

## Research Article

# Knowledge Attitude and Practice Study of Pharmacogenomics amongst Physicians of a Major Indian Metropolitan City

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## Abstract

Pharmacogenomics is a field with a futuristic goal of providing personalized medicine based on an individual's genetic makeup. The field experiences an exponential growth of evidence and research that could enable physicians to prescribe medicines to treat underlying conditions while enhancing the predictability of adverse reactions and efficacy of a drug for an individual. With the continued advancement, the "Right Patient-Right Treatment-Right Dosage" may happen soon and will benefit several patients who consume drugs with narrow therapeutic index. However, there remains a lag in the application of PGx in a clinical setting, especially in countries like India. India is a populous country with multi-ethnic diversity. The scope for PGx tests is unprecedented in the clinical setting. Knowledge dissemination on PGx must be enhanced, to achieve greater application in research and in day-to-day practice. Knowledge Attitude and Practice (KAP) studies are much valuable tools to assess the state of art and enables practical goal setting and strategic planning to achieve the best outcome. In this questionnaire based KAP study, we have captured the contemporary KAP on PGx prevailing among practicing physicians (N=73) in a metropolitan city, Chennai, of India. Most of the respondents possessed a vague understanding of PGx. However, majority of them were inclined to learn more about PGx and demonstrated enthusiasm and willingness to commit few hours of their time by signing up for follow-ups. Despite the setback in the existing knowledge prevailing among the physicians, the response from this study towards implementation of PGx in the future remains encouraging.

**Keywords:** Pharmacogenomics; KAP; Physicians; Personalized medicine; Chennai; India

## Introduction

Pharmacogenomics is a fast-evolving field of medicine that enables understanding of a drug's response in the context of a genome. It has steered a path in drug development and dosage decisions; therefore, the treatment is more personalized with chances for better efficacy and lower side-effects [1-3]. Pharmacogenomics (PGx) can be regarded as the "Gen-Next Therapy" where treatment suggestions for patients are based on their genomic sequence [4-7]. The main aim of PGx is to enhance the predictability of efficacy and safety, which in other words is precision medicine solution through identification of any potential inhibitory enzyme coding genes. The "Right Patient-Right Treatment-Right Dosage" may happen soon and will benefit several patients who consume drugs with narrow therapeutic index [8-10].

Knowledge about PGx must be enhanced, to achieve greater application in research and in everyday practice [11-14]. Knowledge

of PGx can open a new vista in personalized medicine when the clinicians start to apply it in their day-to-day medical practices [15]. The adequate and timely availability and access to diagnostic tests can help in evolving practical evidence and guidelines on the predictability, reliability, and validity of PGx [16,17]. Personal privacy and cultural beliefs may be points of concern but increasing awareness with appropriate regulations could help in addressing such concerns [18]. Practice of PGx with adoption of modern technologies like New Generation Sequencing (NGS) could drastically reduce a lot of treatment failures [19-21].

Various Knowledge, Attitude and Practice (KAP) surveys and studies have been conducted to know, understand and implement the use of PGx in clinical industry of few countries [22-24]. From healthcare, medicine, and ethnicity perspectives, for a developing country like India. these studies, could shed light on the importance of PGx [25,26]. India is a populous country with wide ethnic diversity due to differences in genetic ancestry. Pharmacogenetic studies of individual Indian ethnic groups can improve the efficacy of the PGx tests [27] and augment the growth of knowledge in the field. Conducting KAP studies can help devise a plan and develop skilled workforce and cost-effective solutions while ensuring the safety and privacy of the patients [28,29]. Therefore, we designed a KAP (Knowledge-Attitude-Perception) study on PGx amongst the physicians of one of India's major metropolitan cities, Chennai, to identify the factors behind the current understanding of PGx. Our study group represents health care practitioners of a major metropolitan city of India.

## Materials and Methods

The data for this research study was obtained from a population of doctors who attended a state level meeting of Indian Medical

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Association held in Chennai, 2019. The participants in the study were provided with a standard questionnaire and were requested to answer the questions to the best of their knowledge, attitude, and practice. Later, all the hard copies of the responses were collected and transferred to a google form. The google survey consisted of a total of 20 questions, out of which there were 8 general questions, 3 questions focused to knowledge assessments, 6 on attitude and 3 on practice.

### General questions

1. Name and Affiliation
2. Contact number
3. Email ID
4. What is your primary practice setting?
5. What is your specialty?
6. In general, on which of the following do you predominantly base your drug dosing?
7. Please indicate your preferred mode of contact
8. Please list any additional comments or feedback here

### Knowledge based questions

1. Have you heard of Pharmacogenomics?
2. Will you be able to identify drugs that might require PGx testing?
3. Please list some of the drugs for which these tests will be useful.
4. If your answer is no for a question on ordering a Pgx test, please select why you would not order a test.

