterson H, Hickey M, Kleefield S, Kinneally E, Clapp MD, Hackman JR, Edmondson A. Systems analysis of adverse drug events. ADE Prevention Study Group. *JAMA*, 1995; 274(1): 35-43. Available from <http://dx.doi.org/10.1001/jama.274.1.35> (Accessed on 10th January 2014)
- Leape LL, Brennan TA, Laird N, Lawthers AG, Localio AR, Barnes BA, Hebert L, Newhouse JP, Weiler PC, Hiatt H. The nature of adverse events in hospitalized patients. Results of the Harvard medical practice study II. *N Engl J Med*, 1991; 324(6): 377-84. Available from <http://dx.doi.org/10.1056/NEJM199102073240605> (Accessed on 10th January 2014)
- Levy M, Kewitz H, Altwein W, Hillebrand J, Eliakim M. Hospital admissions due to adverse drug reactions: A comparative study from Jerusalem and Berlin. *Eur J Clin Pharmacol*, 1980; 17(1): 25-31. Available from <http://dx.doi.org/10.1007/BF00561673> (Accessed on 1<sup>st</sup> February 2014)
- Liu Z, Shilkret KL, Finelli L. Initial drug regimens for the treatment of tuberculosis: Evaluation of physician prescribing practices in New Jersey, 1994 to 1995. *Chest*, 1998; 113(6): 1446-51. Available from <http://dx.doi.org/10.1378/chest.113.6.1446> (Accessed on 1<sup>st</sup> February 2014)
- Mannesse CK, Derkx FH, de Ridder MA, Man in't Veld AJ, van der Cammen TJ. Contribution of adverse drug reactions to hospital admission of older patients. *Age Ageing*, 2000; 29(1): 35-9. Available from <http://dx.doi.org/10.1093/ageing/29.1.35> (Accessed on 1<sup>st</sup> February 2014)
- McDonnell PJ, Jacobs MR. Hospital admissions resulting from preventable adverse drug reactions. *Ann Pharmacother*, 2002; 36(9): 1331-6. Available from <http://dx.doi.org/10.1345/aph.1A333> (Accessed on 1<sup>st</sup> February 2014)
- McGettigan P, Golden J, Fryer J, Chan R, Feely J. Prescribers prefer people: The sources of information used by doctors for prescribing suggest that the medium is more important than the message. *Br J Clin Pharmacol*, 2001; 51(2): 184-9. Available from <http://dx.doi.org/10.1111/j.1365-2125.2001.01332.x> (Accessed on 1<sup>st</sup> February 2014)
- Medical Council of India (MCI). Medical Council of India regulation on graduate medical education. New Delhi: Medical Council of India; 1997. Available from <http://www.mciindia.org/Rules-and-Regulation/Gazette%20Notifications%20-%20Amendments/gme%20-%2025.03.2009.pdf> (Accessed on 31<sup>st</sup> January 2014)
- Michel MC, Bischoff A, Zu Heringdorf M, Neumann D, Jakobs KH. Problem-vs. Lecture-based pharmacology teaching in German medical school. *Naunyn Schmiedeberg's Arch Pharmacol*, 2002; 366(1): 64-8. Available from <http://dx.doi.org/10.1007/s00210-002-0570-x> (Accessed 10<sup>th</sup> December 2013)
- Mjörndal T, Boman MD, Hägg S, Bäckström M, Wiholm B, Wahlin A, Dahlqvist R. Adverse drug reactions as a cause for admissions to a department of internal medicine. *Pharmacoepidemiol Drug Saf*, 2002; 11(1): 65-72. PMID: 11998554 Available from <http://onlinelibrary.wiley.com.libproxy.dundee.ac.uk/doi/10.1002/pds.667/pdf> (Accessed on 1<sup>st</sup> February 2014)
- Mohan L, Chogtu B, Adiga S, Shenoy S, Bairy KL, Kishore A. Undergraduate medical students' perceptions regarding personal drug selection exercise. *International Journal of Pharmacology and Clinical Sciences*, 2012; 1(2): 61-7. Available from <http://www.ijpcs.net/uploads/1/0/3/4/10341868/ijpcs-0016-2012.pdf> (31<sup>st</sup> December 2013)
- Momen A, Choudhury SAR, Anwar AKMN. Study of the Extent and Pattern of Antibiotic Use in the Management of Clinically Diagnosed Cases of Common Cold and Fever in Some Selected Government and Private Teaching Hospitals. *Bangladesh J Physiol Pharmacol*, 1999; 15(2): 67-9.
