

INTERNS' KNOWLEDGE OF CLINICAL PHARMACOLOGY AND THERAPEUTICS: A RETROSPECTIVE VIEW IN LIGHT OF MEDICAL UNDERGRADUATE TRAINING

¹Bhandarkar AP, ²Sherkhane RM, ³Shenoy GK, ⁴Aniketana GV, ⁵Shetty MS and ^{6*}Amuthan A

^{1, 3, 5 & 6}Department of Pharmacology, Melaka Manipal Medical College, Manipal University, Manipal.

²Department of Pharmacology, SDM College of Medical Sciences & Hospital, Dharwad.

⁴Department of General Medicine, Mandya Institute of Medical Sciences, Mandya.

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***Correspondence for
Author**

Dr. Amuthan Arul

Department of
Pharmacology, Melaka
Manipal Medical
College, Manipal
University, Manipal.

ABSTRACT

Background: Medical educationists claim that pharmacology is a crucial discipline that endows medical students with knowledge about rationality of prescribing a drug. For any teaching-learning program to be effective and updated, constant review and evaluation of curriculum through feedback from students and modification of the teaching methodologies accordingly, becomes very important. **Objectives:** The study was conducted with the intention to provide some light about the knowledge of CPT among interns in a tertiary care teaching institution so as to assess how adequately their medical undergraduate (UG) teaching in Clinical Pharmacology and Therapeutics (CPT) had prepared them for safe and rational prescribing. **Materials and**

Methods: The study was conducted at a tertiary care teaching hospital,

Karnataka in 81 randomly selected interns. A structured pre-validated questionnaire was used seeking information about their demographics, confidence to prescribe for common illnesses, experience of Adverse Drug Reactions (ADRs) since the start of their internship. The questionnaire also provided them an opportunity to suggest teaching methods which could be adopted to train undergraduates in the area of CPT. **Results:** 88% of interns attributed their knowledge of prescribing to their UG CPT training. Majority of them would confidently prescribe antihistaminics, antibiotics and NSAIDS without supervision. Only handful of them (9.6%) had reported ADRs to hospital authorities during internship. According to interns,

exercises like prescription writing for commonly encountered illnesses, case/problem based learning sessions, hands-on training in ADR reporting, dose calculation needed to be implemented. **Conclusion:** By this study, we perceived a lack of emphasis on principles of clinical pharmacology in undergraduate medical teaching. Hence prompt implementation of necessary modification in the teaching methods is essential to impart adequate knowledge on rational prescribing.

KEYWORDS: Clinical Pharmacology and Therapeutics (CPT), Adverse Drug Reaction (ADR), rational prescribing.

INTRODUCTION

Medical graduates join as interns in their respective teaching hospital soon after graduation and they must be equipped with a knowledge to prescribe rationally. Although interns work is usually under the supervision of a senior consultant, but occasionally they need to make their own decision. The actual medical training in India begins in the preclinical years when the students are taught basic medical science subjects which include gross anatomy, embryology, histology, biochemistry and physiology (in the first year); medical microbiology, pathology, haematology and blood transfusion, and pharmacology (in the second year). Medical statistics, community medicine, ophthalmology and otorhinolaryngology are taught in the third year. The students in final year are taught theoretical and clerkship medicine, obstetrics and gynaecology, surgery, paediatrics and psychiatry. The clinical training spans through the second, third and final (fourth) years. The Medical Council of India (MCI) has recommended that undergraduate pharmacology course should include topics in basic and clinical pharmacology, and therapeutics as well.^[1] Despite the pitfalls^[2,3] traditional teaching of pharmacology exists as the mainstay of teaching pharmacology in most of the colleges in India, though the concept of curriculum integration is widely welcomed.^[4] The traditional teaching is in the form of didactic lectures and bench work practical. Students tend to memorize drug information with this kind of teaching method^[2-4] and renders them less capable to prescribe rationally.^[3,5] Clinical pharmacology and therapeutics (CPT), the discipline which trains doctors for safe, rational and efficacious use of drugs, has been progressively integrated into the undergraduate curriculum in USA,^[6] United Kingdom,^[7] Netherlands^[8] and many developed nations as a way of improving the prescribing knowledge and skills of 'budding' doctors. In the West, attempts to stimulate student interest in medical subjects, particularly basic sciences have resulted into two suggestions, (a) early exposure to