### Attitude based questions

1. What would be your preferred format for learning more about PGx in the future?
2. Please select if you would consider PGx tests for drug prescriptions (Yes/No)
3. If interested, what is the time frame that you expect for obtaining the results?
4. How much cost do you expect for test results?
5. How much time would you spend on an e-learning program on PGx?
6. Will you be interested in updates or follow-up pertaining to our study?

### Practice based questions

1. Do you think PGx could be relevant to your current practice?
2. For a given reliable test, being cost-effective, how often would you be interested in referring a patient for this test?
3. To adjust therapy based on PGx tests (more often) I would need (.....)

### Analysis of methodology

A KAP survey is typically done to collect information on the knowledge, attitudes, and practices about general and/or specific topics. The KAP protocol that was followed here is a popular method that has been used in several researches including the study of oral

cholera, vaccination, and dengue prevention and seroprevalence in a dengue hotspot in Malaysia [28]. The survey objectives were in the forefront when the questionnaire was prepared. Questionnaire was designed to align with the survey objectives and the survey was conducted without any external bias that could manipulate the responses in any manner. It included a few close-ended questions that, when answered by the doctors, could provide us an insight on their perception and understanding of pharmacogenomics. This was done to highlight the best knowledge, attitude, and practices.

### Results interpretation

The survey results are the outcome of a structured and standardized questionnaire. The validity is ensured by carefully planning the questionnaire, observing the survey procedures, and implementation of possible tools inherent to the collection of KAP data. All three factors: Knowledge, Attitude and Practice go hand in hand. Important details such as the study population, methodology, choice of questions were discussed with the intention to provide a contextualised interpretation of results [29].

### Results

A few yes or no type questions were provided to instantly capture the prevailing knowledge attitude and practice among practicing physicians (Table 1). In general, less than 50% of the respondents had an affirmative response to prevailing knowledge and attitude. Majority of them (>80%) showed interest to follow-up with a demand for updating knowledge in genetics and pharmacogenomics. More than 80% of them were inclined to incorporating a cost-effective reliable PGx tests within their practise. Very few, <10% were not inclined to consider PGx for drug prescription or for frequent recommendation of PGx tests. Almost 90% believed that understanding the legal regulations and insurance coverage is not necessary to adopt PGx tests. Around 50% were aware of PGx tests and around 40% were confident about identifying the relevant drugs for PGx tests. More than 50% of the respondents were not sure about suggesting PGx tests frequently to the patients. Majority of the respondents (>80%) acknowledge that understanding genetics, pharmacology and, drug metabolism is necessary to adopt therapy based on PGx tests.

The expected cost of PGx tests were found to be between Rs. 500-1000, Rs. 1000-5000 and Rs. 5000-10,000. Around 85% of the respondents expect the cost of PGx tests to be between Rs. 500 to 1000. Very few people, <1% people are unaware about the cost of PGx tests. Less than 50% of the respondents replied that the expected timeframe to be less than a week, however around 50% respondents expect the timeframe to be flexible within the time limit (Figure 1).

The majorly expressed concerns regarding PGx tests which were voted by more than 5 members was uncertainty about the value of testing, lack of knowledge and legal issues and lack of regulations. Around 10 of the respondents opted for lack of knowledge as one of the concerns with considering PGx. Around 15 people think that the major concerns for considering PGx are privacy and insurance related issues and practicality concerns. Only one of the respondents opted for unavailability of facility as a major concern (Table 2).

Among the drugs prescribed, Rifampicin was most repeatedly suggested by the doctors in the survey. Considering the drugs category, Antibiotics and Antiepileptics were mentioned most compared to other categories of drugs (Table 3).

