

# “Is This a Drug?” Answers From Medical Students in a Tertiary Care Teaching Hospital in Eastern India

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## ABSTRACT

**Introduction:** World Health Organization (WHO) defines what is drug and what is not. Second year MBBS students learn the principles of Pharmacology that they use in their later clinical practice life. The aim of the survey was to determine how medical students classify a range of preparations they might encounter in their professional lives and whether a brand name or a commercial preparation of a drug would influence their decision in the categorization of the preparation as a ‘drug’ or ‘not a drug’.

**Aim:** To assess the knowledge of medical students, if a substance or product is a drug.

**Materials and Methods:** We surveyed 2 concurrent years of medical students to classify 60 candidate medicinal preparations into “drug” and “not-drug” from a validated questionnaire. The candidate preparations were named either in generic or in their commercially available forms and they were all essential drugs as per WHO definition.

## INTRODUCTION

Medical education is an ever evolving and improving field. It aims at providing adequate knowledge of disease pathology as well as making the students aware of the armaments they shall have in their day-to-day clinical practice namely – drugs. For the students, it is not only important to know what is normal and what is not, they need to learn to differentiate between what may be considered as a “drug”. This differentiation should be not in layperson terms but in terms applicable for medical personnel and healthcare providers. This understanding of what is a drug and what is not has important implications for clinicians’ communication with patients and their attitudes to management and treatment. Failing to label a preparation correctly as a drug may mean effective treatment is not prescribed and may lead to irrational prescribing that is followed by several pitfalls in pharmacotherapy including unwanted effects, inefficacy and loss of faith in the physician.

World Health Organization (WHO) defines drug as a “substance or product that is used or intended to be used, to explore a physiological condition or pathological state, for the benefit of the recipient.” [1]. As per this definition all chemicals used for recreational purposes are excluded. For layperson, however, the term “drug” is closely associated with drugs of abuse whereas those that fit this description are usually called “medicines”.

Medical students are at a stage of their learning where opinions about drugs and diseases are being formed. We noted that there has been a similar study where the opinion of medical students regarding what is disease and what is not has been studied [2].

**Results:** The two groups of students, A and B, included 192 and 215 students respectively. Demographically there was little difference in the two groups. Agents like Aspirin, Paracetamol, Amphetamine, Salbutamol, Atropine, Dextromethorphan, Codeine, Diazepam, Ciprofloxacin ear drops, Levonorgestrol, Neosporin eye ointment, Furosemide, Metronidazole, Penicillin, Sorbitrate, Lignocaine, Methotrexate, Penicillin, Zolpidem and Thalidomide received almost unanimous votes as drugs. Arsenic trioxide, Fentanyl and petroleum jelly were considered to be “non-drugs” by most participants. The two groups did not differ significantly in their responses.

**Conclusion:** Some major lacunae were noted in the knowledge of the participating students despite book teaching on the definition of a drug. Drugs used for prophylaxis and those used in physiological conditions or topically, were often missed. These gaps need to be filled by more emphasis on definition of a drug and its clinical applicability based on example and case based studies.

**Keywords:** Medicine, Medical education, Pharmacology

We noted that similar studies have not been conducted among students regarding their knowledge of what is a drug and what is not. Accordingly, we aimed to survey current medical students’ classification of medicinal and branded preparations as “drugs” or “not drugs”.

## MATERIALS AND METHODS

We created a list of 60 preparations combining medicinal preparations in their generic names, as brand names and over-the-counter (OTC) preparations and cosmetics. The questionnaire was pilot-tested with four senior Pharmacologists who were not part of this study. The survey was modified based on their feedback. Within the list, 53 items were named in generics. There were 4 cosmetic preparations including an anti-wrinkle cream containing retinoic acid, calamine lotion, petroleum jelly and sunscreen lotion. One item was herbal or a natural product in combination with a chemical agent. This was an anti-lice agent containing Malathion. A total of 25 items on the list are freely available OTC. The final list contained 60 items with some of the brand names explained regarding their active components within brackets. Of these items all were drugs.

In addition to the questionnaire, there was a short questionnaire for some of the background details of the participant. No name or roll number of the participant was asked for. Their age and gender was recorded followed by an assessment regarding their family income (in three categories:- Category I - Less than 1 lac per annum; Category II - 1 to 5 lacs per annum and Category III - More than 5 lacs per annum). Another question required the

participants to mark if they had either parents or a sibling (or a family member they were living with) who is a Doctor. Both of these questions were asked to check for the background knowledge of the participant regarding medications.