patients to create an awareness of the final objective of their study and (b) the use of integrated teaching.^[9,10] The integrated curriculum involves teaching pharmacology from the preclinical year itself and all through the clinical years in organ system-based manner. This teaching method focuses less on didactic lectures and more on knowledge and skill acquisition on rational drug use. The advantages of the integration system over conventional teaching have been widely reported^[11,12] and has been recommended by the World Health Organization (WHO) as a core intervention in undergraduate teaching to promote rational drug use.^[13] Such integration has been advocated in some medical schools in India.^[11,12] Internship is a period of medical apprenticeship under the supervision of a consultant. At the end of internship, one is expected to demonstrate clinical skills, perform some basic clinical procedures and develop a caliber of arriving at an appropriate medical decision in patient management. Nevertheless, interns being the most junior doctors in a tertiary hospital, have been found responsible for a significant number of prescribing errors.^[14-16] Globally, prescribing-related errors are common^[17-19] and have resulted in a significant patient morbidity and mortality.^[20-22] Many concerns have been raised in the United Kingdom^[16,23] about the adequacy of undergraduate CPT education in preparing new doctors for the complex task of rational and safe prescribing. Looking into the fact that the majority of prescription related errors in hospital environment are made by junior doctors,^[15,24] there is a need to develop an intervention in the CPT teaching right from their para-clinical years that will educate them and improve their prescription qualities. Many studies have evaluated the teaching of undergraduate CPT and its impact on the prescribing ability of junior doctors.^[25-27] In similar lines we wanted to evaluate the Indian medical curriculum for adequacy of CPT training and its impact on the interns' prescribing behavior at our set-up. Traditionally, all newly graduated doctors in India are required to undergo internship in accredited hospitals for a year before they are registered to practice. The MCI has recommended that interns should rotate a period of two months through each of medicine, surgery, obstetrics and gynaecology, and paediatrics departments during internship which are termed as major postings and one month each through any four of radio-diagnosis, radiotherapy, dermatology, psychiatry, ophthalmology, orthopaedics, anaesthesia or Ear Nose and Throat surgery. The first experience of unsupervised prescribing by the interns begins during the internship. In spite of the wide gap between the CPT teaching imparted during their medical schooling and the commencement of their internship, pre-internship CPT is neither taught during employment orientation nor is an opportunity provided for continuous medical education (CME) to enable the interns update their knowledge about rational drug use. This study

therefore aimed at determining the adequacy of undergraduate CPT teaching in preparing the interns in our set up for safe and rational prescribing, and how in retrospect the interns would like to modify their undergraduate CPT training in the best interest of patients and healthcare. The influence of internship training (as per their completed rotations till the time this study was performed) on their prescribing ability was also sought.

OBJECTIVES

The study aimed at assessing how adequately the medical undergraduate teaching on Clinical Pharmacology and Therapeutics (CPT) had prepared interns for safe and rational prescribing and to know how they wanted the undergraduate curriculum to be modified so as to empower them with the knowledge for prescribing P-drug. The effect of internship training on the prescribing ability of the interns was also sought.

MATERIALS AND METHODS

The study was conducted at Sri Dharmasthala Manjunatheshwara College of Medical Sciences & Hospital, Dharwad, Karnataka in January 2013 among 81 randomly selected interns after obtaining the institutional ethical clearance. Those who completed one or more major clinical postings (medicine, paediatrics, surgery, and obstetrics and gynaecology) formed Group 1 of our study while those who had rotated through one or more minor postings only, formed Group 2. A structured questionnaire (Appendix), modified from the work of Tobaiqy *et al.*,^[27] was the instrument of study. The instrument of the study was a structured pre-validated questionnaire which sought information about their demographics, confidence to prescribe for common illnesses, experience of witnessing adverse drug reactions (ADRs) and their reporting since the start of internship. Prescribing errors and polypharmacy are found to be among the leading causes of ADRs in India.^[20] This problem, coupled with inadequate awareness of pharmacovigilance and ADR reporting among doctors in India,^[28] prompted us to include the interns' experience with ADR reporting as one of the parameters to be assessed. The questionnaire also sought in retrospect, any perceived deficiencies in their undergraduate CPT teaching and gave them an opportunity to express their opinion in improving the curriculum in this direction. The questionnaire was distributed among the selected interns in a lecture hall providing them the necessary instructions and a duration of half an hour to fill in. It contained closed ended yes/no type of questions, multiple choice questions and open ended questions. They were given an opportunity not to reveal

their identity if they did not wish to. Results were analyzed by nonparametric statistical tests wherever applicable and P-value <0.05 was considered to be statistically significant.

