



QUESTIONNAIRE BASED ASSESSMENT ON PHARMACOGENOMICS AND PHARMACOECONOMIC IN MEDICAL UNDERGRADUATES OF TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT **Objective-** To assess the knowledge and attitude of medical under graduates towards Pharmacogenomics and Pharmacoeconomics. **Method-** A cross sectional survey is conducted among 2nd year medical students, in the form of pre-test containing questions about Pharmacogenomics and Pharmacoeconomics. After sensitisation on topic same questions were provided in the form of post-test and results were analysed using Chi square test, p value <0.05 was considered statistically significant. **Result-** Out of 250 students, 220(88%) students responded in pre-test while 230(91%) responded during post-test. During pre-test, 40% were female and 60% were male while during post-test, 41% were female and 59% were male. We found highly significant (p value<0.05) improvement in knowledge and attitude towards Pharmacogenomics and Pharmacoeconomics after the post-test. **Conclusion-** Inclusion of these topics in undergraduate curriculum is a good initiative by NMC but there is need to conduct more CMEs, symposium, workshops in medical colleges to update the knowledge regarding PG/PE among medical undergraduates.

KEYWORDS : Pharmacogenomics, Pharmacoeconomics, Medical undergraduates

INTRODUCTION

Sometimes different individuals show different response to a same dose of a drug. Mostly it is due to difference in age, weight and renal function, also due to drug-drug interactions, But the response of a drug also depends on receptors, enzymes, ion channels etc. which are controlled genetically. So, the genetic constitution is also responsible for drug response. "The study of genetic basis for variations in drug response is termed as Pharmacogenetics".¹

Pharmacogenetics also includes Pharmacogenomics (PG) which means "various tools for surveying the entire genome to assess multigenic determinants of drug response that becomes helpful in guiding the choice of drug and dose on individual basis". Pharmacogenomics is an exploding field of science that explores genetic contributions to patient variability in drug response.² It combines our knowledge of drug pharmacokinetics and pharmacodynamics with knowledge from modern genetic testing to provide a comprehensive view of how a specific patient will react to a medication.³ Genetic variations lead to variations of drug responses which can be classified into Pharmacokinetic and Pharmacodynamic variations.

Pharmacokinetic Variations:

Cytochrome P450 is involved in the metabolism of various drugs, on the basis of cytochrome P450 efficacy, individuals have been classified into "poor metabolizers (PM)" having reduced cytochrome P450 efficacy (having increased risk of adverse drug reaction/toxicity) and "ultra-rapid metabolizers (UM)" having significantly increased enzyme efficacy, (may lead to therapeutic failure). Like Isoniazid induced neuropathy/hepatotoxicity – enzyme, N-acetyl transferase causes acetylation of Isoniazid. In slow acetylators Isoniazid gets accumulated in the body and leads to peripheral neuropathy while in rapid acetylators it gets metabolised to acetyl hydrazine which is hepatotoxic.

Pharmacodynamic Variations:

Genetic polymorphism may alter the function of receptors and channels which leads to increase/decrease drug effect like Halothane causes Malignant Hyperthermia due to abnormal release of calcium from Endoplasmic reticulum.

PG can enable healthcare practitioners to predict who will respond to a medication, who will not, what dose to select and who may have an adverse drug reaction to the medication. So, the goal of Pharmacogenomics is to keep step on 'Personalized medicine'⁴.

Pharmacoeconomics(PE) is the branch of economics that uses various

methods to compare pharmaceuticals products and treatment strategies. It measures if the added benefit of one intervention is worth the added cost of that intervention. According to the measurement of health gain we can differentiate four types of economic evaluation⁵

1. Cost-benefit Analysis:

In this method we detect, estimate and compare the benefits and costs of a program/treatment. It is a way to compare the cost and benefit of an intervention (In monetary unit). If Benefit: Cost (B:C) ratio is greater than 1 then the program is of value, if, it is less than 1, the treatment is not economically beneficial and if the ratio is equal to 1 than the benefits equal the cost.

2. Cost-effectiveness Analysis:

It compares treatment alternatives (in Monetary unit) with therapeutic outcomes (in term of physical units like reduction in blood pressure)

3. Cost-utility Analysis-

It compares treatment alternatives (in Monetary unit) and health related quality of life (QALY- Quality Adjusted Life Year)

4. Cost-minimization analysis-

It determines the least costly alternative on comparing treatment alternatives. It is a method of comparing competing programs or treatment alternatives.