The MBBS (Bachelor of Medicine, Bachelor of Surgery) is a comprehensive learning programme that spans over 9 semesters of six months each (4 years 6 months in total) followed by a year of compulsory internship or clinical rotation. Teaching and learning during this period comprises of small group tutorials, lecture classes, tutorial practical classes, clinical skills and laboratory training, interactive seminars, etc. The first two semesters of this course involves study of Anatomy, Physiology and Biochemistry. The next three semesters are dedicated towards learning Pathology, Pharmacology, Microbiology and Forensic and State Medicine. Our study was planned and conducted on students who had completed their fifth semesters. In this manner they could be presumed to know the basics of Pharmacology and be familiar with the names of medicinal preparations.

The survey was completed anonymously and voluntarily in the first 15 minutes of two lectures conveniently selected for each of two year groups. The 2013-2014 and 2014-2015 batches were included. These students were admitted to the MBBS course in 2012 and 2013 respectively. The two groups were named groups A and B respectively. Students were given 15 minutes to complete the survey. They were included in the study only if they consented to participate in it anonymously. The preparatory groundwork, data management analysis and report preparation were conducted at the Department of Pharmacology of the tertiary care teaching hospital and Medical College in Eastern India.

## STATISTICAL ANALYSIS

Standard tests for descriptive statistics were applied which commonly included the use of percentage, where applicable, Chi-square test and unpaired t-test was used, to compare the two groups. The p-value of less than 0.05 was considered to be statistically significant.

## RESULTS

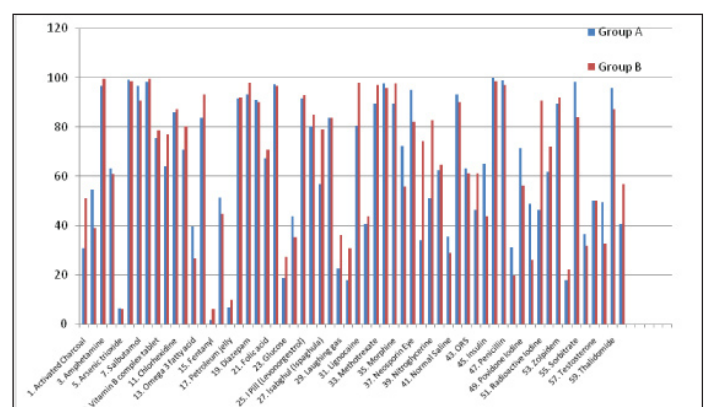
Our study thus was conducted on two batches of students having a total of 249 and 245 candidates respectively. Of these, on the test day 192 and 215 participants were included respectively. These groups were called A and B accordingly. The response rates were high as was the attendance (77.1% and 87.75%) in the test lecture class. The baseline demographic features of our study participants are shown in [Table/Fig-1]. Except for a higher number of female candidates in group B, other features among the two groups were not found to be different on applying Chi-square test ( $p > 0.05$ ).

Among the groups A and B, total number of right answers from individual candidates were assessed with a cut-off of over 50%. On this assessment, 93 candidates in Group A and 119 candidates in Group B were deemed to have a fair idea regarding what was drug and what was not. Based on the demographic statistics, each of the three variables viz., gender, socioeconomic background and

presence of a medical person in the family were compared among the groups. The results of this analysis are depicted in the [Table/Fig-1]. Among Group A students, both socioeconomic background and presence of medical professional in the family was found to be significantly influencing the results and performance of the students ( $p < 0.05$ ). Gender however did not significantly affect the results in Group A. Among Group B students, gender (females scored better) and socioeconomic status affected the performance in the test ( $p < 0.05$ ). Presence of a medical professional in the family however did not affect the results significantly.

There was a wide variation in what the participants considered as drugs and what they did not consider as drugs. Among group A, almost all considered Aspirin and Paracetamol a drug. Similar high positive results were seen with items like Salbutamol, Atropine, Dextromethorphan, Diazepam, Ciprofloxacin ear drops, Levonorgestrol, Neosporine eye ointment, Furosemide, Metronidazole, Penicillin, Sorbitrate and Thalidomide. Highest negative result was with Petroleum jelly with nearly 90% considering it a "non-drug". Arsenic trioxide (81.25%) and Fentanyl (81.77%) also were not considered to be drugs by most participants in this group.