RESULTS

A. Demographics

The respondents were between 23–26 years. The respondents were predominantly males (54, 66%). Forty two (51.85 %) respondents belonged to group 1, while 39 (48.15 %) belonged to group 2.

B. Assessment of

a) Undergraduate teaching in CPT

Majority of the respondents (54, 66.6 %) rated their knowledge of CPT as good, 10 (8.1 %) rated their knowledge as average, 3 (3.7 %) rated it as excellent and the remainder (14, 17.2 %) rated it as poor. When prescribing they considered safety (59, 72.8%), efficacy (24, 29.6%) and cost (14, 17.2%) of the drugs. Seventy one (87.6%) respondents were of the opinion that undergraduate CPT teaching had sufficiently equipped them to prescribe rationally and safely. Interns of group 1 were more confident to prescribe without supervision than group 2 ($\chi^2 = 19.98$, $P < 0.001$) which was statistically highly significant. Respondents would likely prescribe antibiotics (85%, 48 %), NSAIDS (84%, 75%), diuretics (70%, 25 %), antihistaminics (65%, 59%), and oral hypoglycaemic agents (58%, 13%) confidently and unsupervised from group 1 and 2 respectively (Fig.1). Majority (78 %) of the interns were not confident to prescribe for special population (children, elderly, pregnant women and people with impaired renal or liver functions) without supervision and needed assistance from seniors/had to refer to sources or memorize drug dosages before prescribing for them. Difficulties faced by them during their internship which reflect the deficiencies in their undergraduate CPT training are listed in Table no.1.

b). Efficiency in Adverse drug reaction (ADR) reporting: Only 14 (17%) respondents had witnessed a total of 18 ADRs during the internship period without a significant difference between the groups ($p = 0.081$). The ADRs resulted in hospitalization in 7 cases, prolonged hospital stay in 4 and death 1. Six ADRs were observed and followed up on OPD basis only. Drug-drug interactions accounted for 4 of the witnessed ADRs. Unfortunately, a majority of the witnessed ADRs (14, 77%) went unreported. Only 4 (23 %) ADRs were reported to appropriate authority within the hospital and none were reported using CDSCO forms to National Pharmaco-vigilance Centre/WHO-UMC (Table.2). 95% respondents felt there is a

real need for orientation on how to go about ADR reporting and monitoring, at least prior to commencement of internship.

c). Possible areas of improving UG teaching in CPT : Suggested topics under CPT which they felt as necessary to be incorporated in the undergraduate curriculum were: Case/Problem based learning sessions (44), training and assessment sessions on prescription writing for commonly met illnesses (58), hands-on training in ADR identification and reporting (26), exercises enabling them to calculate drug dosage for various age groups (20), to identify clinically significant drug-drug interactions (18) and referring to appropriate sources of drug information (6), module on critical evaluation of drug promotional literature (5) and exercises to develop skills to obtain appropriate drug history (5) (Table.3)