- Motamed N, Kashani Z, Safar MJ, Âlian SH, Khademloo M, Êslamiyan R. Prescription writing ability of interns for common illnesses-Sari Medical School-Summer 2004. *J Mazandaran Univ Med Sci*, 2006; 16(51): 102-11. Available from [http://jmums.mazums.ac.ir/browse.php?a\\_code=A-10-1-93&slc\\_lang=en&sid=1](http://jmums.mazums.ac.ir/browse.php?a_code=A-10-1-93&slc_lang=en&sid=1) (Accessed on 1<sup>st</sup> February 2014)
- Narendran R, Narendranathan M. Influence of pharmaceutical marketing on prescription practices of physicians. *J Indian Med Assoc*, 2013; 111 (1): 47-50. PMID: 24000508 Available from <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1026&context=buspapers> (Accessed on 1<sup>st</sup> February 2014)
- Norris P, Herxheimer A, Lexchin J, Mansfield P. Drug promotion, what we know, what we have yet to learn. *Reviews of materials in the WHO/HAI database on drug promotion. World Health Organization and Health Action International 2005.* Available from Drug Promotion Database URL: <http://www.drugpromo.info/> (Accessed on 31<sup>st</sup> January 2014).
- Nyquist AC, Gonzales R, Steiner JF, Sande MA. Antibiotic prescribing for children with colds, upper respiratory tract infections, and bronchitis. *JAMA*, 1998; 279(11): 875-7. Available from <http://dx.doi.org/10.1001/jama.279.11.875> (Accessed on 1<sup>st</sup> February 2014)
- Odusanya OO. Drug use indicators at a secondary health care facility in Lagos, Nigeria. *Journal of Community Medicine & Primary Health Care*, 2004; 16(1): 21-4. Available from <http://dx.doi.org/10.4314/jcmphc.v16i1.32402> (Accessed on 11<sup>th</sup> January 2014)
- Orme M, Frolich J, Vrhovac B. Towards a core curriculum in clinical pharmacology for undergraduate medical students in Europe. *Eur J Clin Pharmacol*, 2002; 58(9): 635-40. Available from <http://dx.doi.org/10.1007/s00228-002-0531-9> (Accessed on 1<sup>st</sup> February 2014)
- O'Shaughnessy L, Haq I, Maxwell S, Llewelyn M. Teaching of clinical pharmacology and therapeutics in UK medical schools: current status in 2009. *Br J Clin Pharmacol*, 2010; 70(1): 143-8. Available from <http://dx.doi.org/10.1111/j.1365-2125.2010.03665.x> (Accessed on 10th December 2013)
- Oshikoya KA, Bello JA, Ayorinde EO. Medical students' view on the methods of teaching pharmacology at the Lagos State University College of Medicine, Nigeria. *Nig Q J Hosp Med*, 2007; 17(3): 101-7. Available from <http://dx.doi.org/10.4314/nqjhm.v17i3.12554> (Accessed on 1st February 2014)
- Oshikoya KA, Bello JA, Ayorinde EO. Prescribing knowledge and skills of final year medical students in Nigeria. *Indian J Pharmacol*, 2008a; 40(6): 251-5. Available from <http://dx.doi.org/10.4103/0253-7613.45150> (Accessed on 1<sup>st</sup> February 2014)
- Oshikoya KA, Chukwura HA, Ojo OI. Evaluation of outpatient paediatric drug prescriptions in a teaching hospital in Nigeria for rational prescribing. *Paediatric and Perinatal Drug Therapy*, 2006; 7(4): 183-8. Available from <http://dx.doi.org/10.1185/146300906X167728> (Accessed on 1st February 2014)
- Oshikoya KA, Njokanma OF, Chukwura HA, Ojo IO. Adverse drug reactions in Nigerian children. *Paediatr Perinat Drug Ther*, 2007; 8(2): 81-8. Available from <http://dx.doi.org/10.1185/146300907X199858> (Accessed on 1<sup>st</sup> February 2014)
- Oshikoya KA, Oreagba I, Adeyemi O. Sources of drug information and their influence on the prescribing behaviour of doctors in a teaching hospital in Ibadan, Nigeria. *Pan Afr Med J*, 2011; 9: 13. Available from: <http://dx.doi.org/10.4314/pamj.v9i1.71188> (Accessed on 30<sup>th</sup> January 2014).