The primary focus of PE is to provide product and services that show a balance of economic, clinical and humanistic outcomes (ECHO). Pharmacoeconomic evaluation is important in helping clinicians and decision makers to make choices about new pharmaceutical products. Due to the limited financial resources, pharmacoeconomic analyses has become a frequently used criterion for decision making in modern health care policy⁶. The aim of PG is rational and optimal drug therapy to the patient on the basis of genotype to maximize benefit and minimize harm. While PE focuses on the cost and benefit of drug therapy. NMC has included PG/PE in the syllabus of Undergraduates, So, that they could apply the principles of these two in choosing a treatment which is most efficacious, has minimum side effects and cost effective.

The purpose of this article is to assess awareness among 2nd year M.B.B.S. students about PG/PE, and their attitude towards application of these branches in future for the benefit of patient and upgradation of medical interventions which are cost effective.

MATERIAL AND METHOD

It is a cross sectional survey organised in Deptt. Of Pharmacology,

GSVM Medical College, Kanpur, UP. As a part of undergraduate teaching first we organised a pre-test, and provided 20 questions on google form online (time - 45 minutes) about knowledge, attitude and practice regarding PG/PE. Questionnaire contains 10 questions on knowledge about PG and PE (5 each), 6 questions were attitude based while 4 questions were based on practice. We recorded the answers, and then students were sensitised about PG/PE. After sensitisation same questionnaire was provided online on google form in the form of post-test (time - 45 minutes) and answers were analysed. Consent regarding questionnaire was taken from students. Statistical analysis was done using Chi square test and p value less than 0.05 was considered as significant.

RESULTS

Out of 250 students, 220(88%) students responded in pre-test while 230(91%) responded during post-test. (Table 1)

	Total students	Responded	Not responded	χ ²	p-value
Pre test	250	220(88%)	30(12%)	2.22	0.06806
Post test	250	230(91%)	20(9%)		

We applied Chi Square test to test the association between groups and found that p value is >0.05 in both groups during pre and post-test, so the difference in number of students during pre and post-test is statistically nonsignificant.

Gender and Age distribution of students during pre and post-test has been shown in Figure 1 and figure 2 respectively.

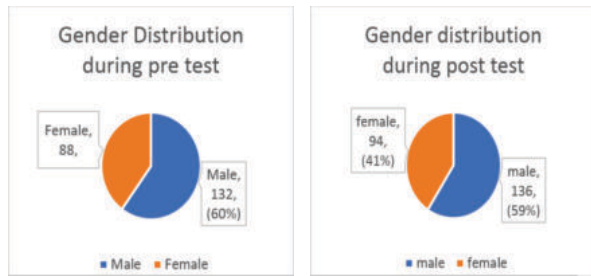


Fig 1

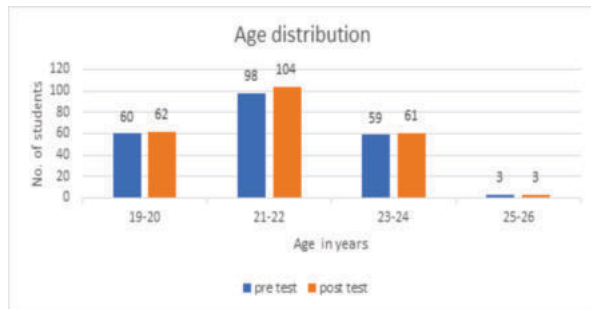


Fig 2

Figure 3 shows sources of information about PG/PE among second year medical students

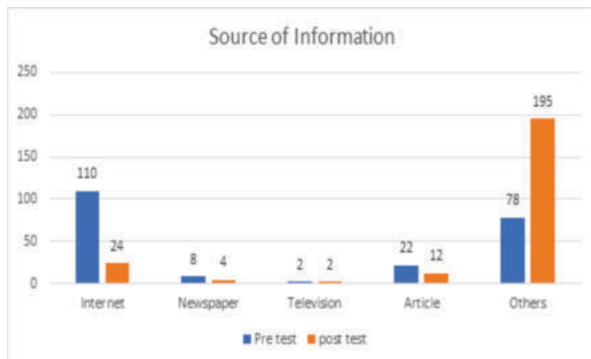


Fig 3

Figure 4 shows responses of knowledge-based questions in pre and post test

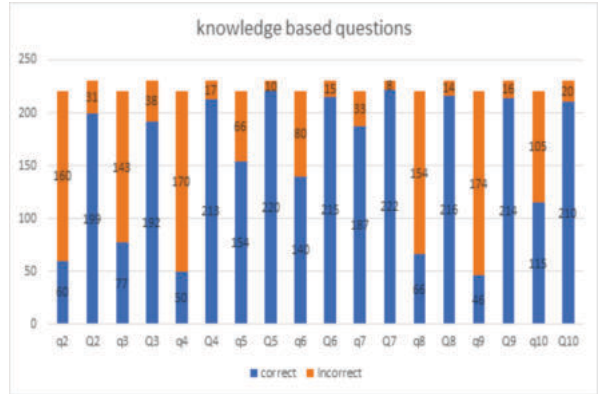


Fig 4 (q2-q10= responses during pre-test, Q2-Q10= responses during post-test)#

Table 2 Shows responses of students on Attitude based questions during pre and post test