Around 60% of the respondents who attended the survey were

**Table 1:** YES/NO type questions about pharmacogenomics based on knowledge, attitude, and practice.

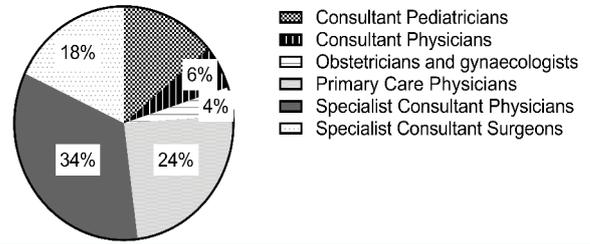
Questions	Yes	No	Maybe
<b>Knowledge-based</b>			
Awareness of PGx** N=78	37 (47%)	29 (37%)	12 (15%)
Identifying drugs N=62	23 (37%)	11 (18%)	28 (45%)
<b>Attitude-based</b>			
Relevance of PGx to their practice** N=74	33 (44%)	11 (15%)	30 (40%)
Considering PGx for drug prescriptions N=69	23 (34%)	8 (12%)	38 (55%)
Interest in follow-up of PGx study N=69	55 (80%)	6 (<1%)	8 (<1%)
<b>Practice-based</b>			
Frequent recommendation of a reliable cost effective PGx test N=69	20 (29%)	7 (<1%)	42 (61%)
Knowledge about genetics, pharmacology, drug metabolism and PGx is necessary to practice therapy based on PGx tests N=78	65 (84%)	13 (<1%)	-
Understanding about legal regulations and insurance coverage is necessary to practice therapy based on PGx tests N=78	8 (<1%)	70 (90%)	-

**Table 2:** Majorly expressed concerns with considering PGx for day-day practise.

Concerns	Number of responses
Uncertainty about the value of testing	7
Lack of knowledge	9
Concerns about privacy	4
Legal issues and lack of regulations	8
Insurance related issues	5
Not applicable	5
Patient resistance	4
Specialist themselves not prescribing	4
No facility available	1

specialist physicians (neurologists, anaesthesiologists, critical care intensivists and cardiologists) and primary care physicians. Around 10% of respondents who participated in the survey were Obstetricians, Gynaecologists (ObGyn) and Internal Medicine (IM) specialists. ObGyn and IM specialists consider that PGx has 100% relevance in practice and they show 100% inclination to consider PGx. Surprisingly, awareness about PGx was less than 60% in case of specialist consultant physicians and surgeons while we anticipated higher number here. Since the medical professionals below the age of 50 were only 4, we did not consider their response as adequate for analysis. However, a table is given to get an understanding of age group wise KAP (Table 4 and Figure 2).

**Distribution of specialists among the respondents**

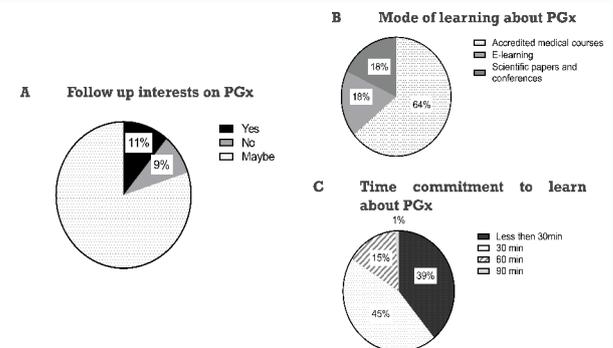


**Figure 2:** Sub-analysis of the specialization of doctors based on their awareness about PGx tests.

Around 80% of the respondents have shown follow-up interest on PGx. Most of the respondents (85%) are interested to commit about 30 minutes or less per day to learn about PGx. 64% of the respondents opted for accredited medical courses for learning about PGx. Less than 20% opted for scientific papers and conferences as a medium to learn about PGx (Table 5 and Figure 3).

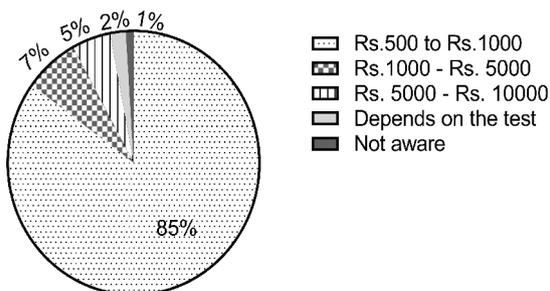
**Discussion**

Pharmacogenomics is a fast-evolving field that has high potential in day-to-day clinical practise. Most of the respondents in our study have shown a great deal of interest towards pharmacogenomics. A study carried out in Malaysia also provide similar results showing an