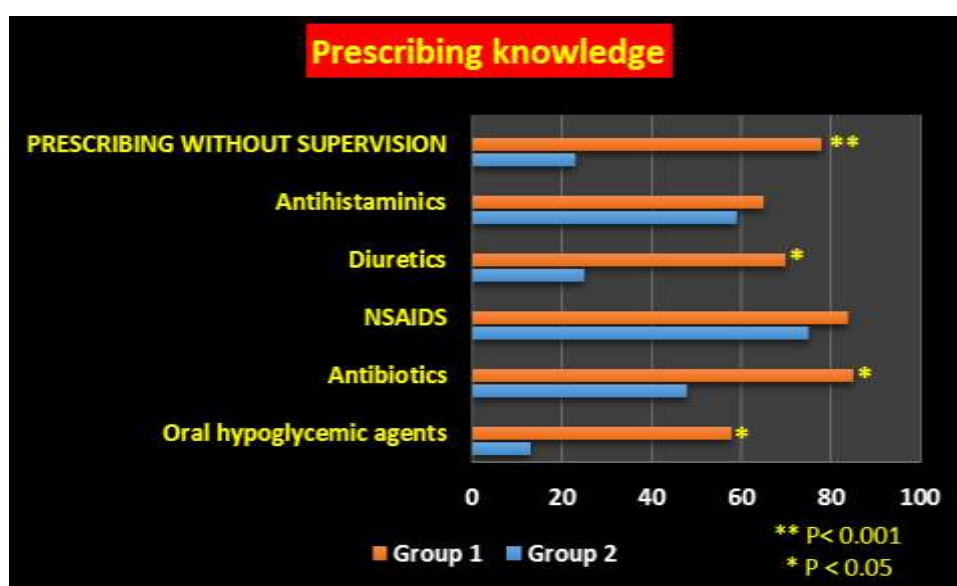


Fig.1. Confidence among interns to prescribe various groups of drugs without supervision.

Table.1. Listing the perceived practical difficulties of interns pertaining to CPT

VARIOUS ASPECTS OF PRACTICAL DIFFICULTIES RELATED TO CPT	% OF INTERNS FACING THE PROBLEM (N = 81)
Deciding the appropriate dosage/regimen to various age groups	80
Deciding the appropriate medication/prescribing for common ailments	51.8
Identifying drugs with potential for drug-drug interactions	67
Identifying generic names of the commonly used brands of drugs	70
Not confident in prescribing for special population* without supervision	78

Table.2: Details about ADRs witnessed and reported by the interns during internship

EXPERIENCE ON ADR REPORTING	IN PERCENTAGE
Interns witnessing the ADRs during internship	17
ADRs possibly due to drug-drug interaction	4
Witnessed ADRs that went unreported	77
Reported only to hospital authorities	23
ADRs reported to National Pharmacovigilance Centre/WHO-UMC	0

Table.3: Enumeration of the suggestions made by the interns for necessary modification in UG CPT teaching

METHODS TO BE ADOPTED IN UG-CPT TEACHING	% OF INTERNS SUGGESTING
Training on:	
Prescription writing →	71.6
ADR reporting →	32
Identification of clinically significant drug-drug interactions →	22
Referring to appropriate sources of drug information →	7
appropriate drug history taking →	6
Problem based learning exercises	54
Critical evaluation of Drug Promotional Literature	6
Exercises on dose calculation for various age groups	25

DISCUSSION

The majority of the respondents rated their knowledge of undergraduate CPT as average and good, thus indicating that undergraduate CPT teaching was likely to be good. This may probably explain the high number of respondents who perceived themselves sufficiently prepared to prescribe rationally. However, these findings did not correlate with the high proportion of respondents who had problems with prescription writing and those who memorized drug dosage for different age groups and special population. This may be due to lack of practical prescribing and regular assessment of the prescribing skills practiced during undergraduate CPT teaching.^[5,25,27] The interns who completed one or more major postings seemed significantly more confident with their prescribing skills and level of confidence to prescribe drugs unsupervised in opposed to the other group. Most of the respondents were not confident to prescribe to special population. About one-third of the respondents claimed they had witnessed ADRs during the internship, a small proportion of which was due to drug-drug interaction. Similar results were reported in few other studies from developed countries.^[29,30]

Only the theoretical knowledge of CPT is imparted to medical students during undergraduation. As they are not formally taught paediatric drug dose calculation either in pharmacology or paediatric, they tend to memorize the dosages/regimen rather than