- Oshikoya KA, Senbanjo IO, Amole OO. Interns' knowledge of clinical pharmacology and therapeutics after undergraduate and on-going internship training in Nigeria: a pilot study. *BMC Medical Education*, 2009; 9: 50. Available from <http://dx.doi.org/10.1186/1472-6920-9-50> (Accessed on 1st February 2014)
- Oshikoya KA, Senbanjo IO, Soipe A. Ability of medical students to calculate drug doses in children after their paediatric attachment. *Pharmacy Practice*, 2008b; 6(4): 191-6. Available from <http://dx.doi.org/10.4321/S1886-36552008000400004> (Accessed on 1<sup>st</sup> February 2014)
- Oshikoya KA. Adverse drug reaction in children: types, incidence and risk factors. *Nig J Paediatr*, 2006; 33(2): 29-35. Available from <http://dx.doi.org/10.4314/njp.v33i2.53096> (Accessed on 1<sup>st</sup> February 2014)
- Otoom S, Culligan K, Al-Assoomi B, Al-Ansari T. Analysis of drug prescriptions in primary health care centres in Bahrain. *East Mediterr*

- Health J, 2010; 16(5): 511-5. Available from [http://applications.emro.who.int/emhj/V16/05/16\\_5\\_2010\\_0511\\_0515.pdf](http://applications.emro.who.int/emhj/V16/05/16_5_2010_0511_0515.pdf) (Accessed on 14th December 2013)
- Palmer NO, Martin MV, Pealing R, Ireland RS, Roy K, Smith A, Bagg J. Antibiotic prescribing knowledge of National Health Service General Dental Practitioners in England and Scotland. *J Antimicrob Chemother*, 2001; 47(2): 233-7. Available from <http://dx.doi.org/10.1093/jac/47.2.233> (Accessed on 15<sup>th</sup> January 2014)
- Parmar DM, Jadav SP. Teaching undergraduate students appropriate dose calculations in relation to intravenous infusion. *Indian J Pharmacol*, 2006; 38(6): 435-7. Available from <http://dx.doi.org/10.4103/0253-7613.28216> (Accessed on 1<sup>st</sup> February 2014).
- Patel H, Bell D, Molokhia M, Srishanmuganathan J, Patel M, Car J, Majeed A. Trends in hospital admissions for adverse drug reactions in England: analysis of national hospital episode statistics 1998–2005. *BMC Clin Pharmacol*, 2007; 7: 9. Available from <http://www.biomedcentral.com/1472-6904/7/9> (Accessed on 30 January 2014).
- Pirmohamed M, James S, Meakin S, Green C, Scott AK, Walley TJ, Farrar K, Park BK, Breckenridge AM. Adverse drug reactions as cause of admission to hospital: prospective analysis of 18 820 patients. *BMJ*, 2004; 329: 15-19. Available from <http://dx.doi.org/10.1136/bmj.329.7456.15> (Accessed on 1<sup>st</sup> February 2014)
- Qayyum F, Wright M, Lee M, Leung C, Sada A, Holbrook A. Medical Student Opinions on their Training in Clinical Pharmacology and Therapeutics. *McMaster University Medical Journal*, 2012; 9(1): 44-8. Available from [www.mumj.org/Issues/v9\\_2012/articles/v9\\_04.pdf](http://www.mumj.org/Issues/v9_2012/articles/v9_04.pdf) (Accessed on 1<sup>st</sup> February 2014).
- Queneau P, Bouvenot G, Grandmottet P. Initial and continuous education. Entreaty for better education of physicians in therapeutics. *Bull Acad Natl Med*, 1998; 182(7): 1369-81. PMID: 9916331 (Accessed on 1<sup>st</sup> February 2014)
- Rahman MS, Begum M, Haque MZ, Akhter N. Drug Advertisement in Medical Journals: A Commentary. *Bangladesh J Physiol Pharmacol*, 1999; 15(1): 31-6.