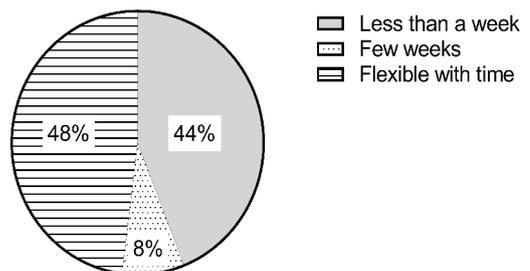


**Figure 3:** Time commitment to learn (A), Mode of learning (B), and Follow-up interests (C) about PGx tests.

**A Expected Costs for PGx Tests**



**B Expected Time Duration for obtaining PGx Test Results**



**Figure 1:** Expected cost (A) and expected timeframe (B) for PGx tests.

excellent attitude as well as great interest to know more about PGx [30]. The attitude to learn is also evident from the participant's interest in follow-up sessions to update their knowledge. The awareness to enhance their knowledge in the field of genetics, pharmacology and drug metabolism among the medical professionals also shows their inclination towards application of PGx in the future. In a study conducted to analyse the medical curriculum in terms of pharmacogenomics education in India, it was noticed that post-graduate medical students had good knowledge about PGx but their interpretation of clinical application was limited. Lack of adequate knowledge about PGx is not surprising and this was captured in various other studies too that were conducted in the Middle Eastern countries [31-33].

Even though only less than half of the respondents had a positive attitude towards PGx, they were interested to explore this field to know more about its strengths and limitations in medical field. The respondents expressed a definitive interest in incorporating PGx tests into their medical practises even though they were not sure about prescribing these tests frequently. The ObGyn and IM physicians among all the medical professionals seem to be inclined towards the PGx tests. Majority of the respondents do not consider that understanding of legal regulations and insurance coverage is necessary for practising PGx tests. One of the least reported concerns by the respondents was the lack of an environment and physical structure necessary for practising PGx tests. This could be interpreted either way as lack of knowledge about the expensive laboratories or as high level of confidence that these could be overcome over a period of usage [34].

Among the different drug categories recommended by the medical professionals, antibiotics and antiepileptics were repeatedly recommended, probably owing to its extensive usage. Despite the challenges faced by the medical practitioners as well as the society, the overall survey response was very receptive.

Our current study has limitations that it was conducted in one group that gathered in an Indian Medical Associations state level meet and may not represent everyone although it could certainly give an idea of the openness of doctors to precision medicine practice.

In a developing country like India, privacy issues were one of the major concerns regarding the practicing of PGx tests. Proper regulations could help overcome those operational and legal concerns. To create a bright future for PGx in India, it is necessary to update the medical curriculum which can provide more physical training on PGx tests. There is also a need for collaborating with other countries in genomic programmes to build genomic databases. Practice of PGx may help to reduce the economic burden of the country by improving efficacy and safety while lending scope to reduce the failure rates of conventional medical treatments [34,35]. A proportional growth in all the areas that concerns PGx must be maintained to see the appropriate benefits of PGx. There is a greater need for pharmacogenetic studies in India and evidence-based treatment guidelines for application in day-to-day practise.

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**Table 3:** List of potential drugs and drug categories for PGx implementation identified by the respondents.

List of drugs	List of drug categories
Paracetamol	Antidiabetic
Diclofenac	Statins
Gonadotrophin	Anticoagulants
Glimepiride	Antibiotic
Metformin	Antifungal drugs
Pioglitazone	Anti-TTB drugs
Erythromycin	Sedatives
Rifampicin	Analgesics
Amikacin	Antihypertension
Phenytoin	Anticancer drugs
Pioglitazone	Anti-glaucoma drugs
Enalapril	Painkillers
Amlodipine	Anti-inflammatory
Gentamycin	Antivirals
Irinotecan	Antiepileptics
Aspirin	Anxiolytics
Rifampicin	All cytotoxic drugs
Prednisolone	
6-mercaptopurine	
Theophylline	
Carbamazepine	
Sulfa/doxycycline	
Sitagliptin	
Isoniazid	
Teneligliptin	
Statins	
Anticoagulants	
Antibiotic	
Antifungal drugs	
Anti-TTB drugs	
Sedatives	
Analgesics	
Antihypertension	
Anticancer drugs	
Anti-glaucoma drugs	
Painkillers	
Anti-inflammatory	
Antivirals	
Antiepileptics	
Anxiolytics	
All cytotoxic drugs	

**Table 4:** Specialist's response to PGx survey.

Specialists	Awareness	Relevance of PGx to practice	Inclination to consider PGx
Consultant paediatrician (N=10)	50%	60%	60%
Consultant Physicians (N=4)	75%	100%	100%
Obstetricians &Gynaecologists (N=3)	100%	100%	100%
Primary care Physicians			
Specialist consultant physicians (N=24)	58%	75%	83%
Specialists Consultant Surgeons (N=13)	54%	77%	77%

**Table 5:** Age-wise sub-analysis of the medical professionals.

Age	Number	Knowledge of PGx			Knowledge of PGx (%)		
		Yes	No	May be	Yes	No	May be
35-50	7	4	0	3	57	0	43
50-60	9	3	6	0	33	67	0
>60	27	12	10	5	44	37	19

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