understanding the basis which makes them more likely to commit prescription/medication errors. As seen with similar other studies,^[31,32] interns in our study too have demonstrated difficulty in calculating paediatric drug doses when prescribing/treating during internship and they have expressed their will to learn if formally taught. As internship is a period of medical apprenticeship under the supervision of senior doctors, especially the consultants, they would have picked up some prescribing skills through informal CPT teaching by the medical officers, residents and consultants, which might have improved their experience and confidence to prescribe appropriately. This would have been the possible reason why majority of the respondents were more confident to prescribe a variety of drugs unsupervised. This inference by us goes further supported by the finding that, their mentioned drugs tended to reflect the pattern of ailment they have commonly attended to and their routine prescribing workload, rather than their knowledge of prescribing based on 'Personalized (P)-drug' concept. Moreover, the mentioned groups (diuretics, antibiotics, NSAIDs and OHAs) are drugs mostly involved in severe and fatal ADRs, hence lack of prudence and caution in prescribing these drugs can end up in havoc.^[19,29,30] The confidence expressed in prescribing them by many of the respondents could be the result of prescribing experience obtained by working under a busy consultant, rather than by their knowledge of assessing the true risks associated with drugs and the complexities involved in the treatment. Most of the respondents were not confident to prescribe to children, elderly, pregnant women and people with impaired renal or liver functions. Therefore medication use in these special people should remain a focus of undergraduate CPT teaching. Confident prescribing witnessed in our study seemed to be significantly dependent on the internship exposure. More the number of clinical rotations covered, more confident were the respondents at prescribing unsupervised. The confidence of the respondents might have come with practice, knowledge, familiarity with frequently used drugs in the ward and/or with adequate supervision of their senior colleagues.^[31] About two-third of the respondents claimed they had witnessed ADRs during the internship, a small proportion of which was due to drug-drug interaction. A significant number of the ADRs resulted in prolonged hospitalisation, morbidity and mortality. Similar results were observed with other studies from developed countries.^[29,30] A majority of the witnessed ADRs that went unreported and none of them reported to the National Pharmacovigilance Centre /WHO-UMC strongly suggest a poor awareness on ADR monitoring/reporting among interns. This calls for a more active ADR monitoring system at the level of tertiary healthcare with regular CMEs involving interns, nurses, pharmacists and general practitioners that can strengthen the pharmacovigilance system at the grass root level.

Perhaps recently, a wonderful initiative has been taken up by Central Drug Standard Control Organization (CDSCO), in bringing up a nationwide pharmacovigilance program under the aegis of Directorate General of Health Services (DGHS), Ministry of Health and Family Welfare, Government of India. This program is largely based on the recommendations made by the WHO in its document titled "Safety Monitoring of Medicinal Products - Guidelines for Setting up and Running a Pharmacovigilance Center". A nationwide network with 25 peripheral centers, 5 regional centers, and 2 zonal centers was established, in a hierarchical fashion, with predefined tasks and responsibilities allocated at each level.^[33] The fact that almost all of the respondents felt the grave need for a pre-internship orientation session on ADR reporting, monitoring and prevention, would necessitate a focus on the all these measures of ADRs in undergraduate CPT teaching and sensitization session prior to internship commencement.

The need to include prescription writing exercises for commonly encountered ailments was suggested by most of the respondents reflects the dearth of practical CPT teaching at the undergraduate level. Many of the respondents recommending the exercise on referring to appropriate sources of drug information in UG-CPT teaching, is of a practical concern as reference to drug formularies for prescribing information has proven to be an important step in preventing ADRs.^[35,36] Doctors should keep abreast of recent developments in the field of therapeutics and refer to appropriate sources of drug information like compendia (CIMS, MIMS etc.) and standard treatment guidelines prior to treatment. Deficiencies in the knowledge and basic skills of prescribing, as well as deficiency in taking good drug history, are responsible for a significant number of medication errors^[37,38] hence needs immediate action in curriculum modification and training the teachers in this direction. The use of a prescribing checklist as an aide memoire has been suggested by Jackson et al^[39] as a means of improving prescribing practice. This can be developed for medical students for their familiarization and use during internship. This is a pilot study and has given us an insight into undergraduate CPT teaching in India. The deficiencies identified in CPT teaching were similar to those of other smaller studies in the UK,^[26,27] which shows a need to be addressed.

The major study limitation was that it relied on self-rated confidence rather than objective demonstration of prescribing knowledge and skills. Confidence of the interns to prescribe rationally may not necessarily translate into good prescribing. While the supposedly confident interns may be incompetent to prescribe appropriately, the insecure ones may

prescribe better. Studies have shown that many doctors who were able to prescribe confidently were actually unable to write clear and legible prescriptions for pharmacists to dispense or nurses to administer without confusion.^[40,41] The study findings derived out of a small sample size from a single set up would not necessarily reflect the precise national picture of UG-CPT training. Moreover the varying clinical exposure among the interns was likely to influence their perceptions of undergraduate CPT teaching and some of their responses may not be genuinely true.