- Rahman MS, Begum M, Khan A IK, Kamal ASMA, Choudhury S, Islam AMZ, Sultana R, Haque ZM, Akhter N. A Baseline Survey on Use of Drugs at Private Practitioner Level in Bangladesh. *Bangladesh J Physiol Pharmacol*, 1998; 14(2): 47-50.
- Rahman MS, Begum ZA, Samad MK. Prescribing pattern of non-steroidal anti-inflammatory drugs at outpatient departments of teaching hospitals. *Bangladesh J Pharmacol*, 2007; 2(1): 1-6. Available from <http://dx.doi.org/10.3329/bjp.v2i1.493> (Accessed on 1<sup>st</sup> Feb 2014)
- Rahman Z, Nazneen R, Begum M. Evaluation of prescribing pattern of the private practitioners by the undergraduate medical students. *Bangladesh J Pharmacol*, 2009; 4: 73-5. Available from <http://dx.doi.org/10.3329/bjp.v4i1.1583> (Accessed on 1<sup>st</sup> February 2014)
- Rangachari PK. Basic science in an integrated medical curriculum: The case of pharmacology. *Adv Health Sci Educ Theory Pract*, 1997; 2(2): 163-171. Available from [http://download.springer.com/static/pdf/726/art%253A10.1023%252FA%253A1009763812617.pdf?auth66=1392609062\\_648a8c742c2e966ff2c685fb36c4b2a5&ext=.pdf](http://download.springer.com/static/pdf/726/art%253A10.1023%252FA%253A1009763812617.pdf?auth66=1392609062_648a8c742c2e966ff2c685fb36c4b2a5&ext=.pdf) (Accessed on 31<sup>st</sup> December 2013)
- Richir MC, Tichelaar J, Geijteman EC, de Vries TP. Teaching clinical pharmacology and therapeutics with an emphasis on the therapeutic reasoning of undergraduate medical students. *Eur J Clin Pharmacol*, 2008; 64(2): 217-24. Available from <http://dx.doi.org/10.1007/s00228-007-0432-z> (Accessed on 1<sup>st</sup> February 2014)
- Rohra DK, Jawaid A, Rehman TU, Sukkurwala AQ, Palanpurwala AS, Gangwani R. Prescription of New Drugs by General Practitioners in Pakistan: An Exploration into Information Sources, Prescription Influences and General Attitudes. *Pak J Med Res*, 2007; 46(1): 1-5. Available from <http://www.pmc.org.pk/prescriptionofdrugs.htm> (Accessed on 31st January 2014).
- Ryan C, Ross S, Davey P, Duncan EM, Francis JJ, Fielding S, Johnston M, Ker J, Lee AJ, MacLeod MJ, Maxwell S, McKay GA, McLay JS, Webb DJ, Bond C. Prevalence and Causes of Prescribing Errors: The Prescribing Outcomes for Trainee Doctors Engaged in Clinical Training (PROTECT) Study. *PLoS ONE*, 2014; 9(1): e79802. Available from <http://dx.doi.org/10.1371/journal.pone.0079802> (Accessed on 1<sup>st</sup> February 2014)
- Salam A, Haque M, Islam MZ, Rahman NIA, Helali AM, Muda TFMBT, Yousuf R, Yesmin F, Rahman Z, Alattraqchi AG. Addressing Rational Prescribers through the Pharmacology and Therapeutics Course Work of MBBS Syllabus in Bangladesh. *Int Res J Pharm*, 2013; 4 (7): 60-63. Available from <http://dx.doi.org/10.7897/2230-8407.04713> (Accessed on 1<sup>st</sup> February 2014)
- Shankar PR, Dubey AK, Palaian S, Pranaya M, Saha A, Deshpande VY. Favourable student attitudes towards pharmacology in a medical school in Western Nepal. *Medical Science Educator*, 2005; 15(1): 31-8. Available from [http://www.iamse.org/artman/publish/article\\_282.shtml](http://www.iamse.org/artman/publish/article_282.shtml) (Accessed on 1<sup>st</sup> February 2014)
- Shankar PR, Mishra P, Shenoy N, Partha P. Importance of transferable skills in pharmacology. *Pharmacy Education*, 2003; 3(2): 97-101. Available from <http://dx.doi.org/10.1080/1560221031000089507> (Accessed on 1<sup>st</sup> February 2014)