S. N.	Test	SD	D	NS	A	SA	χ ²	p-value	
Q1. I feel that Pharmacogenomics will be relevant in future medical practice	No. of response (%)	Pre-test (n=220)	7 (3)	3 (1)	90 (40)	75 (34)	45 (20)	94.46	p<0.0000001
	Post-test (n=230)	7 (3)	2 (1)	8 (3)	95 (41)	118 (51)			
Q2. Pharmacogenomics is cost effective	No. of response (%)	Pre-test (n=220)	26 (12)	46 (21)	84 (38)	30 (14)	34 (15)	13.49	p<0.001179
	Post-test (n=230)	13 (6)	36 (16)	78 (34)	60 (26)	43 (19)			
Q3. Pharmacogenomics/Pharmacoeconomics should be an important part of medical graduation curriculum	No. of response (%)	Pre-test (n=220)	9 (4)	2 (1)	134 (61)	35 (16)	40 (18)	110	p<0.0000001
	Post-test (n=230)	4 (2)	2 (1)	35 (15)	147 (64)	42 (18)			
Q4. Pharmacogenomics can improve patient care	No. of response (%)	Pre-test (n=220)	49 (22)	31 (14)	64 (29)	34 (15)	42 (19)	174	p<0.000001
	Post-test (n=230)	5 (2)	3 (1)	6 (3)	147 (64)	69 (30)			
Q5. Appropriate timing of health economic activities is essential during drug development	No. of response (%)	Pre-test (n=220)	36 (16)	51 (23)	84 (38)	32 (15)	17 (8)	60.04	p<0.0000001
	Post-test (n=230)	30 (13)	21 (9)	45 (19)	84 (37)	50 (22)			
Q6. Pharmacoeconomic evaluation of a treatment will provide a cost-effective treatment in future	No. of response (%)	Pre-test (n=220)	36 (16)	51 (23)	84 (38)	32 (15)	17 (8)	60.04	p<0.0000001
	Post-test (n=230)	30 (13)	21 (9)	45 (19)	84 (37)	50 (22)			

No. of response (%)	Pre-test (n=220)	58 (26)	44 (20)	49 (22)	48 (22)	21 (10)	58.99	p<0.000001
	Post-test (n=230)	30 (13)	36 (16)	13 (6)	93 (40)	58 (25)		

(SD- Strongly Disagree, D- Disagree, NS- Not Sure, A- Agree, SA- Strongly Agree)

Table 3 shows responses of students on Practice based questions during pre and post test

S. No.	Test	SD	D	NS	A	SA	χ ²	p-value	
Q1.	Once in practice, I should be able to spread awareness of Pharmacogenomics testing								
	No. of response (%)	Pre-test (n=220)	26 (12)	32 (15)	98 (45)	31 (14)	33 (15)	30.55	p<0.005
		Post-test (n=230)	21 (9)	25 (11)	59 (26)	62 (27)	63 (27)		
Q2.	I can apply information from a Pharmacogenomics test to medication selection, dosing or monitoring for a patient								
	No. of response (%)	Pre-test (n=220)	5 (2)	1 (0.5)	142 (64.5)	26 (12)	46 (21)	96.69	p<0.0001
		Post-test (n=230)	5 (2)	3 (1)	44 (19)	49 (21)	129 (56)		
Q3.	Once in practice, I should be able to identify medications that require Pharmacogenomics testing								
	No. of response (%)	Pre-test (n=220)	32 (15)	25 (11)	89 (40)	20 (9)	54 (25)	13.7	p<0.0011
		Post-test (n=230)	23 (10)	20 (9)	70 (30)	38 (17)	79 (34)		
Q4.	Is Teaching hospital/ treating physicians in India should follow Pharmacoeconomic guidelines								
	No. of response (%)	Pre-test (n=220)	12 (5)	13 (6)	89 (41)	55 (25)	51 (23)	43.92	p<0.0001
		Post-test (n=230)	4 (2)	7 (3)	39 (17)	93 (40)	87 (38)		

(SD-Strongly Disagree, D- Disagree, NS- Not Sure, A- Agree, SA- Strongly Agree)

From the above table we concluded that the response from Disagree during pre-test has been converted to Agree/Strongly Agree during post-test, in most of the questions. By applying Chi square test, the data obtained is highly significant (p value < 0.05) in all the questions. So, the students are convinced that PG/PE should be an integral part of their curriculum.