CONCLUSION

The main goal of CPT is to impart knowledge, skills, and attitude so that a medical student as he/she reaches internship is able to weigh the potential benefits and cost-effectiveness of a treatment against the risk associated with it. In spite of a number of methodological limitations, this single centre study showed that undergraduate CPT teaching in India may be inadequate. Interns would like principles of rational prescribing and training on ADR prevention, identification, monitoring and reporting to form part of the core curriculum of undergraduate CPT teaching. Theoretical and practical CPT teaching coupled with frequent assessment of the knowledge and skills acquired by the students, would likely improve their rational drug use as interns. Internship training appears to increase the prescribing confidence which needs to be assessed objectively during and after internship. A government funded well-designed multi-centric study including interns from all the teaching hospitals in Karnataka/ South India would likely eliminate all the bias, giving better views of interns about CPT teaching in India and also help to precisely identify the lacunae in the knowledge pertaining to rational therapy among interns.

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STUDY PROFORMA

1) Demographic details

2) Undergraduate clinical pharmacology and therapeutics (CPT) teaching

1. Were you taught prescription writing in your undergraduate pharmacology?

(a) Yes (b) No

2. How would you rate your prescribing knowledge as at graduation?

(a) Very poor (b) Poor (c) Average

(d) Good (e) Excellent

3. Do you feel that your undergraduate training has prepared you to prescribe safely and rationally?
- (a) Yes (b) No
4. What are the drug-related criteria you look into prior to prescribing? (Tick one or more if applicable) Efficacy/safety/suitability/cost
5. If the above is yes, what other factors may affect your ability to prescribe rationally? (please specify)
6. Have you had any specific problems with prescribing during your internship training?
- (a) Yes (b) No
7. If the above is yes, what are the specific problems? (Please specify)
8. Retrospectively, do you think undergraduate CPT teaching should be improved?
- (a) Yes (b) No
9. If the above is yes, please suggest ways of improving the teaching (please specify)

Prescribing information

10. Are you confident to prescribe drugs for commonly encountered illness?
- Yes (b) No
- If yes, which are the groups of drugs you feel you are confident to prescribe?
11. Are you confident to prescribe for special population (children, elderly, pregnant women and people with impaired renal or liver functions) without supervision?
- (a) Yes (b) No
12. Are you aware of the Essential Drugs List?
- (a) Yes (b) No
13. If yes, do you prescribe drugs according to the Essential Drugs List?
- (a) Yes (b) No
14. Usually you prescribe by:
- (a) Generic names (nonproprietary names)
- (b) Trade names (proprietary/brand names)
15. Usually in children you calculate the doses according to the:
- (a) Age (b) Weight
- (c) Height (d) Surface area

16. Usually while prescribing, do you consider the cost of the drugs?

(a) Yes (b) No

17. Have you been taught to consider the cost of the drugs?

(a) Yes (b) No

18. Do you understand the term “pharmacoeconomics”?

(a) Yes (b) No

19. Do you prescribe a newly promoted medicine?

(a) Yes (b) No

20. Do you critically evaluate the drug promotional brochures given by medical representatives, using WHO criteria before prescribing them?

(a) Yes (b) No

21. Do you prescribe supplemental vitamins and iron preparations?

(a) Yes (b) No

22. Usually do you prefer a fixed-dose analgesic combination or paracetamol?

(a) Fixed-dose analgesic combination

(b) Paracetamol

23. Have you prescribed under parental influence even when not necessary?

(a) Yes (b) No

24. Do you routinely check information about drugs before prescribing?

(a) Yes (b) No

25. If the above is yes, which materials do you consult?

(a) Product insert

(b) Internet

(c) Books/journals

(d) Drug information provided by the medical representatives

(e) Drug information index, eg, CIMS, MIMS, Drug Today, IDR etc

(f) Any other (please specify)

ADR experience

26. Have come across any ADR during internship?

(a) Yes (b) No

27. How many ADRs did you witness and how did you follow them up?

.....

28. Did they result in hospitalization/ prolonged hospital stay/ death?

29. Have you reported it to hospital authorities/ National pharmacovigilance centre / WHO-UMC?

(Tick more than one if applicable)

30. Do you feel the need for frequent sensitization and orientation for ADR reporting and monitoring?

(a) Yes (b) No