Group B mostly considered both Amphetamine and Atropine to be drugs. These two ranked highest among all students with only one student not sure of their status as drug. Other agents marked as drugs by almost all participants were Aspirin, Codeine, Dextromethorphan, Diazepam, Furosemide, Levonorgestrol (emergency contraceptive), Lignocaine, Methotrexate, Metronidazole, Morphine, Paracetamol, Penicillin and Zolpidem with over 90% participants considering them to be drugs. Similarly highest ranking non-drugs that most candidates were sure of as "non-drugs" were Arsenic trioxide and Fentanyl with only 6.04% considering them to be drugs. In both groups A and B, several drugs were closely split as "drugs" or "non-drugs" among students. For example Infliximab, 5% Dextrose, Nitroglycerine, Oral Polio vaccine, Testosterone and Tetanus toxoid in group A were marked by 48-52% candidates as drugs. Similarly in group B, 48-52% candidates marked Activated charcoal and testosterone as drugs.



[Table/Fig-2]: Distribution of ayes among students in the two groups.

\*Abbreviations/explanations given in questionnaire: Anti wrinkle cream – Containing Retinoic acid; Itch Guard™ – Containing Menthol, Boric acid, Clotrimazole & Zinc oxide); Lici™ – Containing Malathion; OCP – Combined oral contraceptive pill; ORS – Oral rehydration salt; OPV – Oral polio vaccine

	Group A (n = 192)	Successful candidates in Group A (n = 93)	Group B (n = 215)	Successful candidates in Group B (n = 119)
Mean age	22.4 years	-	22.23 years	-
Percentage of female participants	20.83% (40 in 249)	23 females; $p = 0.21$	42.79% (90 in 245)	67 females; $p < 0.01$
Family income group*	62.3% in Category III; 25.4% in Category II; 12.1% in Category I	Category III 72; Category II 17; Category I 4; $p < 0.01$	59.22% in Category III; 24.3% in Category II; 16.4% in Category I	Category III 82; Category II 26; Category I 11; $p < 0.01$
Medical professional in the family	9.89% (19 candidates)	15 candidates; $p < 0.01$	6.51% (14 candidates)	10 candidates; $p = 0.27$

[Table/Fig-1]: Demographic and baseline distribution of the two groups.

\*Family income groups - Category I - Less than 1 lac per annum; Category II - 1 to 5 lacs per annum and Category III - More than 5 lacs per annum

Of the 60 drugs that were in the list, 15 in group A and 19 in group B received more than 90% "Ayes" whereas 6 drugs in group A and 4 in group B received less than 20% Ayes as drugs. The results from the two groups were compared using unpaired t-test and no significant difference was found between the two groups. ( $p = 0.68$ ). The detailed results are depicted in [Table/Fig-2].

## DISCUSSION

This was a unique study the likes of which we did not find in any literature. We provided the students with a list of agents that are all classified as drugs under the aegis of the WHO definition. There were some red-herrings for the students to decipher and get to the real understanding of what is a drug. Of the 60 drugs that were in the list, 24 in group A and 27 in group B, received more than 80% "Ayes". The results obtained from the two groups were concordant across year cohorts for all the drugs. Overall the results were heartening with most students aware of what defined a drug. Success rates were found to be 48.43% (93 of 192) in Group A and 55.34% (119 of 215) in Group B, respectively. On a deeper look at the demographic influencers, we noted that females performed better in group B and those in Category III and II in both groups performed better in the test. While in Group A presence of a medical professional in the family was found to be significantly associated with better performance, it did not influence the results in group B.

This study was based on the idea explored by Erueti et al., who tried to decipher the student knowledge about common physiological conditions and differentiate them from diseases [2]. They included conditions like menopause, fractures, heat stroke, baldness etc. They noted a good concordance between the two cohorts that they tested. We found no significant difference between the two groups and what they considered to be drugs. However, the high number of responses that were unsure lying between 21 to 79% in our study (30% in group A and 35% in group B) show a poor concordance or agreement of what is a drug and what is not.

While there are clearly demarcated conditions that are physiological and those that are pathological, drugs are a more ambiguous area especially for students. Agents that are herbal or those that are available OTC, vaccines and contraceptive agents are commonly perceived as non-drugs. Some of our major non-drug labels were Arsenic trioxide, Fentanyl, Petroleum jelly, Vitamin E, Glucose, OTC. Anti-lice agent with Malathion and Sodium Chloride with over 80% nays or responses saying "not sure". A split opinion with only around half of the participants marking positive response was seen with agents like Activated charcoal, Infliximab, 5% Dextrose, Nitroglycerine, Oral Polio vaccine, Testosterone and Tetanus toxoid.