DISCUSSION

PG/PE are not new terms to medical field but healthcare workers still lack awareness about them and their application in overall healthcare system of India is a challenge. In our study we assessed the knowledge, attitude and practice approach among second year medical students towards PG/PE. In our study male to female ratio was 60/40 and 59/41 during pretest and post- test respectively. Maximum students were in age group of 21-22 years (48%), 19-20 yrs (28%) and 23-24(24%) yrs, during study. Pre-test shows that they have very poor knowledge about PG/PE (on average only 30% correct answers). Ratio of correct responses increased surprisingly to an average of 90% to post test. In a study conducted by Meg Moen⁷ among Pharmacy students, Nursing students and Second year medical students in USA showed that 75.3% of medical students agreed or strongly agreed that Pharmacogenomics should be an important part of their curriculum, while in our study only

34% students in pre-test said yes about inclusion of PG/PE in UG curriculum and it is converted to 82% during post-test. Another study by Pisanu C⁸, among medical graduates and post graduates in Universities of South-east Europe stated that 85% students are convinced that PG should be an integral part of their curriculum which is consistent with our study. Study by Meg Moen⁷ showed that 90% of students agreed/strongly agreed(A/SA) that PG can improve patient care in future, while our study revealed that 33% students during pre-test and 93% students during post-test A/SA that PG can improve patient care in future. In a study by Rohini Gupta and Pavan Malhotra⁹ in a tertiary care hospital among post graduate students revealed that only 33% aware about different types of PE studies, while our study shows that 33% during pre-test and 93% students during post-test were aware about types of PE studies. In our study only 48% of students are A/SA that PE guidelines should be followed by every institution in India which converted to 78% during post-test. In another study by Jayasree D et al¹⁰, among medical postgraduates, 75% of students wanted to conduct continuous medical education on PE, while in our study 82% students agreed that it should be a part of their curriculum.

Overall Undergraduate students have very poor knowledge/awareness regarding PG/PE but they believe that they should have knowledge to use genetic information and PE to make drug therapy decisions and educate the patient regarding same.

CONCLUSION

Present study shows that medical students are not updated about PG/PE but they are convinced that in future implementation of these branches will improve patient care, it will also help the physician to select a cost-effective therapy suits the patient best. It is a good initiative done by NMC to include these topics in undergraduate curriculum but there is need to conduct more CMEs, symposium, workshops in medical colleges to update the knowledge regarding PG/PE among health care workers.

Questions of figure 4

Q2. Pharmacogenomics is

- (1) Study of genetic structure to identify disease
- (2) Study of genes to solve paternity dispute
- (3) Various tools to survey entire genome to assess multigenic determinants of drug response
- (4) Various tools to identify genetic defects

Q3. Pharmacogenomics is a step towards Personalized medicine, It deals with

- (1) Individual treatment as per his choice
- (2) Individual treatment that is cost effective
- (3) Individual treatment according to his physical structure
- (4) Individual treatment according to patients molecular and genetic makeup

Q4. Term “Ultra rapid metabolizers” refers to

- (1) Person having more no. of enzymes
- (2) Person having increased enzyme efficiency
- (3) Person with decrease enzyme efficacy
- (4) Person with very low no. of enzymes

Q5. Primaquine causes hemolytic anemia in few patients due to

- (1) G6PD Deficiency
- (2) Hypersensitivity to Primaquine
- (3) Severe Anemia
- (4) Incorrect Diagnosis

Q6. Pharmacoeconomics is

- (1) To provide economic medicine to patients
- (2) The branch of economics that uses cost benefit, cost effectiveness, cost minimization and cost utility analysis to compare pharmaceutical products and treatment strategies
- (3) To provide best treatment without cost consideration
- (4) Does not deals with treatment of patient

Q7. In Pharmacoeconomics ECHO is defined as

- (1) Echocardiography
- (2) Balance of Economic, Clinical and Humanistic outcome
- (3) Electrocardiogram
- (4) All of Above

Q8. All comes under Pharmacoeconomics except

- (1) Cost benefit analysis
- (2) Cost effective analysis
- (3) Cost utility analysis
- (4) Cost minimization analysis
- (5) Cost reduction analysis

Q9. Which of the following are direct nonmedical costs (Multiple Choice)

- (1) Medication the patient must take
- (2) Taking the bus to get to the hospital
- (3) CT Scan cost
- (4) Hiring a baby care taker, so you can visit the doctor

Q10. The measurement unit for cost utility analysis is

- (1) Dollar/ Monetary unit
- (2) Natural unit
- (3) Quality Adjusted Life Year
- (4) Perfect life

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