- Strauss WE, Alexis G, Tapley RD. Use of a tiered review for evaluation of appropriate use of hydroxymethylglutaryl coenzyme A reductase-inhibitor therapy. *Clin Ther*, 1999; 21(2): 422-9. Available from [http://dx.doi.org/10.1016/S0149-2918\(00\)88297-1](http://dx.doi.org/10.1016/S0149-2918(00)88297-1) (Accessed on 1<sup>st</sup> February 2014)
- Theodorou M, Tsiantou V, Pavlakis A, Mani-adakis N, Fragoulakis V, Pavi E, Kyriopoulos J. Factors influencing prescribing behaviour of physicians in Greece and Cyprus: results from a questionnaire based survey. *BMC Health Serv Res*, 2009; 9: 150. Available from <http://dx.doi.org/10.1186/1472-6963-9-150> (Accessed on 11th January 2014)
- Thiesen S, Conroy EJ, Bellis JR, Bracken LE, Mannix HL, Bird KA, Duncan JC, Cresswell L, Kirkham JJ, Peak M, Williamson PR, Nunn AJ, Turner MA, Pirmohamed M, Smyth RL. Incidence, characteristics and risk factors of adverse drug reactions in hospitalized children—a prospective observational cohort study of 6,601 admissions. *BMC Medicine*, 2013; 11: 237. Available from <http://dx.doi.org/10.1186/1741-7015-11-237> (Accessed on 30 January 2014)
- Tobaigy M, McLay J, Ross S. Foundation year 1 doctors and clinical pharmacology and therapeutics teaching: a retrospective view in light of experience. *Br J Clin Pharmacol*, 2007; 64(3): 363-72. Available from <http://dx.doi.org/10.1111/j.1365-2125.2007.02925.x> (Accessed on 1<sup>st</sup> February 2014)
- Upadhyaya P, Seth V, Sharma M, Ahmed M, Moghe VV, Khan ZY, Gupta VK, Jain SV, Soni U, Bhatia M, Abhijit K, Goyal J. Prescribing knowledge in the light of undergraduate clinical pharmacology and therapeutics teaching in India: views of first-year postgraduate students. *Adv Med Educ Pract*, 2012; 3: 47–53. Available from <http://dx.doi.org/10.2147%2FAMEP.S31726> (Accessed on 10th July 2013)
- Vollebregt JA, van Oldenrijk J, Kox D, van Galen SR, Sturm B, Metz JC, Richir MC, de Haan M, Hugtenburg JG, de Vries TP. Evaluation of a pharmacotherapy context-learning programme for preclinical medical students. *Br J Clin Pharmacol*, 2006; 62(6): 666-72. Available from <http://dx.doi.org/10.1111/j.1365-2125.2006.02742.x> (Accessed on 1<sup>st</sup> February 2014)
- Wall D, Bolshaw A, Carolan J. From undergraduate medical education to pre-registration house officer year: how prepared are students? *Med Teach*, 2006; 28(5): 435-9. Available from <http://dx.doi.org/10.1080/01421590600625171> (Accessed on 1<sup>st</sup> February 2014)
- Walley T, Bligh J, Orme M, Breckenridge A. Clinical Pharmacology and therapeutics in undergraduate medical education in the UK. *Br J Clin Pharmacol*, 1994, 37(2): 129-35. Available from <http://dx.doi.org/10.1111/j.1365-2125.1994.tb04252.x> (Accessed on 1<sup>st</sup> February 2014)
- Weingart SN, Wilson RM, Gibberd RW, Harrison B. Epidemiology of medical error. *BMJ*, 2000; 320(7237): 774-7. Available from <http://dx.doi.org/10.1136/bmj.320.7237.774> (Accessed on 10<sup>th</sup> January 2014)
- World Health Organization. WHO Policy Perspectives on Medicines. Promoting rational use of medicines: core components. Geneva



2002. Available from <http://apps.who.int/medicinedocs/pdf/h3011e/h3011e.pdf> (Accessed on 31<sup>st</sup> January 2014).

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