Arsenic trioxide was one of the drugs that got marked as a non-drug by most candidates. Arsenic has been used in medicines for over two millennia. Recently, arsenic trioxide ( $As_2O_3$ ) has been introduced into the treatment of both de novo and relapsed Acute Promyelocytic Leukemia (APL), with remarkable clinical success [3]. Students' confusion is based on the Arsenic contamination of ground water and the resultant adverse health effects that is a problem in parts of Bengal and Eastern India [4].

Fentanyl sodium is routinely used as an anesthetic adjuvant as well as a potent analgesic in cancer pain [5]. We were disappointed with the poor response regarding Fentanyl. One of the reasons for this could be the fact that the students did not deem a Fentanyl transdermal patch to be a drug. They decided it to be a drug delivery device. Emollients such as petroleum jelly, paraffin, aloe vera etc., are moisturizers that are beneficial in many dry skin conditions and are thus considered to be drugs [6]. These are sometimes also used as vehicles for several medications used in the topical form. Since petroleum jelly is available OTC as a cosmetic product, most of our students failed to consider them

as drugs. Vitamins, Vitamin E, nutrients like omega three fatty acids, iron preparations etc. are another group of agents that, many practicing health care professionals fail to identify as drugs. These are used in physiological conditions as part of diet and also in several pathological states and malnutrition. These belong to the class of agents called nutraceuticals [7]. Many of our study participants failed to identify these agents as drugs despite the fact that these agents have been discussed in lecture classes as drugs that are beneficial upon judicious use.

Glucose and Sodium chloride are part of Oral Rehydration Therapy (ORT). We had provided an item titled ORS. Over 60% students marked that as a drug. However, Glucose and Sodium Chloride, which along with other ingredients, that can be part of home-based-oral rehydration solution was not considered by the participants [8]. This shows a knowledge gap among our students from book-teaching and practical application. In India, where paediatric mortality and morbidity related to malnutrition and diarrhea is a significant problem, our budding doctors need to be helped so that they can bridge this knowledge gap.

We had provided an OTC preparation of an anti-lice agent called Lici<sup>TM</sup> containing among other ingredients Malathion. This ingredient was specified in the questionnaire. Topical agents that help in eradication of surface parasites, insects and worms such as Permethrin and Malathion [9] can be classified as drugs. Most of the students missed out on this due to the brand name that was used in the questionnaire or due to the topical nature of the agent.

Vaccines and other agents used prophylactically to prevent disease are often missed when classifying drugs and "non-drugs". Nearly half of our participants thus missed oral polio vaccine as a drug. Hormonal contraceptives, emergency contraceptive levonorgestrol and hormonal preparations such as testosterone were also missed by a substantial number of participants as drugs. These agents, especially hormonal contraceptives are used by healthy individuals in physiological states and thus many of the responders mistook them for "non-drugs". The split between ayes and nays could be due to the fact that many of the responders remembered correctly the no-contraceptive uses and benefits of these hormonal contraceptives [10].

## LIMITATION

Like most scientific studies, our study was also not devoid of limitations. One of the major shortcomings of our study was the lack of follow-up of the groups. Comparisons of the results obtained after a particular group completed his or her MBBS final examination with a more vivid and clearer knowledge about diseases and drugs would have been an ideal design for this study. This would also help us determine a trend or progression of knowledge and help us design our lectures and study materials accordingly. There were difficulties in accessing more experienced medical students because they were not under our direct guidance anymore. In addition if the study sample were to include only students who were in their final year of MBBS or were interns or house staffs, there would be a clearer picture on this issue. These study participants, not having yet the complete knowledge of disease and drugs were not an ideal sample for the study. However, since we had access to only this student group for our study, we could not provide a clearer picture of knowledge of drugs among the new prescribers. We hope to plan larger studies with this in mind. Despite our good response rate, we surveyed students from only one institution who may not be representative of all medical students.

## CONCLUSION

Our study was a small step in assessing the attitude of future prescribers towards what is a drug and what is not. With rise of irrational and unnecessary prescribing trends and as a result lack

of compliance, medication errors, breach of trust and faith on the physician, it was a vital study that helped us in the understanding the concept of a drug. Our findings could have implications for the way we teach students about drugs useful both in physiological conditions as prophylaxis or for other benefits such as contraception and in pathological conditions. Emphasis could be on more example-based and case-based training. Further research into the curriculum and learning opportunities for the students is required.

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